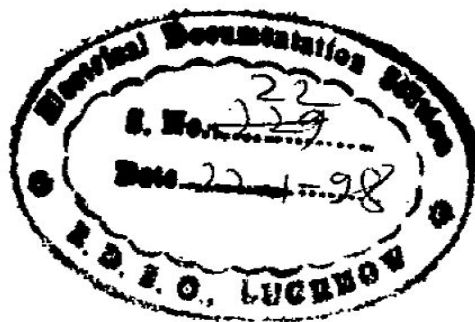


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Tech. Specification No 7/20.



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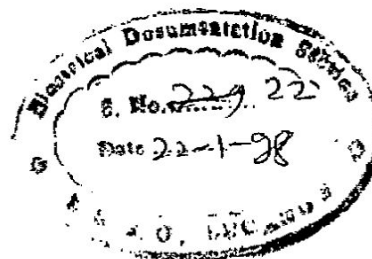
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TECHNICAL SPECIFICATION FOR TRACTION MOTOR  
TYPE TAO-659 ALONG WITH ROLLER SUSPENSION  
BEARING ASSEMBLY AND GEAR CASE FOR 25 KV  
AC BG CO-CO LOCOMOTIVE FOR INDIAN RAILWAYS



SEPTEMBER - 1997

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ISSUED BY

RESEARCH DESIGNS & STANDARDS ORGANISATION.

MANAK NAGAR. LUCKNOW - 226 011.

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E-7/20

TECHNICAL SPECIFICATION FOR TRACTION MOTOR TYPE TAO-659  
ALONGWITH ROLLER SUSPENSION BEARING ASSEMBLY AND GEAR  
CASE FOR 25 KV AC BG CO-CO LOCOMOTIVES FOR INDIAN RAILWAYS.

CHAPTER 1

1.1.0 Scope

1.1.1 The traction motor shall be supplied complete with earthing brush with holder, roller suspension bearings and suspension tube assembly & gear case (modified) alongwith any other accessories that may be required for its correct assembly and commissioning as well as reliability and maintainability on the locomotive. Pinion is not supplied with the traction motor.

1.1.2 Any deviation from this specification, incorporated by the tenderer to improve the performance, durability, reliability and maintainability of the equipment or to reduce its cost significantly, may be favourably considered provided full particulars of the anticipated benefits alongwith technical data supported by drawings calculations are furnished in the tender offer.

1.2.0 SCHEDULE OF PARTICULARS, DRAWINGS AND AS MADE TRACINGS

1.2.1 The tenderer shall furnish all relevant design data for pulsating DC and calculations, technical specifications, test results and relevant equipment drawings, and descriptive write-ups etc. necessary for correct appreciation of the offer. The technical data and particulars shall be generally in line with the proforma of Annexure C.

1.2.2 In case of deviation from this specification, the successful tenderer shall prepare and submit to the purchaser complete working drawings of components/Sub assembly in duplicate for scrutiny and approval of purchaser, before taking up manufacture of the component.

1.3.0 TESTING, COMMISSIONING AND PROTOTYPE TRIALS

1.4.1 The traction motor and its accessories covered by this specification shall be subjected to type/endurance and routine tests at the manufacturer's works before shipment/despatch, in the presence of purchaser's representative as per the test programme enclosed at Annexure 8.

1.4.2 The prototype motors after tests will be first despatched to examine their correct fitment on the bogies of existing locomotives and any modification.

tions if required will be checked up and carried out accordingly at site.

1.4.3 These prototype motors will be subjected to service trials for a period of three months or less as deemed necessary by the purchaser to prove the design, equipment performance, maintainability and reliability. All modifications found necessary based on these limited service trials to improve upon the motor design and physical construction and as mutually agreed shall be incorporated in the prototype motors and in the series supplies of the equipment at the cost of the supplier and in the manner approved by the purchaser. The service trials shall generally cover the following.

- i) Observations on the mechanical and electrical conditions of the equipment including wear & tear when subjected to practical working conditions and in service.
- ii) Overall reliability and maintainability aspects.

1.4.4 The detailed scheme of prototype trials to satisfy the above, shall be indicated by the supplier and mutually finalised in consultation with the purchaser. Special instrumentation, if any for correct appreciation of the various data will have to be arranged by the tenderer.

1.4.5 The above tests may, at the discretion of the purchaser, be reduced in scope in case of motors proved under local conditions of service.



## CHAPTER II

### OPERATION REQUIREMENTS & SERVICE CONDITIONS

- 2.1.0 GENERAL : The general services conditions and particulars of the system have been indicated in general governing specifications. In addition, for the traction motor in particular, the following are applicable.
- 2.1.1 Flood Proofing: The traction motor and gear case etc. shall be designed to permit propulsion of the locomotive at 10 Km/h through water upto a height of 200 mm above rail level. Further, the traction motor will be made completely water proof to a standing water depth of 300 mm above rail level.
- 2.1.2 The motor shall be designed for operation with pulsating current (rectified single phase alternating current) with a ripple factor of about 30%. The ripple factor is given by the formula:
- $$\frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}} \times 100\%$$
- 2.1.3 The motor shall be of axle-hung nose-suspended, series - excited, forced ventilated type for use in electric locomotive.
- 2.1.4 The general temperature of the cooling air at the inlet of the traction motor shall be 55 degree C maximum, with relative humidity varying upto 100% saturation.
- 2.1.5 The diameter of the wheel when new is 1092 mm and when worn fully is 1016 mm.
- 2.1.6 The axle load of the locomotive is 19.8 tonnes. However, the mechanical design of the motor shall suit maximum axle loads upto 22 t.
- 2.1.7 The maximum service speed of the locomotives on which these motors may be used is 160 Km/h. The overspeed test of motor shall be carried out at 1.35 times of its maximum service speed.
- 2.1.8 The weight of motor complete with pinion, gear and gearcase shall not exceed 2800 Kg.
- 2.1.9 Minimum clearance from the rail level to bottom of traction motor/gear case shall be 102 mm under fully worn wheel diameter.

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## 2.2.0 DIMENSIONS AND FITMENT OF BOGIE

2.2.1 The motor shall be designed to fit the present 3-axle trimount bogie used on locomotives. RDSO drawing No. SK.EL 3861 and 3862 gives the details of bogie and space available for mounting the traction motor. The traction motor nose is fitted with 11% to 14% manganese steel liners on both the upper and lower lugs. The detailed drawings of fitment of traction motor offered to the bogie shall be furnished. Drawing No. SK.EL.3863 shows the details of wheel and axle assembly. The two end axles of the bogie have a maximum lateral movement of 6 mm in each direction and the middle axle has a maximum lateral movement of 16 mm in each direction.

## 2.3.0 INTERCHANGEABILITY:

2.3.1 The motor offered shall work with the traction equipment, as available on the existing locomotive satisfactorily without any reduction in performance.

2.3.2 The motor is to be mounted on the existing bogie, the drawing of which is enclosed. The gear ratio and also the pinion and gear should be kept the same as existing, or as per requirement of Rlys. Modified axle machining drawing should be furnished by the tenderers.

2.3.3 Electrical characteristics of the new motor will match those of the existing motor (RDSO/GEL/1064 ).

2.3.4 The tenderer may, however, offer an alternative of a better economical design which would fit in the existing locomotive to give the required electrical characteristics and to meet the same or better operating performance. However, the design should be based on an existing working traction motor proved in service without major electrical or mechanical modification.

2.3.5 The terminal box and terminal arrangement for the traction motor shall conform to RDSO drg. No. SKEL-4413 and 4414. The sequence of terminals shall be E, F, A & H from CE side.

MP connection shall be at PE side and compole connection at CE side, MP coils terminals can be connected with each other by solid copper bar and their terminal connections should be with 150

Fluonlex cable or equivalent 1500 V cable while coils should necessarily be connected using 150  $\text{mm}^2$  fluonlex cables or equivalent 1500 V cable.

- 2.3.6 Rocker Ring interconnections shall be done with the help of 80  $\text{mm}^2$ , 1500 V fluonlex or equivalent 1500V cable and not by solid copper rod.

TABLE

clearance and creepage distance

Voltage of equipment (V)	Air clearance (mm)		Creepage distance (mm)	
	Clean	Dirty	Clean	Dirty
750V	13	38	19	51
1500V	19	51	38	70
25000V	140	140	203	380

- 3.2.3 The motor has to operate on 2S-3P, 3S-2P or 6P combination and shall be designed to withstand 1800 volts minimum.
- 3.2.4 Terminals shall be such that they cannot turn or be displaced when the connecting screws/bolts are tightened and are such that the conductors cannot become displaced.
- 3.2.5 No contact pressure shall be transmitted through insulating materials and the gripping of the conductors shall normally take place between metal surfaces.
- 3.3.0 GENERAL - MECHANICAL
- 3.3.1 Standard metric hardware shall be used.
- 3.3.2 All nuts and screws/bolts shall be securely locked and shall not loosen in service due to the excessive vibration to be met in service.
- 3.3.3 All components including bolts, nuts, washers and screws etc. shall be suitably protected against corrosion and rust.
- 3.3.4 At locations such as gear case suspension, suspension bearing scrap fixture, end shield fixations, nose suspension sandwich block fitment etc. adequate material should be available or suitable anti-wear replaceable bushes should be used to either minimise wear or permit future building up for restoring these surfaces or replacement of the bushes etc. High tensile fasteners as per IS:1367 class 10.9 from M/s Unbrako/LPS should be used.

