SW5 — 808 — W6 - 946

PUBLIC TRANSPORT CORPORATION

G.E. 247 TRACTION MOTOR

MAINTENANCE INSTRUCTION

PUBLIC TRANSPORT CORPORATION

FOREWORD

This maintenance instruction has been prepared to collate the relevant data and specifications required for overhauling the General Electric 247 Traction Motor.

The information and instructions will be subject to revision as required.

Public Transport Corporation

G.E.247 Traction Motor

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SECTION

1

General Description

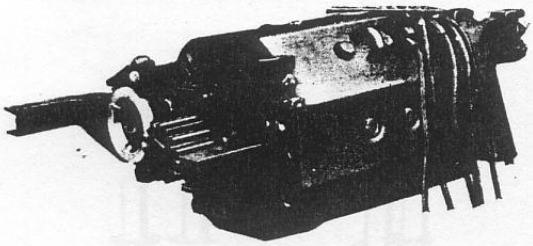
GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

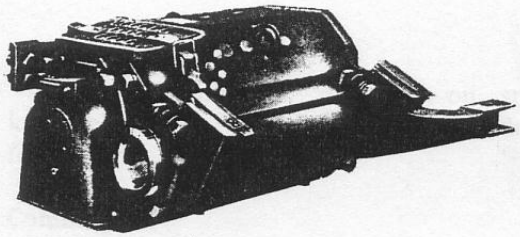
June, 1926 — *Bulletin No. GEA-418*

GE-247-A, 600-VOLT RAILWAY MOTOR

For Light Weight Cars in City, Suburban or Interurban Service



Suspension Side



Axle Side

GE-247-A RAILWAY MOTOR

RATINGS

Hourly, for 75 deg. rise by thermometer;
40 h.p., 600 volts, 60 amperes, 715 r.p.m.

Continuous, for 65 deg. rise by thermometer;
36.6 amperes at 600 volts.
35.8 amperes at 450 volts.
34.4 amperes at 300 volts.

TRUCK DATA

	Form A 26-in. Wheel Motor
Maximum diameter of car axle in bearing linings	4 in.
Clearance under frame with 26-in. wheels (maximum reduction)	$4\frac{5}{16}$ in.
Clearance under gear case with 26-in. wheels (max. red.)	$4\frac{5}{32}$ in.
Max. gear reduction ($3\frac{1}{2}$ pitch)	58/15

WEIGHTS

	APPROX. WT. in Lb. Form A 26-in. Wheel Motor
Motor, including gear, pinion, gear case and axle linings.	1740
Two-motor equipments, complete with two K-36 controllers	4590
Four-motor equipments, complete with two K-35 controllers	8520
Two-motor equipment, with Sprague G-E Type PC control complete	4680
Four-motor equipment, with Sprague G-E Type PC control complete	8400

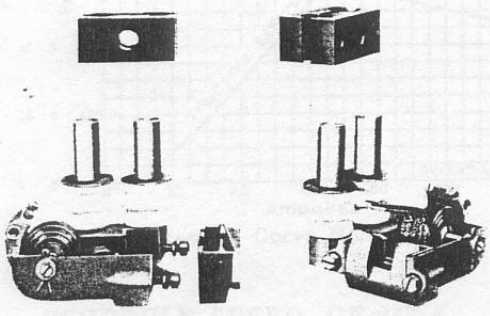
Supersedes 44406A

Frame

Cast steel, box type, bar suspension, large opening over commutator, covered hand hole suspension side, commutator end.

Axle Bearings

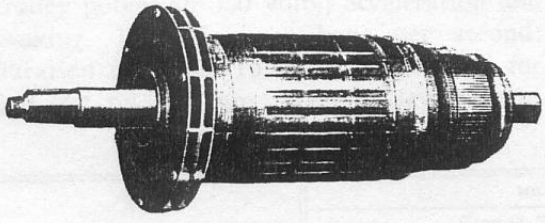
Bronze linings, standard size 4 in. diameter, 7 in. long, interchangeable, linings held by dowels.



Brush-holders

Brush-holders

Adjustable pressure, renewable carbon-way, 1 brush per holder, size $2\frac{1}{4}$ in. by $2\frac{1}{2}$ in. by $\frac{1}{2}$ in.



Armature

Armature

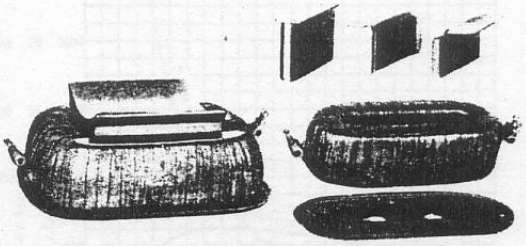
Hot banded, shaft removable without disturbing windings. Bearing surfaces rolled; thrust collars, drop forged, shrunk on shaft.

Armature Bearings

Linings held by keys, bronze lined with babbitt, pinion end $2\frac{3}{4}$ in. by $6\frac{5}{8}$ in., commutator end $2\frac{3}{8}$ in. by $4\frac{3}{4}$ in.

Field Coils

Wound with rectangular wire, compounded by vacuum process. Supported by spring flanges, terminals on coils.



Exciting and Commutating Field Coils

Pole Pieces

Exciting, laminated, mounted on steel key, held by tap bolts; commutating, drop forged, held by tap bolts.

Commutator

Hard drawn copper segments; selected mica insulation, mica grooved $\frac{3}{64}$ in. One-piece mica cones, moulded.

Lubrication

Oil and waste; large capacity wells; auxiliary wells.

Ventilation

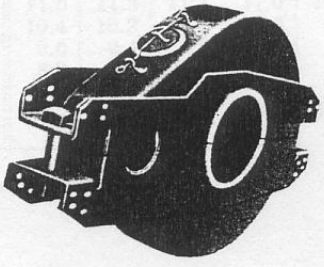
Multiple fan path through armature core, path around field coils, exhaust at pinion end.

Gearing

Short addendum gear tooth; long addendum pinion teeth, $3\frac{1}{2}$ pitch, 4-in. face.

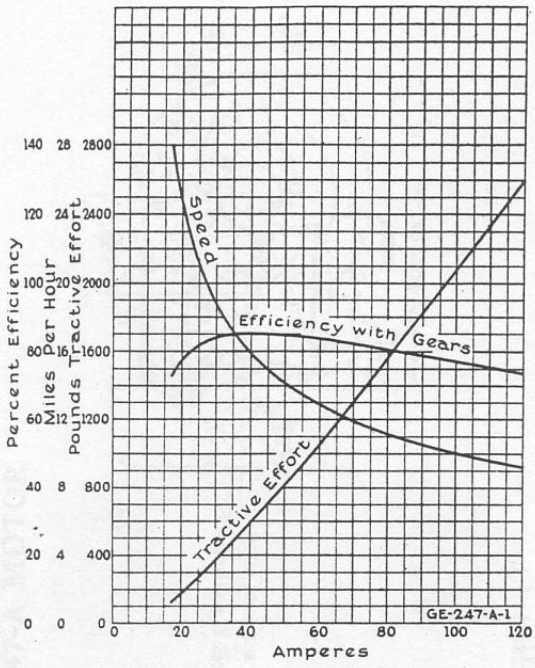
Gear Case

Pressed steel gear-case welded to supporting cradle.



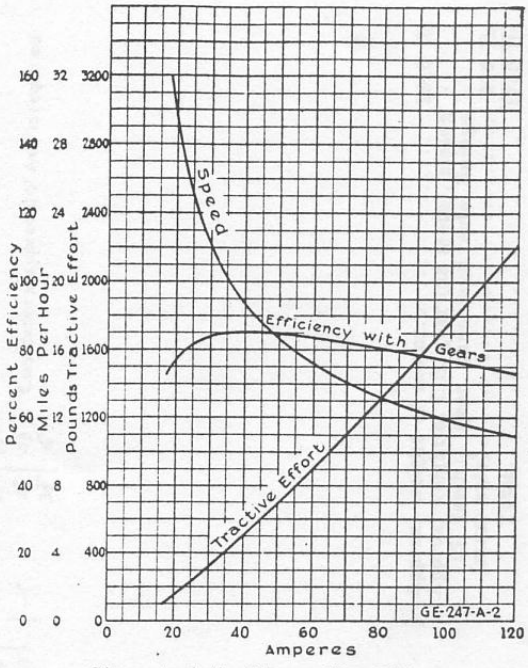
Pressed Steel Gear Case

GE-247-A 26-IN. WHEEL MOTOR
Characteristic Curves on 550 Volts, Diameter of Car Wheels, 26 Inches; Gear, 58 Teeth; Pinion, 15 Teeth; Ratio, 3.87; Maximum Gear Ratio



Characteristic Curve No. 388

GE-247-A 26-IN. WHEEL MOTOR
Characteristic Curves on 550 Volts, Diameter of Car Wheels, 26 Inches; Gear, 56 Teeth; Pinion, 17 Teeth; Ratio, 3.29



Characteristic Curve No. 399

SCHEDULE SPEED, GE-247-A 600-VOLT MOTOR

The following table indicates the capacity of the GE-247-A motor and will assist materially in determining whether this motor is suitable for the desired schedule. It is based on the following assumptions: Average trolley potential, 550 volts; acceleration and braking, 1.5 miles per hour per second; duration of stops, 10 seconds; coasting for 230 feet on all runs; straight level track, maximum temperature rise not exceeding 65 deg. C. Schedule speeds given are 10 per cent less than theoretical values, to allow for delays due to grades, curves, slow downs, or other factors that may affect the schedule.

It is strongly recommended that service data be supplied and the General Electric Company's engineers be consulted before the final selection of a motor and gear ratio, since co-operation has been found to be mutually beneficial.

Stops per Mile	MILES PER HOUR WITH LOAD IN TONS PER MOTOR											
	Gearing 58/15						Gearing 56/17					
	4.5	5	5.5	6	7	8	4.5	5	5.5	6	7	8
1	20.1	19.7	19.1	18.3	17.7	17.2	21.2	20.7	20.2	19 8	19.3	18.3
3	14.1	13.8	13.6	13.5	13.2	13.0	14.5	14.3	14.0	13.8	13.6	13.0
5	11.2	11.1	11.0	10.9	10.7	10.6	11.5	11.3	11.1	11.0	10.9	
6	10.1	10.0	9.9	9.9	9.8	9.7	10.4	10.2	10.1	10.0		
7	9.4	9.3	9.2	9.2	9.1	9.0	9.6	9.4	9.3	9.2		
8	8.7	8.6	8.5	8.5	8.5		8.9	8.7	8.6	8.5		
9	8.1	8.1	8.0	8.0	8.0		8.5	8.2	8.1			
Maximum free-running speed	29.5	28.4	27.8	25.5	24.7	23.3	32	31.5	30.4	29.3	27.2	26.0

Above free-running speed based on four-motor equipment.
Max: free-running speed of two-motor equipment approximately 90 per cent of above values.

General Electric Company
Schenectady, N.Y.

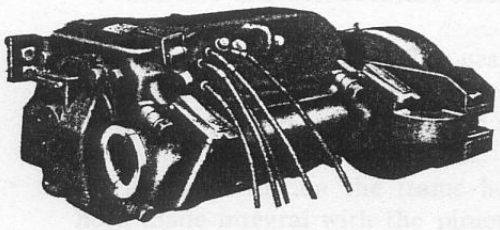
RAILWAY DEPARTMENT

March, 1917

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Bulletin No. 44406A

GE-247 VENTILATED COMMUTATING-POLE RAILWAY MOTOR

The GE-247 railway motor has been developed by the General Electric Company especially for city service. Large numbers of this motor are now in use on various types of city cars in all kinds of service, and the satisfactory operation and low cost of maintenance that users of this motor have experienced, prove it to be admirably adapted to the service for which it was developed.



GE-247 RAILWAY MOTOR—AXLE SIDE

In design, the motor follows the lines of standard G-E ventilated, commutating-pole motors, and embodies those features in general demand by operating engineers, which have been found necessary for successful and economical operation. By the use of the box type of frame and a specially effective system of ventilation, and of pressed steel for certain parts, a motor sufficiently light in weight to be suitable for light weight cars has been obtained without any sacrifice of strength or reliability, the desirable features that are found in larger and heavier motors being retained. The excellent commutating qualities of the motor, and the effectiveness of the ventilation employed permit a high continuous output without overheating the motor.

The GE-247 motor is built in forms suitable for trucks with wheels 24 inches in diameter, or for those with wheels of 30 inches or more in diameter. It is, therefore, well adapted both in characteristics and design for low floor cars and for a considerable range in types of light and moderate weight cars operating under all conditions of city service.

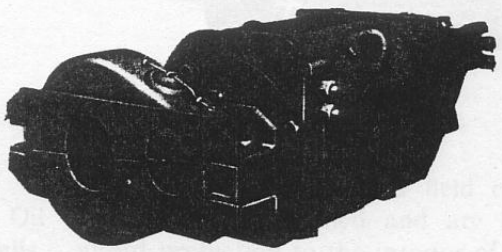
Rating

The GE-247 motor has an hourly rating of 40 horse-power on 600 volts, with an input of 60 amperes. The continuous rating for a temperature rise of 65 deg. C. by thermometer is 36.6 amp. at the same voltage.

Details of Construction

The motor possesses all the advantages of high structural strength for a minimum weight, great durability, together with the low cost of maintenance inherent to the box type of frame. Adequate openings are provided for the inspection of the interior.

The armature bearings are of bronze lined with babbitt, and are designed to prevent injury to the armature or shaft bearing surfaces in the event of the babbitt running from overheating. The armature bearings are held from turning by keys and the axle linings by means of dowels. The armature shaft may be removed, if necessary, without disturbing the windings or connections of the armature. The bearing surfaces are accurately ground and rolled giving a bearing surface which has reduced wear to a minimum. The



GE-247 RAILWAY MOTOR—SUSPENSION SIDE

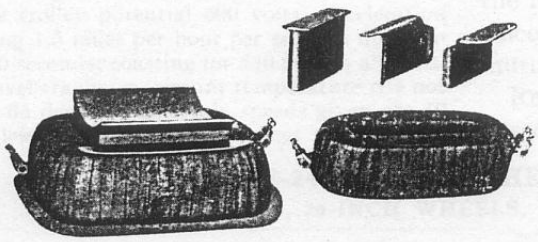
NOTE.—The data in this publication are subject to change without notice.

* *Supersedes Bulletin No. 44406.*

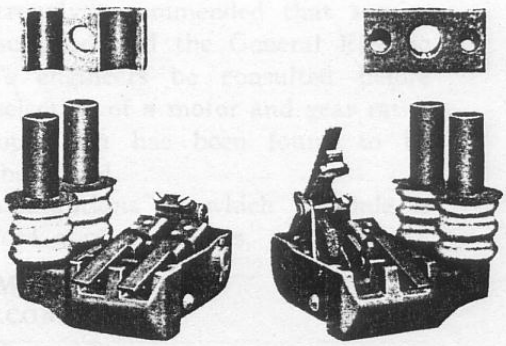
Class 19.

hot binding process is employed in banding the armature, this process having largely eliminated the possibility of loose coils.

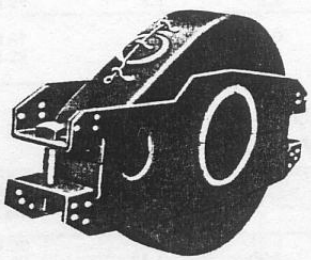
The field coils are thoroughly impregnated with insulating compound by the vacuum process and are securely held in place by spring steel angle flanges. The gear case is of specially light and strong construction each half being pressed to shape from a steel plate, and welded to a supporting cradle. These are carried by a lug on the frame head and a horn made integral with the pinion end axle cap.



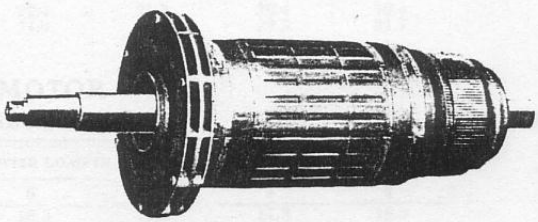
EXCITING AND COMMUTATING FIELD COILS



BRUSH HOLDERS



PRESSED STEEL GEAR CASE



ARMATURE

Lubrication

Oil and waste are used throughout. Oil boxes are provided with auxiliary oil wells, and have felt lined, deep lipped covers held closed by springs. The axle is enclosed between bearings by a sheet steel dust guard.

Ventilation

All parts of the motor are effectively cooled by air drawn into the motor by a double or multiple fan on the armature shaft. The cooling air passes through the motor in two parallel streams, one through the commutator shell and armature core, the other over and around the armature and field coils. The air inlets are screened and are located to afford protection to the interior of the motor when operating under unfavorable conditions.

