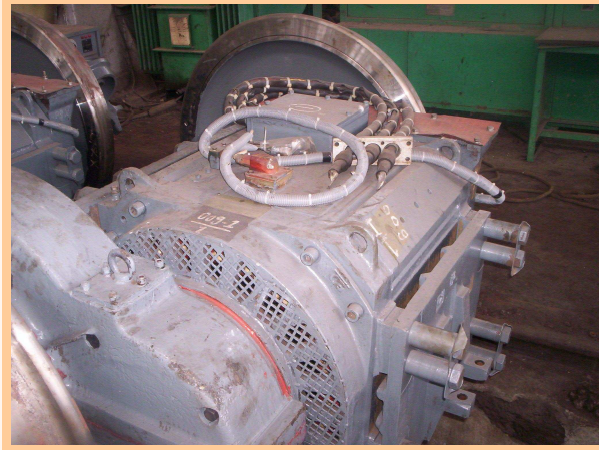




केवल कार्यालयीन उपयोग हेतु
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भारत सरकार GOVERNMENT OF INDIA
रेल मंत्रालय MINISTRY OF RAILWAYS



ए.सी. विद्युत लोकोमोटिव की 3 फेस कर्षण मोटर पर
अनुरक्षण हस्तपुस्तिका

*Maintenance Handbook on 3 Phase Traction Motor
of AC Electric Locomotives*

लक्ष्य समूह : टीआरएस अनुरक्षण कर्मचारी
TARGET GROUP: TRS Maintenance Staff

कैमटेक / ई / 2010 / 3फेस-टीएम / 1.0

CAMTECH/E/2010/3Ph-TM/1.0

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Indian Railways
Centre for Advanced Maintenance Technology

महाराजपुर, ग्वालियर — 474 005
Maharajpur, GWALIOR - 474 005

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गुणवत्ता नीति

रेलों में यात्री और माल यातायात की बढ़ती माँग को पूरा करने के लिए गुणवत्ता प्रबंध प्रणाली में अनुसंधान, डिजाइनों और मानकों में उत्कृष्टता तथा सत्त सुधारों के माध्यम से सांविधिक और नियामक अपेक्षाओं को पूरा करते हुए सुरक्षित, आधुनिक और किफायती रेल प्रौद्योगिकी का विकास करना ।

QUALITY POLICY

"To develop safe, modern and cost effective Railway Technology complying with Statutory and Regulatory requirements, through excellence in Research, Designs and Standards and Continual improvements in Quality Management System to cater to growing demand of passenger and freight traffic on the railways".

प्राक्कथन

भारतीय रेलवे के सभी मुख्य विद्युत इंजन जैसे WAP-5, WAP-7 और WAG-9 3 फेस एसी तकनीकी एवं सींक्रोनस इन्डक्शन मोटर से युक्त हैं। ये मोटरें डीसी कर्षण मोटरों की अपेक्षा अधिक मजबूत, विश्वसनीय, वजन में हल्की एवं अनुरक्षण में किफायती हैं। चूंकि यह तकनीक अपेक्षाकृत नई है अतः 3 फेस कर्षण मोटर के अनुरक्षण पर एक हस्तपुस्तिका की आवश्यकता महसूस की जा रही थी।

3 फेस कर्षण मोटर के अनुरक्षण एवं ओवरहॉलिंग हेतु सभी आवश्यक पहलुओं को ध्यान में रखते हुये कैमटेक ने इस हस्तपुस्तिका को बनाया है। इसमें रचनात्मक वर्णन, विभिन्न अनुरक्षण अनुसूचियाँ, ओवरहालिंग कार्य विधि के साथ विशेष औजारों, सफाई कारकों, स्नेहकों इत्यादि को बताया गया है।

मुझे विश्वास है कि यह पुस्तिका विद्युत लोको शेड और कार्यशालाओं में 3 फेस लोकोमोटिव का अनुरक्षण करने वाले हमारे अनुरक्षण कर्मचारियों के लिए बहुत उपयोगी सिद्ध होगी।

कैमटेक, ग्वालियर
दिनांक 06, अप्रैल, 2010

एस.सी.सिंघल
कार्यकारी निदेशक

FOREWORD

All the major electrical working horses of Indian Railways such as WAP5, WAP7 and WAG9 locomotives are equipped with three phase AC technology with asynchronous induction motors. These motors are very robust, reliable, low weight and economical in maintenance compared to DC traction motors. Since this technology is comparatively new, need for a handbook on maintenance of three phase traction motors has been felt.

CAMTECH has prepared this handbook to cover all essential aspects of maintenance and overhauling of three phase traction motors. It describes constructional features, various maintenance schedules, overhauling procedure along with special tools, cleaning agents, lubricants etc.

I am sure the book will prove to be very useful for our maintenance staff in electric loco sheds and workshops maintaining three phase locomotives.

CAMTECH, Gwalior
Date :06.04.2010

S.C. Singhal
Executive Director

भूमिका

पॉवर इलैक्ट्रॉनिक्स, आईजीबीटी एवं माइक्रोप्रोसेसर आधारित डिजीटल नियंत्रण प्रणालियों के क्षेत्र में हुए तकनीकी उन्नयन ने 3 फेस इन्डक्शन मोटरों का प्रयोग कर्षण सेवाओं के लिए सम्भव बना दिया है। 3 फेस सीक्रोनस इन्डक्शन मोटर अपनी उच्च शक्ति घनत्व, अत्यधिक विश्वसनीयता, उच्चतर परिचालन गति एवं निम्नतर अनुरक्षण के कारण कर्षण उपयोगों के लिए अधिक उपयुक्त है। वजन में हल्के, आकार में छोटे एवं उच्च शक्ति एक फेज से तीन फेज कन्वर्टर की वाणिज्यिक उपलब्धता होने से थ्री फेज लोकोमोटिव पूरे विश्व की रेल्वे द्वारा अपनाये जा रहे हैं।

ट्रैक्शन मोटर इलैक्ट्रिक लोकोमोटिव के सबसे महत्वपूर्ण उपकरणों में से एक है जो कि चक्के को चालन शक्ति प्रदान करती है। इसका उचित रखरखाव और अनुरक्षण इलैक्ट्रिक लोकोमोटिव की कार्य के दौरान अच्छी विश्वसनीयता एवं उपलब्धता सुनिश्चित करने के लिये आवश्यक है।

3 फेस ट्रैक्शन मोटर के अनुरक्षण पर यह हस्तपुस्तिका अनुरक्षण कर्मचारियों को सही अनुरक्षण एवं ओवरहाल तकनीकों को कार्य क्षेत्र में अपनाने के उद्देश्य से कैमटेक द्वारा बनाई गई है।

यह स्पष्ट किया जाता है कि यह हस्तपुस्तिका आरडीएसओ या रेलवे बोर्ड द्वारा विनिर्दिष्ट किसी भी विधान को विस्थापित नहीं करती। यह हस्तपुस्तिका केवल मार्गदर्शन हेतु है एवं यह एक वैधानिक दस्तावेज़ नहीं है।

मैं, भारत हैवी इलैक्ट्रीकल्स लिमिटेड का उनके बहुमूल्य सहयोग के लिये बहुत आभारी हूँ। मैं, कार्यक्षेत्र के उन सभी कर्मचारियों का भी आभारी हूँ जिन्होंने इस हस्तपुस्तिका को बनाने में हमारी सहायता की।

तकनीकी उन्नयनता और सीखना एक सतत् प्रक्रिया है। अतः इस हस्तपुस्तिका में जोड़ने/सुधारने के लिये हमें लिखने में स्वतंत्र महसूस करें। इस दिशा में हम आपके योगदान की सराहना करेंगे।

कैमटेक, ग्वालियर
दिनांक 26, मार्च, 2010

जयदीप गुप्ता
निदेशक (विद्युत)

PREFACE

Improved technology in the field of power electronics, IGBTs and microprocessor based digital control systems have made the application of three phase induction motor possible in traction applications. The asynchronous three phase induction motor is more suitable for traction applications because of its high power density, greater reliability, higher operational speed and lower maintenance. With the commercial availability of light weight, compact and high power single phase to 3 phase converter three phase locomotives are now an ideal choice by the Railways all over the world.

Traction motor is one of the most important equipment of electric locomotives which provides driving power to the wheel. Its proper upkeep and maintenance is necessary to ensure good reliability and availability of electric locomotives in service.

This handbook on maintenance of three phase traction motor has been prepared by CAMTECH with the objective of making our maintenance personnel aware of correct maintenance and overhaul techniques to be adopted in field.

It is clarified that this handbook does not supersede any existing provisions laid down by RDSO or Railway Board. The handbook is for guidance only and it is not a statutory document.

I am sincerely thankful to Bharat Heavy Electricals Ltd. for their valuable inputs. I am also thankful to all field personnel who helped us in preparing this handbook.

Technological upgradation and learning is a continuous process. Hence feel free to write us for any addition/modification in this handbook. We shall highly appreciate your contribution in this direction.

CAMTECH, Gwalior
Date : 26th March 2010

Jaideep Gupta
Director Electrical

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संशोधन पत्रियों का प्रकाशन

इस हस्तपुस्तिका के लिये भविष्य में प्रकाशित होने वाली संशोधन परिचियों को निम्नानुसार संख्यांकित किया जायेगा।

कैमटेक/ई/2010/3फेस-टीएम/1.0 सीएस # XX दिनांक-----

जहाँ “XX” सम्बन्धित संशोधन पर्ची की क्रम संख्या है (01 से प्रारम्भ होकर आगे की ओर)

प्रकाशित संशोधन पर्चियाँ

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ISSUE OF CORRECTION SLIPS

The correction slips to be issued in future for this handbook will be numbered as follows :

CAMTECH/E/2010/3Ph-TM/1.0/C.S. # XX date-----

Where “XX” is the serial number of the concerned correction slip (starting from 01 onwards).