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3.3.5 Whenever welding is done, the welded portion will be finally ground-off to give a smooth finish and to remove the notch effect at the toes of the welds. Fillet welds as far as possible should be avoided and butt welding should be preferred.

3.3.6 Adequate provision shall be included in the design to ensure that the motor does not fall on the track, in the event of failure of the sandwich mounting arrangement.

3.3.7 Armature head should be forged type.

3.3.8 Armature shaft shall be without set ring groove as per RDSO drawing No. SKEL 4415 and corresponding armature sleeve as per RDSO drawing No. SKEL 4416.

#### 3.4.0 GENERAL - MISCELLANEOUS

3.4.1 In the design, the manufacturer shall avoid introduction of parts/components which would have only slight differences in size and capacity and shall endeavour to have minimum number of standards.

3.4.2 Corresponding components/parts of different motors supplied against this tender shall be fully interchangeable from motor to motor.

3.4.3 The number of parts requiring special attention and periodical inspection should be minimum and should be easily accessible and easy to handle.

3.4.4 In selecting the materials, the typical weather conditions prevailing in India shall be kept in view. In this regard, the manufacturer shall furnish full information regarding the suitability of selected materials under various climatic conditions given in chapter II. Necessary tests for ensuring suitability of materials shall be conducted by the manufacturer and the test results advised to the purchaser.

3.4.5 It shall be ensured by suitable design that failures of the parts caused by rain, atmospheric dust and metallic dust from the brake shoes etc. are avoided.

3.4.6 **Consumables:** All normal wearing and consumable items such as carbon brushes, roller bearing grease, bearings, lubricating oil and gear case compound etc. etc. shall be selected to the same grades/specifications as are already in use on the existing stocks on Indian Railways. Details of these will be furnished to the successful tenderer.

- 3.4.7. It must be ensured by the manufacturer that while manufacturing of traction motors all the modifications sheets and special Maintenance Instructions of PRDSO issued from time to time are implemented. (See Annexure 'D').

### 3.5.0 STANDARD SPECIFICATIONS, RATING, CURVES, CALCULATIONS :

- 3.5.1 Read with any deviations and additions mentioned in this specification, the motor in general shall comply with IEC 349. Following is the list of standards referred to in this specification.

IEC 50	: Definition terminology.
IEC 216	: Guide for the determination of thermal endurance properties of electrical insulating materials. Part I, II, III & IV.
IEC 349-1991	: Rules for rotating electrical machines for rail and road vehicles.
IEC 505 & its draft supplement	: Guide for the evaluation and identification of insulation systems of electrical equipment.
IEC 563	: Permissible limiting temperature in service for components of electrical equipment of traction vehicles.
IEC 165/1963	: Rules for the testing of electric rolling stock on completion of construction and before entry in to service.
IEC 356/1971	: Dimensions for commutators and slip rings.
IEEE-11	: American standard for rotating Electric machinery.
IEEE-304	: Test procedure for Evaluation and classification of insulation systems for direct current machines.

IEEE 429 : Test procedure for the evaluation of sealed insulation systems for AC Electric machinery employing form wound stator coils.

International Electro-Technical Commission.  
The Institute of Electrical & Electronics Engineers  
(An American National Standard)

3.5.2 The motor design shall be suitable for existing power and control circuits of the existing locomotive.

### 3.5.3 ELECTRICAL CHARACTERISTIC:

#### .1 Line Voltage

- System : 25 KV AC
- Nominal : 22.5 KV AC
- Maximum : 27.5 KV AC

#### .2 Motor Voltage

- Nominal : 750 V
- Maximum : 900 V

.3 Application : Pulsating current. 30% ripple factor.

.4 Ventilation : Forced cooled air flow 80m<sup>3</sup>/min at 20°C and static head of 150mm water gauge in commutator chamber.

#### .5 Class of Insulation

Armature : B or 200-Class

Main Pole : B or 200-Class

Com Pole : B or 200-Class

## 3.6 Rating

	Voltage	Amps.	PPM	KW
a) Continuous	750	840	1095	605
b) One hour	750	870	1070	605
c) Short-time rating.	1300A for 5 minutes and 1100Amp. for 10 minutes.			

3.7 Gear Ratio : 62/15 or 21/58 or as per requirement of Rly.

3.8 Traction motor : RDS0/GEL/1064  
characteristics  
curves including  
efficiency without  
gears.

3.9 Tractive effort at standard gear ratio (15/62).

- At maximum F.S. and cont. rated current. 4067 Kg.
- At minimum F.S. and Cont. rated current. 2503 Kg.
- At minimum field and max. service speed. 1095 Kg.

3.10 Tractive effort at gear ratio (21/58).

- At max. F.S. & continuous rated current 2718 Kg

3.11 Number of poles : Six

3.12 Field strength

- Maximum F.S. : 95% or suitable.
- Intermediate F.S. : 77%, 61% & 50% or suitable.
- Minimum F.S. : 42.8% or suitable.

## 3.5.4 SPEED:

3.5.4.1 The continuous rated speed shall be calculated with half worm wheels.

- 3.5.4.2 The maximum service speed shall correspond to a locomotive speed of 120 Km/h with gear ratio of 15/62 and 180 Km/h with gear ratio of 21/58. However, the maximum operating speed of locomotive is restricted to 160 Km/h.



### 3.5.5 VENTILATION:

1. It is proposed to use the existing blowers provided on the locomotive. The available quantity of cooling air is 270m<sup>3</sup>/min at 20°C for three traction motors. However, the static head of 150 mm W.G. should be maintained in the commutator chamber of each traction motor.

2. Air pressure switch is provided in the traction motor blower ducting to ensure that voltage can not be applied to the motors till sufficient pressure is built up. For emergency operation, short circuiting switch to by pass the switch is provided. The tenderer shall indicate the reduction of rating consequent upon failure of forced ventilation.

### 3.6.0 INSULATION SYSTEM:

3.6.1 The armature shall be vacuum-pressure impregnated with solventless resins suitable for class 'H' or 200 class, temp. rise limits as per clause 3.6.11 of specifications. Armature and field coils should be provided with suitable moisture impervious sealing insulation.

3.6.2 The field coils should be vacuum pressure impregnated using solventless resin of class-'H' or 200 class as in 3.6.1.

3.6.3 The maximum electric stress in the armature and field coils in service shall be well below the corona inception voltage.

3.6.4 The insulation system to be employed shall be particularly designed to withstand adverse environmental conditions. The materials comprising this system and the system itself shall have been proved to be of the highest reliability in traction application. Imperviousness to moisture will be an essential requirement.

3.6.5 The evaluation of the insulation system for thermal endurance shall be made with fabricated test models by way of accelerated ageing tests as per the test programme drawn up in accordance with the norms specified in IEC 505/1975, IEC 505 draft supplement and IEEE 304. The value of the proof voltage for dielectric test prescribed in IEEE 304 for determining the end point after each ageing cycle shall correspond to 83% of the dielectric test to voltage on new machine prescribed in IEC 348 (NOT 2E as laid down in IEEE 304).

3.6.6. Evaluation of insulation system for sealing against moisture shall be done in accordance with IEEE 429.

3.6.7. Various ageing parameters, such as heat, vibration, mechanical/compressive stresses, special environmental effects of humidity, dust, metallic dust from brake shoes etc. will be incorporated to simulate the actual working conditions as closely as possible.

3.6.8. The temperature at which an extrapolated life of 20,000 hours is obtained shall be treated as the thermal endurance limit (Temperature Index) of the insulation system.

3.6.9. The motor shall be designed such that the "hot spot" temperature under any condition of loading in any winding (armature or field) does not exceed the average temperature of that winding measurement by resistance method by more than  $15^{\circ}\text{C}$ .

3.6.10. Having regard to the system of insulation adopted and the environmental conditions, the manufacturer shall provide maximum possible margin in temperature rise, for prolonged life of the traction motors.

3.6.11. The temperature rise of traction motors during type/routine tests shall be limited to the following, it being clearly understood that no motor exceeds these limits:

i) Permissible temperature rise ...  $\text{TI}_a$  minus  $90^{\circ}\text{C}$   
- on armature windings by  
- resistance method.

ii) Permissible temperature rise on ...  $\text{TI}_f$  minus  $70^{\circ}\text{C}$   
- field windings by resistance  
- method.

iii) Permissible temperature rise ...  $85^{\circ}\text{C}$   
- on commutator.

Where  $\text{TI}_a$  is the established Temperature Index for the armature insulation system.

Where  $\text{TI}_f$  is the established Temperature Index for the field insulation system, as determined by tests as prescribed above.

3.6.12. The stipulation as per IS 349 duly modified by Clause 3.6.11 for determining the permissible temperature rise limits of series production of traction motors with reference to the first lot of prototype motor, shall also apply.

3.6.13 The temperature rise test shall be carried out on D.C. and P.C. supplies (R.F. 28-30%) as per the test programme duly approved by RDSO, Lucknow.

### 3.7.0 ARMATURE AND COMMUTATOR ASSEMBLY

#### 3.7.1 Reshafting and Assembling:

1. The armature and commutator assembly shall be so mounted on the armature shaft so as to facilitate reshafting, during maintenance, without disturbing the armature windings and commutator connections.

2. Similarly, it would be possible to remove and replace the commutator assembly from the shaft as a unit itself without disturbing the armature core etc.