WEIGHTS

	APPROX. WT. IN LB.	
	24 in. Wheel Motor	30 in. Wheel Motor
Motor complete with gear, gear case, pinion and axle linings	1740	1870
Two motor equipment with two K-36 controllers complete	4590	4850
Four motor equipment with two K-35 controllers complete	8520	9040
Two motor equipment with Sprague G-E Type PC control complete	4680	4940
Four motor equipment with Sprague G-E Type PC control complete	8400	8920

SCHEDULE SPEED, GE-247, 600-VOLT MOTOR

The following tables indicate the capacity of the GE-247 motor and will assist materially in determining whether this motor is suitable for the desired schedule. They are based on the following assumptions:

Average trolley potential 500 volts; acceleration and braking 1.5 miles per hour per second; duration of stops 10 seconds; coasting for 230 feet on all runs; straight level tracks, maximum temperature rise not exceeding 65 deg. C. Schedule speeds given are 10 per cent less than theoretical values to allow for delays due to grades, curves, slow downs, or other factors that may affect the schedule.

It is strongly recommended that service data be supplied and the General Electric Company's engineers be consulted before the final selection of a motor and gear ratio, since co-operation has been found to be mutually beneficial.

Read assumptions on which schedule is based before applying tables.

GE-247 24-INCH WHEEL MOTOR

500 VOLTS, 24-INCH WHEELS, 10-SECOND STOPS

Stops per Mile	Gear Ratio	MILES PER HOUR WITH LOAD IN TONS PER MOTOR						
		4.5	5	5.5	6	7	8	9
1	3.87	18.6	18.1	17.6	17.3	16.6	16.1	15.6
1	3.29	20.1	19.5	19.1	18.8	18.0	17.5	19.0
3	3.87	13.5	13.2	13.0	12.9	12.6	12.4	12.2
3	3.29	13.9	13.7	13.6	13.4	13.1	12.9	12.7
5	3.87	10.9	10.8	10.7	10.6	10.4	10.3	10.2
5	3.29	11.2	11.0	10.9	10.8	10.6	10.5	10.3
6	3.87	10.0	9.9	9.8	9.7	9.6	9.4	9.3
6	3.29	10.2	10.1	10.0	9.9	9.8	9.7	
7	3.87	9.2	9.1	9.0	8.9	8.8	8.7	8.7
7	3.29	9.4	9.3	9.2	9.1	9.0	9.0	
8	3.87	8.7	8.6	8.5	8.4	8.3	8.2	8.1
8	3.29	8.8	8.8	8.7	8.6	8.5	8.4	
9	3.87	8.0	8.0	7.9	7.8	7.7	7.6	7.6
9	3.29	8.2	8.1	8.0	8.0	7.9	7.8	
Max. free running speed four-motor equipments	3.87	25.2	24.0	23.1	22.4	21.3	20.4	19.4
	3.29	28.2	26.8	25.8	24.9	23.6	22.5	21.7

GE-247 30-INCH WHEEL MOTOR

500 VOLTS, 30-INCH WHEELS, 10-SECOND STOPS

Stops per Mile	Gear Ratio	MILES PER HOUR WITH LOAD IN TONS PER MOTOR						
		4.5	5	5.5	6	7	8	9
1	4.20	19.9	19.4	18.9	18.5	17.9	17.3	16.8
1	3.59	21.1	20.6	20.1	19.8	19.1	18.5	18.0
3	4.20	14.0	13.8	13.7	13.5	13.2	13.0	12.8
3	3.59	14.4	14.2	14.0	13.9	13.6	13.4	13.2
5	4.20	11.0	10.9	10.8	10.7	10.5	10.4	10.3
5	3.59	11.4	11.3	11.1	11.0	10.8	10.7	10.6
6	4.20	10.2	10.1	10.0	9.9	9.8	9.7	9.6
6	3.59	10.4	10.3	10.2	10.1	10.0		
7	4.20	9.4	9.3	9.2	9.1	9.0	9.0	8.9
7	3.59	9.6	9.5	9.4	9.3			
8	4.20	8.7	8.7	8.6	8.6	8.5	8.4	
8	3.59	8.9	8.8	8.8	8.7			
9	4.20	8.1	8.0	7.9	7.9	7.8	7.7	
9	3.59	8.3	8.2	8.2	8.1			
Max. free running speed four-motor equipment.	4.20	27.9	26.5	25.5	24.8	23.4	22.3	21.4
	3.59	30.7	29.1	28.0	27.2	25.8	24.6	23.4

Max. free running speed of two-motor equipment approximately 90 per cent of above.

The approximate schedule speeds at voltages other than that on which the tables are based may be obtained as follows:

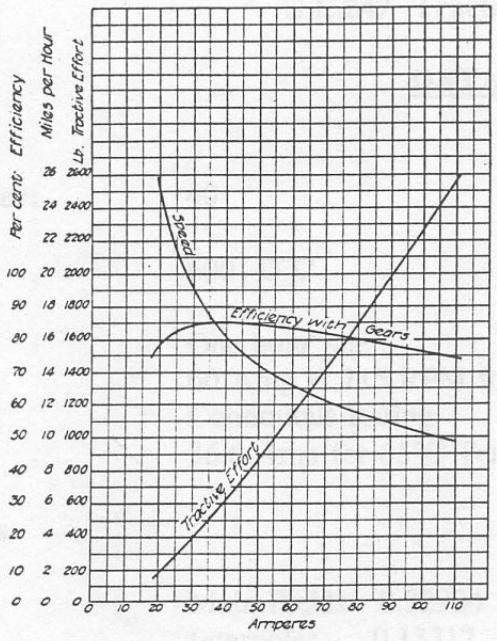
For each one per cent reduction or increase of voltage there will be approximately the following reduction or increase of schedule speed:

At one stop per mile 0.5 per cent.
At three stops per mile 0.2 per cent.
At seven stops per mile 0.1 per cent.

It must be remembered, however, that an increase of voltage will increase the heating effect on the motors and make it desirable in some cases to check the temperature rise.

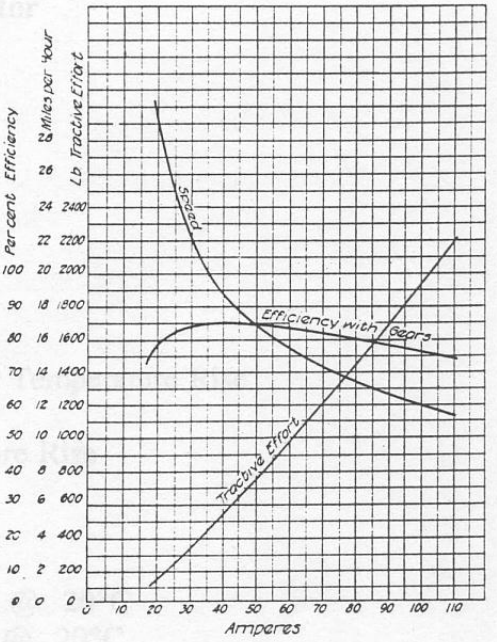
44406A-4 GE-247 Ventilated Commutating-Pole Railway Motor

GE-247—24-inch Wheel Motor
Characteristic Curves on 600 Volts
Diameter of Car Wheels 24 in.
Gear 58 teeth, Pinion 15 Teeth, Ratio 3.87
Maximum Gear Ratio



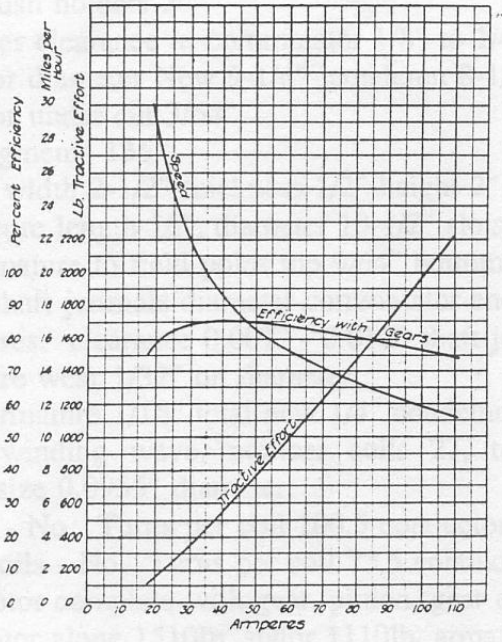
CHARACTERISTIC No. 277

GE-247—24-inch Wheel Motor
Characteristic Curves on 600 Volts
Diameter of Car Wheels 24 in.
Gear 56 Teeth, Pinion 17 Teeth, Ratio 3.29



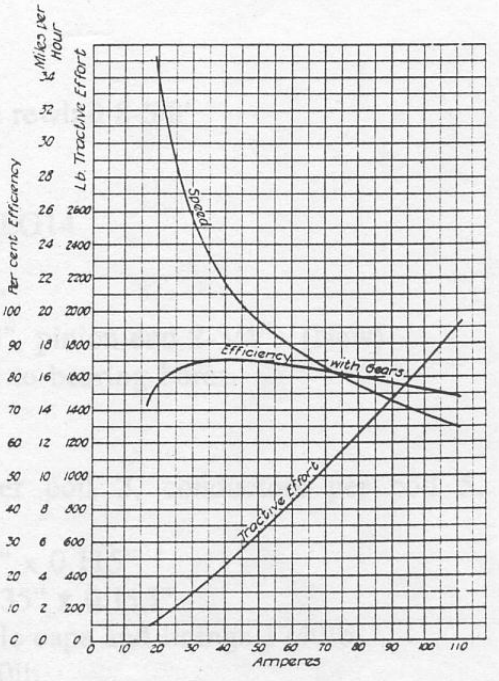
CHARACTERISTIC No. 279

GE-247—30-inch Wheel Motor
Characteristic Curves on 600 Volts
Diameter of Car Wheels 30 in.
Gear 63 Teeth, Pinion 15 Teeth, Ratio 4.20
Maximum Gear Ratio



CHARACTERISTIC No. 281

GE-247—30-inch Wheel Motor
Characteristic Curves on 600 Volts
Diameter of Car Wheels 30 in.
Gear 61 Teeth, Pinion 17 Teeth, Ratio 3.59



CHARACTERISTIC No. 283

Public Transport Corporation

G.E.247 Traction Motor

DATA

Horse Power: 40

Voltage: 600 D C

Current: One hour rate
60 Amp at 715 RPM for 75°C Temperature Rise
Continuous Rating
36.6 Amp for 65°C Temperature Rise

Resistances

Main Fields	0.32904	Ohms	@	20°C
Interpoles	0.13317	Ohms	@	20°C
Armature	0.41797	Ohms	@	20°C

Number main field poles 4
Number interpole field poles 3
Number brush holders 2
Brush holder clearance to commutator 1/8" to 1/4"
Commutator diameter New 9-1/4" condemn 8-1/2" last rewind 8-5/8"
Commutator under cut 3/64"
Number segments 135
Brush size width 2-1/2" thickness 1/2" height 2" grade EG14
Armature core length 10", diameter 10-1/2" slots 27
Air gap armature to field poles top 9/64" bottom 11/64"
Armature shaft journals diameter commutator end 2-3/8", pinion end 2-3/4". (New)
Bearing bores. clearance 0.007" - 0.012" shaft journals to bearing bores.
Bearing bore wear 1/32" on diameter.
End play armature 1/16" total new 1/4" condemn
Armature winding wave, number coils 27, turns per coil 3, conductors per coil 5, conductor size 0.0955" diameter.
Field coils - No. Turns per coil 100.5 conductor 0.235" x 0.115"
Interpole coils - No. Turns per coil 73.5 conductor 0.235" x 0.115".
Weight Motor complete with gear, pinion, gear case axle caps and linings 1740lb.
Weight motor alone 1510lb, stator 1110lb, armature 400lb.

APPENDIX A

G.E. 247 TRACTION MOTOR

DATA

HorsePower: 40
Voltage: 600 D.C.
Current: One hour rate
60Amp at 715 RPM for 75°C Temperature Rise
Continuous Rating.
36.6Amp for 65°C Temperature Rise

Resistances

Main Fields	0.32904 Ohms @ 20°C
Interpoles	0.13317 Ohms @ 20°C
Armature	0.41797 Ohms @ 20°C

Number Main Field Poles 4

Number Interpole Field Poles 3

Number Brush Holders 2

Brush Holder Clearance to Commutator 1/8" to 1/4"

Commutator diameter New 9 1/4" Condemn 8 1/2"

Commutator Under Cut 3/64"

Number Segments 135

Brush Size Width 2 1/2" thickness 1/2" height 2" Grade EG14.

Armature Core length 10", diameter 10 1/2" slots 27.

Air Gap Armature to Field Poles Top 9/64" Bottom 11/64"

Armature Shaft Journals diameter Commutator end 2 3/8", pinion end 2 3/4". (New)

Bearing Bores. Clearance 0.007" - 0.012" shaft Journals to bearing Bores.

Bearing Bore Wear 1/32" on diameter.

End Play Armature 1/16" Total New 1/4" Condemn.

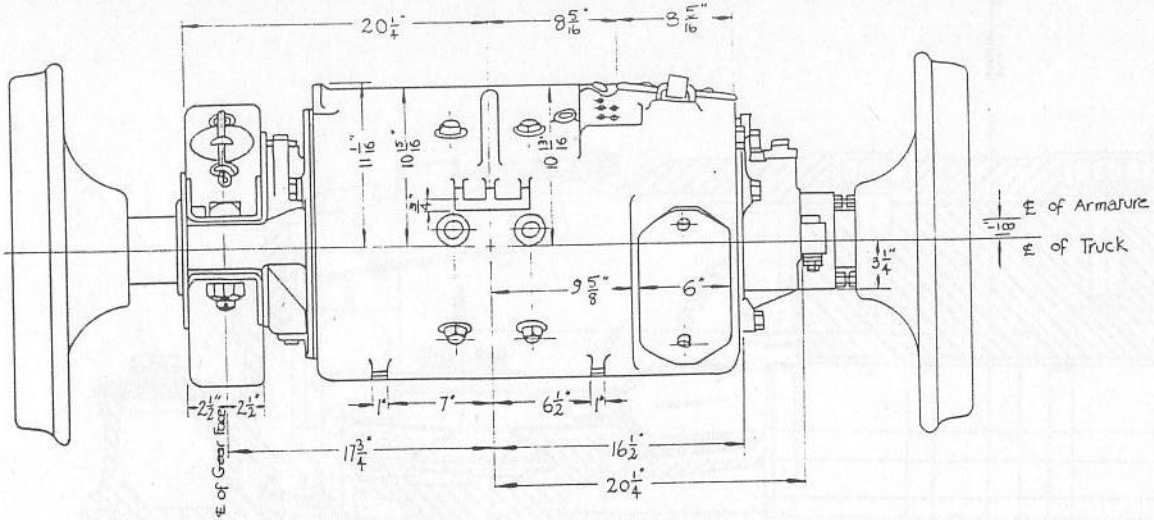
Armature Winding Wave, Number Coils 27, Turns per coil 3, Conductors per coil 5, Conductor size 0.0955" diameter.

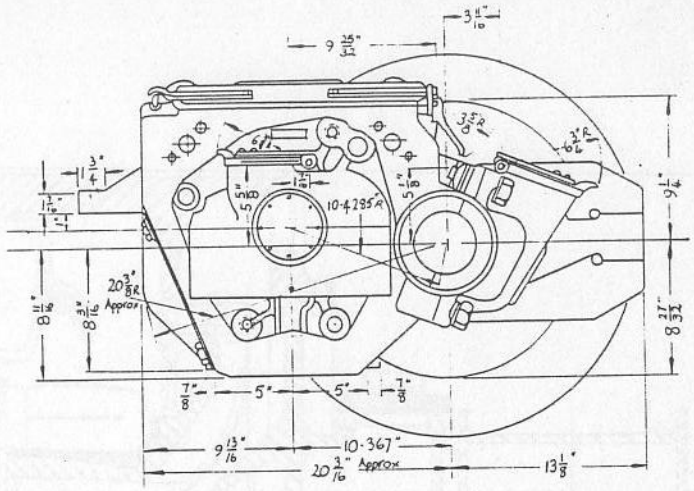
Field Coils - No. Turns per coil 100.5 Conductor 0.235" x 0.115".