CORRECTION SLIPS ISSUED

[illegible]

अध्याय 1 CHAPTER 1

सामान्य विवरण GENERAL DESCRIPTION

1.1 प्रस्तावना/ INTRODUCTION

There has always been a strong desire to utilize the time proven robust squirrel cage induction motor for traction application because of its high power density, greater reliability, higher operational speed and lower maintenance. It has become possible due to improved technology in the field of power electronics, IGBTs and microprocessor based digital control system. The high power single phase to 3-phase converter system not only meets the weight and space constraints peculiar to locomotive design but also is economically viable. Consequently, 3-phase locomotive are now found suitable for commercial use in Railways all over the world.



The basic system comprises of an input converter, a DC link and a drive converter. Single phase power from OHE, after being stepped down in the loco transformer is fed to the input converter. The force commutated line converter serves two basic functions. First it maintains the DC link voltage at the desired value and secondly it forces a sinusoidal input current in phase with the input voltage. The input converter is designed to operate in a 4-quadrant mode with the pulse width modulation (PWM) technique. The DC link consists of a large bank of capacitors for storing energy to maintain the link voltage during sudden mismatch of power between the load side and the supply side. A tuned filter in the DC link filters out the double power frequency power pulsations as a result of single phase rectification.

The drive converters convert DC voltage (from DC link) to 3 phase alternating voltage. These are operated in Variable Voltage Variable Frequency (VVVF) mode to achieve torque/ speed control of traction motors. The output frequency of the inverters is controlled by timing the turn on and turn off pulse to the devices in each phase. Simultaneously a phase shift of 120° between the firing angles of devices in the three phases is maintained. Full range continuous voltage control of the inverter is achieved by Pulse Width Modulation (PWM) technique. The configuration of line converters and drive converters are similar which makes it

possible to force a reverse power flow in case of regenerative braking. A reverser in the rotational direction of the traction motors is achieved without the use of reverser by simply altering the phase sequence of the inverter output voltage through switching sequence of the devices.

1.2 परिवर्तनीय वोल्टेज परिवर्तनीय फ्रिक्वेन्सी नियंत्रण के सिद्धांत/ PRINCIPLE OF VARIABLE VOLTAGE VARIABLE FREQUENCY (VVVF) CONTROL

Torque of an Induction motor is

$$T = K. (v/f)^2 \cdot f_s$$

Where, T = Torque, K = Constant

v = Inverter output voltage

f = Inverter output frequency &

f_s = Slip frequency

Constant torque is obtained by keeping (v/f) constant, through VVVF. After V is attained to maximum value, slip frequency is controlled. In this manner desirable characteristics are obtained.

1.3 3 फेस ट्रैक्शन मोटर के फायदे/ ADVANTAGES OF THREE PHASE TRACTION MOTOR

- The size of 3 phase traction motor for the same output power is much less compared to DC motor. Resulting in low power to weight ratio.
- Maintenance cost is less due to absence of brush-gear and commutator.
- These motors are very robust. Consequently reliability of a 3-phase locomotive is higher.
- Full power is available up to the maximum speed.
- Overload capabilities are more liberal.
- Regenerative braking is possible in 3 phase locomotives from the full speed till dead stop. Resulting in energy saving and higher operational efficiency.
- A much improved adhesion is available due to superior drop characteristics of speed Vs torque and motor speed is limited by the synchronous speed.
- It operates at near unity power factor throughout the speed range except at very low speeds.
- Due to lesser weight of traction motor, the unsprung masses are low. This reduces the track forces and consequently minimizes wear on rails and disturbance to track geometry.

1.4 तकनीकी आँकड़े / TECHNICAL DATA

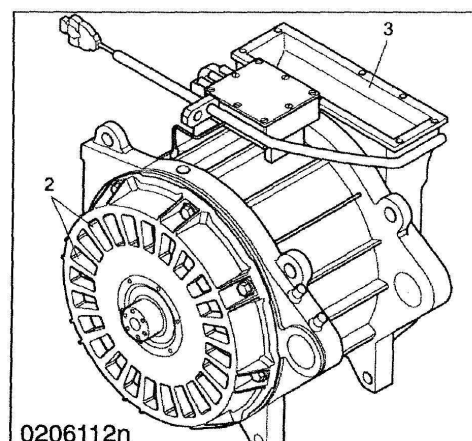
S.No.	PARAMETERS	WAG9/WAP7	WAP5
1.	Make	ABB	ABB
2.	Motor type	6 FRA 6068	6 FXA 7059
3.	Insulation	Class 200	Class 200
4.	Suspension	Axle hung. Nose suspended	Fully suspended
5.	Ventilation	Forced air	Forced air
6.	Weight	2100 kg	2070 kg
7.	1 Hr Rating	1156 HP, 2089 V, 290A, 1135 rpm	1563 HP, 2044 V, 396A, 1485 rpm
8.	Cont. Rating	1156 HP (850 kW), 2180V, 270A, 1283 rpm, 132 Hz	1563 HP (1150 kW), 2180V, 370A, 1585 rpm, 160.3 Hz
9.	Gear ratio	5.133 (77:15)	3.91 (67:17)

1.5 बियरिंग विवरण / BEARING DETAILS

Rotor bearings	DE side	NDE side
Type of bearings	NU 2236	NJ 320/ NH 320
Manufacturer	SKF/ FAG	SKF/ FAG
Inner dia	180 + 0, - 0.025 mm	100 + 0, - 0.020 mm
Outer dia	320 + 0, - 0.040 mm	215 + 0, - 0.030 mm
Radial clearance of free bearing when new	0.170- 0.220 mm	0.105- 0.140 mm
Radial clearance of bearing when installed	0.110- 0.190 mm	0.060- 0.110 mm

1.6 रचनात्मक वर्णन / CONSTRUCTIONAL FEATURES

The traction motor is an asynchronous 6 pole squirrel cage rotor motor which operates by a three phase supply fed by 3 phase converter. It is forced air cooled through a vent in the non-drive end housing. The traction motor blower supplies filtered air to cool the traction motor. The flexible bellows connect the traction motor vent and the air outlet of the blowers on the locomotive under frame.



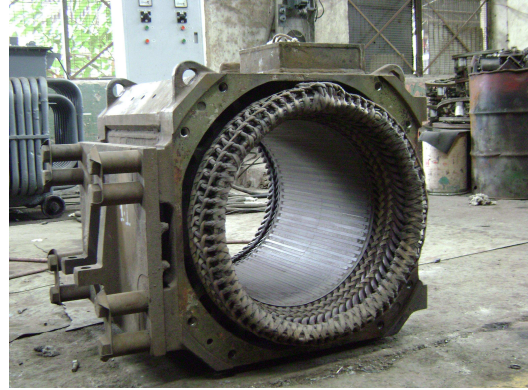
The rotational force from the traction motor is transmitted to the gear box by a drive coupling. The opposite end of rotor shaft is enclosed by end plate.

Following are the main parts of traction motor and its support assembly:

1.6.1 स्टेटर / Stator

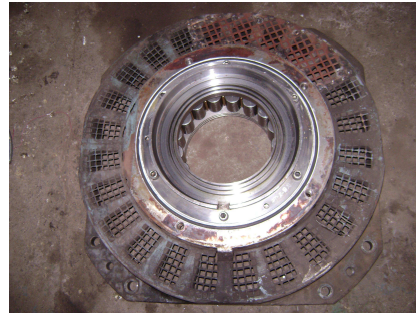
The stator is constructed from a stack of laminated plates secured together by wrap-around rings and traction rails welded to the end plates. The stator winding is insulated under vacuum conditions with a solvent free silicon resin using the ABB 200 class “Veridur” insulating system.

Temperature probes are provided in the stator stack, which monitor the temperature of the stator winding during operation and thus stator windings are protected from thermal overloads.



1.6.2 एंड प्लेट / End Plates

There are two end plates one at drive end and other at non drive end. The openings for air inlet and outlet are integrated in the end plates. The plug in cartridge for the rotary speed transmitter is fitted on the non drive end plate.



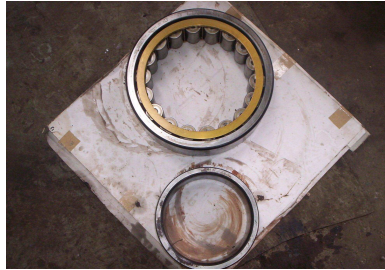
1.6.3 रोटर / Rotor

It is a squirrel cage rotor consists of one winding which is designed with rotor bars whose ends are short circuited by means of end rings. The rotor plates are laminated and fitted directly on to the shaft.



1.6.4 रोटर बियरिंग / Rotor Bearings

The rotor is supported and guided at both ends on two grease lubricated cylindrical roller bearings. Radial non contacting seals are provided to protect the bearings from the loss of grease and penetration of dirt.



1.6.5 स्पीड सेंसर / Speed Sensors



1.6.6 टेम्प्रेचर सेंसर / Temperature Sensors



1.6.7 पीनियन / Pinion



अध्याय 2

CHAPTER 2

ट्रैक्शन मोटर का अनुरक्षण MAINTENANCE OF TRACTION MOTOR

Periodical maintenance is essential to ensure safety, reliability and continuous operation of traction motors over long time periods.

Following maintenance schedules shall be followed for traction motors type 6FRA 6068 & 6FXA 7059 as per RDSO letter no. EL/ 3.1.35/ 16 dtd. 30.03.2007.

