



MAINTENANCE HANDBOOK OF 3-PHASE TRACTION MOTOR OF AC ELECTRIC LOCOMOTIVES

TARGET GROUP	TRS MAINTENANCE STAFF
OBJECTIVE	MAKING MAINTENANCE PERSONNEL AWARE OF CORRECT MAINTENANCE & OVERHAUL TECHNIQUES TO BE ADOPTED IN THE FIELD
VERSION	1.0
DATE	10 MARCH 2018

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 with the objective of making the maintenance personnel aware of correct maintenance and overhaul techniques to be adopted in field.

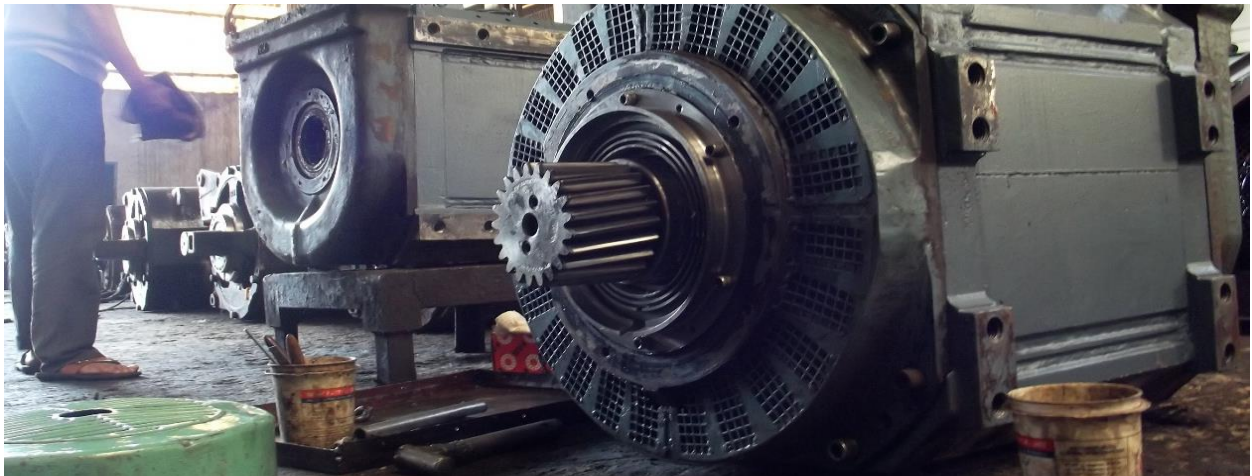
The handbook is for guidance only and it is not a statutory document.





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TECHNICAL DATA

S. No.	PARAMETERS	WAG9/WAP7	WAP5
1.	Make	CLW	CLW
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 rmp	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)



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



INSPECTION AND TESTING PROFORMA FOR OVERHAULING OF THREE PHASE TRACTION MOTOR 6 FXA 7059 / 6 FRA 6068

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

Sr. No	ACTIVITY	STANDARD	ACTUAL
	Frame No.		
	Rotor No.		
	Hurth Coupling No.		
	Pinion No.		
1.0	INCOMING TEST		
1.1	Check the insulation resistance between phase and earth with 2.5 kV megger as per formula $R_{ins} \geq \frac{Un}{1000}$ in M Ohms. Where, Un =Rated voltage in kV (Reference manual F5)	2.18 M Ohm min	
1.2	Continuity test between phase to phase with 500V megger a. Phase U &V b. Phase V & W c. Phase U &W	OK	



Sr. No	ACTIVITY	STANDARD	ACTUAL
1.3	<p>Run the motor by raising voltage gradually to 400 V AC for 2 Hrs. then measure & record the following</p> <p>a. Current in phase U b. Current in phase V c. Current in phase W d. Bearing noise</p> <p style="text-align: right;">DE side NDE side</p> <p>e. Vibration f. Record the room temperature g. Check & record the bearing temperature on End Shield</p> <p style="text-align: right;">DE side NDE side</p> <p>h. Temperature rise i. Speed in rpm j. Check the distance between shaft face and pinion teeth back face (Advancement)</p>	<p>20 dB max 20 dB max No vibration</p> <p>0.5 mm to 1.5 mm</p>	
2.0	AFTER DISMANTLING OF MOTOR		
2.1	<p>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).</p>	2.18 M Ohm min	
2.2	<p>Check visually the stator body, core and windings for any damage and flashing.</p>	<p>No damage No flash mark</p>	
2.3	<p>Check the tightness of each phase cable connection in terminal box.</p>		



Sr. No	ACTIVITY	STANDARD	ACTUAL
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 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
2.14	Spheriblock details a. Condition of Spheriblock i. DE ii. NDE b. Spheriblock housing Dia. i. DE ii. NDE c. Spheriblock housing 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	
3.3	Ultrasonic testing of Rotor shaft	No crack	
3.4	Perform Growler testing of rotor to detect cracks of rotor bars	No crack	
3.5	Bake the rotor in oven at 120 degree Centigrade 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		
Sr. No	ACTIVITY	STANDARD	ACTUAL
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		
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 11.6 mm	
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	Run the motor by gradually raising voltage to 400 V AC for 2 Hrs. then measure & record the following a. Current in phase U b. Current in phase V		



	c. Current in phase W d. Bearing noise DE side NDE side e. Vibration f. Record the room temperature g. Check & record the bearing	20 dB max. 20 dB max. No vibration	
Sr. No	ACTIVITY	STANDARD	ACTUAL
	temperature on End shield DE side NDE side h. Speed in rpm		
6.2	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) 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		

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%.

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

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 Pattern	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



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.

KlUber Isoflex Topas Li 52
KiUber Isoflex Topas NCA52

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

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)



LIST OF MUST CHANGE ITEMS

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	√

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	√