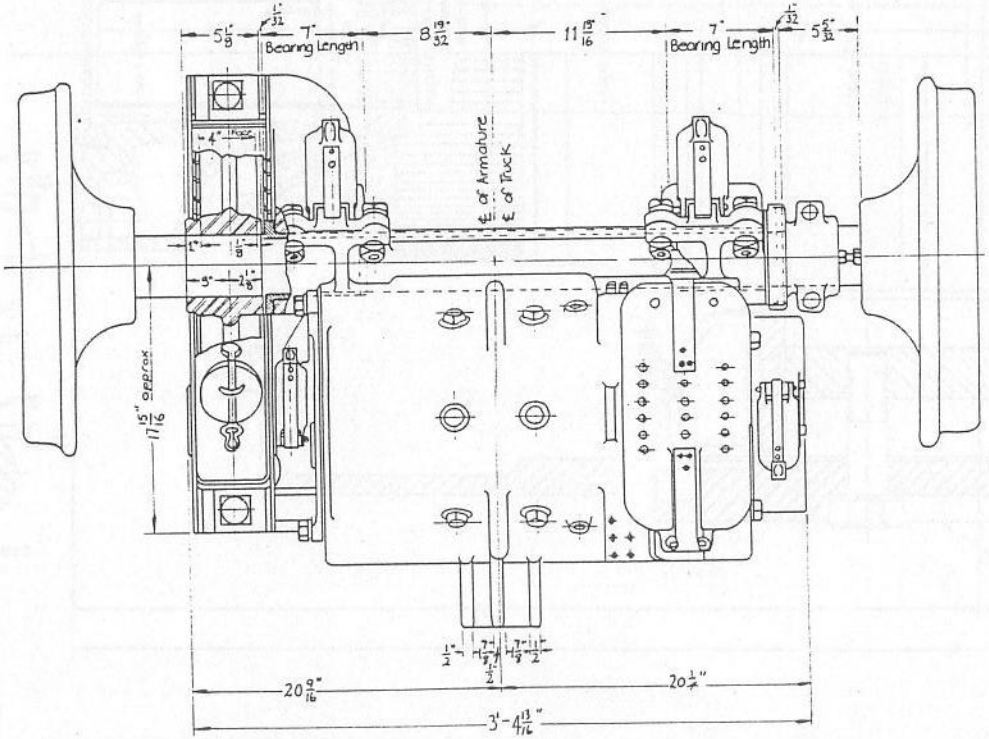
Interpole Coils - No. Turns per coil 73.5 Conductor 0.235" x 0.115".

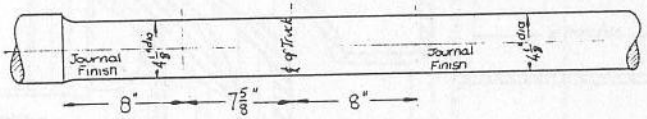
Weight Motor Complete with gear, pinion, gear case axle Caps and linings 1740lb.

Weight Motor alone 1510lb, Stator 1110lb, Armature 400lb.





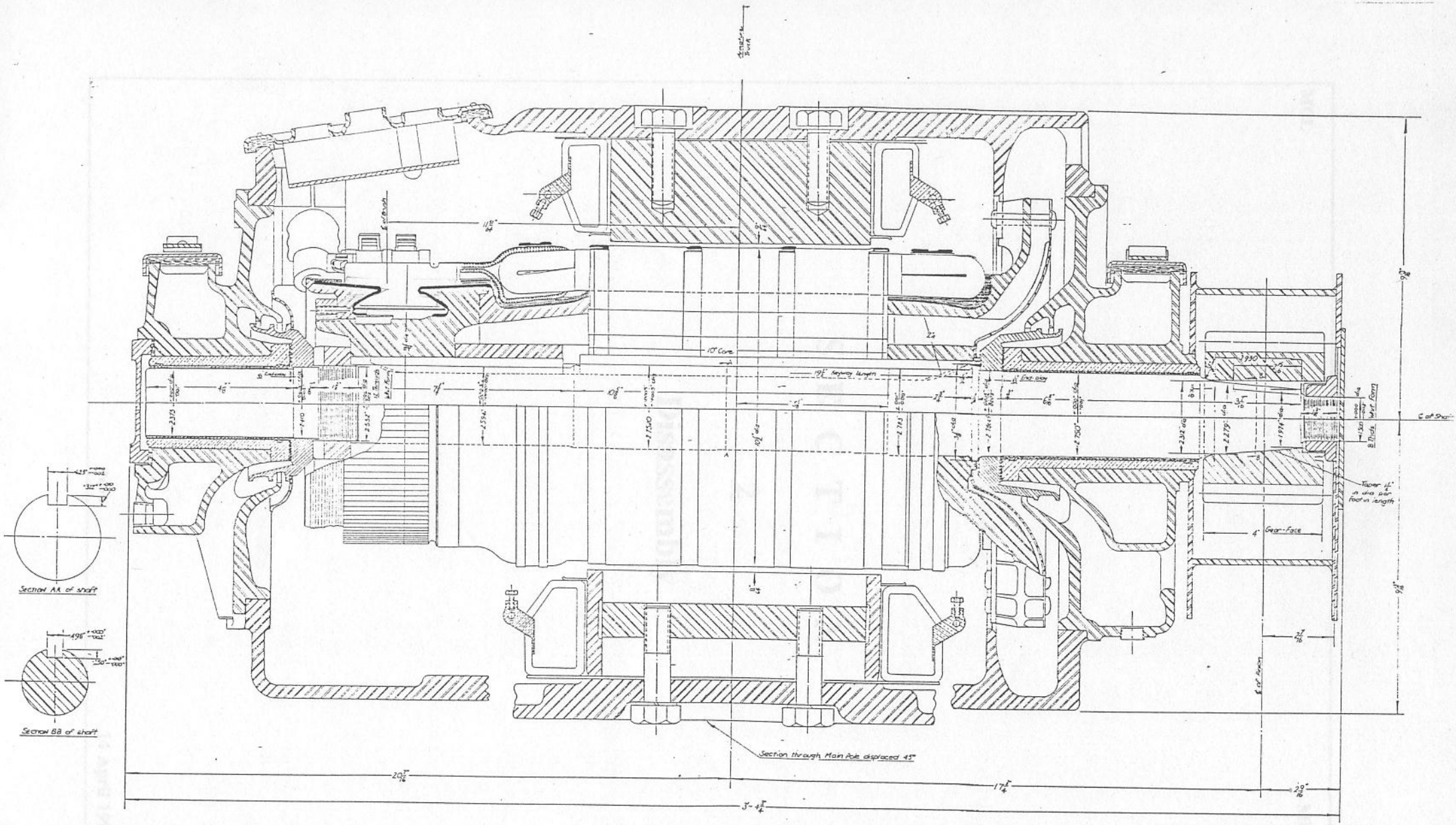




AXLE

Traced From Australian General Electric Dwg B 61622 7-2-45.
See Also General Electric Co Schenectady N.Y. Dwg. P-1040-45 8-4-26.
M.M.T.B. Foreign Print 1604.

APPROVALS	PUBLIC TRANSPORT CORPORATION RAIL VEHICLE MAINTENANCE DIVISION WORKSHOPS		LOCATION	
	DRAWN E. JOHNSTON	DATE 7-10-93	SCALE	TITLE OUTLINE FOR GE 247A TRACTION MOTOR WITH NOSE SUSPENSION
	DESIGNED			DO NOT SCALE IF IN DOUBT ASK
				DRG. No 4925-1018-13 REV



REV	DATE	DESCRIPTION	BY	APPD

APPROVALS

PUBLIC TRANSPORT CORPORATION
TECHNICAL SERVICES DIVISION
WORKSHOPS ENGINEERING

DRAWN	DATE	SCALE
CJ	10-6-93	Same as "A"
DESIGNED		
PASSED		

LOCATION

TITLE GE 247A MOTOR
LONGITUDINAL SECTION

Traced from drawing A50028 (1955-56 A50028 AUSTRALIAN GENERAL ELECTRIC LTD (NEWBURY WORKS) LC4457 The first two figures may be a 19 or 20 depending on the year of manufacture)

DO NOT SCALE IF IN DOUBT ASK

DRG. No. 4925-1018-12

REV.

SECTION

2

Disassembly

Public Transport Corporation

G.E.247 Traction Motor

Disassembly

1. Remove The Pinion

- Straighten the lock washer tabs away from the pinion retaining nut.
- Using a pneumatic impact gun and suitable socket loosen and remove the retaining nut.
- Remove the drive pinion using a hydraulic ram and suitable fittings.

When assembling the removal fittings and the hydraulic ram ensure that the assemble is aligned with the axis of the armature shaft.

Use either a hand pump or hydraulic power pump to activate the hydraulic ram.

If the pinion does not become free on the first attempt it may be necessary to use the hydraulic force in combination the impact force. The impact force can be applied by striking several "blows" to the hydraulic ram with a medium weight sledge hammer.

Should the above procedure fail to "break" the pinion free from the shaft permission must be sought to apply heat to the pinion to aide the removal process.

Note: The pinion is a taper fit on the armature shaft, there is also an anti-spin key fitted between the shaft and pinion.

2. Remove the commutator access cover and the commutator end side access plate.
3. Disconnect and remove the brush gear.
4. Fit a threaded lifting fitting to the pinion end of the armature shaft.

Using suitable slings attached to the lifting fitting and the stator lifting bails turn the motor to the vertical position commutator end down.

Ensure the motor is positioned vertically by packing under the commutator end with timber wedges.

.../2

Disassembly Cont'd

5. Remove the three pinion end end cover retaining studs.

   Screw two 7/8" whitworth bolts into the jack out threads in the end shield.

   Using an impact wrench "jack" the end shield out of the stator.

6. Apply a single leg lifting sling to the armature lifting fitting with a suitable lifting shackle.

7. Using the overhead crane lift the armature and end shield out of the stator, turn to the horizontal position then place the assembly on suitable armature stands.

8. Remove the pinion end end shield from the armature.

9. Fit two lifting eye bolts to the pinion end end shield retaining stud threads in the stator.

   Using suitable lifting slings applied to the eye bolts and stator lifting bails turn the stator to the horizontal position.

10. Remove the three commutator end retaining studs.

    Screw two 7/8" whitworth bolts into the "jack" out threads in the end shield.

    Using a pneumatic impact wrench jack the end shield out of the stator.

11. Press the bearings out of the end shields.

    The bearing anti-spin keys are to be retained the bearings are to be scrapped.

12. All motor components are to be thoroughly steam cleaned.

    Particular attention being paid to the oil lubricating pockets. Ensure all sludge deposits are removed from the bottom of the pockets.

    All dirt, carbon, oil, flaking paint and loose scale deposits are to be removed from the stator both internal and external.

S E C T I O N

3

End Shield Overhaul

G.E.247 TRACTION MOTOR

END SHIELD OVERHAUL

- Steam Clean the End Shields ensuring the following areas clean:

  Bearing housing bores.

  Wool waste pockets making sure all sludge has been removed.

  Inner and outer surfaces.

- Dry the end shields making sure the wool waste pockets are clean and dry.
- Inspect the jack out bolt threads repair if required.
- Check oil box lids, pivot, spring and seal replace worn components and seals.
- Check condition of commutator end dust cover.
- Check for warpage.
- Check bearing seat bores for wear.
- Check bearing retaining keyways for wear.
- Check for dimension and wear pinion end gear case support bracket.
- Check for wear and dimension the end shield stator spigot diameters/matting surfaces.

Armature Bearings

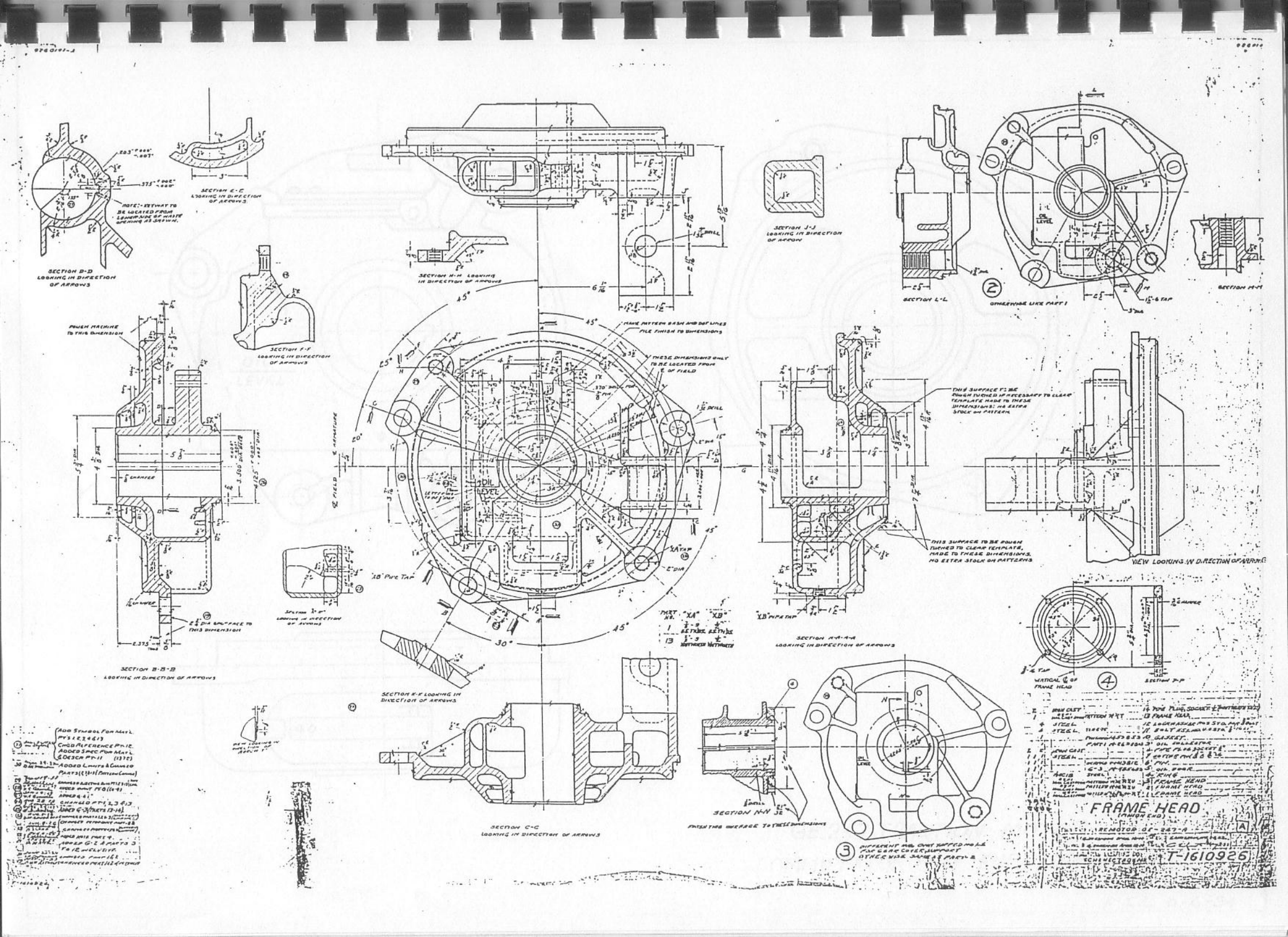
- Machine O.D. of bearings to + .001" Interference to End Shield bores.
  .000
- Machine bearing bores to suit journals of armature to be used, clearance before pressing bearings .007" to .008".
- Machine bearing collars to suit and set end clearance for armature to be used. Total end Float 1/16".
- Scrap the lubrication window opening reliefs.
- Clean all swarf off bearings.

GE247A Stator

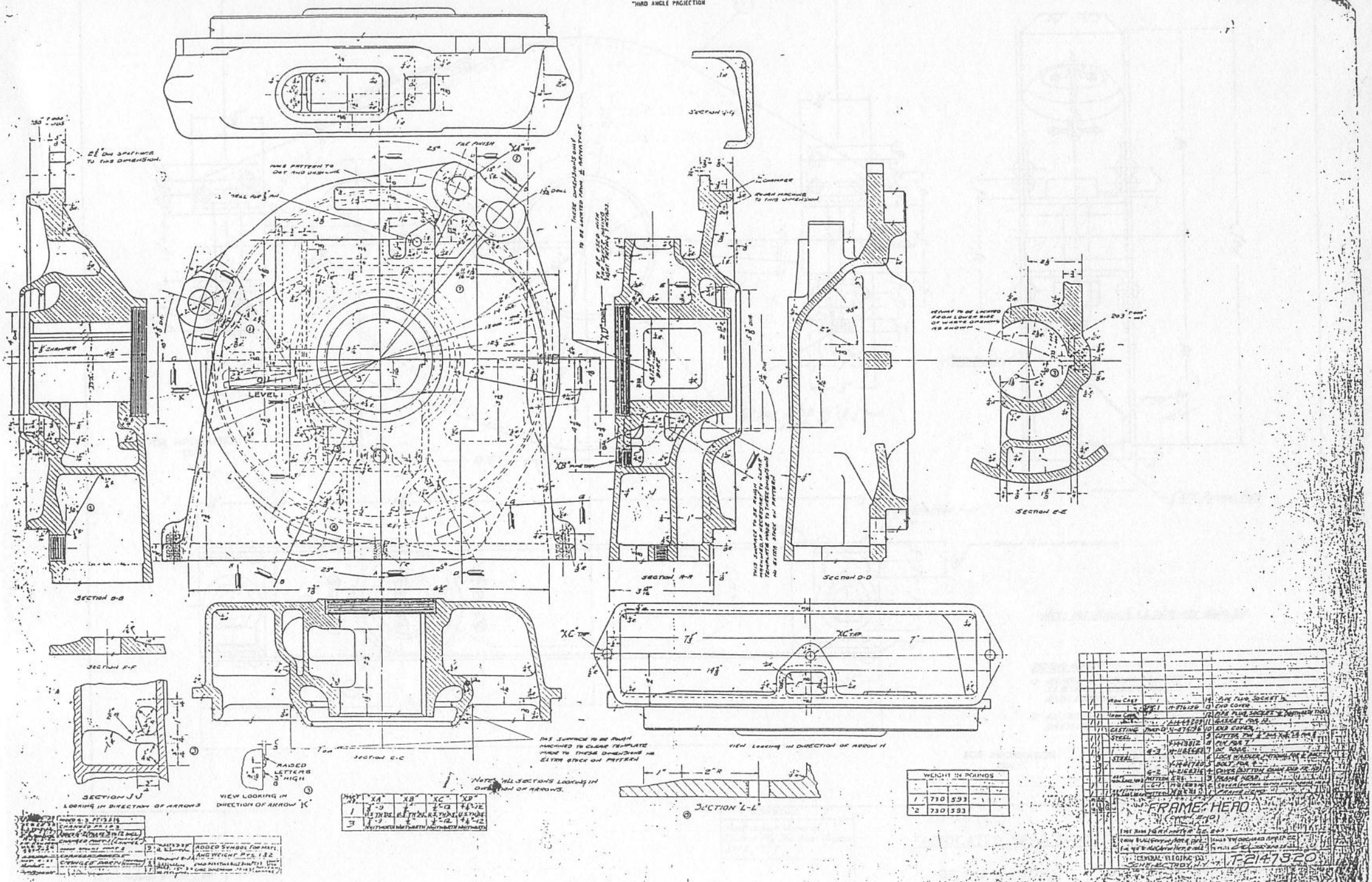
Serial N°	Comm End		Pinion End	
	Vertical	Horizontal	Vertical	Horizontal
A2844	13.001"	13.001"	14.255"	14.255"
A2359	13.00"	13.00"	14.258"	14.257"
A5355	13.004"	13.003"	14.246"	14.251"
A2481	13.000"	13.000"	14.252"	14.247"
A4163	13.007"	12.994"	14.253"	14.246"
A1898	13.004"	13.000"	14.256"	14.247"
A2775	12.995"	13.002"	14.246"	14.251"
A2457	12.998"	13.000"	14.251"	14.256"
8897	13.001"	12.999"	14.248"	14.243"
A5389	13.004"	13.000"	14.250"	14.243"

End Shields Pinion End.