Schedule	Freight locomotives WAG9	Pass./ Mail/ Exp. Locomotives WAP5/ WAP7
TI	Every 45 days	3000 kms. or one trip whichever is latter
IA	90 days	90 days
IB	180 days	180 days
IC	270 days	270 days
AOH	After 18 months	After 18 months

Work to be carried under each maintenance schedule is given below:

2.1 ट्रिप निरीक्षण / TI SCHEDULE

- Examine all traction motors for signs of damage caused by ballast. Check air outlets are not obstructed in any way.
- Check traction power cables, speed sensor and temperature sensor cables are not chafed or damaged in any way.
- Check the condition of bearing by seeing the grease, which comes out from grease inlet. Check the condition of grease too.
- Check the condition of spheriblocks. Replace if required.
- Measure inductance at TM power cable terminals of SR-1 and SR-2.
- Check end shield bolts tightness.
- Visually check TM support plate lugs for any damage/ crack.
- Attend logbook/ PPIO bookings if any.

2.2 आई ए / आई बी निरीक्षण / IA / IB SCHEDULE

In addition to TI Schedule carry out the following activities:

- Open TM junction box at body side and check the tightness of connections.
- Check the intactness of junction box cover and bolts.

- Check the condition of bellows and replace if required.
- Check grease nipple on DE & NDE sides.
- Check for oil falling on traction motor from under frame.
- Check for proper tightness of cable with Din Rail for cable connection and tie up with cotton tape for additional protection.
- Check rubber grommets of power cables, earthing connection with traction motor body and earthing screw.
- Check and tighten NDE cover bolts.
- Measure resistance of speed sensor at SR electronics.

2.3 आई सी निरीक्षण / IC SCHEDULE

In addition to IA/IB Schedule carry out the following activities:

- Before greasing, open NDE speed sensor cover. Take grease sample for checking ferrous content.
- Check the condition of speed pulse generator unit on traction motor (NDE) for any grease ingress.
- Lubricate TM bearing with specified grease (Kluber Isoflex Topaz L 152) DE- 50 storke (150 gms), NDE- 25 storke (75 gms)
- Check the suspension tube bearing grease (NDE) and do the greasing.
- Open TM junction box at TM side and check the tightness of connection and water ingress.
- Check the condition of DE side stator winding for any abnormality from DE side net.

2.4 एओएच निरीक्षण / AOH SCHEDULE

In addition to IC Schedule carry out the following activities:

- Measure the resistance of traction motor temperature sensor, speed sensor, winding inductance and IR value.
- Check the condition of bearing grease sample.
- Check base tangent of pinion and conduct UST.
- Change DE side 'O' ring.
- Check tightness of PGR and NDE lock bolts.
- Check and ensure temperature sensor modification as per RDSO/MS/350 or latest.
- Check tapping of traction motor bellow plate holes.
- Check terminal connection of traction motor by opening terminal box.
- Check traction motor temperature sensor and speed sensor wiring crimping.
- Replace the gasket of temperature sensor.

अध्याय 3 CHAPTER 3 ओवरहॉलिंग OVERHAULING

Overhauling of traction motor shall be carried out during every IOH/ POH.

ओवरहॉलिंग के लिये आवर्तिता / Periodicity for Overhauling

Schedule	Freight locomotives WAG9	Pass./ Mail/ Exp. Locomotives WAP5/ WAP7
IOH	6 Years \pm 6 months or 12 lakhs kms whichever is earlier	4.5 Years \pm 6 months or 12 lakhs kms whichever is earlier
POH	12 Years \pm 6 months or 24 lakhs kms whichever is earlier	9 Years \pm 6 months or 24 lakhs kms whichever is earlier

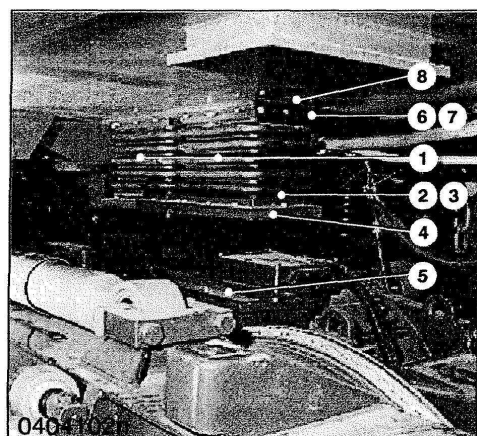
Details of work shall be carried out during overhauling is as under:

3.1 ट्रैक्शन मोटर को निकालना / REMOVAL OF TRACTION MOTOR

- Remove the bogie from the locomotive.
- Disconnect the motor bellows and cabling from the locomotive as described below:

3.1.1 ट्रैक्शन मोटर बैलो को निकालना / Removal of Traction Motor Bellows

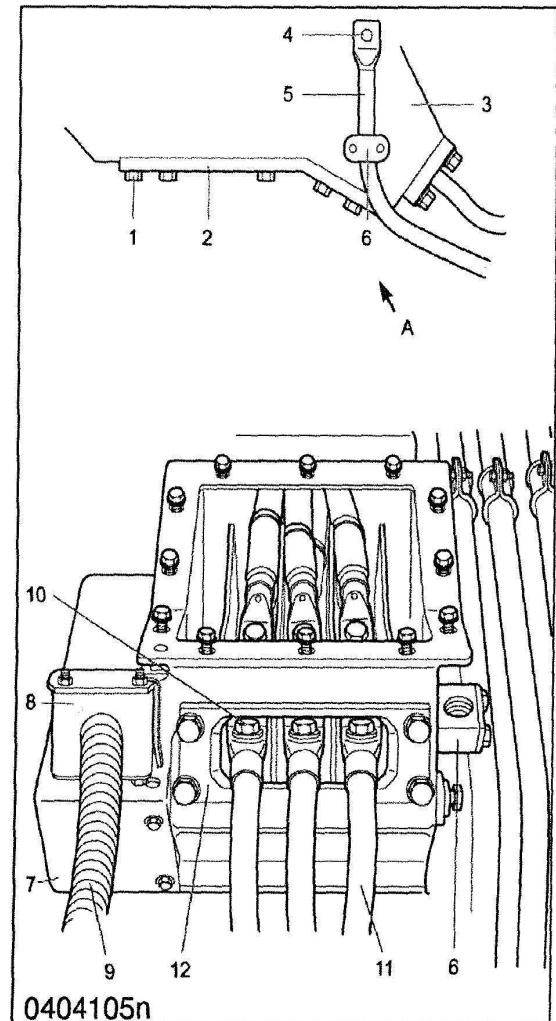
- Each traction motor has two bellows (1) connected on combined mounting flanges (4, 8).
- Remove the bolts and washers (2, 3) securing the lower bellows mounting frame (4) to the traction motor ventilation inlet duct (5).
- Remove the bolts and washers (6, 7) securing the upper bellows mounting frame (8) to the locomotive under frame then remove the bellows assembly from beneath the locomotive.



- Place and secure a dummy plate over the cooling air inlets on the traction motor to avoid foreign particles and debris entering the traction motor and causing damage to the motor internals.

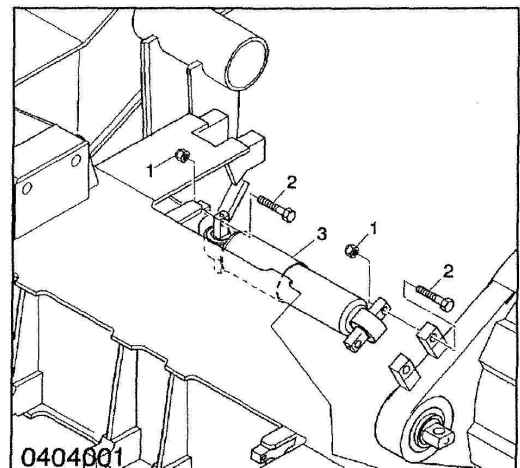
3.1.2 ट्रैक्शन मोटर केबिलों को निकालना / Removal of Traction Motor Cabling

- Remove the bolts (1) then remove the junction box cover (2) from the junction box (3).
- Remove the bolt (4) securing the earth lead (5) tang to the under frame.
- Remove the outer half of the earth lead retaining clamp (6) and earth cable (5) from the clamp (6).
- Replace outer half of clamp (6).
- Remove access cover (7) from beneath cable clamp (8) for the signal cables (9).
- Disconnect the three UIC plugs from the sockets.
- Remove the signal cable (9) from the clamp (8).
- Unbolt the three power cable (11) tangs from the under frame junction box at the bolts (10).
- Remove the bolts securing the power cables retaining plate (12) to the junction box (3), and withdraw the cables (11).
- Secure all cabling to prevent entanglement or fouling during future operations.

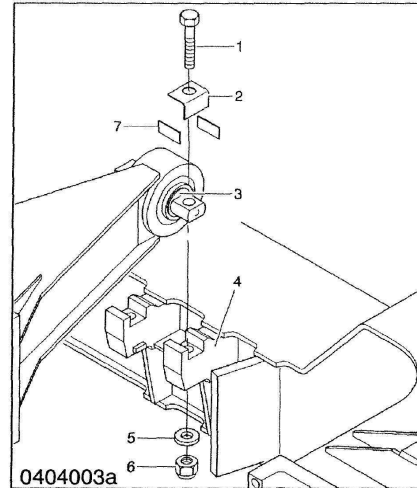


3.1.3 ट्रैक्शन मोटर को निकालना / Removal of Traction Motor

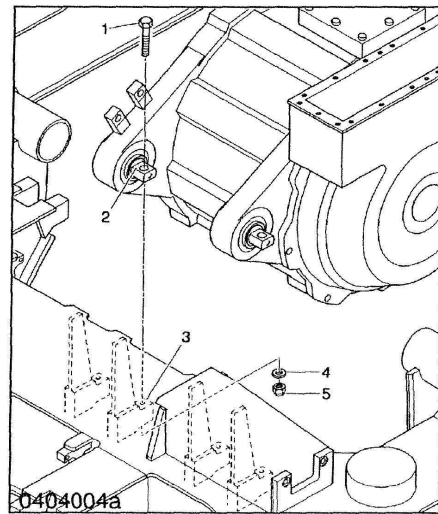
- Attach suitable lifting equipment to the lifting eyes on the traction motor. Raise the equipment slightly to support the weight.
- Remove the bolts (2) and nuts (1) securing the traction motor damper (3) between the motor and bogie frame.
- Disconnect the drive coupling between the motor and gear box.