3. To facilitate correct placement of armature core, the bearings and other parts on the shaft, a few built-in exact matching surfaces/parts between armature core and shaft may preferably be provided.

3.7.2 The armature - commutator assembly shall be dynamically balanced such that the residual unbalance is not more than 1.5 gramme metre.

3.7.3 Maximum number of ventilating ducts possible shall be provided.

#### 3.7.4 WINDING BEHIND COMMUTATOR RISER:

1. The armature windings portion immediately behind the commutator riser is very vulnerable to puncture and burning due to the various operating and ambient conditions and the peculiar layout of coils in this region.

2. Hence, special precautions shall be taken in the design of the winding, particularly for the 50 mm zone behind the commutator riser. Special insulation with high mechanical and electrical strength shall be provided particularly at the transition bend of the coils behind the riser.

3. Further, adequate steps must be taken to make sure that the winding insulation in this zone is not affected during the process of banding.

4. The insulation in this region of 50 mm behind the commutator riser would in any case be not less than 120% of the inter-turn puncture voltage in the slot portion.

3.7.5 Percentage equalisation shall not be less than 50%.  
Only rectangular Kapton covered conductor with 7/2 d  
lap of Kapton film of 1.5 mil thick shall be used for  
equaliser connections.

3.7.6 Slot wedge should be of epoxy glass fibre material.  
Its properties in terms of shearing strength, compressive  
strength, water absorption, resistance to flame  
will be furnished. The breaking strength of slot  
wedges will not appreciably change upto a temperature  
of 200°C.

3.7.7 Resi-glass banding shall be provided. Resi-glass tape  
of RDSO approved sources only shall be used and banding  
procedure may be submitted for approval. Polyglass  
tape should also meet RDSO Specn. No. SPEC/E-7/17 of  
Oct. 1994.

### 3.7.8 MATERIAL OF COMMUTATOR:

- 1 The commutator bar shall be silver bearing electrolytic copper.
- 2 Its silver and copper content shall be in the range of 0.06 - 0.12 and 99.9% (min) respectively.
- 3 Electrical conductivity at 20°C shall be 97% minimum.
- 4 The hardness value of a test piece of the commutator bar, after heating for one hour at 300 ± 15 degree C and then cooling to room temperature, shall be 105 HV (20)
- 5 The bar shall be finished by cold drawing or cold rolling process.

### 3.7.9 COMMUTATOR CONSTRUCTION:

- 1 The commutator shall be of arch bound construction.
- 2 Tolerances on dimensions shall be as per IEC 356/1991.
- 3 The commutator shall have a safe wearing depth of 8 mm minimum, measured radially on the radius, to allow for a sufficient number of resurfacing operations.

### 3.7.10 COMMUTATOR MANUFACTURE:

The commutator manufacturing process shall include at the  
percentage of assembly and consolidation of copper segments  
and insulating separators an adequate number of static  
dynamic seasoning cycles comprising cold and hot  
tightening of assembly fixture before machining of  
V-grooves.

3.2 Complete details of commutator manufacture and the seasoning process shall be furnished.

3.3 If the commutator is purchased from outside agency other than CIW/BHEL, the process of manufacture, material of bars and segments and dynamic seasoning cycles details may be submitted for approval.

3.7.11 TIG welding of the conductor to commutator riser is necessary using automatic tig welding plant. The width of risers shall be preferably 17 mm.

3.7.12 Commutation sparking index as observed by the degree of sparking at the trailing edges of the brushes will not exceed one and half.

3.7.13 Exposed portion of V-ring shall be covered with PTFE ring and shall be heat shrunk fitted over Vee Cone insulation.

3.7.14 The commutator riser side shall be properly sealed to prevent ingress of dust and other foreign particles.

### 3.8.0 FIELD SYSTEM

3.8.1 The main pole and interpole coils shall be of fully insulated type. Instead of split coils, potted single coil design of field coils should be used and moulded with the pole core without using any spring or packing between pole core and coil.

3.8.2 The pole cores along with the field coils should be firmly held in position by pole fixation bolts and their inter-connectors shall be firmly held in position by C-clamps welded at suitable location on magnet frame to sustain against excessive vibrations.

3.8.3 The field intercoils and connections will be brazed with silver brazing rod and cuprum foil.

3.8.4 The welded C-clamps of inter-connections shall be provided with 100% higher special ground insulation with very high mechanical strength than that of field coils.

3.8.5 The main pole and interpole connectors shall be firmly supported by tying with self bonding silicon rubber tape and glass tape. Epoxy/nomex spacer shall be used between welded C-clamp and inter connectors.

3.9.0 PERMANENT FIELD DIVERTING RESISTANCE & SHUNTING RESISTANCE:

3.9.1 Details of existing resistances and inductive shunt are enclosed at Annexure 'A'.

3.10.0 BRUSH GEAR.

3.10.1 Brush holder will be of single piece construction and its material should be Aluminium bronze to IS:305-81 Gr. AB1 and manufactured by chill casting process. Alternatively, leaded gun metal casting to IS:1458, Class V can be used.

3.10.2 The brush box design shall be such that brushes are staggered to cover the entire working length of the commutator to avoid grooving.

3.10.3 Brushes shall be of the split type with single spring as per RDSO's Drg. No. EL.BS.002 (MDD) Alt.1..

3.10.4 Brush holder spring shall be spiral type. The spring pressure shall remain fairly constant over the entire wearing length of the brushes.

3.10.5 The design of the brush holder should be such that the brush box is close to the support and the spring anchor at the far end.

3.10.6 The brush holder insulating studs shall be made of glass bonded mica and to be provided with PTFE sleeves and should withstand a tensile strength of 6500 Kgs between inserts.

3.10.7 It shall be possible to remove and examine the brushes easily during inspections. Separate spring rests will be included to hold the spring in released position for attending to the brushes.

3.10.8 Carbon brushes will be of grades Morganite EG 105 (I) or EG 367 of Leicardone (imported) or equivalent as approved by RDSO, Lucknow from time to time.

3.11.0 SPARK GAP:

3.11.1 Adjustable spark gaps will be provided between the brush boxes and the brush holder revolving ring. The sparking studs will also be replaceable. The spark gap is to be adjusted as 10-2.5 mm.

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### 3.12.0 TERMINAL BOX:

3.12.1 The terminal connections of the motor, one each for the armature & interpole and two for the main fields, shall be brought up to a terminal box located on the stator frame. The terminal box shall be water proof and also designed to keep out dust and oil etc. The arrangements shall conform to RDSO drawing No. SKEL 4369.

3.12.2 The terminal support insulators shall be made of glass-bonded mica and shall be provided with PIFE sleeves. It shall withstand a tensile strength of 6500 Kgs & a torsional load of 45 Kgf-m between inserts.

3.12.3 The design of the fastening shall be such as to permit substantial tightening torque to enable adequate contact pressure between the terminals about 3 kg/cm<sup>2</sup> to be maintained. Suitable spring washers or bevelled washers shall be used to prevent loosening under vibrations.

3.12.4 The sizes of the internal and external cable terminals shall be liberally rated.

3.12.5 The cable layout shall be such as to prevent fraying of the insulation during operation and maintenance. The cleats, if any provided for such a purpose at the exit of the terminal box, shall be so designed as to have a positive grip over 50 mm length of the cable with the ends suitably chamfered to avoid any damage.

3.12.6 The terminal box cover will have a neoprene sheet affixed to its inside surface to act as a gasket and as an insulation.

### 3.13.0 EARTH-BRUSH ASSEMBLY:

3.13.1 An earthing brush assembly may be provided on the axle cap/suspension tube of traction motor assembly.

### MECHANICAL DESIGN ASPECTS:

### 3.14.0 GENERAL CONSTRUCTIONAL FEATURES

3.14.1 The motor shall be designed and manufactured to be fitted into the existing bogies of the locomotive, the details of which are shown in the drawings No. SKEL 3861 and 3862.

### 3.15.0 MOTOR WEIGHT

3.15.1 The total weight of the motor including pinion, gear, gearcase, axle support bearing shells and the axle bearing cap presently is 2600 Kg.



### 3.16.0 NOSE SUSPENSION:

3.16.1 Existing arrangement of the nose suspension is given vide drawing No. SKEI 3861.

3.16.2 The nose suspension to be provided in the motor herein specified will be accommodated within existing ~~slugs/brackets~~ provided on the bogie frame without any major changes or modification being made.

3.16.3 In general the bonded sandwich mounting shall consist of end mounted metallic plates, rubber pads and intermediate metallic plates.

3.16.4 Testing physical properties, e.g. shore hardness 'A', tensile strength, percentage elongation at break, percentage compression etc. will be furnished. The unit should have been subjected to accelerated ageing tests, low temperature test, compressive load deflection test, shear test and fatigue test etc.

3.16.5 New and condemning dimensions/condition of nose suspension components shall be specified.

3.16.6 Bonded sandwich mounting pad assembly may not be supplied along with the traction motor unless otherwise specified.

### 3.17.0 AXLE SUPPORT (SUSPENSION) BEARING :

3.17.1 Roller suspension bearing shall be adopted as per RD 0 drawing No. SKEI-4421. Taper roller bearings shall be adopted on PE & CE side. The taper roller bearings, suspension tube and associated accessories shall be supplied along with the traction motors. The detailed drawings and design of roller suspension assembly shall be approved by RDSO, Lucknow before adoption on traction motors.