Vertical	Horizontal
14.248"	14.246"
14.236"	14.244"
14.249"	14.245"
14.250"	14.248"
14.238"	14.247"
14.238"	14.244"


SECTION D-D LOOKING IN DIRECTION OF ARROWS
SECTION E-E LOOKING IN DIRECTION OF ARROWS.
SECTION H-H LOOKING IN DIRECTION OF ARROWS
SECTION J-J LOOKING IN DIRECTION OF ARROW
SECTION L-L
OTHERWISE LIKE PART 1
SECTION M-M
SECTION F-F LOOKING IN DIRECTION OF ARROWS
SECTION B-B-B LOOKING IN DIRECTION OF ARROWS
SECTION A-A-A LOOKING IN DIRECTION OF ARROWS
VIEW LOOKING IN DIRECTION OF ARROW
SECTION K-K LOOKING IN DIRECTION OF ARROWS
SECTION C-C LOOKING IN DIRECTION OF ARROWS
SECTION N-N
SECTION P-P
FRAME HEAD
(PINION END)
T-1610926

"THIRD ANGLE PROJECTION



	XA"	XB"	XC"	XD"
1	3/8-16	1/2-13	1/2-13	1/2-13
3	1/2-13	5/8-11	5/8-11	5/8-11

WEIGHT IN POUNDS				
1	730	593	-	-
2	730	593		

1	CASTING	A-576136	FRAME, HEAD
1	STEEL	6-3	PIN FOR 7
1	STEEL	6-3	LOCK WASHER, INTERNAL TOOTH
1	CASTING	A-576136	END COVER
1	STEEL	6-3	BOLT, FOR 9
1	STEEL	6-3	CHECK BUTTON COMPLETE
1	STEEL	6-3	FRAME HEAD
1	STEEL	6-3	SPRING
1	STEEL	6-3	PRAYER LEVER

FRAME, HEAD

T-21473-20

SECTION

4

Stator Overhaul

G.E.247 TRACTION MOTOR

STATOR OVERHAUL

Steam clean stator dry in oven 115° C. 12-24 hours.
Check axle bearing seats for dimensions and condition.
Check motor nose suspension bracket for wear.
Replace seal on commutator inspection covers top & side.

Electrical Tests

Insulation Resistance Test - 25 Meg Ohm min. @ 20° C.
2 Meg Ohm min. @ 75° C.

High Voltage Test - 1000 Volt A.C. for one minute.
1600 Volt D.C. leakage less than 10 Micro Amp.

Field Resistance (Total)

Main Fields	.32904 Ohm @ 20° C.
Interpoles Fields	.13317 Ohm @ 20° C.

Shorted Turns Test Field Coils

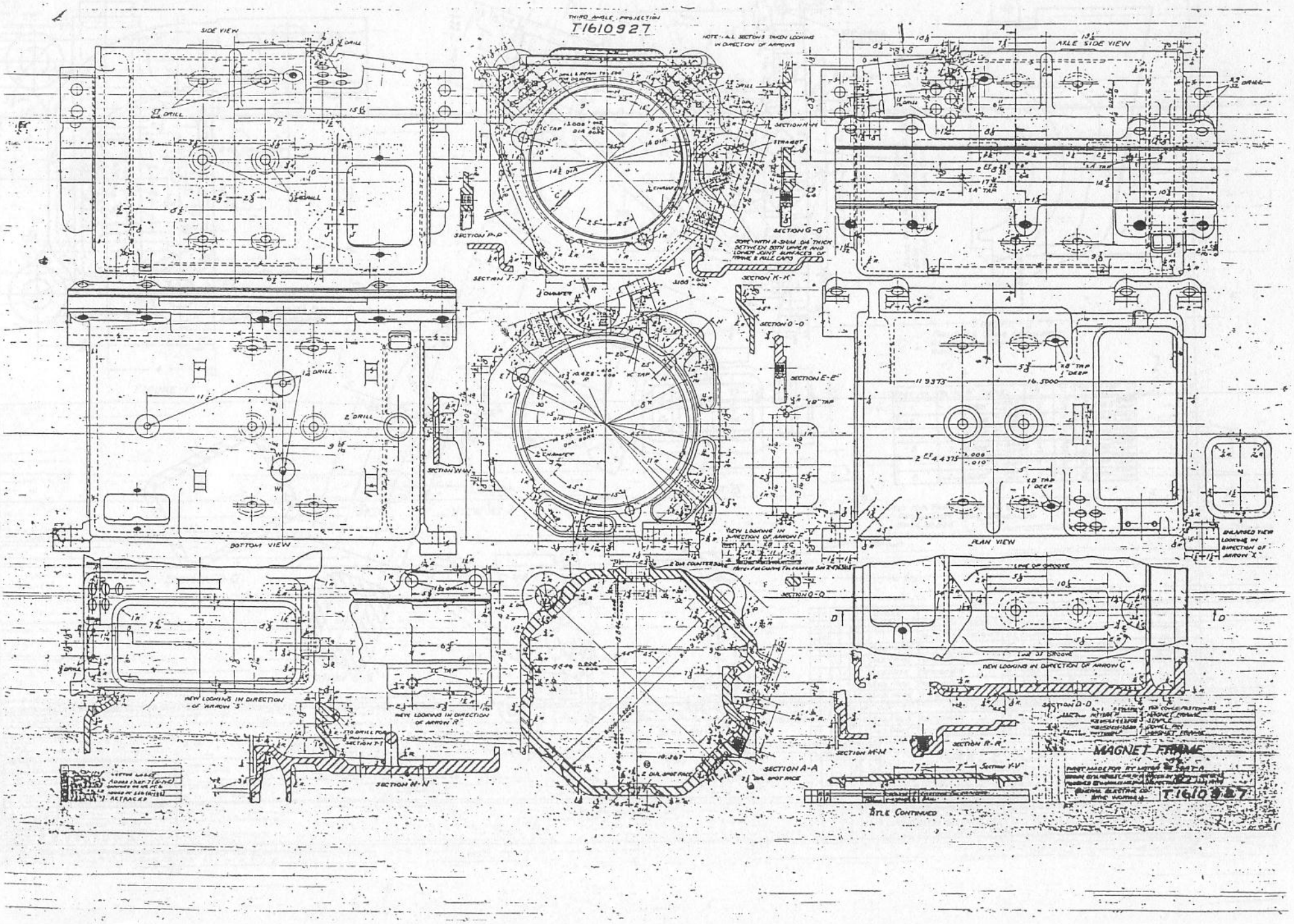
Apply 20 Amps to Main Fields and Interpoles and measure volt drop across each coil
Main Field Coil 1.645 Volt at 20° C.
Interpole Coil .8878 Volt at 20° C.

Check Polarity Main Fields & Interpoles.
Replace Main Fields or Interpoles if Defect.

Note: Air Gaps - Top Interpole 9/64".
- Bottom Interpole/Main Poles 11/64".

Armature core diameter 10-1/2".

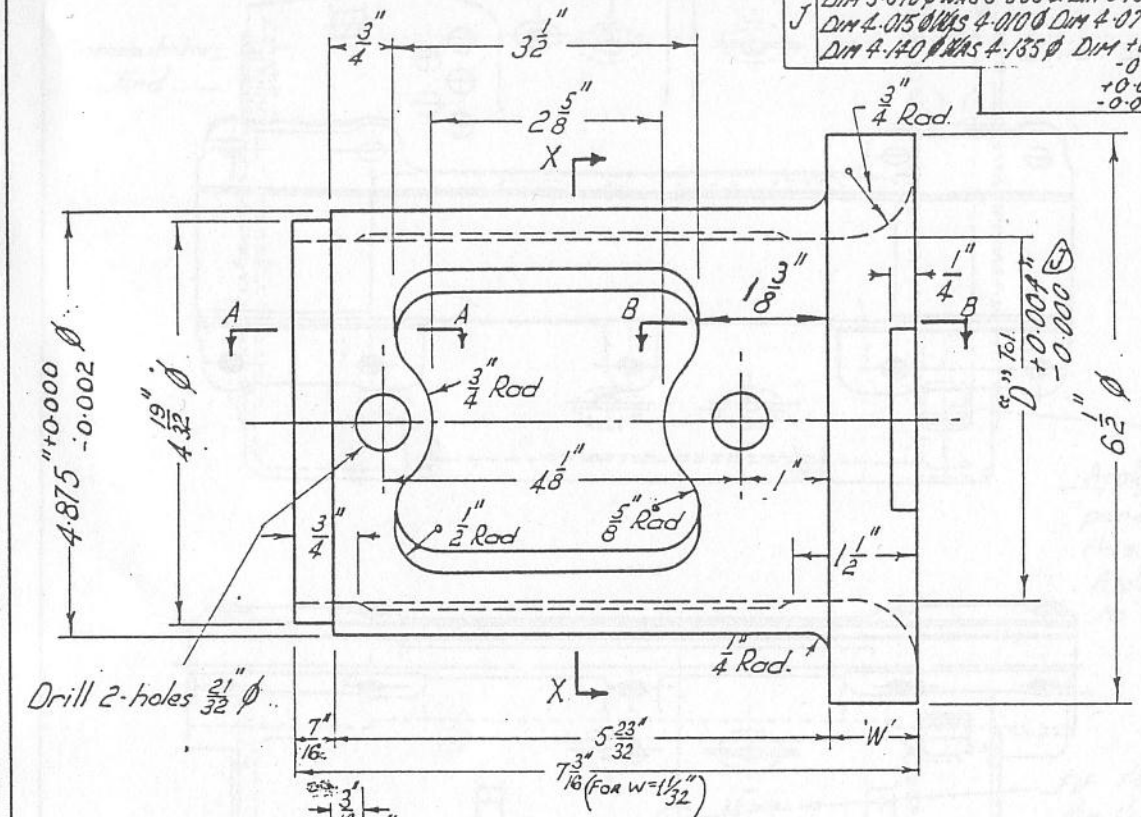
Replace poles that are badly scored due to armature rubbing.
Check lead condition replace if necessary.
Check lead to case grommets replace if necessary.
Retape and seal Field/Interpole Connections if necessary.
Check lead cleats replace if necessary.
Reseal field/Interpole Studs if required.
Check stator end shield housing bore diameters for wear.
Check threads.
Check stator end shield mating faces.

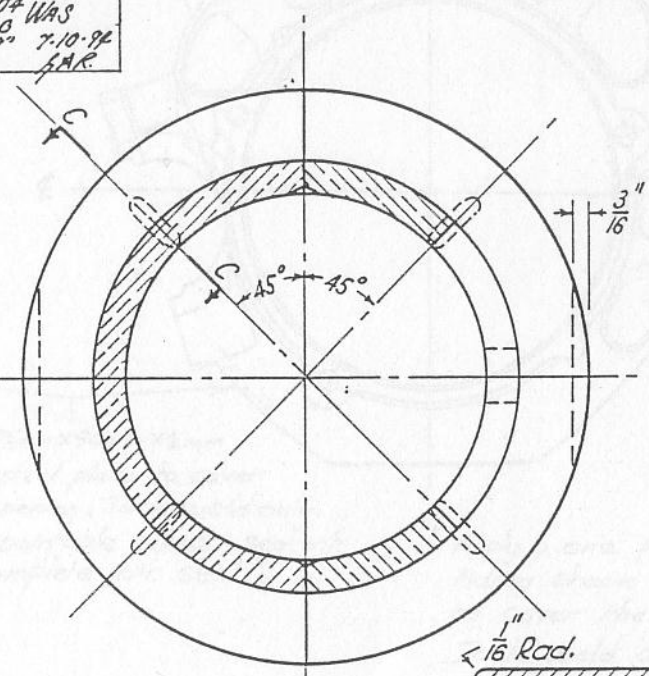

THIRD ANGLE PROJECTION
T1610927
SIDE VIEW
AXLE SIDE VIEW
BOTTOM VIEW
PLAN VIEW
SECTION A-A
SECTION D-D
SECTION E-E
SECTION G-G
SECTION H-H
SECTION K-K
SECTION M-N
SECTION P-P
SECTION Q-Q
SECTION R-R
SECTION T-S
SECTION V-V
SECTION W-W
MAGNET FRAME
T1610927

J | Dim 3.890 ø Was 3.885 ø Dim 3.953 Was 3.948 ø Dim 4.015 Was 4.010 ø Dim 4.077 Was 4.072 ø Dim 4.140 ø Was 4.135 ø Dim +0.004 Was -0.000 +0.009 -0.000 7-10-84 J.A.R.

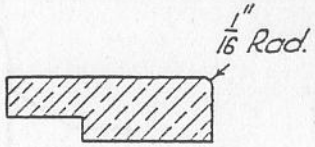
I | +0.009 -0.000 ADDED 15-7-94 J.A.R.

H | 3 7/8" ADDED TO TABLE. J.K. 12-11-93



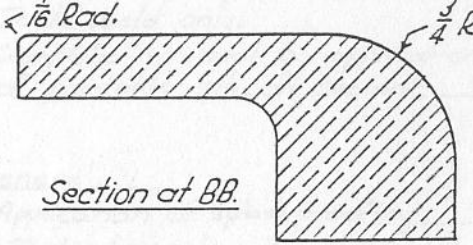


Section X-X.

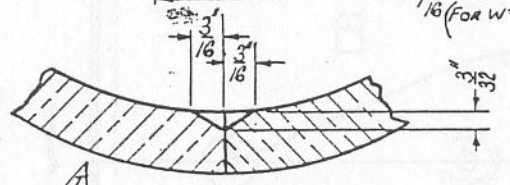


Section at A-A.

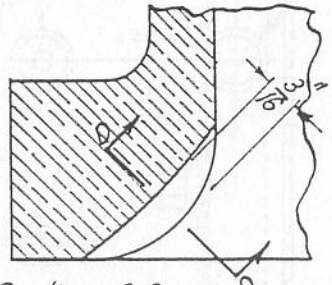
FOR INFORMATION ONLY
Updates are not provided



Section at BB.



Detail of oil groove.



Section C-C.

Section D-D.

G Material:- G.M. To A.S. 1565 - Grade C92610

f.a.o.

Pattern Nº 4305

A SHELL MOULD CASTING PATTERN Nº 4305S.

Axle ø	Bore 'D'	Sched & Item Nº's W=1 1/32"	W=1 1/4"
3 7/8"	3.890" ø	39192	
3 15/16"	3.953" ø	39187	
4"	4.015" ø	39190	
4 1/16"	4.077" ø	39178	
4 1/8"	4.140" ø	39189	

C Bore added for 3 15/16", 4", 4 1/16" ø axles. Title revised R.J.H 25-9-61

B Schedule & Item Nos. revised R.J.H 13-6-61

A Schedule & Item Nos added DEJ 12-8-59

D Table re-drawn. A.G.B. 18-2-65.