- Remove bolts (1), nuts (6), washers (5) and locking plates (2) securing the traction motor support arm spheriblock (3) to the bogie frame mounting tugs (4).
- Carefully remove the compensating plates (7) from between the mounting lug (4) and spheriblock (3) cross-pin.

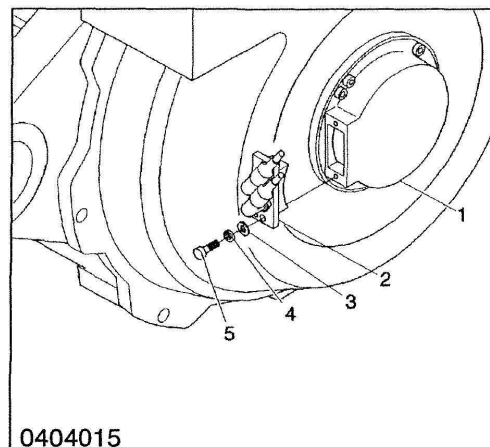


- Remove the bolts (1), washers (4) and nuts (5) securing the traction motor spheriblocks (2) to the centre transom mounting lugs (3).
- Raise the traction motor slightly and ensure nothing is entangled.
- Lift the traction motor from the bogie frame and position on a suitable stand.

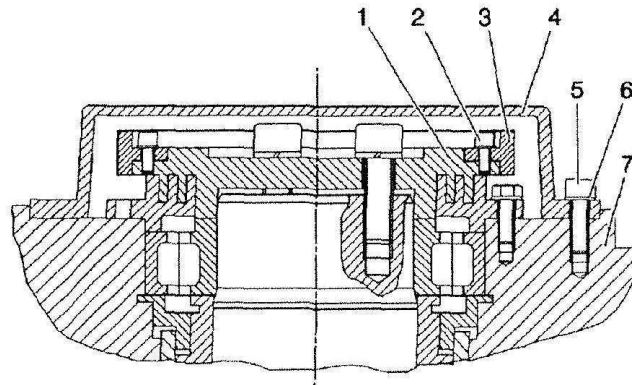


3.1.4 रोटरी स्पीड ट्रॉसमीटर कारट्रेज को निकालना / Removal of Rotary Speed Transmitter Cartridge

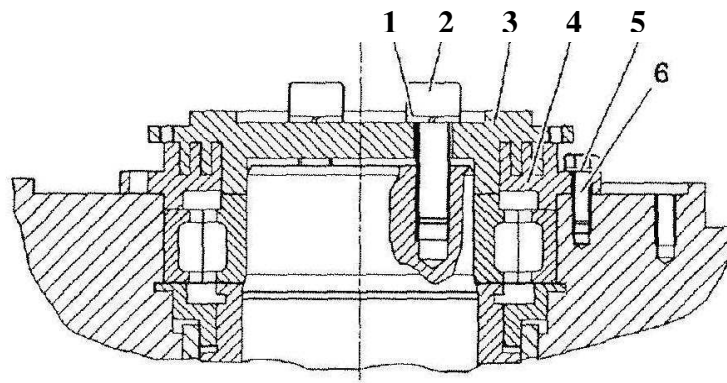
- Remove screws (5), washers (3) and spring washers (4) securing the speed transmitter cartridge (2) to the non drive end bearing cover (1).
- Remove the speed transmitter cartridge (2).



3.1.5 नॉन ड्राइव एंड बियरिंग कवर को निकालना / Removal of Non-Drive End Bearing Cover



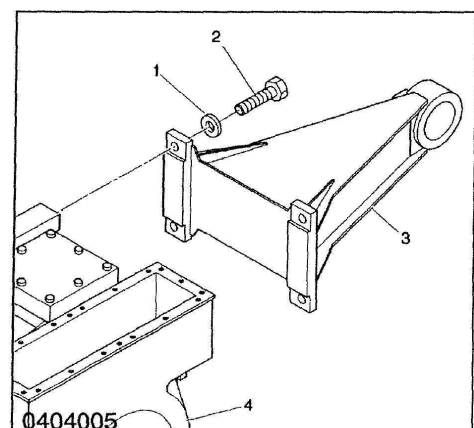
- Remove screws (5) and spring washers (6) securing the non-drive end bearing cover (4) to the traction motor (7).
- Remove the bearing cover (4). Pay attention to the pulse transmitter ring (3).
- Remove screws (2) securing the pulse transmitter ring (3) to the support (1).
- Remove the pulse transmitter ring (3).



- Remove the screws (2) and spring washers (1) securing the pulse transmitter ring support (3).
- Remove the pulse transmitter ring support (3).
- Remove the screws (6) and spring washers (5) securing the thrust collar (4). Remove the thrust collar (4).

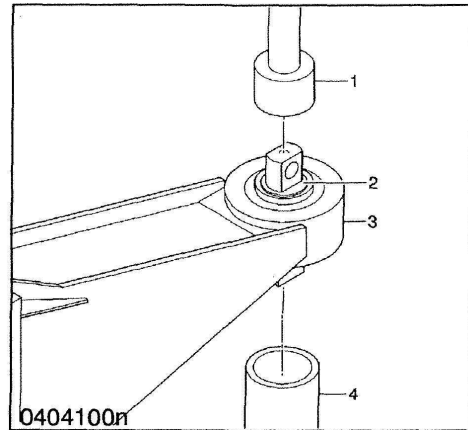
3.1.6 सपोर्ट आर्म को निकालना / Removal of Support Arm

- Take the weight of the arm (3) using suitable lifting equipment.
- Remove the four bolts (2) and washers (1) securing the support arm (3) to the traction motor (4).
- Separate the arm (3) from the traction motor (4).



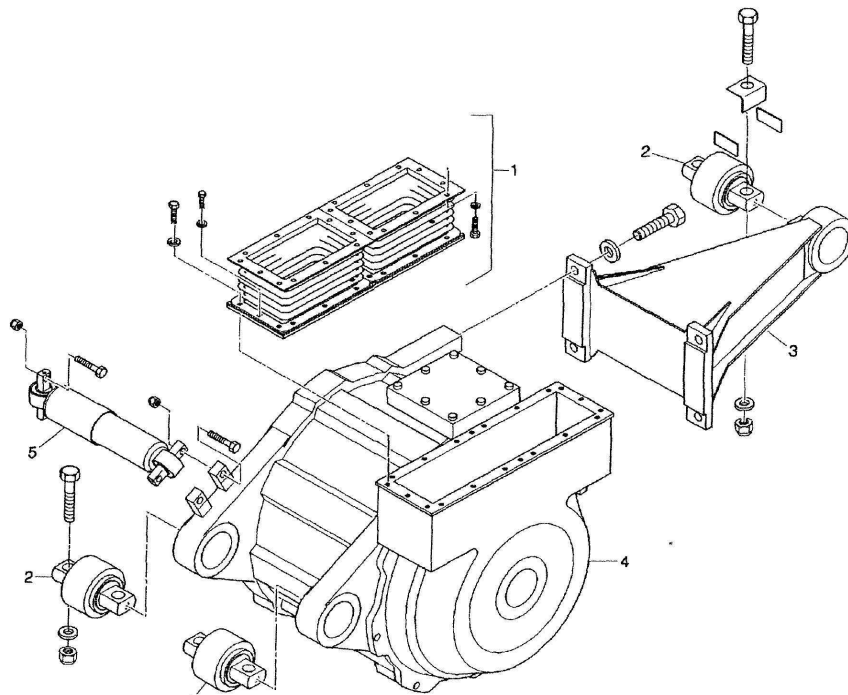
3.1.7 स्फेरीब्लॉक को निकालना / Removal of Spheriblock

- Mark the location of the Spheriblock (2).
- Position the support arm (3) in a suitable press (1, 4).
- Support the eye around the Spheriblock (2) using a suitable steel tube (4). Ensure the tube (4) will not interfere with the Spheriblock (2) during removal.
- Position a suitable mandrel (1), slightly smaller than the outer diameter of the collar, over the Spheriblock (2).
- Check that the mandrel (1) is square with the yoke on the press and contacts around the entire perimeter of the Spheriblock collar.
- Press the Spheriblock (2) out.



3.2 पूर्व निरीक्षण / PRE INSPECTION

- Inspect the condition of the traction motor mounting points on the bogie frame.
- Inspect the condition of all cables. Ensure all cables and cable insulation is in good condition and free from wear, cracks or other damage. If necessary, replace any damaged or suspect cabling.
- Ensure all cable tangs, plugs and sockets are in good condition and free from oxidation, wear, cracks or other damage.



- Inspect the condition of the traction motor.

- Visually inspect the support arm for cracks or damage. Pay particular attention to the eye and traction motor mounting flange.
- Measure the inside diameter of the eye bore (x). If greater than the specified, replace the support arm.
- Remove any burrs from the eye or mounting flange using a suitable honing stone.
- Test the support arm for damage using a non-destructive method and replace if required.