### 3.18.0 MODIFIED GEAR CASE ASSEMBLY:

3.18.1 Modified gear case assembly to suit the roller suspension bearing arrangement shall be supplied along with traction motors.

### 3.19.0 ARMATURE BEARING:

3.19.1 The armature shall be mounted on anti-friction roller bearings of standard make and dimensions as per international standards.

3.19.2 The bearings shall have the basic life rating L-10, calculated vide ISO 281 recommendation, of at least 12 million kms (ISO - International Standards Organisation).



3.19.3 The roller bearings type NH-318 and NU-328 respectively for the commutator and pinion ends, both with 14 mm clearances - should be adopted for the motor.

3.19.4 Maximum permissible speed of the armature shall not exceed the catalogued limiting speed of the bearing. The rolling elements and greasing arrangement will be so designed that the working temperature of the bearings shall be well within the catalogue's limits under worst operating conditions.

3.19.5 The lubricant to be used shall be indigenously available.

3.19.6 An effective labyrinth arrangement will be provided so as to arrest any ingress of gear compound into the bearings from the pinion end side. Commutator end bearings shall be protected against ingress of dust and other foreign matter. In addition, a drain pocket will be incorporated in the housing of the pinion end suspension bearing, for collecting any traces of overflowed gear compound.

3.19.7 The sealing arrangement to be provided will be on similar lines. Moreover, the sealing design shall also ensure a greasing interval of 2 years.

#### 3.20.0 SHAFT:

3.20.1 Material used for the shaft shall be EN25 as per BS-970 or a superior quality of alloy steel.

3.20.2 The design of the shaft shall be such as to avoid sharp corners and any steep changes of cross-section.

Armature shaft without set-ring groove may be used as per manufacturer as per RDSO drawing No. SKEL 4415 corresponding armature sleeve as per drawing No. SKEL 4416.

3.20.3 Design of the shaft and of the bore of armature core shall be such as to permit reshafting without damage to core or windings.

3.20.4 The shaft surface shall be closely controlled especially at the bearings and the pinion seat locations. It shall be ground all over. High surface finish of 0.8 microns or less will be provided at least from these locations.

3.20.5 All the armature shaft before fitment should be ultrasonically tested as per the code of practice, issued by Metallurgical and Chemical Div. of RDSO, Lucknow to SMT of all Zonal Railways/Production Units.

3.25.0 MARKING/RATING PLATE:

3.25.1 Each motor shall be provided with a suitable rating plate giving usual information including the following:

- Manufacturer's name
- Type and serial number of motor
- Rated voltage
- Rated current
- Rated speed
- Insulation class
- Date of manufacture
- Rated Kw
- Minimum and Maximum Field Strength.
- Maximum current and its duration.
- Maximum service speed.
- Maximum voltage.

3.25.2 The rating plate shall be clearly visible when the motor is installed in position.

3.25.3 Identification numbers shall also be suitably stamped on non-interchangeable matched components to facilitate assembly and to prevent mixing up. Brush holder revolving ring is non-interchangeable and may be punched with same identification mark as that of motor.

3.26.0 If any parts/components of traction motor, gear case and suspension tube etc. are procured from sub-suppliers the QAP of the vendors may be submitted along with the list of the parts which are proposed to be procured from such vendors.

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# ANNEXURE-A

## PARTICULARS OF THE PERMANENT FIELD DIVERTER AND SHUNTING RESISTORS AND INDUCTIVE SHUNT PROVIDED FOR THE TRACTION MOTOR.

Permanent field diverter resistance	...	285 milli ohm
Shunting resistance :		
- 1st position	...	76.5 milli ohm
- 2nd position	...	46.4 milli ohm
- 3rd position	...	32.1 milli ohm
- 4th position	...	22.4 milli ohm
Inductive shunt resistance	...	.0023 ohm at 110°C
Smoothing Reactor :		
- Resistance	...	.00707 ohm at 110°C
- Inductance	...	5 mH

### NOTE :

The ohmic values of permanent field diverter and shunting resistors are at the operating temperature of the resistance corresponding to continuous rating of the motor.

163395

## TEST PROGRAMME FOR TRACTION MOTORS

S. No.	Nature of Test	IS: 349-1971 Clause	Type of Test
<hr/>			
1.	Preliminary checks :	-	Type & Routine
	a) Verification of direction of rotation.	-	-
	b) Verification of brush holder setting.	-	-
	c) Measurement of cold ovality of commutator.	-	-
	d) Measurement of resistance of individual windings.	-	-
	e) Measurement of Impedance.	-	-
	f) Calibration of ventilation.	With motor speed '0' & rated	Draw curves.
2.	Measurement & separation of no load losses - Determination of no load characteristic.	-	Type
3.	Temperature Rise Test :	27,35	-
	a) Continuous rating.	-	Type
	b) One hour rating	-	Type & Routine
	c) Other rating - at minimum field and low voltage rating P.C/D.C.	-	Type
4.	Over speed Test - Measurement of hot ovality.	36	Type & Routine.
5.	Starting Test	34	Type.
6.	Commutation Test P.C./D.C.	39	Type & Routine
7.	Interruption & Restoration Test	40	Type
8.	Dielectric Test	41	Type & Routine

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9. Characteristic curves P.C./D.C. 42 & Type & Routine  
at rated/low voltage rating. 43

10. Polarisation Index Spec 41

11. Tan Delta Test Special

TRACTION MOTOR TAO-6591. Continuous rating:

- Temperature rise	...	As per Specification
- Shaft output	...	585 kW
- R.P.M.	...	1060
- Volts	...	750
- Amps	...	840
- Max Voltage	...	900 Volts
- Max. service speed	...	2500 RPM
- Insulation	....	Class-H/Class 200
- Excitation		Series excitation.
- No. of Poles	...	Main : 6 Commutating : 6

2. Armature:

- Core	Out side/Inside diameters 500/140 mm
	Length : 390 mm

- Main Laminations - Grade No. B630 or CRNGO-M45-C4  
0.5 mm thick to IS-648.  
Alternatively, 0.5 mm thick  
CRNGO sheet as per DIN 46400 -  
1983, Grade V600 - 50A.

- End Laminations - Gr. No. 1120-1mm thick.  
Alternatively, 1 mm thick  
cold rolled carbon steel  
annealed sheet as per DIN  
1623-1983 or IS-513-1994.

- No. and dimensions of slots - 69 of 7.5 x 40.5 mm

- Winding - Lap - progressive

Note: Annexure-C is for the guidance to the designer and  
deviations may be permitted to improve the design.

- Throw of coils Slot 1 to 12
- Commutator pitch Segment 1 to 2
- No. of sections per slot 8
- No. of turns per section 1
- Conductor dimensions 2.8 x 8 mm (r = 0.8 mm)
- Conductor covered with 1 layer 2/3 lapped kapton film of 1.5 mil. thick.
- Max. dimensions of covered conductor 3.097 x 8.337 mm
- Slot Insulation:
  - Two and quarter turns of Kapton mica wrapper GE 77916 of 0.15 mm thick or equivalent
  - 1 layer 1/8 lapped 0.05 thick x 20 PTFE tape.
- Slot liner:
  - Nomex Grade 410 sheet of 4 mil. thick.
- Overhang:
  - 2 layers 1/2 lap of GMS lap, size 0.08 mm thick x 15 mm wide.
- Final Taping over complete coil :
  - 1 layer edge to edge of fibre glass tape, size 0.08 mm thick x 10 mm wide.
- Lead Insulation:
  - 1 layer 1/2 lap of Kapton adhesive tape size 0.065 mm thick x 10 mm wide.
  - 1 layer 1/2 lap of Nomex tape grade 410 size 2 mil thick x 10 mm wide.
  - 1 layer edge to edge of fibre glass tape size 0.08 mm thick x 10 mm wide.
- Interlayer varnish - SI 400
- Impregnation :
  - VPI with solventless Varnish FI 2005/500 EK or HEW 290 or GE 712 (Equivalent Rotomac RE-009).

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- Test Voltages:

As per Annexure C-1

- Armature resistance at 110°C : 0.012  $\Omega$ /m

- Net weight of copper : 81 Kg

- 1 section mean length : 11.450 m

- Slot wedge : Epoxy moulded slot wedge 3.5 mm thick.

- Banding : Resiglass banding on either side of PE and CE.

3. Equalizers

- Total number : 138 i.e. 1 every 2 segments.

- Location : Commutator side.

- Pitch : Segment 1 to 93

- No. of equalizing connections per bundle : 6

- Conductor dimensions(mm) : Bare = 1.2x5.2, r = 0

- Conductor covered with one layer 2/3 lap Kapton film 1.5 mil thick, Maximum dimension of covered conductor : 1.497 x 5.517 mm

- Net weight of copper : 4 Kg

4. Commutator

- Diameter (new) : 380 mm

- Useful length : 140 mm

- Diameter (top of risers) : 498 mm

- Width of risers (new) : 17 mm

- Width of risers (machined) : 14 mm (minimum)

- Maximum permissible radial wear : 8 mm

- Number of segments : 276



- Weight of copper : 52 Kg
- Mica thickness between segments : 1.2 mm
- Vee Cones : 2.5 mm

##### 5. Brush Holders

- Number of brush holders : 6
- Number of brushes per holder : 3
- Type of brushes : Duplex
- Dimensions of brushes (mm) : 52 x 18 x 43
- Height of brushes - New : 52 mm
- Worn limit : 27 mm
- Pressure per duplex brush - New : 2.4 kgf.
- Worn : 2.2 kgf.
- Brush holder ring should be revolving type.