E. 1 3/8" ADDED. R.D.T. 25-5-70

F. REF. ADDED. RDT. 5/6/84

G. MATL SPEC UPDATED, NOTE ADDED. APPROVED J.A.R. 11/8/85

A Original Bearing R.2091; Wide Flange Bearing R.10-229

B NOTE: FOR SUSPENSION BEARING CASTING DETAILS SEE R12-057

SUSPENSION BEARING.

FOR REBORED GE.247 AX. MOTOR.

Superseding R.4656

MELBOURNE & METROPOLITAN TRAMWAYS BOARD

DATE

CHIEF ENGINEER

DRAWN TRACED T.A.B 17-9-56 C.N.C. 8/10/11

R9766

SCALE 6" = 1'-0" FULL SIZE.

S E C T I O N

5

Field Coil Replacement

G.E.247 Traction Motors

Fitting Main and Interpole Coils

1. Inspect the new coils check the following:

   - Coil tapping in secure.
   - Terminal connectors are secure.
   - The overall coil dimensions, compare with an original coil and dimensions shown on attached sketched.
   - Coils have been varnished.

2. Test coils electrically to determine correct polarity.

   All coils have the terminal connectors marked I and O.

   The "I" terminal is connected to the start of the coil winding, the "O" to the finish of the winding. All coils are wound in a clockwise direction viewed from the upper or pole face side.

3. Components of coil assembly:

   - Steel backing plate.
   - Spring steel angle flanges.
   - Iron pole piece.
   - Mounting studs with spring washers.
   - Insulated coil with terminal screws.
   - Insulation packing pieces.

4. **Coil Installation**

   The procedure for fitting main and interpole coils are similar.

   (a) Place the iron pole piece on a work bench pole face side down.

   (b) Fit the appropriate spring steel angle flanges to the pole piece, then fit the one piece upper insulation packing over the angle flanges.

   Note: The angle flanges must be clean, free from any burrs or burn marks, the clamping faces must be concaved in profile. If the clamping faces are flat this indicates the flanges no longer possess the required spring tension and should be rejected.

   (c) Fit the coil to the pole iron/angle flange assembly.

Coil Installation Cont'd

The pole face or upper side of the coil should be nearest the work bench. (i.e.) the coil is "upside" down.

Note: The pole face side of a coil is identified by the tapered profile. The narrow/tapered sections of the coils are at the pole face or upper side, the terminal screws also face the upper side.

(d) Place insulation packing pieces between the coil sides and the angle flanges to ensure the coils are a tight fit to the pole iron/angle flange assembly.

(e) Place the steel backing plate on the stator field coil mounting then place the coil to backing plate insulation piece on top of the plate.

Locate the coil/pole iron assembly over the backing plate ensuring the mounting stud holes are aligned.

Note: All coils are installed with the terminal marked "I" at the commutator end.

Pass the mounting stud through the stator holes from the outside and screw them into the pole piece.

Tighten the mounting studs.

(f) Repeat the procedure to install all other main and interpole coils.

Check the clearances between all coils and pole pieces. The clearances must be as evenly spaced as possible around the stator.

Using suitable gauge techniques check to ensure the pole face to armature air gaps will be to specification.

The upper 3 pole face air gaps to be 9/64" between the faces and the armature core.

The bottom 3 pole face air gaps to be 11/64".

Ensure adequate clearance between the terminal connectors and the fan shroud at the pinion end of the stator.

(g) Ensure all coils are securely clamped in position.

(h) Torque the mounting studs to the appropriate torque value for the size/thread from of the studs being used.

5. Fit new cable grommets to the cable entry holes at the commutator end of the stator.

   Fit a new one piece cable bushing inside the stator at the axle side to support the interpole jumper cable.

6. Cable the stator with new cables as per the cabling diagram and tighten the terminal screws. Do not overtighten the screws as this will strip the brass terminals threads.

   Fit a new earth cable.

7. Electrically test the installation for:

   - Insulation resistance.
   - Correct polarity of all coils.

8. Tape all terminal connectors with self seal silicone insulation tape.

   Secure the tape with string binding and apply a suitable adhesive sealant to the string.

9. Secure all external cables to a new cable cleat at the connector ends.

   Ensure the cables lay across the cleat in the correct orientation with respect to the earth cable (i.e.) Earth, **A,F,FF,AA.**

   Stamp the cable connectors using letter stamps.

   Apply cable identification labels to each cable.

   Note: Depending on the type of identification label used these may need to be applied prior to fitting the cables to the new cable cleat.

SECTION

6

Armature Overhaul

G.E.247 TRACTION MOTOR

Armature Overhaul

Steam Clean

Dry in oven at 115° C for 12-24 hours.

Note: Original conductors are D.C.C., other insulation cotton tape, cambric cloth varnished (i.e.) Class E insulation, maximum temp. 120° C.

Armatures rewound from 1993 onward have dual polesterimide or double glass insulated conductors.

Check shaft condition and size of journals, journals new Pinion end 2-3/4" Comm End 2-3/8" dia. Condemn limit pinion end 2-5/8" comm end 2-1/4" dia.
Check commutator diameter New 9-1/4" Condemn 8-1/2".
Check oil thrower thrust faces for score marks.
Check for poling damage, perform hot spot test if necessary.
Check bands and clips for condition.
Check string banding and comm service ring bands.
Check fan for warpage and loose rivets.
Check pinion end taper, thread, key way.
Examine commutator for overheat, burnt, loose, lifted bars or damaged mica.

Electrical Tests

Meggar Comm/Windings 1.5 Meg 75° C min.
20 Meg 20° C min.

High Potential 1000 VAC or 1600 D.C. one minute.

Drop Test 10 Volt 20 Amp ± 5% allowance variation bar to bar millivolt reading.

Varnish if required with low temp curing varnish.
Turn Commutator.
Undercut Mica 3/64".
Apply red air drying insulating enamel to bands only do not apply to laminated iron core.
Balance.

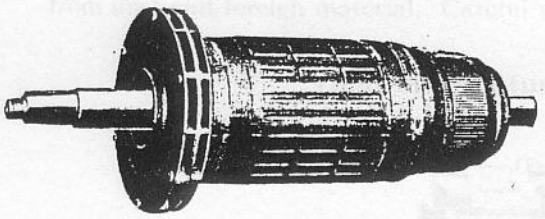
Note: Extreme care must be taken with high potential tests on very old armatures refer to revised test data.

RAILWAY AND MINE HAULAGE MOTORS

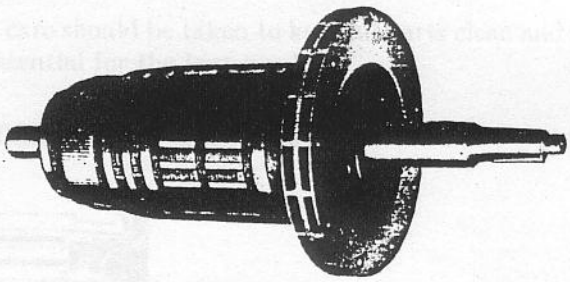
ARMATURES

Armatures for General Electric railway and mine haulage motors are built up of soft iron laminations interspaced with air ducts which provide good ventilation. These laminations are pressed on the shaft and are securely held in place by the armature heads.

The shaft which is ground and rolled may in the later type motors be removed from the armature without disturbing the armature windings or the connections to the commutator. To remove the



GE-247 Armature

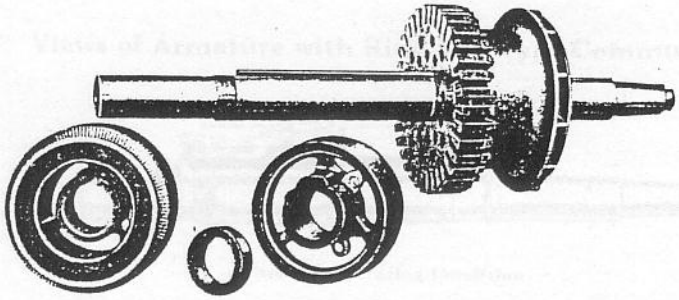


GE-264 Armature

shaft, bolts are inserted through the rear core head and screwed into tapped holes in the front head. The bolts securely hold the structure together while the shaft is being replaced. This construction eliminates the use of a solid spider which, in a limited diameter of armature, materially restricts ventilation and otherwise reduces the service capacity of the motor.

The armature coils are wound on forms, with insulation between the adjacent coils composing the unit or polycoil, which is pressed to exact shape and size in a steam mould. The coils are then covered with insulating material of high quality, and as a final protection, principally from mechanical injury, are covered with tape filled with an insulating compound. The windings are specially well protected from dust, oil or mechanical injury and at both ends are covered with a strong canvas dressing securely bound in place. All armatures are hot banded and the binding bands placed on flat surfaces and securely anchored in position.

Great care is taken in the construction of the commutator. The segments are made of hard drawn copper bars and insulated throughout with the best grade of mica. The cone micas are built up and pressed hard and compact in steam moulds. The mica between the segments is made of a softer quality to make it wear down evenly with the copper.



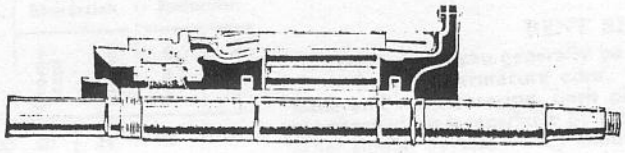
Armature Parts

The cone surfaces are carefully machined and cleaned from burrs and sharp edges to prevent short circuits between the segments, and the creepage distances are made long to prevent grounding. The shells and caps are made of cast steel in strong sections in order to prevent breakage and keep the shape of the commutator true. Before tightening the commutator nut, the segments are clamped tight by the cap which is pressed home in a hydraulic press.

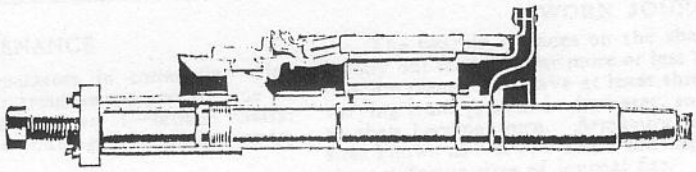
The liberal wearing depth of the segments and the excellent commutation of the motor insures a long life.

In making repairs to the commutator, especial care should be taken to keep all parts clean and free from dust and foreign material. Careful work is essential for the best results.

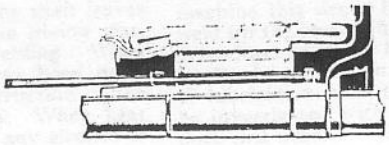
Views of Armature with Bolted Type Commutator



Normal Operating Condition

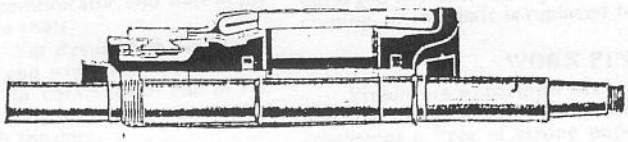


Showing Bolts for Removing Commutator

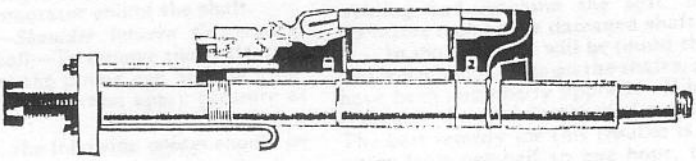


Shaft and Commutator Removed

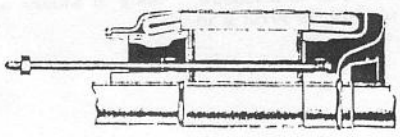
Views of Armature with Ring Nut Type Commutator



Normal Operating Condition



Showing Hook Bolts for Removing Commutator



Shaft and Commutator Removed

Removal and Replacement of Complete Commutators

In case the commutator as a whole must be replaced, the above illustrations show methods of removing it from the shaft for both the bolted and the ring nut types of commutators. Note the bolts used for clamping the core laminations together while the armature nut is removed.

Railway Motor Shafts and their Maintenance

A large number of the shafts of the older type of railway motors were made originally from a good grade of mild steel, and in general they were satisfactory. The tendency of present day practice in motor design, is to supply shafts made from heat treated steel or from a special alloy steel, such as chrome nickel or manganese. In connection with shaft renewals, on the older motors, operators having a high percentage of shaft breakage should consider the advisability of making shaft replacements using either the heat treated axle steel or special alloy steel.

Table I shows that the yield point of the heat treated material is 44 percent higher than the untreated axle steel, and the alloy steel is 77 percent higher, which in either case shows a considerable increase in the factor of safety, which would insure a reduction of shaft troubles.

TABLE I—CHARACTERISTICS OF STEEL FOR AXLES

	Ultimate Strength Lb.perSq.In.		Yield Point Lb.perSq.In.		Percent Elongation		Percent Reduction	
	Guaranteed	Average	Guaranteed	Average	Guaranteed	Average	Guaranteed	Average
Alloy Steel	100000	117000	65 000	80 000	20	24	45	50
Axle Steel	80 000	105000	50 000	65 000	18	23	50	55
Heat Treated Axle Steel	75 000	85 000	40 000	45 000	18	20	30	35

SHAFT MAINTENANCE

The experience of railway operators in connection with armature shafts indicate that their troubles are mostly due to some one or more of the following reasons: 1—broken shafts; 2—bent shafts; 3—worn journals; 4—damaged pinion key seats; or 5—worn pinion fits.

BROKEN SHAFTS

These breaks largely occur at points where the shaft leaves the spider or armature iron or at the end of the pinion seat. Some operators repair broken shafts by electric welding. When carefully done by experienced workmen this has been quite successful, although it is well known that the structure of the steel is more or less weakened by this process. When heat treated shafts are used, it is not advisable to do any electric or gas welding on them unless they are reheat-treated after being welded. It is more customary among operators to replace a broken shaft by a new one. There are four different types of construction that have been used in connection with the mounting of the shaft in the armature core, which are known as follows:

Laminations Built on Shaft—Nut At Commutator End of Shaft.—To remove the shaft, take off the fan at the pinion end, the wiper ring and shaft nut at the commutator end and apply pressure at the commutator end of the shaft.

Laminations Built on Spider—No Nut Required on Shaft—To remove the shaft, take off the pinion end wiper ring (or the fan if one is used) and apply pressure at the commutator end of the shaft. In this case it is not necessary to remove the commutator end wiper ring, as it will come off with the core.

Laminations Built on Shaft—Nut between Commutator Nut and Core—To remove the shaft, take off the pinion end wiper ring, the commutator end wiper ring, the commutator and shaft nut and apply pressure at the commutator end of the shaft.

Laminations Built on Shaft—Shoulder between Commutator and Core, Nut at Pinion End of Shaft—To remove the shaft, take off the wiper ring and shaft nut at the pinion end and the commutator end wiper ring and commutator and apply pressure at the pinion end of the shaft.

In replacing armature shafts, the following points should be kept in mind:

1—Check the bore of the spider or of the laminations, also the diameter of the shaft and see that the shaft measures several thousandths of an inch larger than the bore to insure a good press fit.

2—Apply a little white lead on the shaft at the fits to provide a lubricant and prevent rusting.

3—Check the clearance between the top of the key and the key seat in the core to prevent binding at this point.

4—Chamfer the start of the bore to allow the shaft to enter straight and to get an even start.

5—When ready to press in place, see that the shaft is level. This can best be determined by means of a small spirit level. This is important to get the shaft pressed in straight.

6—Shafts should press in at from 15 to 25 tons on motors ranging from 25 to 50 hp. and from 40 to 50 tons for sizes above 50 hp.

7—Shafts will press out at approximately 1.5 to 2 times the tonnage used when they are pressed in, because of slight rusting and flowing of the metal.

8—The press fit should vary, depending upon the metal of the core and whether keys are used. Steel or malleable iron can safely stand a higher tonnage than cast iron. In cores without keys, a higher tonnage should be used.

BENT SHAFTS

Bent shafts can generally be straightened without removing them from the armature core. The armature is swung in a lathe and while rotating, both pinion end and commutator end are checked for eccentricity by means of a Bath indicator or some other similar device. They should be straightened so that they will not run out of true more than from four to six thousandths of an inch before being put back in service.

WORN JOURNALS

The bearing surfaces on the shafts do not wear down uniformly but tend to wear more or less tapered. Common practice in some places is to have at least three different sizes of journals varying from $\frac{1}{8}$ inch in diameter, to which shafts are machined as they become worn. Armature bearings with corresponding sizes known as No. 1, 2 and 3 bearings, are made to be used with these different sizes of journal fits. Some operators, after the shafts have been turned down to the minimum workable size, shrink a sleeve of seamless steel tubing over the journal fit and machine this sleeve back to the original size. Other operators weld up the journal fit to bring it back to its original size. This procedure, as stated before tends to weaken the structure of the steel. In connection with excessive journal wear, the question of lubrication, also the material of the bearing surface might be investigated with resulting improvements that would minimize this wear.

DAMAGED PINION KEY SEATS

A very common practice in connection with a damaged key seat on the pinion fit is to enlarge the key seat and use a special offset key. Another method is to cut a new key seat in the opposite surface of the pinion fit. When the key seat is so badly damaged that the above repairs are not practical, the damaged key seat is sometimes built up by welding and remachining, or the shaft is replaced by a new one.