3.3 पूर्व परीक्षण / INCOMING TESTING

- Bring motor to the testing place.
- Check the insulation resistance between each phase and earth with 2.5 kV megger. It should be min. 2.18 M Ohms.
- Carry out continuity test between phase to phase with 500V megger
 - Phase U & V
 - Phase V & W
 - Phase U & W
- Run the motor at 100 V 3 phase AC 50 Hz for 5 minutes and measure the current in each phase.
- Carry out run test of the motor by raising voltage gradually to 400 V AC for 2 Hrs. then measure & record the following:
 - a. Current in each phase
 - b. Bearing noise (DE & NDE side)
 - c. Vibration
 - d. Check the bearing temperature on both end shields and record temperature rise.
 - e. Record speed of the motor with the help of tachometer.

3.4 पिनियन की डिस-असेम्बली / DISASSEMBLY OF PINION

- Check the distance between shaft face and pinion teeth back face (Advancement).
- Clean pinion inside hole by Kerosene oil.
- Provide a wooden lever across the pinion teeth and secure the lever against turning.
- Connect the SKF pressure pump and fit the special plug 1/4" into the pinion.
- Screw the special screw M24 into the shaft by using the pressure bearing. A clearance of approx. 0.5 mm is required between pressure bearing and pinion face.
- Increase the pressure of the pressure pump up to 130 MPa and maintain it for 15 minutes.
- Increase the pressure further to 150 MPa and maintain it for 15 minutes.

- Increase the pressure further to 180 MPa and wait until a ring of oil is visible at the pinion shaft end towards the teeth. Now the pinion is free.
- This pressure can be increased up to 200 MPa, if necessary.
- Increase the pressure steadily and loosening the screw M24 at same time, until the pressure collapsed and the pinion is totally released.
- Disconnect the special plug 1/4" and remove the wooden lever.
- Remove the pinion.

3.5 ट्रेक्शन मोटर की डिस-असेम्बली / DISASSEMBLY OF TRACTION MOTOR

- Remove speed probe & its housing.
- Remove bearing deflector (outer labyrinth) from the shaft with the help of press out tool.
- Fit the dummy pinion.
- Remove speed sensor ring, locking plate and thrust collar.
- Keep motor vertical (equal level) on wooden block (pinion top side).
- Unscrew M 20 x 55 screws (8 nos.) and remove drive end cover.
- Fit the coupler on dummy pinion and lift the rotor carefully and place on the wooden block.
- Keep motor horizontal and remove NDE cover by unscrewing M 20 x 55 screws (08 nos).
- Remove temp sensor.
- Open terminal box cover and open cable connections.
- Preserve the coupler of speed and temp sensor.

3.5.1 मोटर डिस्मैन्टलिंग के पश्चात जाँचें / Checks after Dismantling of Motor

- Check the insulation resistance between phase and earth with 2.5 kV megger. It should be min. 2.18 M Ohms.
- Check visually the stator body, core and windings for any damage and flashing.
- Check the tightness of each phase cable connection in terminal box.

3.6 स्टेटर की ओवरहॉलिंग / OVERHAULING OF STATOR

3.6.1 स्टेटर की शुष्क सफाई / Dry Cleaning of Stator

- Clean the stator frame by wire brush and scraper.
- Clean the stator from inside by nylon brush.
- Clean difficult portion of stator by wedges of fiber glass.
- Blow the stator thoroughly with dry compressed air to remove dust/ dirt.

- Heat the stator in oven at 120°C for 2 Hrs. and remove loose dust by vacuum cleaner.
- Check the insulation resistance between phase and earth with 2.5kV megger after dry cleaning of stator. It should be min. 6.36 M ohm for 6FRA 6068 & 3.18 M ohm for 6FXA 7059.

3.6.2 स्टेटर की सोल्वैन्ट से सफाई / Solvent Cleaning of Stator

- Spray liquid Xylol on stator inside out side, coil, core and terminal box etc. and allow it to act for 5 to 10 minutes.
- Again spray liquid Xylol.
- Clean inside by nylon brush and outside by wire brush.
- Blow the stator thoroughly with dry compressed air from inside and out side.
- Repeat the cleaning process, if required.
- Wipe the stator by calico cloth inside and out side.

3.6.3 स्टेटर की जाँच एवं मरम्मत / Checking & Repairing of Stator

- Check visually the winding for any damage after cleaning.
- Check the winding resistance between phases with Wheatstone bridge or multimeter at room temperature.
 - a. Phase U and V
 - b. Phase V and W
 - c. Phase U and W
- If any repairing is done on stator coils, measure the diameter at core portion.
- Check broken bolt in stator body and act accordingly.
- Visually check for any crack on lug housing, lifting hook etc..
- Bake the stator in oven at 120 deg C for 24 hrs.
- Check the winding resistance between phases with Wheatstone bridge or multimeter at 120 deg C.
 - a. Phase U and V
 - b. Phase V and W
 - c. Phase U and W
- Cool the stator at room temperature.
- After baking of stator, do varnishing with SI 620 resin varnish and allow drying in air for minimum 12 hrs at room temperature.
- Check the insulation resistance between phase & earth after baking and varnishing with 2.5 kV megger. It should be min 63.6 M ohm for 6FRA 6068 & 31.8 M ohm for 6FXA 7059.

- Clean and check the following for any damage:
 - a. Pulse generator ring
 - b. Pulse pick up unit and speed sensors
 - c. Couplers of speed and temperature sensors
 - d. Cables of speed and temperature sensors
- Check the resistances of speed and temperature sensors at room temperature
 - a. Speed sensor 93.2A between terminals A & B, terminals C & D
 - b. Speed sensor 93.2B between terminals A & B terminals C & D
 - c. Temperature sensor 98A between terminals A & B terminals C & D
- Check and clean terminal box cover cleat & clip hardware.
- Check the terminal box connection lead & support visually. If any crack is there, replace the lead support.
- Clean all hardware by 'K' oil.

3.7 रोटर की ओवरहॉलिंग / OVERHAULING OF ROTOR

3.7.1 रोटर की शुष्क सफाई / Dry Cleaning of Rotor

- Remove the old grease from racers on both ends.
- Clean the out side case portion cavities, shrink ring and in side hole cage by nylon brush.
- Blow the rotor thoroughly with dry compressed air to remove dust/ dirt.

3.7.2 रोटर की सोल्वैन्ट से सफाई / Solvent Cleaning of Rotor

- Spray the liquid Xylol by air or by brush to out side rotor cage and in side hole etc. Allow it to act for 5 to 10 minutes.
- Clean racers by petrol.
- Rub the nylon brush on cavities & holes. Blow the rotor thoroughly with dry compressed air to remove dust/ dirt from core & holes.
- Repeat the cleaning process, if required.
- Wipe the rotor & racer by calico cloth.

3.7.3 रोटर की जाँच एवं मरम्मत / Checking & Repairing of Rotor

- Check the condition of rotor bars
- Check the condition of rotor stamping for any deformation, crack, looseness, overheating mark etc.
- Perform ultrasonic testing of rotor shaft.
- Perform Grawler testing of rotor to detect crack in rotor bars.

- Check the diameter of rotor, if repaired.
- Bake the rotor in oven at 120 deg C for 24 hrs.
- Allow to cool the rotor at room temperature.
- After baking of rotor, do varnishing with SI 620 resin varnish and allow drying in air for minimum 12 hrs at room temperature.
- Remove the both side inner racers.
- Check the shaft diameter on racer seat both side & record it.
- Perform dynamic balancing the rotor.
- Fit the new set of inner racer by Induction heater & allow to cool at room temperature.
- Cover the rotor by suitable means.

3.8 एंड कवर एवं बियरिंग की ओवरहॉलिंग/ OVERHAULING OF END COVERS & BEARINGS

3.8.1 सफाई/ Cleaning

- Remove the bearing caps.
- Remove grease by hand.
- Rub the wire brush on covers to remove dirt/ dust.
- Clean by dry compressed air.
- Apply petrol on the covers and bearings and clean after 10 minutes by dry compressed air.
- Wipe covers and bearings by clean cloth.
- Clean all part like labyrinth & hardware by 'K' oil.

3.8.2 जाँच एवं मरम्मत/ Checking & Repairing

- Check diameter of inner/ outer labyrinth.
- Remove the bearings.
- Check cover visually for any damage.
- Weld the air net on DE end cover.
- Repair mechanically as per requirement.
- Check end shield bearing housing diameter & record it.
- Heat up the both end covers in oven for 2 hrs. at 150°C.
- Fit inner labyrinth in both end covers with matching slot of labyrinth with grease hole.
- Fit the new bearing set on cover housing.
- Cool the cover by fan at room temperature.
- Paint the covers and protect them by suitable means.

3.9 ट्रैक्शन मोटर की असेम्बली / ASSEMBLY OF TRACTION MOTOR

- Put stator on wooden block.
- Apply RTV compound on stator body at NDE side surface.
- Fit NDE side cover on stator. Apply ANR-124 compound on M 20 x 55 (08 nos.) screws and tighten them with specified torque.
- Fill up the specified quantity of approved grease in NDE bearing & DE bearings.
- Keep the stator in vertical position (NDE side bottom) on wooden base.
- Fit dummy pinion on rotor.
- Fit coupler on rotor. Lift rotor by crane and put it into stator slowly by taking care of its centre.
- After full lowering of rotor in NDE racer.
- Revolve the rotor in stator
- Apply RTV on stator at DE side.
- Lift DE cover & place on TM keeping grease nipple bottom side.
- Fit DE side cover on stator. Apply ANR-124 compound on M 20 x 55 (08 nos.) screws and tighten them with specified torque.
- Keep TM horizontal on wooden block.
- Remove coupler & dummy pinion.
- Check bearing clearances at both NDE & DE side.
- Fit locking plate by M16 screw (3 nos) at NDE side.
- Fit speed indicator ring on locking plate.
- Fit speed probe housing cover by M 8 x 12 screws.
- Fit speed sensor on housing cover.
- Fit speed & temperature sensor cables in cleat and provide protection pipe.
- Fit the cables after providing protection sheet.