##### 6. Field coils

###### Series Field & Commutating Field

- Coils type : - Edgewise wound - single  
Section coil moulded to pole core.

###### Series      Commutating

- No. of turns per coil : 11      10
- Conductor size : 4.6 x 45      7.5 x 27  
or 4.8 x 45

- Impregnation : VPI with Dr. Beck's 2005/500EK  
or GE 712 (RE-009) OR HEW 290  
solventless varnish.

- Insulation between turns : 2 layers of 0.15 thick semi  
cured ceramic paper.

- Ground Insulation : (a) 1 layer 1/2 lapped Kapton  
tape (.05 tk) x 25 mm.
- (b) 1 layer 1/2 lapped sodium  
treated PTFE tape (.05 tk)  
x 13 mm.

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(c) 3 Layer 1/2 lapped glass  
backed uniform mica tape.  
(0.13 mm thick) x 25mm.

(d) 1 layer 1/2 Lapped Glass  
tape (.13 tk) x 20 mm.

Alternatively: 4 layer 1/2 lap of glass  
backed uniform mica tape size  
0.13 mm thick x 20 mm wide.

(Alternatively: -

(i) 2 layers 1/2 lapped glass  
backed flexible (processed)  
mica tape 0.13 mm thick  
(Rotomac 779 R5C)

(ii) 2 layers 1/2 lap B'staged  
varnished glass tape  
0.13 mm thick (Rotomac  
765 ROC)].

1 layer 1/2 lap of Tetra  
Fluora Ethylene tape, size  
0.038 mm thick x 19 mm wide.

1 layer 1/2 lap of fibre glass  
tape size 0.13 mm thick x  
20 mm wide.

Lead are reinforced with an  
extra layer, 1/2 lapped Kapton  
tape 0.025 x 20 mm.

Net wt. of copper/coil (approximately)	23.68 Kg	16 Kg
Resistance at 20 degree C per coil. (+5%)	0.001141	0.000748 ohm
Type coil	Potted	Potted

#### 7.4 Ventilation (Forced)

Air flow 80 Cubic meter per minute static  
head of 150 mm water gauge in  
commutator chamber.

Air inlet Section 8.3 sq. dm

Air outlet Section 8.1 sq. dm

### . Balancing:

### Roller bearings

- SKF/FAG roller bearings:

- Pinion side : TYPE: SKF NU: 328 ECM/C4.VA301  
or FAG NU 328 EM1 C4 F1.

- Timken/SKF/FAG make taper roller bearings  
Non-gear end Timken Cone M349547  
Cup M349510

- Lubrication: Grease

## 10. Mechanical Part

- Type of suspension

AC 80-100-1 Track gauge 1676 mm

New wheel diameter : 1092 mm

Hardworm wheel diameter : 1054 mm

- Gear ratio : 62/15 or 58/21 or suitable.
- Distance between gears centres : 476 mm
- Gear modulus : 12.36
- Maximum axle load : 22 t.
- Clearance under gear case : 140 mm
- Clearance under motor : 140/155 mm
- Nominal axle diameter : 210 mm
- Axle bearings plain sleeve type -
- Commutator side length : 1200 mm
- Pinion side length : 310 mm
- Axle bearing oil :  
Servo prime 76 (IOC) or Turbinol 77 (HPC)  
or Turbol 78 (BPC).
- Gear Compound :  
Servo coat 170T (IOC)/Blue coat 3 (BL).

#### 11. Main pole pieces

- Magnetic steel sheet - grade No. A 1120 - 1 mm thick

Alternatively, 1 mm thick cold rolled carbon steel annealed sheet as per DIN 1623-1983 or IS 513-1994.

- Core : Length : 420 mm
- Width : 120 mm
- Pole arc : 39°
- Radial gap length : Centre : 5.5 mm
- Tip : 10 mm
- Pole seat : Steel sheet 1 mm thick

### Commutating pole pieces

- type : Laminated

- Fixing screws of M 16 size : non-magnetic

- Magnetic steel sheet : Grade No. 8 630 to 815-648  
0.5 mm thick.  
Alternatively, 0.5 mm thick  
CRNGO sheet as per DIN 46400  
-1983, grades V600-50A.

- Core length : 370 mm

- Width : 32 mm

- Pole face width : 26 mm

- Radial gap length - armature side (centre) 6 mm  
- frame side .. SILIRITE SHIM  $1.55 \pm 0.001$

STEEL SHIM  $4.45 \pm 0.002$  mm

### 12. Magnetic frame:

- Type : solid

- Useful section : 2 x 290 sq.cm.

### 13. Weight:

- Complete armature (without pinion) : 850 Kg approx.

- Motor without gears, gearcase, axle

bearings plain, axle bearing cap. : 2250 Kg

- Complete motor : 2800 Kg approx.

- Characteristics curve: ERDSO GEL-1064.

# TESTING VOLTAGE SCHEDULE STAGE TESTING

TEST NO.	VOLTAGE	DURATION
----------	---------	----------

## COMMUTATOR

1. - Between adjacent segments 1200 V 5 sec.  
after turning.
2. - Between adjacent segments 1000 V 5 sec.  
after mounting on mechanical parts.
3. - Between all segments connected together and ground after mounting on mechanical parts. 8200 V 1 min.

## EQUILIZERS

4. - Between adjacent conductors on completely finished bundles before mounting on the armature. 800 V 5 Sec.

## ARMATURE COILS

5. - Between adjacent conductors after first bounding of conductors. 800 V 5 sec.

## ARMATURE ASSEMBLY

6. - Between adjacent segments after machining putty between commutator and core. 850 V 5 sec.

After mounting and baking of equalisers:

7. - Between adjacent conductors 700 V 5 sec.

8. - Between all conductors connected together and core. 7800 V 1 min.

9. - After mounting armature coils but before driving home (hot) between all conductors connected together and core. 7500 V 1 Min.

10. - After hot driving home and baking of armature coils, between all conductors connected together and core. 7000 V 1 min.

After mounting slot wedge but before stator bath soldering/ TIG welding.

11. - Surge voltage test between adjacent segments 250 V 1 pulse.

12. - D.E. test between all conductor and core. 6500 V 1 min.

After banding and commutator turning to drawing dimensions plus 0.5:

13. - D.E. test between all conductors and ground 5500 V 1 min.

14. - Surge voltage test between adjacent segments. 200 V 1 pulse

15. - Measurement of resistance between adjacent segments

#### - FIELD COILS

16. - High frequency test (range of 1000 c/s) between turns after bonding. 20 V 5 sec. per turn

17. - High frequency test between turns after complete insulation. 20 V 5 sec. per turn

18. - D.E. test between copper and metal fixture after complete insulation 7500 V 1 min

19. - Between copper and frame after mounting in the motor frame. 7000 V 1 min.

20. - Between copper and frame after complete cabling. 6200 V 1 min.

#### - BRUSH HOLDERS

21. - Acceptance test of insulating studs:

- Between the 2 steel fittings 15000 V 1 min

## SPECIAL MAINTENANCE INSTRUCTIONS

SL	SMI NO.	DESCRIPTION
1.	ELRS/SMI/1	Fitting of nuts/bolts/screws.
2.	ELRS/SMI/6	Resurfacing of commutator of TM and its amendment.
3.	ELRS/SMI/13	Tightening & locking of gripping ring in TAO-659 Traction Motor.
4.	ELRS/SMI/14	Maintenance of terminal connections of TAO 659 Traction Motor; instruction for tightening of the insulators.
5.	ELRS/SMI/15	Sealing of tapped holes for terminal insulators of TAO-659 Traction Motors.
6.	ELRS/SMI/7	Providing of essential running clearance between the axle toothed ring of the oil pump drive of the suspension bearing of TAO 659 Traction Motor and recess provided in the suspension bearing cap.
7.	ELRS/SMI/25	Millivolt drop or micro-ohm resistance test on traction motor.
8.	ELRS/SMI/29	Resurfacing of commutator speed, feed, tool.
9.	ELRS/SMI/31	Undercutting and chamfering of traction motor commutator.
10.	ELRS/SMI/41	Improving the insulation of the stator internal connection of TAO 659 TM and Field Coil Ground Insulation.
11.	ELRS/SMI/39	Checking of air flow in the commutator chamber of TAO-659 Traction Motor.
12.	ELRS/SMI/42	Non-interchangeability of BHRR on TAO-659 Traction Motor.
13.	ELRS/SMI/51	Bar to bar conductor resistance and equalised resistance test on Traction Motor.