WORN PINION FITS

Pinion fits sometimes become worn and slightly under size, allowing the pinion to ride up too far on the taper. Under these conditions a liner of strong paper or of sheet metal (either has been used successfully) fitted over the taper provides a good tight fitting pinion properly located axially on the taper. When this fit is badly worn, some operators build up the pinion seat by welding and machine the seat to its original size. Other operators replace the damaged shaft by a new one.

In most cases it will be found that damaged pinion key seats and worn pinion seats on the shafts, are due to loose pinions which have been improperly applied. Where this trouble is chronic, it is suggested that the method of putting on pinions be investigated. The best remedy for this trouble is to heat the pinion in boiling water from one-half to one hour, depending upon its size, and drive it on to the shaft with a six to eight pound sledge hammer. After the pinion is in place, apply the pinion nut with its lock washer and screw the nut tight with a wrench having a purchase or a lever arm of three to four feet.

Removing and Replacing Railway Motor Armature Shafts

There are four general methods of mounting the commutator and core on a railway motor armature shaft. On the more modern motors, especially of the smaller sizes for low floor cars, the iron is built directly on the shaft and held in place by a nut at the commutator end; this type is used mostly on the ventilated type motors having longitudinal ventilating ducts through the core and a fan at the rear end. Where space is available the spider type of construction is also used. The other two types mentioned below have been superseded, as it is necessary to disconnect the

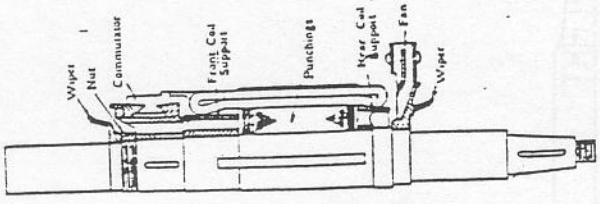


FIG. 1—IRON BUILT ON SHAFT.
Nut at Commutator End.

armature leads from the commutator when a shaft is to be replaced. Some of these older type shafts have wiper rings screwed on the shaft, but this practice has been changed to a shrunk-on type of wiper on the more modern motors.

IRON BUILT ON SHAFT—NUT AT COMMUTATOR END

In Fig. 1 is shown the construction in which the armature iron and commutator bushing are mounted directly on the shaft and depend upon the press fit, the key, and the lock nut at the commutator end to keep them in place. The fan and commutator end wiper ring which have been shrunk on, are removed by heating them with one or more blow torches (keeping the shaft cool by wrapping it with wet asbestos) and driving them off with a hammer and chisel. After the fan and wiper are removed, clamp the core and commutator together by placing over the shaft two pieces of iron pipe, one on each end, large enough to clear the armature nut and long enough so that the plates placed over the shaft and against the pipes will clear the end of the commutator and the end of the coils at the pinion end, as shown in Fig. 5. Bolt the plates together, using four or more bolts just clearing the outside of the armature. Take special care to cut the pipes off square and to pull the bolts up evenly to prevent warping the core when the shaft is removed. Allow clearance enough at the

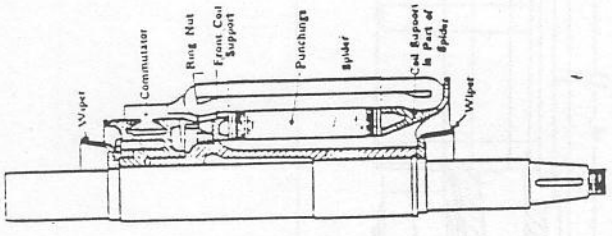


FIG. 2—IRON BUILT ON A SPIDER

pinion end between the plate and the shaft so that the key will clear. Another form of clamp has rings machined to fit the commutator and rear coil support, with bolts through the longitudinal vent ducts. When the clamp is in place, back off the lock nut at the commutator end, press out the shaft by applying pressure at its commutator end, and replace with a new one. With the new shaft in the core, apply and tighten the armature nut, remove the clamp and shrink on the fan and wiper ring.

SPIDER CONSTRUCTION

In Fig. 2 is shown the construction where the armature iron and commutator bushing are mounted on a spider, which is, in turn, mounted on the shaft. The commutator end wiper and the fan are shrunk on. To remove the shaft, take off the pinion end wiper ring (or fan, if a fan is used) by heating as described above. With this type it is not necessary to remove the commutator end wiper, as it comes off with the core. Pressure is applied at the commutator end of the shaft in removing. The new shaft is pressed in and after it is in place, the commutator end and pinion end wiper or fan are shrunk on. This method applies both to spiders with separate rear end bells and to spiders with rear end bells cast integral.

IRON BUILT ON SHAFT—NUT BETWEEN COMMUTATOR AND CORE

In Fig. 3 the commutator spider and core are shown mounted directly on the shaft with a ring nut between the commutator and the core. With this type of construction, it is necessary to lift the

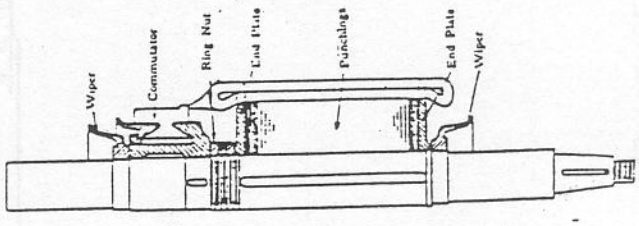


FIG. 3—IRON BUILT ON SHAFT
Nut Between Commutator and Core.

armature leads out of the commutator neck, remove the wiper rings and pull the commutator first. The commutator is provided with tapped holes for bolts to aid in this operation. After the commutator is removed, clamp the core together, using a modification of the clamping devise shown in Fig. 5, back off the ring nut, and press out the shaft, applying pressure at the commutator end. After the new shaft is in place, apply the ring nut to secure the core, press on the commutator, shrink on the wiper rings and reconnect the windings.

IRON BUILT ON SHAFT—NUT AT PINION END

In Fig. 4 is shown a type in which there is a shoulder on the shaft between the commutator and the core. In this case it is necessary to disconnect the windings the same as for Fig. 3. Remove the wiper rings and pull the commutator as described above. Clamp the core together, back off the ring nut at the pinion end and press out the shaft, applying pressure at its pinion end. Press in the new shaft and apply the ring nut, which should be drawn up tight before the clamp is removed. Replace the commutator and reconnect, then shrink on the wiper rings.

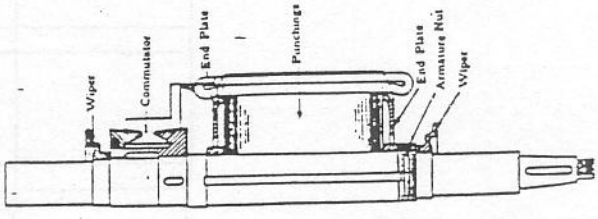


FIG. 4—IRON BUILT ON SHAFT
Shoulder Between Commutator and Core.

PRECAUTIONS

In connection with the replacing of shafts of railway motor armatures, the following points should be kept in mind.

1—A little white lead on the shaft at the fit before pressure on acts as a lubricant and prevents rust.

2—New shafts should have fillets at all changes in diameter, as it tends to prevent breaking of shaft.

3—New shafts should be made about 0.004 in. larger than the original shaft at the press fit, to insure the proper tonnage in pressing them in.

4—Check the clearances between the top of the key and the key seat in the core to prevent binding at this point.

5—Chamfer the start of the commutator bore to allow the shaft to enter straight and get an even start.

6—Shafts should be pressed in at approximately 20 to 25 tons on motors from 25 to 50 hp and about 40 to 50 tons for sizes above 50 hp.

7—Wherever possible, the armature nut should be removed and replaced while the clamps are in place.

8—Shafts will press out at approximately 1.5 to 2 times the tonnage used when they are pressed in, because of slight rusting and flowing of metal.

9—The press fit will vary, depending upon the material of the core. Steel or malleable iron can safely stand a higher tonnage than cast iron.

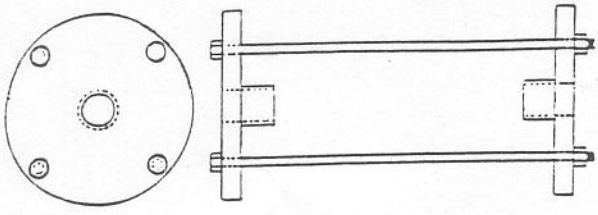


FIG. 5—CLAMP FOR HOLDING ARMATURE WHILE SHAFT IS REMOVED

SECTION

7

Armature Rewind

Public Transport Corporation

G.E.247 Traction Motor

Armature Rewinding

1. Inspect the Armature

- Check the fan for loose rivets.
- Check the condition and size of the armature shaft bearing journals. Measure the journal diameters, the minimum or condemning diameters are as follows:-

  Pinion end 2-5/8". (66.5 mm).

  Commutator end 2-1/4 (57mm).
- Check the pinion end thread and the pinion mounting taper of the shaft for damage. Should the thread on taper be damaged they must be reworked or the armature shaft condemned.
- Check the oil slingers for excessive score marks. Replace if required.
- Check the keyway for damage and dimensions.
- Check the core laminations for damage. (i.e.) burn marks, poling damage, if necessary perform a core loss lamination hot spot test.
- Check the commutator for size and suitability for rewind.

  Minimum diameter before rewind to be 8-5/8" (219 mm).
- Test the commutator for loose bars, deteriorated mica. If the commutator has loose/damaged bars or deteriorated mica it must be condemned.

2. Strip, Clean, Test

- Strip the armature of all windings and insulation.
- Thoroughly clean the commutator segment risers of all traces of the previously used soft solder.
- Thoroughly clean the armature iron core.

  Ensure there are no burrs or shorted laminations.

...../2

2. Strip, Clean, Test Cont'd

- Electrically test the commutator for insulation resistance to ground and bar to bar test.

  Insulation resistance to ground 50 Meg. minimum at 20° C. 500 Volt D.C.

  High potential test the commutator at 3700 V.D.C. for 1 minute, leakage current less than 10 micro AMP.

  Insulation resistance to ground 50 Meg. minimum at 20° C. 500 Volt D.C.

  Bar to Bar test at 125 D.C. Zero leakage current.

  If the commutator fails the tests it is to be condemned.

3. Reinsulated The Armature

- Insulate the back of the fan with a fibre glass annulus.

- Insulate the coil supports with glass/mica insulation.

  Both the front and back coil supports are to be filled with insulation up to the level of the bottom of the core slots.

- The foundation insulation is to be treated with suitable air drying varnish of a minimum class "f" temperature rating.

4. Fitting The Armature Coils

- Mark out the armature as follows:-

- Establish the alignment of core slot number one with commutator bar number one. Slot one aligns with the centre of commutator bar one.

  Number the core slots 1-27 anti-clockwise.
  Number the commutator bars 1-135 clockwise.

  Count from commutator bar 1 to commutator bars 15,16,17,18,19 in a clockwise direction facing the commutator at the commutator end of the armature. Mark the bars.

- From commutator bar 15 count the bars anti-clockwise 1-68. Mark the commutator bars 83,84,85,86,87.

- From core slot number one count the slots 1 to 8 in an anti-clockwise direction mark core slot number 8.

- Coil number one is to be installed in slots 1 and 8.

Fitting The Armature Coils - Cont'd.

- The coil side in slot one will be in the bottom of slot number one. The coil side in slot eight will be in the top of the slot.
- The leads from the coil side in slot number one will be positioned in commutator bars 15,16,17,18,19.
- The leads from the side in slot number eight will be positioned in commutator bars 83,84,85,86,87.

Note:- Refer to the armature winding diagram on drawing K-1629315.

- Place suitable slot liners in the first eight slots.
- Install the first coil in slots one and eight.

Note:- Insulation packing pieces are to be installed under each coil in the slots and between the top and bottom coil sides in each slot.

- Ensure the first coil is symmetrical in the armature core.
- Place the leads of the coil side in slot one in commutator bar risers 15,16,17,18,19.

  The leads from the coil side in slot eight are to be left out of the commutator risers 83,84,85,86,87 at this time.

- Install a further 6 coils in a similar manner. Progress in a clockwise direction.
- After installing the first seven coils commence placing insulation pieces between the upper and lower coil sides of the coil overhangs at both fan and commutator ends.

  The insulation pieces should extend from the inside of the coil involutes knuckles to the armature core.

  Insulation pieces are also to be placed between the top and bottom leads behind the commutator risers.

- Proceed to install the remaining coils in the same manner as the first 7 coils. Install the coils in groups of 4 to 7 at the same time progressing the inter turn insulation pieces as well as the top to bottom lead insulation.

  Take care to ensure the winding remains symmetrical in relation to the armature core and does not become tight or bunched up.

- Close off the winding by placing the last bottom coil sides under the first 8 top coil sides.

Fitting The Armature Coils - Cont'd.

- Test the windings for insulation resistance to frame using a 500 V.D.C. Tester.

- Place the top leads in the correct commutator risers commencing with leads of coil number one from slot number eight. These leads are to be placed in risers 83,84,85,86,87, all remaining leads are placed in the commutator risers following in a clockwise direction.

5. Place packing sticks in the top of the core slots over the coils.

6. Band the core section of the armature in the banding grooves with fibre glass banding tape.

   - Follow the manufacturers recommendation for banding tension.

   - Place the armature in a baking oven to cure the bands.

7. High potential test the windings.

   Note: This is a reduced voltage prior to varnishing the armature. Test the windings for insulation resistance before and after the high potential test.

8. Cut the leads off at the commutator risers and turn for T.I.G. welding.

   - T.I.G. weld the commutator.

   - Clean the commutator risers after T.I.G. welding.

9. Test the armature for short circuits.

   - Perform bar to bar voltage drop test.

   - Surge test the armature.

10. Varnish the armature by two consecutive V.P.I. varnish and bake procedures.

    - Clean up the armature after varnishing.

11. Band over the coil ends.

    - Band of the fan end.
    - Band behind the armature core at the commutator end.
    - Band over the leads behind the commutator risers.

    - Cure the banding in an oven.

12. Test the armature for insulation resistance.

    - High potential test the winding at 3700 V.D.C. for one minute.
    - Test the armature for insulation resistance.
    - A minimum of 50 Meg Ohms insulation resistance is required before and after the high potential test.

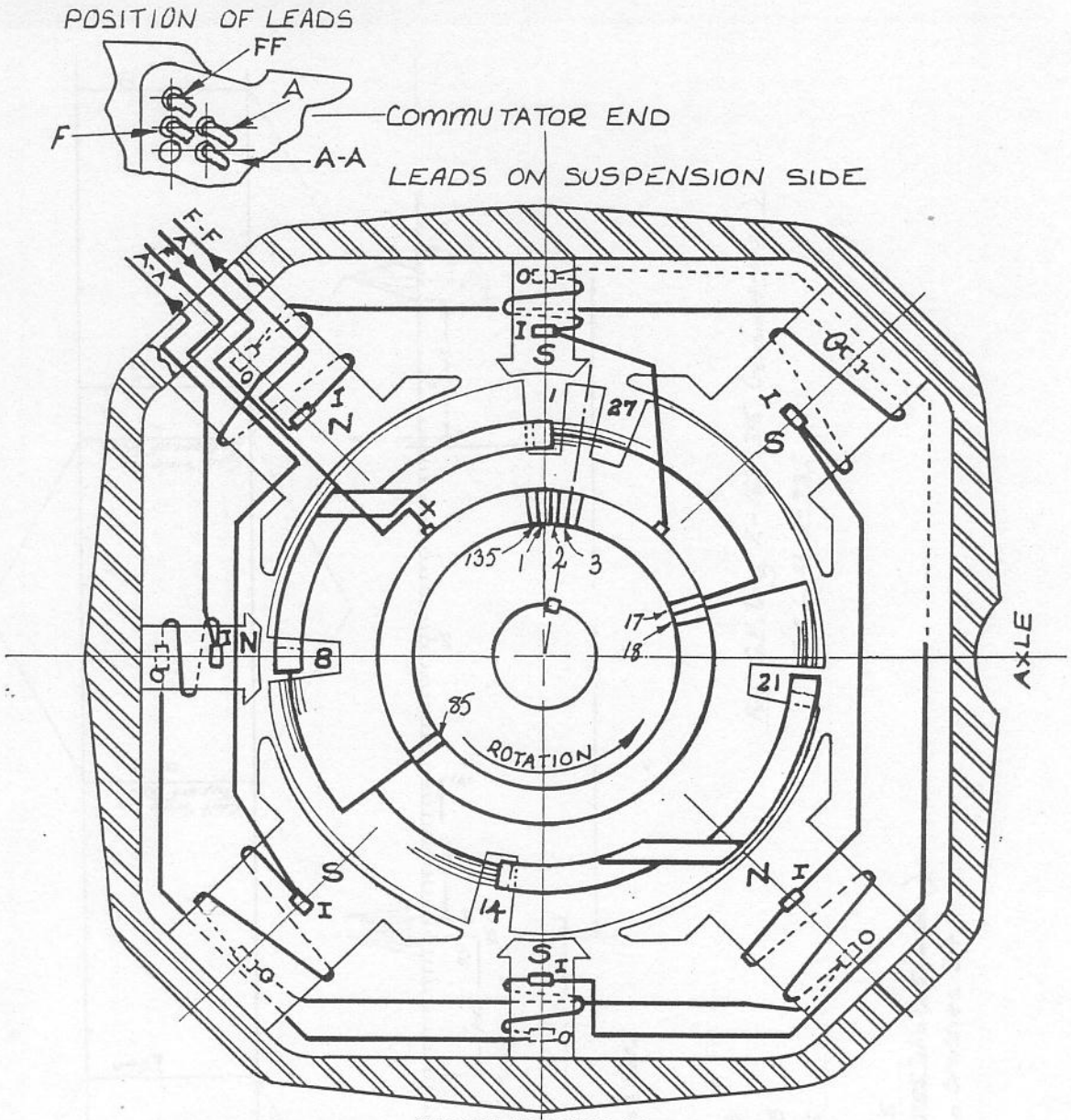
13. Turn the commutator brush surface.