3.10 पिनियन की असेम्बली / ASSEMBLY OF PINION

- Clean the conical shaft of the pinion and bore hole of the rotor shaft carefully.
- Insert the conical shaft of the pinion into the bore hole of the rotor shaft. Measure the distance a between the shaft and the end of the pinion.
- Apply glycerine on pinion shaft and inside bore hole of the rotor shaft.
- Insert the pinion shaft carefully into the bore hole of the rotor shaft by applying slight pressure.
- Position the pressure bearing.
- Locate and secure special screw into the rotor shaft.
- Fit the special plug for SKF pressure pump into the pinion shaft.

- Secure the wooden lever against the pinion turning clockwise.
- Tighten the special screw with preload.
- Increase the pressure of the pressure pump up to approximate 170- 190 MPa. Ensure that under no circumstances this pressure exceeds 200 MPa. At the same time tighten the special screw steadily until the pinion has come to its final position. Thereby a maximum torque of 600 Nm should be applied.
- Decrease the pump pressure and disconnect the special plug.

3.11 रन टेस्ट / RUN TEST

- Connect 3phase, 440V 50 Hz AC supply to the traction motor.
- Start the plant and increase the voltage gradually 0 – 100V for 5 minutes & measure the following:
 - i. Bearing noise at DE & NDE.
 - ii. Current in every phase by Tong tester.
- Increase the voltage gradually up to 400 volts & run the motor for 2 hrs.
- Measure and record the following:
 - i. Current in each phase
 - ii. Bearing noise at DE & NDE.
 - iii. Vibration
 - iv. Temperature rise at DE & NDE.
 - v. Speed in RPM.
- Ensure tightness of all bolts and screws with proper torque value as per torque table given below:



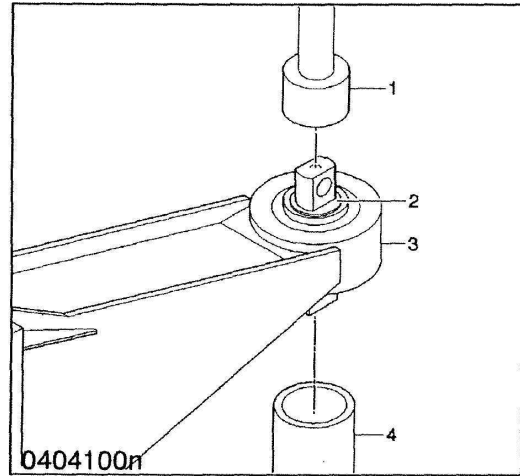
M6	-	9.5 Nm
M8	-	23 Nm
M10	-	46 Nm
M12	-	80 Nm
M14	-	125 Nm
M16	-	195 Nm
M18	-	270 Nm
M20	-	380 Nm

- Paint the traction motor with recommended quality of paint.

3.12 संस्थापना/ INSTALLATION

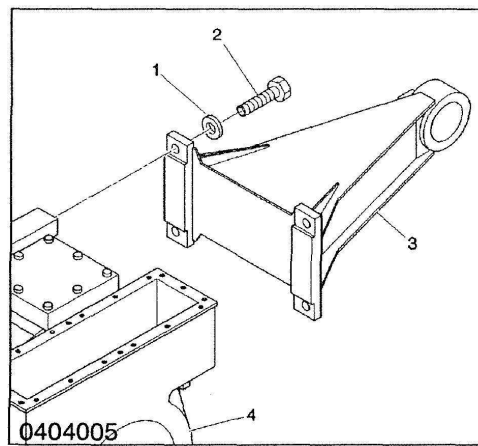
3.12.1 सर्पोट आर्म पर स्फेरीब्लॉक को लगाना / Assembly of Spheriblock on Support Arm

- Provide the new spheriblock on support arm.
- Apply a thin film of machine oil to the spheriblock collar.
- Position the support arm (3) in a suitable press (1, 4).
- Support the eye using a suitable steel tube (4). Ensure the tube (4) will not interfere with the spheriblock (2) during installation.
- Position a suitable mandrel (1), slightly smaller than the outer diameter of the collar, over the spheriblock (2). Check that the mandrel (1) is square with the yoke on the press and contacts around the entire perimeter of the spheriblock collar.
- Ensure the spheriblock (2) is square with the eye before pressing.
- Press the spheri-block (2) into the eye until the face is flush.

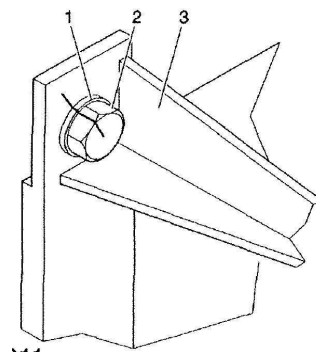


3.12.2 ट्रैक्शन मोटर पर सर्पोट आर्म को लगाना / Mounting of Support Arm on Traction Motor

- Position the support arm (3) onto the traction motor (4) using suitable lifting equipment.
- Align the holes in the support arm (3) and traction motor (4), then install the four bolts (2) with washers (1) through the arm (3) into the traction motor (4). Tighten the bolts (2).

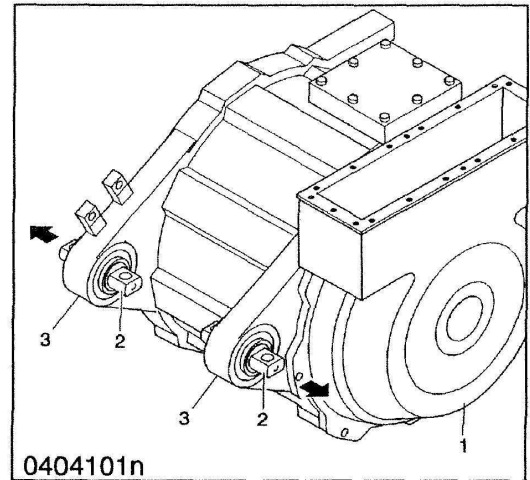


- Match mark the bolts (2) and washers (1) to the support arm (3) using a felt tipped pen. This will aid in identifying if the bolts (2) are becoming loose in service.



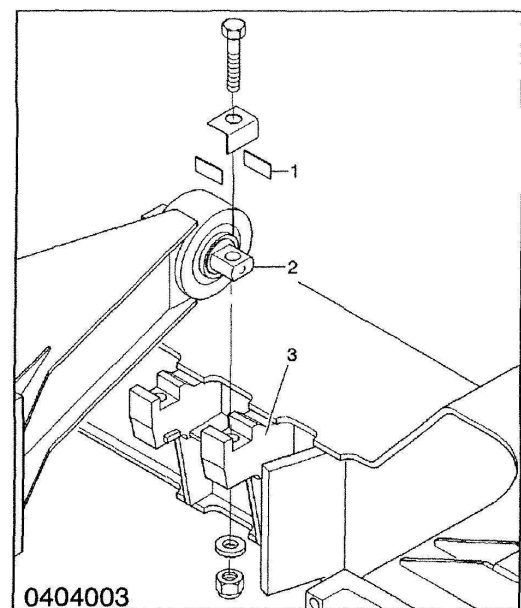
3.12.3 ट्रैक्शन मोटर पर स्फेरीब्लॉक को लगाना / Assembly of Spheriblocks on Traction Motor

- Provide the new Spheriblock on traction motor mounts.
- Apply a thin film of machine oil, or other suitable lubricant, to the Spheriblock collar.
- The Spheriblocks are to be pressed into place from the inside of the mounts, as indicated by the arrows.
- Position the Spheriblocks in place between the mounts (3).
- Position a suitable press or jack between the mounting lugs (3) on the traction motor (1).
- Ensure the Spheri-block (2) is square with the eye before pressing.
- With a suitable mandrel positioned on the Spheri-block (2), press the Spheriblock (2) into the eye on the traction motor mounts (3) until the face is flush.

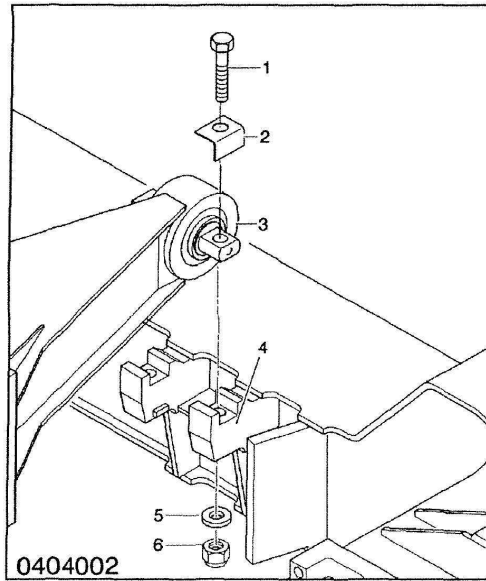


3.12.4 बोगी पर ट्रैक्शन मोटर को लगाना / Installation of Traction Motor on Bogie

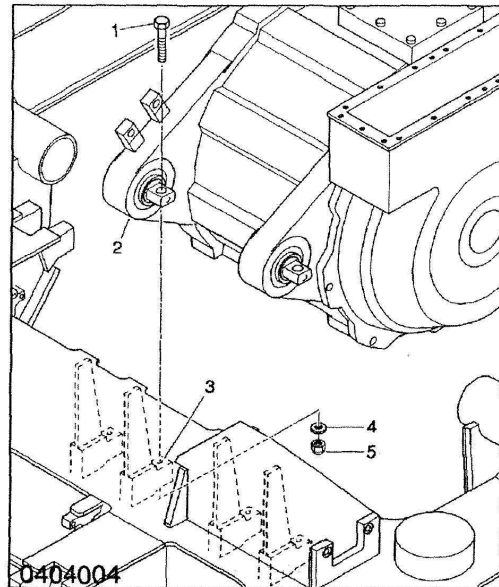
- Raise the traction motor into position above the bogie.
- Ensure that nothing will become entangled during installation and then lower the traction motor into position. Ensure the cross-pins do not catch on the mounting lugs.
- Install an even amount of compensating plates (1) on each side of the support arm cross pin (2).
- Ensure there is no free movement between the cross-pin (2) and mounting lug (3). The edge of the compensating plates (1) must be flush with the end of the cross pin (2).