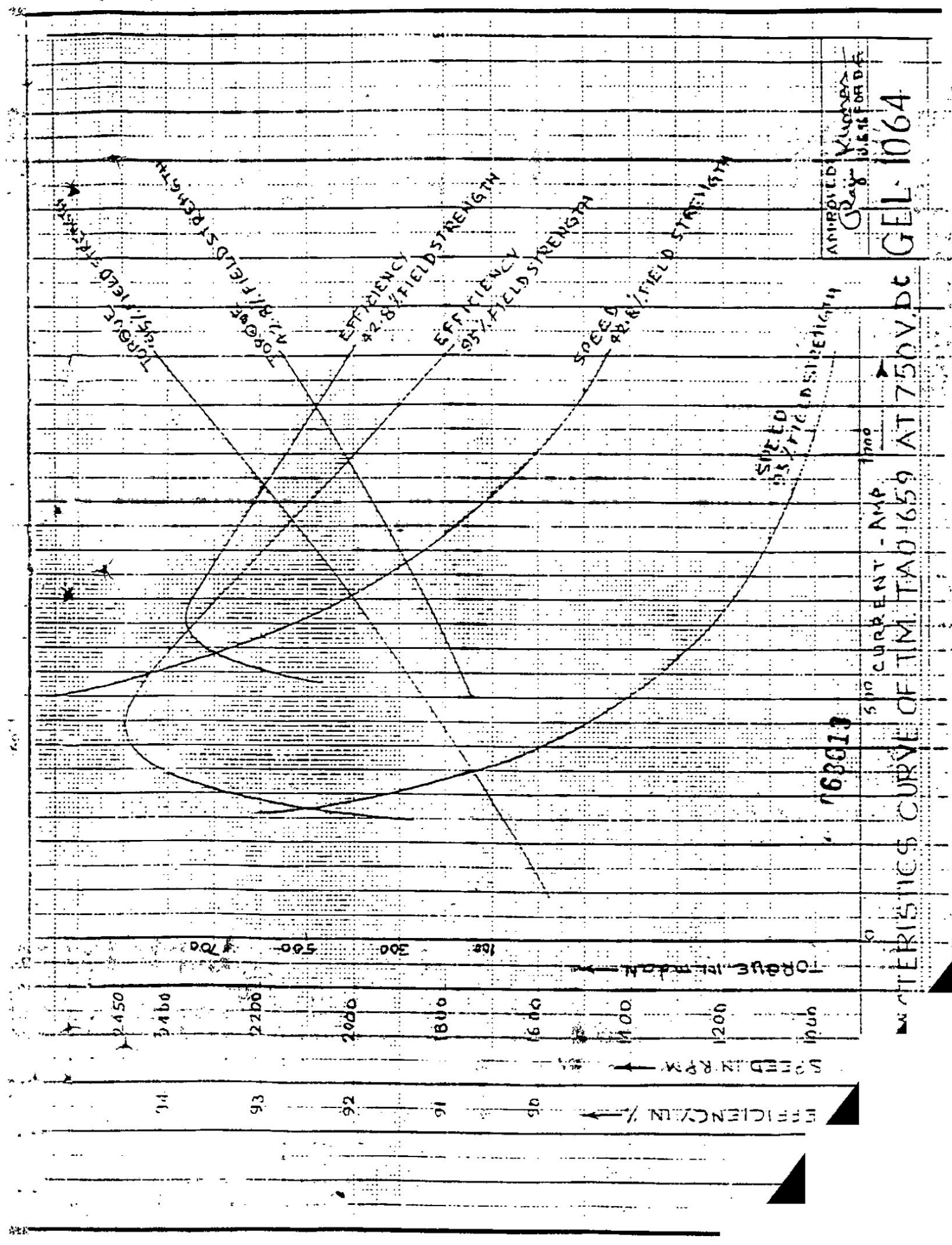
14. ELRS/SMI/53 Insulating Scheme using Class "H" material at the leads of armature coils in Traction Motor.
15. ELRS/SMI/58 Special Maintenance Instructions for on condition monitoring of bearings.
16. ELRS/SMI/60 Discontinuing high voltage DE test on overhauled traction motor.
17. ELRS/SMI/84 Procedure for drying out of TA0-659 TM.
18. ELRS/SMI/128 Tan Delta measurement of TM Armature.
19. ELRS/SMI/151 Testing of brazing joint of field coils circuits of Traction Motor type TA0-659 and HS-1050 Er/HS-15250A.
20. ELRS/SMI/160 Measurement of back lash of traction gears.
21. ELRS/SMI/166 Ventilation of TA0-659 Traction Motor.
22. ELRS/SMI/167 Precaution while tapping of bus bars and clamps of traction motor stators.
23. ELRS/SMI/168 Copper bus-bar used in stator of TA0-659 Traction Motors in the Locomotive.
24. ELRS/SMI/170 Checks on main pole and interpole coils of TA0-659 Traction Motors.
25. ELRS/SMI/171 Fitment of "Mica-lex Insulator" on TA0-659 Traction Motors.
26. ELRS/SMI/180 Draft rehabilitation procedure for mechanical portion of traction motor Type TA0-659 of BG, AC Electric Locomotives.
27. ELRS/SMI/181 Neutral setting of brush holder revolving ring of traction motor by electrical method known as "KICK METHOD".
28. ELRS/SMI/183 Procedure for proper tightening of suspension tube fixation bolts fitted on Traction Motor type TA0-659 and HS-15250A.

MODIFICATION SHEET

S1. No.	Modification No.	Description
1.	RDSO/WAM4/63	Taping of leads of traction motor type TA0-659 to prevent chafing in cleats.
2.	RDSO/WAM4/67	Fixing of Neoprene gasket on the terminal box cover of TA0-659 TM.
3.	RDSO/WAM4/68	Modification to Bellow of TA0-659 Traction Motors.
4.	RDSO/WAM4/90	Modification at commutator end of TA0-659 Armature, Shaft and the Set Ring.
5.	RDSO/WAM4/118	Replacement of flexible contact assembly by a braided shunt in TA0-659 TM.
6.	RDSO/WAM4/158	Modification to negative connection lead of comm. pole coil (Lead No. 13) on TA0-659 TM.
7.	RDSO/WAM4/162	Modification to 'L' clamp of comm. pole of TA0 659 T.M.
8.	RDSO/WAM4/164	Prevention of suspension bearing oil leakage into the stator frame.
9.	RDSO/WAM4/165	Provision of thread locking compound on bolts/screws.
10.	RDSO/WAM4/166	Modified support plate assembly for main pole and comm. pole.
11.	RDSO/WAM4/167	Modified adjustment punching for main pole core assembly to TA0-659 Traction Motor.
12.	RDSO/WAM4/168	Modified adjustment shim and silite shim for commutating pole core of TA0 659 Traction Motor.
13.	RDSO/WAM4/169	Improved insulation scheme for interconnectors of TA0-659 TM.

14. RDSO/WAM4/174 Improved interconnector layout for  
TAO-659 Traction Motor.
15. RDSO/WAM4/186 Modification to the protection  
screen of pinion end shield and  
air outlet of magnet frame of TAO-  
659 Traction Motor.
16. RDSO/WAM4/188 Adoption of forged armature head on  
the armature shaft of TAO-659 T.M.
17. RDSO/WAM4/191 Adoption of Teflon ring in lieu of  
Teflon band on the exposed surface  
of V-cone of Traction Motor.
18. RDSO/WAM4/194 Improved interconnector layout for  
TAO-659 Traction Motor with potted  
Single Section Field Coils.
19. RDSO/WAM4/196 Adoption of improved BHEL assembly  
on Traction Motor type TAO-659 with  
Flexible Lead wires.
20. RDSO/WAM4/198 Improvement in the design of  
Armature Shaft of TAO-659 Traction  
Motor.

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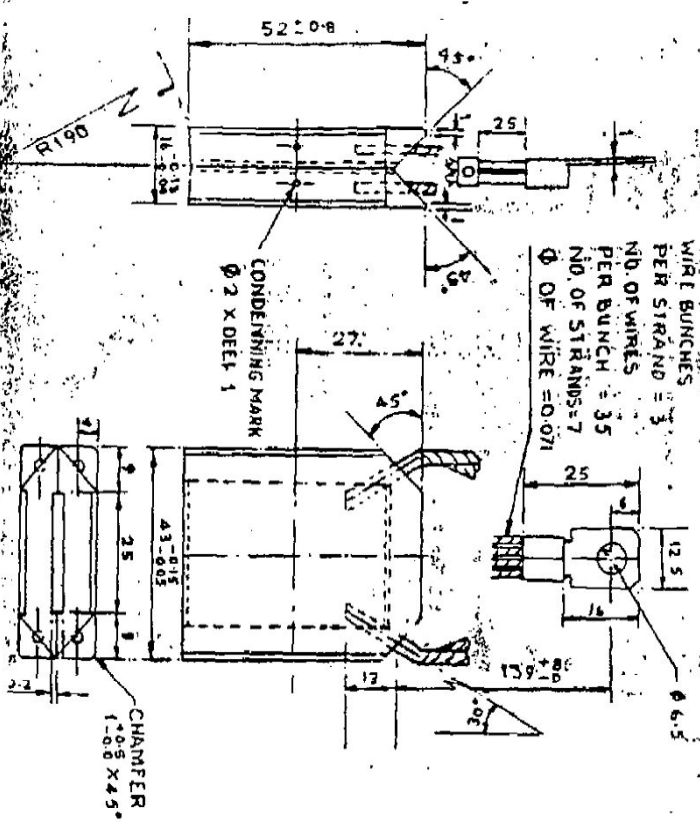
APPROVED: *W. H. HARRIS*  
*Gray* 13516 DRA DE

GEL-1064

CHARACTERISTICS CURVE OF T.M. TAO 1659 AT 750V. DC

163913

WIRE BUNCHES



GENERAL NOTES:  
1. CARBON BRUSH SHALL GENERALLY CONFORM TO IS: 3003 PT. I TO IV UNLESS OTHERWISE STATED.  
2. BRUSH GRADE AND MANUFACTURER'S NAME/TRADE MARK SHALL BE ENGRAVED ON BOTH THE WIDER FACES ABOVE THE CONDEMNING MARK.  
3. CONDEMNING MARKS SHALL BE MADE ON TWO SIDE FACES.  
4. RECOMMENDED DIRECTION OF CUTTING OF CARBON BRUSH - GRAIN AXIAL.\*  
5. SPECIAL TEST: ENDURANCE TEST AS PER RDSO LETTER NO EL/2.2.70 DT. 27.9.82.  
6. THIS DRG. SUPERSEDES DRG. NO SKEL-B77 MOD 2 & EL.BS.002.  
7. ALL DIMENSIONS ARE IN MM.  
8. REFER TO LATEST INSTRUCTIONS ISSUED BY RDSO FOR THE VALIDITY OF APPROVAL OF BRUSH GRADES.