    - Undercut the commutator segments and chamfer the top edges of the bars.

14. Balance the armature.

15. Paint the bands with air drying insulating enamel.

    Red enamel at the fan end.
    Grey at the commutator end.



SPECIFICATIONS

TURNS	ARMATURE	EXCITING	COMMUTATING
3	A-54728	F-117390	F-117391
3	A-54728	F-120318	F-120319

℄ slot 1 Aligns ℄ Comm Bar 1

REVISED NOV 4-20

CONNECTIONS

OF ARMATURE AND FIELD WINDING FOR G.E. 247 600 VOLT RAILWAY MOTOR

GENERAL ELECTRIC CO., SCHENECTADY. N.Y.

CHECKED E. L. Priest

DRAWN BY L.C. Milton Jan 11-16 INSPECTED Jan 21-16

K-1629315

Note: Field and Interpole connections changed 8-11-1928 Drg MMTBR2102. 23-2-1928.

RAIL VEHICLE MAINTENANCE
WORKSHOPS GROUP
Drg No 4925-1018-16
Traced 12-11-1993 EJ

PUBLIC TRANSPORT CORPORTATION

ELECTRICAL WORKSHOPS - SPOTSWOOD

W Class Tram Motor Type GE247

Armature Test Sheet

Serial No. .....

Date: ...../...../.....

CONDITION	TEST	OPERATION	SPECIFICATION	RESULTS
Bare Commutator	Insulation Resistance	500 V. Tester 3700 V. D.C. 1 Min. 500 V. Tester	Greater than 50 M Ohm Less than 10 Micro Amp Leakage Greater than 50 M Ohm.	
Bar to Bar Bare Comm.		125 V. D.C.	~~Zero~~ Less than 1 MicroAmp ~~Leakage~~ Leakage	
Partly Wound		500 V Tester 1600 V DC 5 Sec. 500 Tester	Greater 50 M Ohm Less that 10uA To Frame Greater 50 M Ohm	
Fully Wound Prior to Varnishing		500 V Tester 2200 V DC 5 Sec. 500 V Tester	Greater 50 M Ohm Less that 10uA To Frame Greater 50 M Ohm	
Fully Wound After Varnishing		1000 V Tester 2200 A.C. 1 Min 1000 V Tester	Greater 50 M Ohm To Frame Greater 50 M Ohm	
Voltage Drop Test	Commutator Bar to Bar	Apply 10 Amps to Commutator 1-34 Bars apart.	Voltage Drop Bar to Bar to be within ± 5% each reading in millivolt	

Comments: .....

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Tester: .....

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SECTION

8

Brush Holder Overhaul

G.E.247 TRACTION MOTOR

BRUSH HOLDERS

General

There are two types of brush holders fitted to the G.E.247 traction motor:

1. The barrel spring type having separate springs, brush hammer levers and ratchet wheels.

2. The clock spring type having one end of the clock spring extended to form the brush hammer. This style of brush holder also uses ratchet and pawl spring tension adjustment.

Both styles of brush holder employee a toggle action between the brush holder body and brush hammers to transfer the spring tension to the carbon brushes.

Cleaning

The brush holders must be disassembled before cleaning by either solvent or sand blasting.

Note:

1. The insulated mounting posts must not be soaked in cleaning solvents.

2. If complete assembles are sand blasted the brush holders must be disassembled to remove all traces of blast medium from the pivot spindles, ratchet wheels and pawl mechanisms. Traces of sand remaining in an assembled brush holder can cause premature wear if put into service.

Inspection and Overhaul

(a) When disassembled examine the brush holder body, check for:

- Worn spindle mounting holes
- Excessive flash over damage
- Warpage
- Excessive wear in the Carbonways, the allowable wear is 1/32" total over the width and thickness of a new brush.

Inspection and Overhaul Cont'd

(b) Examine the brush holder components check for:

- Loose or worn brush contacts
- Bent or worn brush hammer levers
- Worn or distorted springs
- Cracked, burnt or loose porcelain insulators on the mounting posts
- Frayed/Burnt braided copper shunts
- Worn ratchet wheels
- Worn ratchet pawls

Components that are excessively worn or distorted must be replaced.

Excessive wear in the brush holder body lever spindle mounting holes must be rectified by bushing.

When the brush holder has been reassembled set the brush hammer tension by rotating the ratchet wheels. Ensure the ratchet pawls fully engage in the ratchet wheel teeth.

The spring tension is to be adjusted to produce a force of 6-8 lb (2.7 - 3.6 Kg) total for the two levers. (ie) 3-4 lb (1.35-1.8kg) per lever

Measure the force using a spring balance.

Brush Holder Posts

Check porcelains, if cracked or damaged renew.

If the porcelains are loose these will require the packing to be reworked. The original packing consists of friction tape and mica with shellac as the binder.

Note: The porcelain does not insulate the metal post from the extruded brass sleeve at the top of the post. The main insulant is a red fibre tube pressed over the round metal post. The brass extrusion is held in position by being crimped 180° apart down the length of its diameter.

There is a brass cap fitted to the top of the extrusion under which are a series of mica washers.

The brass extrusion protects the red fibre insulant from being damaged when the brush box is mounted in the stator and the saddle clamps are bolted in position.

The porcelain provides a smooth surface to prevent carbon from settling on the post and causing an electrical tracking path to earth.

Electrical Tests

Electrically test the post for insulation resistance by applying a minimum of 1600 Volts D.C for one minute the allowable leakage current is zero.

If the post fails the test it will require replacement.

Replace the post with a new 2 piece resin insulated type of post.

Fitting a New Brush Holder Post

When replacing the post press the original post out of the body after removing the retaining pin.

Ream the mounting holes to 3/4" dia.

The new post mounting diameter is 0.750" + .001
- .000°

Press the new post in position.

Drill and fit new retaining pin.

SECTION

9

Assembly

ASSEMBLY G.E.247 TRACTION MOTOR

Pressing the bearing into the end shields

1. Each bearing has a key to prevent the bearing turning in the housing.

   The bearings are an interference fit.

   Before commencing the pressing operation ensure the end shield is well supported on the press table, the bearing must enter the housing square off.

   Do not attempt to press a bearing that is out of alignment.

   Smear the end shield bore and the outside of the bearing with a small amount of grease to aid pressing operation.

   Fit the anti spin keys to the keyways on the bearings outside diameters then press the bearings into their respective end shields.

   Note: It may be necessary to dress the keyways and keys to remove burns or other damage.

Assembly of the Traction Motor

1. Fit the commutator end shield housing to the stator. Use the three retaining studs to pull the housing into the stator, tightening the studs in sequence until the housing is fully home against the stator end.

2. Turn the stator on end, commutator end down.

   Level the stator using wooden packing blocks and wedges. Check with a level.

3. Screw three guide pins into the pinion end end shield retainer stud holes.

4. Apply bearing oil to the pinion end journal of the armature shaft and the pinion end bearing.

5. Fit the pinion end end shield to the armature.

   Ensure the end shield/bearing is applied square to the shaft, take care not to dig the end of shaft into the bearing babbitt lining.

6. Lift the armature to the vertical position using the crane with the hook attached to the pinion end lifting fitting.

Assembly of the Traction Motor

7. Apply bearing oil to the commutator end journal of the armature shaft and the commutator end bearing.

8. Lower the armature into the stator carefully ensuring that the commutator does not contact the field poles as it is lowered.

   Align the pinion end end shield over the guide studs.

   Continue to lower the armature until the commutator end of the shaft is about to enter the bearing, stop the crane.

   Check that the shaft will enter the bearing square/true, commence lowering the armature again, slowly rotate the armature as the shaft passes through the bearing.

   Do not rush the operation otherwise the end of the shaft will dig into the bearing babbitt lining.

9. Remove the guide pins.

   Use the pinion end retaining studs to pull the end shield into the stator.

   The studs must be tightened in sequence to allow the end shield to be pulled in as square as possible to the stator.

   Do not rush the operation otherwise the bearing babbitt metal may be damaged by uneven pressure causing flat spots on the bore.

10. Turn the motor to the horizontal position using suitable slings attached to the bail lifting lugs of the stator and the armature lifting fitting at the pinion end.

11. Ensure the armature turns.

    Note: Initially the armature will be hard to turn. Once the armature is made to turn with oil present between the shaft and the bearings it should turn freely.

    If the armature cannot be made to turn it will be necessary to dismantle the motor to ascertain the reason why.

12. Torque the end housing studs to the recommended torque value for the stud thread form and diameter.

13. Pack wool in the end shield lubrication pockets.

It is important that the wool extends from the bottom of the pockets and contacts the armature shaft at the bearing lubricating windows.

The wool strands should extend from the bottom of the pocket to the window opening with the strands in the vertical position there must not be any lumps or vacant space in the strands. For the oil to feed correctly there should be no breaks in the strands of wool between the oil supply and the point of contact, gaps will destroy the capillary action.

String the wool out vertically and pack it in the pocket ensuring it is securely in position against the shaft. The entire pocket cross section area is to be filled, this may require more than one hank of wool.

Only presoaked wool is to be used.

14. Fill the pockets with oil down the filler tubes taking care not to flood the bearings.

Do not rush the operation allow time for the oil to soak into the wool.

Fill only to the oil level marked on the end shields. Check the level with a suitable gauge stick.

Do not pour oil on top of the wool as this tends to settle the wool into a sodden wad and stop the capillary action.

Close the lubrication pocket lids.

15. Fit the commutator end bearing seal and dust cover.

16. Apply brush bedding abrasive paper and secure around the commutator.

17. Fit the brush boxes and connect the leads to the terminals.

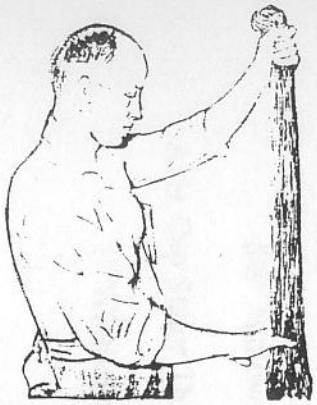
18. Fit the brushes and bed in by turning the armature 3-4 revolutions.

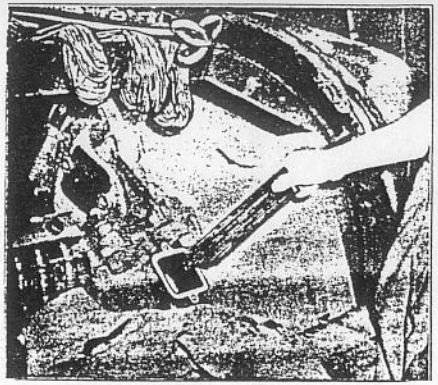
19. Remove the abrasive paper through the commutator end side cover and vacuum the carbon dust out of the machine.

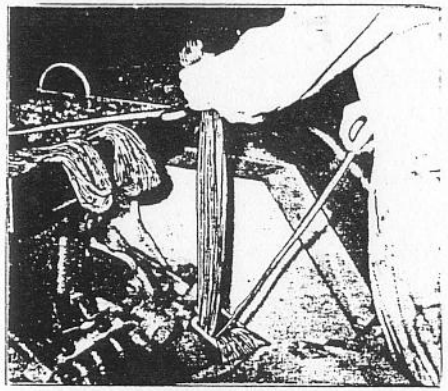
20. Set the brush box clearance to the commutator between 1/8" and 1/4".

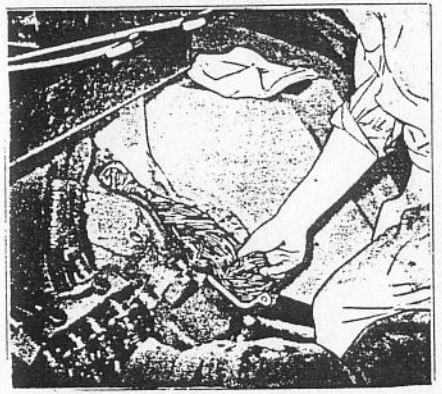
21. Apply new seals to the commutator end side cover and the commutator inspection cover.

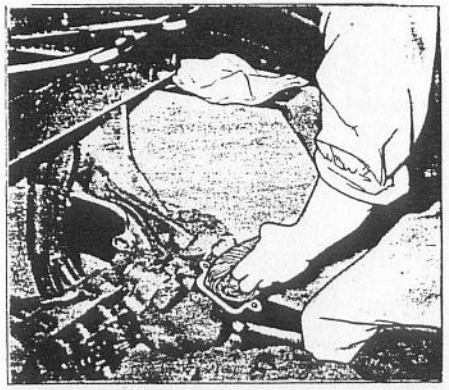
Fit the covers to the traction motor.

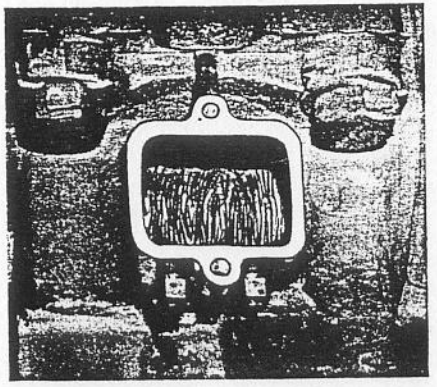


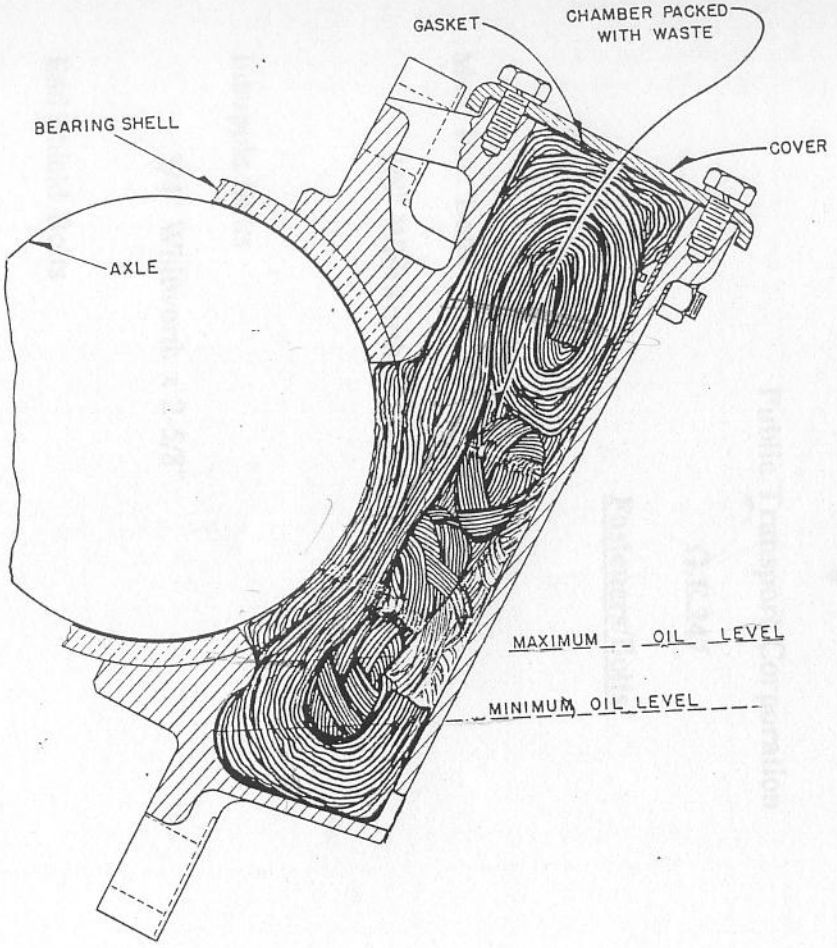












Traction Motor Axle Cap

Public Transport Corporation

G.E.247

Fasteners/Bolts

Main Pole Bolts

7/8" Whitworth x 3-1/4".

Interpole Bolts

3/4" Whitworth x 2-5/8".