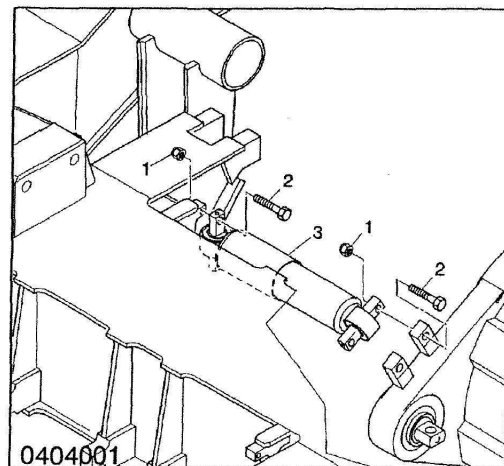
- Align holes in the Spheriblock cross-pin (3) with those in the bogie frame (4).
- Install the bolts (1) and locking plate (2) through the cross-pin (3) and mounting lug (4). The end of the locking plate (2) is used to retain the compensating plates.
- Install the washers (5) and lock nuts (6) and tighten finger tight.



- Align the holes in the traction motor spheriblock cross-pins and the mounting lugs (3) on the bogie frame.
- Install the bolts (1) through the cross-pins and mounting lugs (3).
- Install the washers (4) and lock nuts (5) then tighten the nuts (5) finger tight.
- Check the alignment of the traction motor and gear box. The Spheriblock must be centralised in the lugs and clear the bump stops by at least 17mm.
- Tighten the nuts on the support arm and centre transom mounting cross-pin.
- Connect the drive coupling between the motor and gear box.
- Lower the traction motor so that all the weight of the traction motor is supported by the bogie frame.

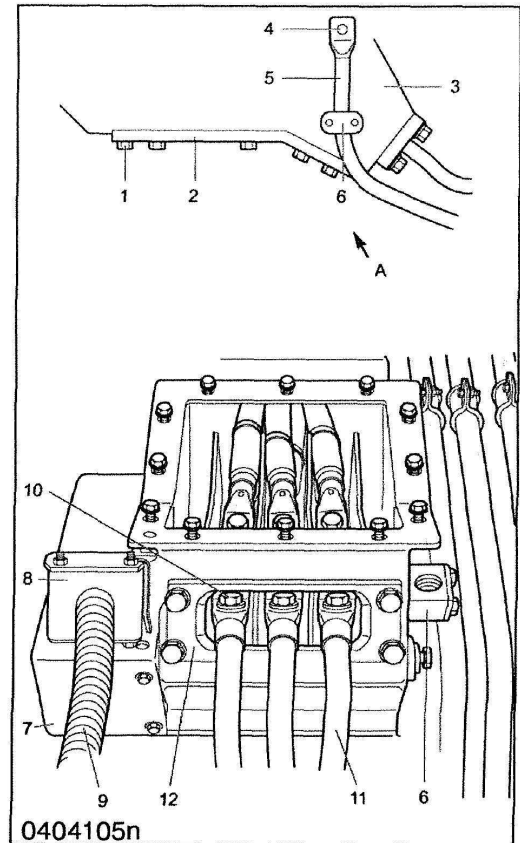


- Connect the traction motor damper (3) between the motor and bogie frame with bolts (2) and nuts (1).



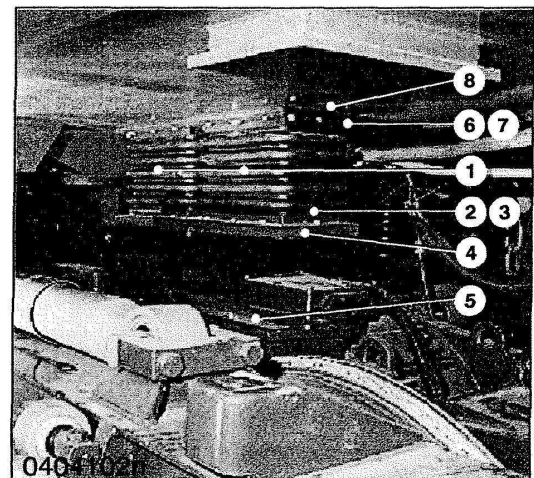
3.12.5 ट्रैक्शन मोटर केबिलों को लगाना / Traction Motor Cabling

- Insert the power cables (11) through the aperture in the junction box (3), and then secure the cable retaining plate (12) to the junction box (3)
- Attach the three power cable (11) tangs to the under frame junction box at the bolts (10).
- Install the junction box cover (2), then install the bolts (1) and tighten.
- Remove the outer half of the earth lead retaining clamp (6).
- Install the bolt (4) through the earth lead (5) tang and secure the tang to the under frame.
- Position the earth cable (5) in the clamp (6).
- Replace outer half of clamp (6) after cable (5) has been installed.
- Connect the three UIC plugs to the sockets, and then secure the signal cables (9) in the clamp (8).
- Install the access cover (7) beneath cable clamp (8) for the signal cables (9).



3.12.6 ट्रैक्शन मोटर बैलो को लगाना / Installation of Traction Motor Bellows

- Remove all dummy plates from the apertures on the traction motor.
- Install new bellows to the underside of the locomotive by means of bolts and washers (6, 7) to secure the upper bellows mounting frame (8) to the locomotive under frame.
- Install the bolts and washers (2, 3) to secure the lower bellows mounting frame (4) to the traction motor ventilation inlet duct (5).



1.	SECTION	:
2.	TYPE AND MAKE	:
3.	SR. No. OF TM & ROTOR	:
4.	LOCO NO.	:
5.	DATE OF O/H	:

Maintenance Handbook on 3 Phase Traction Motor of AC Electric Locomotives

Sr. No	ACTIVITY	STANDARD	ACTUAL
2.0	After dismantling of motor		
2.1	Check the insulation resistance between phase and earth with 2.5 kV megger as per formula $R_{ins} \geq U_n$ in M Ohms. Where, U_n =Rated voltage in kV (Reference manual F5).	2.18 M Ohm min	
2.2	Check visually the stator body, core and windings for any damage and flashing.	No damage No flash mark	
2.3	Check the tightness of each phase cable connection in terminal box.		
2.4	Check the insulation resistance between phase and earth with 2.5kV megger after Dry cleaning of stator as per formula $R_{ins} \geq C (U_n+1)$ in M Ohms. Where, $C=1$ for 6 FXA 7059 & $C = 2$ for 6FRA 6068. U_n =Rated voltage in kV (Reference manual F5).	6.36 M Ohm. min for 6FRA 6068 & 3.18 M Ohm. min for 6 FXA 7059	
2.5	Wash with recommended solvents or with hot water and recommended detergents.		
2.6	Check visually the winding for any damage after cleaning.	No damage	
2.7	Check the winding resistance between phases with Wheatstone bridge or multimeter at room temperature. a. Phase U and V b. Phase V and V c. Phase U and W	Record Record Record	
2.8	Measure the diameter at core portion (If any repairing is done for coils of stator)	380 mm for 6FRA 6068 510 mm for 6FXA 7059	
2.9	Bake the stator in oven at 120 deg C for 24 hrs. Check the winding resistance between phases with Wheatstone bridge or multimeter at 120 deg C. a. Phase U and V b. Phase V and W c. Phase U and W	Done Record Record Record	

Sr. No	ACTIVITY	STANDARD	ACTUAL
2.10	After baking of stator, do varnishing with SI 620 resin varnish and allow drying in air for minimum 12 hrs at room temperature.	Done	
2.11	Check the insulation resistance between phase & earth after baking and varnishing with 2.5 kV megger as per formula $R_{ins} \geq X (U_n+1)$ in M Ohms. Where, $X=10$ for 6 FXA 7059 & $C = 20$ for 6FRA 6068. U_n =Rated voltage in kV (Reference manual F5).	63.6 M Ohm. min for 6FRA 6068 & 31.8 M Ohm min for 6FXA 7059	
2.12	Check the following for any damage: a. Pulse generator ring b. Pulse pick up unit and speed sensors c. Couplers of speed and temperature sensors d. Cables of speed and temperature sensors	No damage No damage No damage No damage	
2.13	Check the resistances of speed and temperature sensors at room temperature a. Speed sensor 93.2A between <div style="text-align: right;">Terminals AB Terminals CD</div> b. Speed sensor 93.2B between <div style="text-align: right;">Terminals AB Terminals CD</div> c. Temperature sensor 98A between <div style="text-align: right;">Terminals AB Terminals CD</div>	Record Record Record	
2.14	Spheriblock details a. Condition of spheriblock i. DE ii. NDE b. Spheriblock housing Dia. i. DE ii. NDE c. Spheriblock outer Dia. i. DE ii. NDE		
3.0	Rotor		
3.1	Clean the Rotor	Cleaned.	
3.2	a. Check the condition of rotor bars b. Check the condition of inner racers of DE and NDE side for any pitting marks c. Check the condition of rotor stamping for any deformation, crack, looseness, overheating mark etc.	No damage No pitting marks. No deformation crack/looseness over heating	