REF ID: A66021

ALT	REF	DESCRIPTION	SIGN	DATE
2		NOTE NO. 9 DELIVERED		
1		CONTINUOUS PATTERNS OF STENOGRAPHIC SOUNDING OF THE ALPHABETICALLY SOUNDING OF THE ALPHABETICALLY		

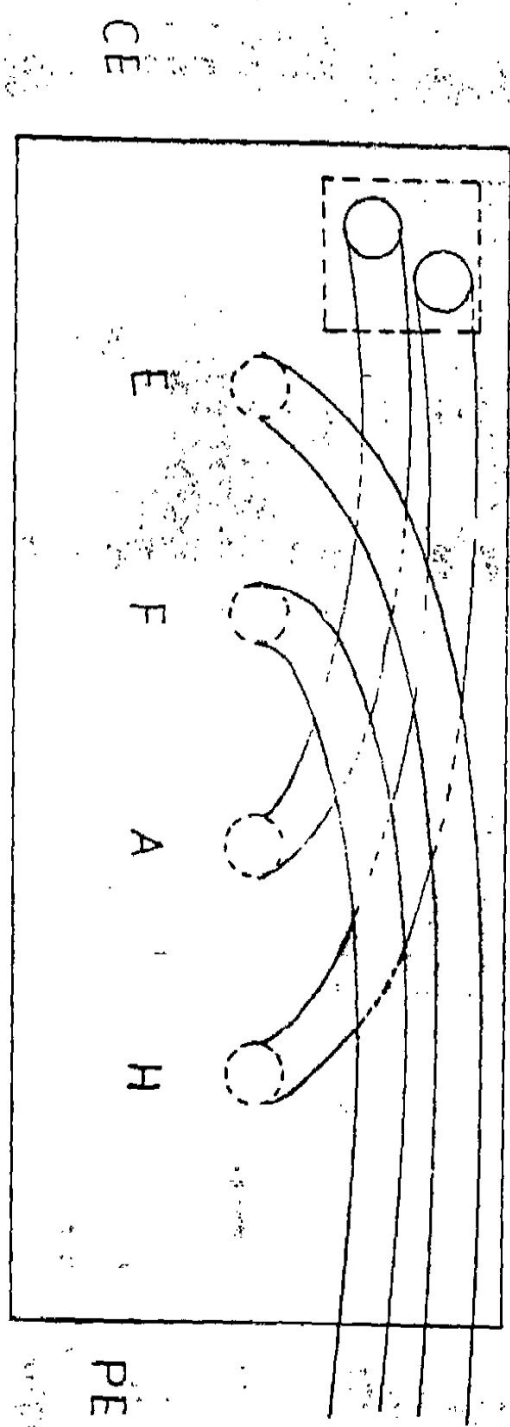
SUPPLIER'S NAME		GRADE		
	ORIGINAL	SUBSTITUTE	APPROVED BY RDJO	A PROPOSED RESTRICTION
M/S SHREE CARBONMET	LE CARBONE E 6357		- I -	
M/S ACPL			MORGANITE E 6 105 (I)	MORGANITE E 6 116 S (I)
M/S ELCA				SIE GRADE E 24 (I.)

S.NO.	DESCRIPTION	VALUE
1.	MAKE & TYPE	ALSTHOM, CLV: T-0659
2.	CONTINUOUS RATING	750V, 600A, 1000 rpm 3500W
3.	ONE HOUR RATING	750V, 870A, 1000 rpm 6000W
4.	MAX. SPEED	2500 rpm
5.	COMMUTATOR DIA (NEW)	380 mm
6.	COMMUTATOR DIA (OLD)	314 mm.
7.	NO. OF BRUSH ARMS	6
8.	NO. OF BRUSHES PER ARM	3
9.	TOTAL NO. OF BRUSHES PER MACHINE	18
10.	CONDEMNING LIMIT	27 mm
11.	EFFORT OF SPRING ON BRUSH	2.2 TO 2.4 kg
12.	CURRENT DENSITY	136 mA/mm <sup>2</sup>

3.	TERMINAL	1		TINNED & ELECTRIC LITIC COPPER	CLASSE 5.2 10F
2.	PIG TAIL	4		ELECTROLYTIC GRADE COPPER	15.3009 PT IV
1.	CARBON BRUSH	1		ELECTRIC GRAPHITE	
PART NO.	DESCRIPTION	QTY.		MATERIAL	SPECIFICATION
REF: ALSTHOM DRG. NO. 5604117		SCALE: NTS		APPROVED:	

CARBON BRUSH FOR TM TAO 659	
USED ON WAM4 LOCO,	
ELEC. DTE.	RDSO EL. BS. CO2 (MAY)

51989



THIS DRAWING SUPERSEDES DRG. NO. SKEL-4369.

REF:	SCALE: NTS	APPROVED <i>Raj Kumar</i> FOR DRG
TERMINAL BOX CONNECTIONS OF TAD-659 TRACTION MOTOR		
R.D.S.O. ELECT. DTE	SKEL-413	

7-7-97
CHANDRA
M.A.
HILLON

GOVERNMENT OF INDIA MINISTRY OF RAILWAYS  
RESEARCH DESIGNS & STANDARDS ORGANISATION  
MANAK NAGAR LUCKNOW - 226 011

No. EL/3.2.5

Dt. 17.9.98

Distribution as per list enclosed

AMENDMENT No. 1

Sub : Amendment to Technical specification of traction motor type TAO 659 having roller suspension bearing assembly.

Ref : RDSO's Specification No. SPEC/E-7/20 of Sept'97, circulated to all Zonal Rlys & Railway Board vide this office letter of even number, Dt. 31.12.97

The few clauses of the above RDSO specification under reference have been modified as follows :

1. Clause 3.10.3 (Page No.17) - Carbon Brush Drawing

Follow RDSO's Drg. No. EL.BS.002(MOD) Alt 2 in place of Alt.1.

2. Clause 3.12.1 (Page 18) - Terminal Box

Follow RDSO's Drg. No. SKEL 4413 & 4414 in place of SKEL 4369.

3. Clause 3.15.1 (Page 18) - Motor Weight

2nd & 3rd Line Delete axle support bearing shells & axle bearing cap

Read the revised matter as follows :

"The total weight of the motor including pinion, gear, gear case /tube and suspension/assembly is presently 2800 Kgs."

4. Clause 3.18.0 (Page 19)

Read the heading as follows :

"Modified Gearcase assembly/Gear wheel in lieu of modified gear case assembly."

contd...2/-



5. Clause 3.18.2 (Page 19)

Add this clause

"The modified gear wheel shall be procured as per RDSO Drg. No. SKDL 4455 & 4456 for 62 teeth and 58 teeth respectively.

6. ANNEXURE 'C' (Page 26)

Clause 2 - Armature (Page 26)

- Max Dimensions of covered conductor (Page 27)
- Follow 3.03 x 8.23 mm in place of 3.097 x 8.337 mm
- Interlayer Varnish (Page 27)

Read the matter as follows :

"Alstom SI 40C or Metroare 140 C Varnish

Clause 6 - Field Coils (Page 29)

Ground Insulation (Page 29 & 30)

a) - Kapton tape

Size 0.05 mm thick x 20 mm wide in place of 0.05 mm thick x 25 mm wide.

b) - Sodium treated PTFE tape

Size 0.038 mm thick x 19 mm wide in place of 0.05 mm thick x 13 mm wide.

c) - Glass backed Uniform mica tape

Size 0.13 mm thick x 20 mm wide in place of 0.13 mm thick x 25 mm wide.

d) Fibre Glass tape

Size 0.18 mm thick x 20 mm wide in place of 0.13 mm thick x 20 mm wide.