Sr. No	ACTIVITY	STANDARD	ACTUAL
3.3	Ultrasonic testing of Rotor shaft	No crack	
3.4	Perform Grawler testing of rotor to detect crackness of rotor bars	No crack	
3.5	Bake the rotor in oven at 120 deg C for 24 hrs.	Done.	
3.6	After baking of rotor, do varnishing with SI 620 resin varnish and allow drying in air for minimum 12 hrs at room temperature.	Done.	
3.7	Measure the diameter of rotor (if repaired).	Record	
3.8	Shaft diameter of bearing seat i. DE side ii. NDE side		
3.9	Dynamic balancing of rotor	Done	
3.10	New Bearing details Make and number i. DE side ii. NDE side		
3.12	Diameter of end shield bearing housing i. DE side ii. NDE side		
3.13	Diametric clearances of bearing a. Before fitting i. DE side ii. NDE side b. After fitting i. DE side ii. NDE side	0.11 - 0.19 mm 0.11 - 0.19 mm 0.06 - 0.11 mm 0.06 - 0.11 mm	
3.14	Axial clearance of bearing after assembly.	0.18 mm to 0.3 mm	
3.15	Replace traction motor end plate 'O' ring and terminal box gasket.		
4.0	Pinion		
4.1	No. of pinion teeth		
4.2	Sr .No. of pinion		

Sr. No	ACTIVITY	STANDARD	ACTUAL
5.0	Hurth coupling		
5.1	Check the condition of hurth coupling for pitting and chipping	Good No pitting & chipping mark	
5.2	Check the advancement of hurth coupling	9.4 to 11.6mm	
5.3	Check the distance between shaft face & Hurth coupling face.	0.5 to 1.5	
5.4	Replace the membrane	Must change.	
6.0	Testing of traction motor		
6.1	<p>Run the motor by gradually raising voltage to 400 V AC for 2 Hrs. then measure & record the following</p> <p>a. Current in phase U</p> <p>b. Current in phase V</p> <p>c. Current in phase W</p> <p>d. Bearing noise</p> <p style="text-align: right;">DE side</p> <p style="text-align: right;">NDE side</p> <p>e. Vibration</p> <p>f. Record the room temperature</p> <p>g. Check & record the bearing temperature on End shield</p> <p style="text-align: right;">DE side</p> <p style="text-align: right;">NDE side</p> <p>h. Speed in rpm</p>	<p>20 dB max.</p> <p>20 dB max.</p> <p>No vibration</p>	
6.2	<p>Ensure tightness of all bolts and screws with proper torque value as per torque table in manual F5 (For property class 8.8 steel screws/bolts)</p> <p>M6 - 9.5 Nm</p> <p>M8 - 23 Nm</p> <p>M10 - 46 Nm</p> <p>M12 - 80 Nm</p> <p>M14 - 125 Nm</p> <p>M16 - 195 Nm</p> <p>M18 - 270 Nm</p> <p>M20 - 380 Nm</p>		

3.14 सफाई एजेंट / CLEANING AGENTS

Only cleaning agents free from Halogens may be used to clean the traction motors. To prevent deterioration of silicone rubber components in the traction motor, the hydrocarbon content of any cleaning solvents must not exceed 30%.

3.14.1 उचित सॉल्वेन्ट / Permissible Solvents

Solvents suitable for use on traction motors include white spirits, turpentine and Xylol. The products listed below, along with their manufacturer, are also admissible solvents.

- | | | |
|---------------------------|---|-----------------------|
| • Impag, Zurich | - | Turpentine substitute |
| • Hauser Wädenswil | - | Turpentine substitute |
| • F. Steinfels AG, Zurich | - | Air Ro 17-05 |
| • Shell | - | Crystal oil 30 |
| • Shell | - | Aromat 45* |
| • Esso | - | Varsol |
| • BP | - | White spirit* |
| • Mobil Oil | - | White spirit |
| • Chevron | - | White spirit* |
| • Valvoline | - | White spirit |
| • Castrol | - | White spirit |

* Not to be used for cleaning silicone rubber coverings

3.14.2 उचित सफाई एजेंट / Permissible Cleaning Agents

The following products may be used for washing and rinsing when cleaning the traction motor. W indicates washing, R indicates rinsing

Manufacturer	Trade name	Proportions
Henkel & Co. AG CH-4133 Pratte)n	W: P3-KF special R: P3-t225 W: P3-Saxin R: P3-VR-740-N-20	6.5 kg/m ³ water 7.5 kg/ m ³ water 25 kg/ m ³ water 5 kg/ m ³ water
Fa.Cetema Ijsselstraat 41 NL-Oss Postbus 19	Cetemal	10 kg/ m ³ water

3.15 उचित स्नेहक ग्रीस/ **ADMISSIBLE LUBRICATING GREASES**

The following greases are recommended for the roller bearings in traction motors. Suitable greases of the lithium and mineral oil type are listed below. Only one brand of grease should be used to lubricate the traction motor bearings.

- Esso Beacon EP2
- SKFLGMT2
- SKFLGEP2
- Mobilgrease 22
- Mobilux EP2
- Optimol Longtime PD2
- Exxon Ronex MP
- Exxon Unirex EP2
- Exxon Unirex N2
- Exxon Lidok EP2
- BP Energrease LS-EP2
- Shell Calithia EPT2

Suitable greases of the synthetic basic oil type are listed below. Different brands and types of synthetic greases must not be mixed.

- KIUber Isoflex Topas Li 52
- KIUber Isoflex Topas NCA52

Synthetic and lithium/ mineral oil based greases must not be mixed.

3.16 ट्रैक्शन मोटर के लिये विशिष्ट औजार/ **SPECIAL TOOLS FOR TRACTION MOTOR**

1. Tool for WAG9/ WAP7 pinion mounting & extraction with high pressure (2500 bar) pump and jack.
2. Induction Heater (40kVA) for different sizes of bearing racers & labyrinth rings for traction motor (cylindrical roller bearing NU2236E/ C4, NJ320, HJ320 & NU224, NJ219, HJ219).
3. Pinion push-pull rod.
4. Ring Gauge
5. Shaft Gauge (plug gauge)
6. 'L' nozzle set
7. Nozzle
8. Filler Gauge (0.5 mm to 10 mm)
9. Disc Micrometer (75 mm to 100 mm)
10. Lifting Chain (04 hooks)

3.17 अनिवार्य रूप से बदलने वाले सामान की सूची LIST OF MUST CHANGE ITEMS (As per RDSO letter No. EL/3.1.35/ 16 dt 30.03.2007)

3.17.1 स्फेरीब्लॉक / Spheriblock

SN	DESCRIPTION	IOH	POH
1.	The Spheriblocks of the axle guide rod, gear case support arm, TM & TM support arm (WAP5).	√	√
2.	The Spheriblocks of the axle guide rod and TM support arm (WAP7/ WAG9).	√	√
3.	Spheriblocks of all types of dampers.	X	√

3.17.2 ट्रैक्शन मोटर / Traction Motor

SN	DESCRIPTION	IOH	POH
1.	Traction motor bearing (DE + NDE) along with Outer/inner labyrinth pins and accessories.	√	√
2.	Suspension tube bearing.	X	√
3.	Bull gear (WAG9/WAG9H/WAP7)	X	√
4.	TM pinion (WAG9/ WAG9H)	√	√
5.	TM pinion (WAP7).	√	√
6.	End plate “O” Rings & the gaskets on the terminal box of traction motor.	√	√
7.	TM bellows.	√	√
8.	Gasket of temperature sensor cover.	√	√
9.	The helical inserts of Junction box of TM.	X	√

संदर्भ

1. एबीबी (ABB) द्वारा जारी श्री फेज ट्रैक्शन मोटर प्रकार 6 एफआरए 6068 का अनुरक्षण एवं आपरेशन मैनुअल।
2. आरडीएसओ का पत्र सं. ईएल/3.1.35/16 दिनांक 30.03.2007 के तहत श्री फेज इलेक्ट्रिक लोकोमोटिव के अनुरक्षण शैड्यूल पर जारी रिपोर्ट।
3. ईरीन जर्नल सं. वॉल्यूम 13 सं. 3 जुलाई-सितम्बर 2003
4. विभिन्न विद्युत लोकोशेड/कार्यशालाओं का क्षेत्र अध्ययन एवं वहाँ से एकत्र सामग्री।
5. इरकैमटेक ग्वालियर में दिनांक 10/11 सितम्बर 2009 को आयोजित सेमीनार में विभिन्न रेलों से आये हुये प्रतिनिधियों द्वारा दिया गया प्रस्तुतीकरण।

REFERENCES

1. ABB Operating Instructions and Maintenance Manual of 3 Phase Traction Motor type 6 FRA 6068.
2. Report issued by RDSO vide letter No. EL/ 3.1.35/ 16 dt 30.03.2007 on Maintenance Schedule for 3 phase Electric Locomotive.
3. IRIEEN Journal Vol.13 No. 3 July – Sept. 2003
4. Field study and Literature collected from various electric loco sheds/ workshops.
5. Presentations given by participants from various Railways during seminar conducted on 10-11 Sep 2009 at IRCAMTECH/ Gwalior.

हमारा उद्देश्य

अनुरक्षण प्रौद्योगिकी और कार्यप्रणाली का उन्नयन करना तथा उत्पादकता और रेलवे की परिसम्पत्ति एवं जनशक्ति के निष्पादन में सुधार करना जिससे अन्तर्विषयों में विश्वसनीयता, उपलब्धता, उपयोगिता और दक्षता प्राप्त की जा सके।

यदि आप इस संदर्भ में कोई विचार और विशेष सुझाव देना चाहते हों तो कृपया हमें इस पते पर लिखें।

सम्पर्क सूत्र : निदेशक (विद्युत)

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OUR OBJECTIVE

To upgrade maintenance technologies and methodologies and achieve improvement in productivity, performance of all Railway assets and manpower which inter-alia would cover reliability, availability, utilisation and efficiency.

If you have any suggestions and any specific Comments please write to us.

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