Resistance at 20 degree C per coil (+ 5%)

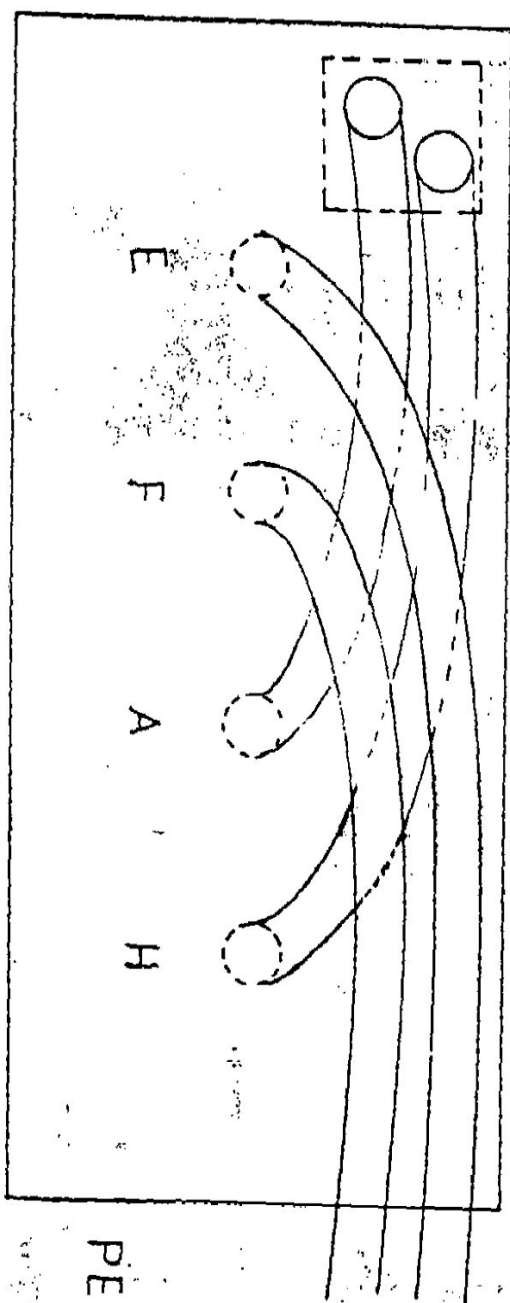
Resistance of comm Pole Coil

- Follow 0.00078 ohms in place of 0.000748 ohms

contd....3/-



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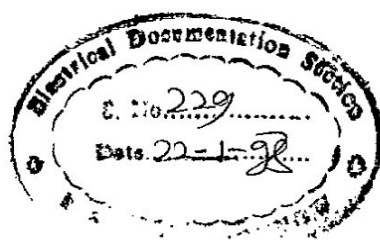
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THIS DRAWING SUPERSEDES DRG. NO. SKEL-4369

REF:	SCALE: NTS	APPROVED <i>Raj Kumar</i> FOR D.G.
TERMINAL BOX CONNECTIONS OF TAD-659 TRACTION MOTOR		
R.D.S.O. ELECT. DTE		SKEL - 413

L. 7.92  
CHANDRA  
M. S.  
MILLEN



Clause 10 Mechanical Parts (Page 32)

Delete : Details of axle bearing plain sleeve type & axle bearing oil

Clause 13 Weight (Page 33)

Delete : "Axle bearing plain sleeve axle bearing cap

Read the revised matter as follows :

" Motor without gears, gear case and suspension tube assembly.

7. Annexure D-I (Page 37 & 38 )

Special Maintenance Instruction

Delete : Following SMIs are not applicable/superseded presently  
SMI/ 1, 41, 53 & 58

Add : SMI/186

- Bonded rubber sandwich mounting for nose suspension of traction motors.

8. Annexure D-II (Page 39 & 40)

Modification Sheets

Delete : Following Modification Sheets are not applicable/superseded presently.  
MS/90, 118, 158, 169 & 174

*Rajiv Kumar*

( R.K.Kulshrestha )  
for Director General/Elect.

63617

GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS  
RESEARCH DESIGNS & STANDARDS ORGANISATION

NO.EL/3.2.5

Manak Nagar, Lucknow-11  
Dated: .10.1998

Distribution as per list enclosed.

AMENDMENT NO.2

Sub :- Amendment to Technical Specn. of  
Traction Motor type TA0659 having  
roller suspension bearing assembly.

Ref.:- RDSO's Specn. No.SPEC/E-7/20 of Sept.'97  
circulated to all zonal railways and  
Railway Board vide this office letter of  
even number dated 31.12.1997.

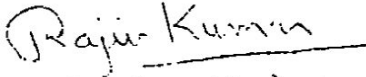
The few clauses of the above RDSO specification  
under reference have been modified as follows :-

1. ANNEXURE D-I (Page 37 & 38)

Special Maintenance Instructions

Add - SMI/TM/0205-98 (Rev.-0)

Procedure for tightening of axle cap  
fixation bolts of traction motor type  
TA0659.

  
(R.K.Kulshrestha)  
for Director General(Elec)

टेलिक्स/Telex : 0535-2424 RDSO-IN  
फैक्स/Fax : 91-0522-458500  
तार : रेलमानक लखनऊ  
Telegram : 'RAILMANAK', Lucknow  
टेलीफोन/Tele : 450567 & 451200



भारत सरकार - रेल मंत्रालय  
अनुसंधान अभिकल्प और मानक संगठन  
लखनऊ-226011  
Government of India-Ministry of Railways  
Research Designs & Standards Organisation  
LUCKNOW-226011

No.EL/3.2.5

Dated 28.6.99

Distribution as per enclosed list

AMENDMENT No. 3

Sub: Amendment to Technical specification of traction motor type TA0-659 having roller suspension bearing arrangement.

Ref: RDSO Specification No.SPEC/E-7/20 of Sept'97 circulated to all Zonal Rlys and Rly. Board vide this office letter of even number dt.31.12.97.

...

The few clauses of the above RDSO specification under reference have been modified as follows:

1. Chapter III Detailed Engg. Specification

Clause 3.5.0 Standard specification, rating curves & Calculation

Clause 3.5.1

Read IECs & IEEEs as follows:

- IEC 216-1, 1990, 4th Edition
- IEC 349-1991, 2nd edition
- IEC 505-1975, 1st edition and its draft supplement.
- IEC 563-1976, 1st edition
- IEC 356-1971, 1st edition
- IEEE-11-1980 (R1992)
- IEEE-304-1977(R1991)
- IEEE-429-1994

Clause 3.10.0 Brush Gear

Clause 3.10.1

Read IS as follows:

"IS 305-1981, 2nd Revision, Reaffirmed 1991".

"IS 1458-1965 (Revised), Amendment 4, Reaffirmed 1991"

Clause 3.19.0 Armature bearing

Clause 3.19.2

Read the ISO as follows:

"ISO-281-1991 Revision 3, Amendment 1".

Clause 3.20.0 Shaft

Clause 3.20.1 Shaft material

Read 'BS' as follows  
"BS.970, Part3, 1991"

2. Annexure C

Traction Motor TAO 659 Data

Armature

Clause 2

Main Lamination

Read 'IS' as follow:

"IS648-1994 Fourth Revision"

End Lamination

Read 'IS' as follow:

"IS 513-1994, Fourth Revision".

3. Drawing:

1) Carbon brush (Drg No. RDSO.EL.BS.002 (Mod) Alt.2)

Read 'IS' as follow

'IS 3003 Part 1, 1977, Amendment 1, Reaffirmed 1991

Read IS-3003 Part 2 as IS 13584-92

Read IS-3003 Parts 3 & 4 as IS-13466-92

11) Modified arrangement of terminal box assembly (RDSO Drg.No. SKEL-4414)

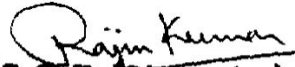
Read IS as follow:

- Follow IS 2062-1992, Fourth revision, Amendment 1 in place of IS 226-1975.
- IS 1570-1961, Amendment 5, Reaffirmed 1993
- IS 1367 Part 1-1980 2nd Revision, Reaffirmed 1991
- IS 3063 - 1994, Second Revision
- IS 1364 Part 1, 1992, Third Revision.
- IS 1079-1994, Fourth revision

Armature Sleeve (RDSO Drg. No. SKEL 4416)

Read IS as follows

IS 1030-1989, Fourth Revision, Amendment 2.

  
(R. K. Kulkarni)

टेलिक्स/Telex : 0535-2424 RDSO-IN  
फैक्स/Fax : 91-522-458500  
तार : 'रेलमानक' लखनऊ  
Telegram : 'RAILMANAK', Lucknow  
लीफोन/Tele : 451200 (PBX)  
450115 (DID)



भारत सरकार - रेल मंत्रालय  
अनुसंधान अभिकल्प और मानक संगठन  
लखनऊ - 226011  
Government of India-Ministry of Railways  
Research Designs & Standards Organisation  
LUCKNOW - 226011

No.EL/3.2.5

Dated: 29.9.99

(Distribution as per enclosed list)

**Amendment No.4**

Sub: Amendment to Technical specification of traction motor type  
TAO-659 having roller suspension bearing arrangement.

Ref: RDSO Specification No.SPEC/E-7/20 of Sept'97 circulated to  
all Zonal Railways & Railway Board vide this office letter of  
even number dt.31.12.97.

....

The few clauses of the above, RDSO specification under reference  
have been modified as follows:-

**Chapter -III Detailed Engg.specification.**

- (i). Clause 3.3, General-Mechanical and clause 3.20.0,shaft .  
clause 3.3.8 - (Page No.8)  
and  
Clause 3.20.2,Para 2 (Page No.20)

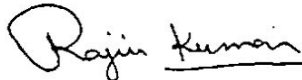
Follow RDSO Drawing No. SKEL 4415 Alt.1 in place of Drg. No.  
SKEL 4415 Alt.0

- (ii). Clause 3.17.0 Axle support (suspension) bearing (Page No.19)  
Clause 3.17.1

General Arrangement of motor suspension unit for traction motor  
type TAO-659.

Follow RDSO Drawing No. SKEL4510 in place of Drg No.SKEL-4421.

Encl:Nil

  
(R. K. Kulshrestha)  
for Director General/Elect

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