End Shield Bolts

1" Whit x 1-7/8".

Jack out Studs

7/8" Whitworth.

Brush Holder Mounting Bolts

7/8" Whitworth x 3-1/4".

Side Cover Plate Studs

5/8" Whitworth x 1".

Earth Stud

5/8" Whitworth x 1".

Axle Cap Stator Threads

1" Whitworth.

IMPERIAL FASTENERS

THREAD SIZE	B.S.W. (WHITWORTH) NC, UNC	B.S.F. NF, UNF
Inch	lbf ft	lbf ft
3/16	2	2-3
1/4	6-9	8-10
5/16	12-16	14-19
3/8	28-34	33-38
7/16	44-48	55-60
1/2	70-75	80-90
9/16	85-95	105-112
5/8	130-140	160-170
3/4	230-240	285-295
7/8	400-420	470-490
1	540-560	620-650
1-1/8	760-790	850-900
1-1/4	1000-1050	1150-1200
1-1/2	1500-1550	1650-1700

METRIC FASTENERS

The chart below is based on Average torque values for fasteners under DIN 267/3 standard, 8.8 strength rating.

THREAD SIZE	TORQUE N m	THREAD SIZE	TORQUE N m
M 3	1.3	M12	78
M 4	2.8	M14	127
M 5	5.6	M16	196
M 6	9.8	M18	260
M 7	15.7	M20	373
M 8	25	M22	500
M 9	34	M24	637
M10	44	M27	961
		M30	1314

SECTION

10

Fitting Motor Pinion

Public Transport Corporation

G.E.247 Traction Motor

Fitting of Motor Pinion

1. Check the armature shaft taper, keyway and thread.

   - If necessary use a die nut to restore the thread.
     Thread size is 1-1/2" dia. 8 threads per inch whitworth form.

   - If required dress the keyway to remove burrs, to not remove excessive amounts of metal.

     Keyway dimension as new .498" + .000"
     _ .002" (Width)

     .250" + .010"
     _ .000 (Depth)

     Maximum wear condition .502" (Width)

   - Ensure the key will fit the keyway as a neat sliding fit.

     The key should not be loose nor require force fitting to the keyway.

     If using a new key dress the width to attain the correct fit.

2. - Try the pinion to be fitted to the shaft by hand, if necessary use prussian blue to establish the degree of fit between the shaft taper and pinion bore taper.

     A fit of 50% minimum is required. The majority of the contact between the pinion bore and the shaft taper should occur at the smallest diameter. If the contact occurs at the large diameter of the taper only the fit is incorrect.

   - The shaft may be dressed using a fine grade emery of 240 grit to establish the required fit.

   - The pinion may be lapped to the taper using a fine lapping compound to ensure a good fit.

Fitting of Motor Pinion Cont'd

Note: - Should the shaft taper be excessively worn or distorted the pinion must not be fitted.

- Should the pinion bore be excessively scored or distorted it must not be fitted.

3. Having attained the correct fit between the shaft and pinion the key must be tried in the pinion keyway for correct top clearance.

   - Fit the key to the shaft.
   - Fit the pinion to the shaft by hand.
   - Check the clearance between the top of the key and the pinion keyway.

   The correct clearance is 1/64" minimum, if the clearance is less that 1/64" dress the key to obtain the clearance.

4. Clean the pinion bore and shaft taper.

   Heat the pinion on an induction heater or in an oil bath to 100° C.

5. Ensure the key is properly positioned then fit the heated pinion to the shaft taper.

   Drive the pinion up the taper parallel to the armature shaft, using a hollow cylindrical dolly with one end closed off, by striking several blows with a medium weight sledge hammer.

   Do not strike the pinion without the dolly, to do so will cause the pinion to dig in to the shaft taper and advance out of square.

6. Fit the lock tab washer and pinion retaining nut.

   Tension the nut with a pneumatic impact gun.

   Turn the lock washer tab over against the nut.

SECTION

11

Wool Preparation

G.E.247 TRACTION MOTOR

WOOL WASTE PREPARATION

Hank Preparation

Twisting

- Holding both ends twist the hank one and half turns end to end.

Binding

- While still holding the hank ends, to maintain the 1-1/2 turn twist, fold the hank in half and bind the ends with a single strand of wool.

Drying

Dry wool waste at 95° C in an oven to drive off the natural moisture for 2-4 hours.

Note: Damp wool will not absorb oil or wick properly.

Oil Impregnation

Soak the wool waste in bearing oil heated at 25° C to 40° C for a minimum of 24 hours.

Waste Packing

Prior to packing lubricating boxes the waste must be drained until oil stops dripping.

Waste wool to be lightly wrung out such that sufficient oil remains to leave a film on a clean polished metal plate when pressed against the wool.

The waste should be immediately packed in the lubricating boxes and boxes filled with oil to gauge level on end shields.

Note: Prior to packing the wool waste in the bearing lubrication pockets the abovementioned binding is removed.

S E C T I O N

12

Running Maintenance

Public Transport Corporation

Rail Vehicle Maintenance Division

Workshops Group

Electrical Workshops Spotswood

G.E. 247 TRACTION MOTOR

RUNNING MAINTENANCE

To ensure satisfactory operation of the traction motor in service regular maintenance inspections and adjustments must be performed.

At Regular Intervals carry out the following procedures and adjustments:

Cleaning

- Clean the top of the traction motor around the commutator inspection cover.
- Clean the lids of the armature lubricating oil pockets and the area around the lids to remove the build up of sand, road grime and oil.
- Clean the lids of the axle cap lubricating oil pockets and the area around the lids to remove the build up of sand, road grime and oil.
- Clean the areas around the axle suspension brasses of sand, road grime and oil.
- Clean the commutator end side inspection cover.

Internal Inspection

Remove the top commutator inspection cover and the commutator side inspection cover.

Clean the following:-

- Brush holders and their mounting posts of all carbon deposits.
- Clean the outer service band of the commutator.
- Clean all oil, sand and carbon deposits from the inside of the motor by wiping out with a clean cloth.

Internal Inspection Cont'd

Examine the Commutator:

Check the surface for burn marks, pits, rough spots, loose or lifted bars, excessive flashover damage.

Check the condition of the outer service banding. Ensure the band is in a sound serviceable condition. Minor flash over damage may be repaired by cleaning the band with fine glass paper and applying a coating of red air drying insulating enamel.

- Check the condition of each carbon brush, if the brushes are chipped, cracked or worn down within 1/8" of the top of the carbonway the brushes must be replaced.

  Note: Do not drop used brushes in the bottom of the motor. If a used brush is accidently dropped in the motor it must be removed by gaining access through the commutator side inspection opening. Before replacing the cover ensure the gasket is in good condition, then replace the cover and tighten the retaining bolts.

- Check the clearance of the brush holders to the commutator, the clearance is to be 1/8" - 1/4" between the bottom of the carbonway and the commutator, adjust if necessary.

- Check and adjust the brush hammer tension if required.

  For twin brush hammers set the spring tension at ~~3-4~~ 1.35–1.8 kg (~~2.7 - 3.2 Kg~~) per hammer.

  For single hammer brush holders the spring tension should be ~~10-11~~ 6–8 lb.

Motor Leads

Check the condition of the motor leads both internal and external.

Ensure the leads are secure in the brush holder terminals, tighten if necessary.

Check the condition of the cable entry grommets in the stator, the grommets should be firmly in place in the stator.

If the grommets are loose or dislodged push them back into the entry holes, apply electrical quality silicone sealant to the grommets and leads.

Note: Electrical quality silicone only is to be used, other qualities of silicone are not compatible with copper or electrical equipment due to the acetic acid present in the material.

Armature bearings

Measure the armature to pole iron air gaps, compare to specifications for correct clearance and worn condition.

The bottom armature to pole iron air gap is an indication of the diametral wear of the armature bearing babbitt linings.

The total allowable wear clearance on diameter is 3/64".

With new bearings fitted the bottom air gap to armature clearance is 11/64".

These measurements are made through the commutator end side inspection cover.

Wipe out the bottom of the motor at the commutator end.

Replace the cover.

- Replace the commutator inspection covers both top and side cover plate.

Lubrication

Top the armature and suspension bearing lubrication oil pockets with oil at every brake examination.

The oil should be poured into the side filler tubes only not on top of the wool waste.

Do not overfill. Overfilling merely floods the bearings with oil, the excess pouring into the traction motor from the armature bearings or pouring out of the axle bearings. This not only wastes oil but also creates a messy condition to which dirt/sand will readily adhere too.

Note: The wool waste packing must be replaced at three monthly intervals.

Gears and Gear Lubricant

Remove the gear case lid.

Examine the condition and quantity of grease lubricant present or the gears.

Check the motor pinion gear teeth for excessive wear or broken teeth.

Add lubricant to the gear case if necessary.

Replace the lid ensuring the spring clip is in position.

Replacement of Wool Waste Packing

The lubrication oil pockets wool waste packings must be replaced every three months.

When the wool has been removed the bottom of the pockets must be cleaned to remove accumulated sludge, oil and water.

This can be done by using a syringe.

Water present in the lubrication pockets prevents the capillary oil flow up through the wool waste to the bearings.

The wool waste must be replaced as it tends to glaze at the area in contact the the armature shaft or axle journals. Wool that has become wet in service also begins to rot and deteriorate into a sodden wad which will not allow the oil to flow by capillary action.

Fasteners - Bolts

Check for security/tightness all external bolts around the traction motor.

Retighten as required:

Suspension bearing caps
End shield bolts
Axle spacing collar
Motor nose suspension bracket
Lead terminal connectors
Commutator end side cover plate bolts.

Commutator End Outer Bearing Cover

Every three months remove the commutator end outer bearing cover.

Wipe out the end cavity, clean the cover and gasket.

Replace the cover ensuring the gasket is in position then tighten the cover to ensure adequate security.

This procedure is necessary to remove the oil and wear products that accumulate in the cavity as a result of normal motor operation.

G.E.247 TRACTION MOTOR

TESTING

As Series Motor

Run machine on D.C. supply of approximately 10% - 20% rated voltage (i.e.) 60 volt D.C. to 120 volt D.C. supply may be from welding machine.

Monitor

- Rotational speed.
- Bearing temperature.
- Overall machine temperature 65° C max rise for continuous operation.
- Current taken from supply (Amps).
- Oil loss from bearings.
- Sparking at Brushes.

After Initial Starting Period

When the machine has attained steady rotational speed use brush bedding store on the commutator to bed brushes.

Test Run Time.

Run the machine 1/2 - 1 hour both directions.

While machine is running monitor current (Amps) from supply. If the current increases, the machine rotational speed drops or bearings overheat stop test run. Check bearings for pick up/seizure.

Electrical Test After Run In (While at Temperature)

Insulation Resistance 1.5-2 Meg at 65° C Dielectric Test.

Public Transport Corporation

Electrical Workshops Spotswood

GE247 Traction Motor

Light Running Tests

Date: ..... Stator No: .....

Ambient Temperature: ..... Armature No: .....

Tested By: .....) Rewound Fields

Level 2:)

Name of Contractor: .....) Rewound Armature

.....

1. Bed Brushes 100% - Polish Commutator.

2. Connections - 100 V. D.C. Supply.

   C.W. Rotation Join A-F Positive to FF Negative AA.
   C.C.W. Rotation Join A-FF Positive to F Negative AA.
   Rotation as observed at Commutator End.

3. Run 1/2 hour Clockwise (CW)

Time Minutes	15	30
Voltage/Current		
Motor Speed R.P.M.		
Bearing Temp. Commutator End Deg. C.		
Bearing Temp. Pinion End Deg. C.		
Commutator Temperature Deg. C.		

4. Run 1/2 hour Counter Clockwise (CCW)

Time Minutes Voltage/Current Motor Speed R.P.M. Bearing Temperature Comm. End Deg. C. Bearing Temperature Pinion End Deg. C. Commutator Temperature Deg. C.	15	30

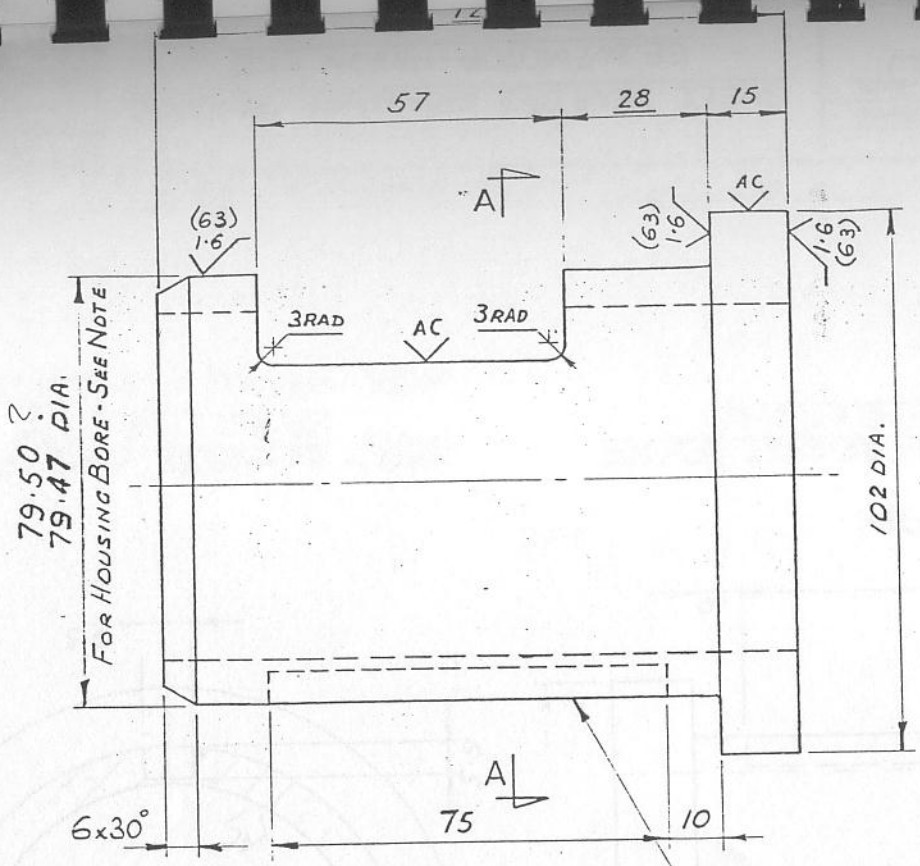
5. Insulation Resistance/High Potential Test after Run

Polyesterimide insulated conductors (enamel films).

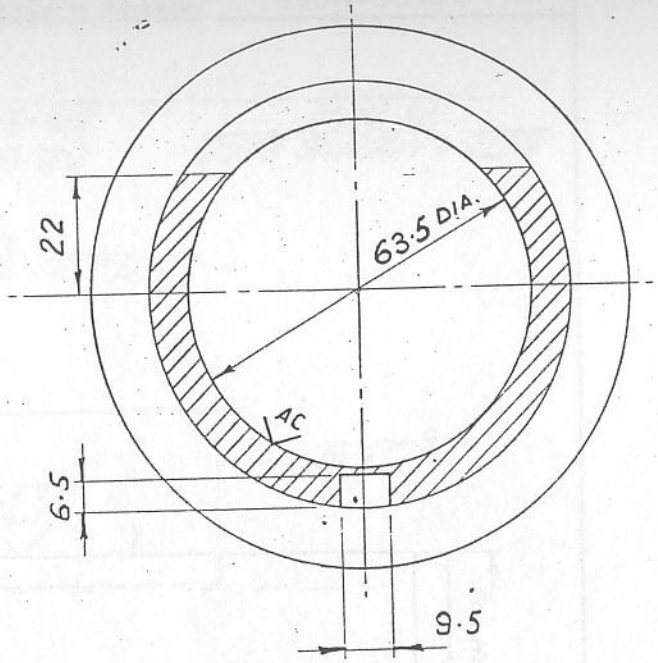
1000 Volt D.C. Insulation Resistance Tester - High Potential 2200 Volt A.C. 1 Minute.

	1000 Volt Insulation Resistance Tester	High Potential 2200 Volt A.C. 1 Min.	1000 Volt Insulation Resistance Tester
Main Fields	Meg Ohms		Meg Ohm
Interpoles & Armature	Meg Ohms		Meg Ohm

Note: Insulation resistance test value - second reading to be the same as the initial reading or higher.



KEYWAY TO BE CAST TO SIZE AND CLEANED UP ONLY.



SECTION 'A-A'

MATERIAL - GUNMETAL ALLOY 903C TO AS1565-1974.

NOTE - SURFACES MARKED AC TO BE 'AS CAST'.

NOTE: HOUSING BORE 79·38 3·125"
79·44 3·127"

TOLERANCES — IMPERIAL — FRACT DIMS. ± 1/64" — DEC DIMS ± 0·005 } UNLESS OTHERWISE SPECIFIED.
METRIC — ± 0·25 i.M.

REFERENCE

R1579 EXISTING BEARING

SHELL MOULDED - PINION END DRG R11-566

SHELL MOULDED ARMATURE BEARING

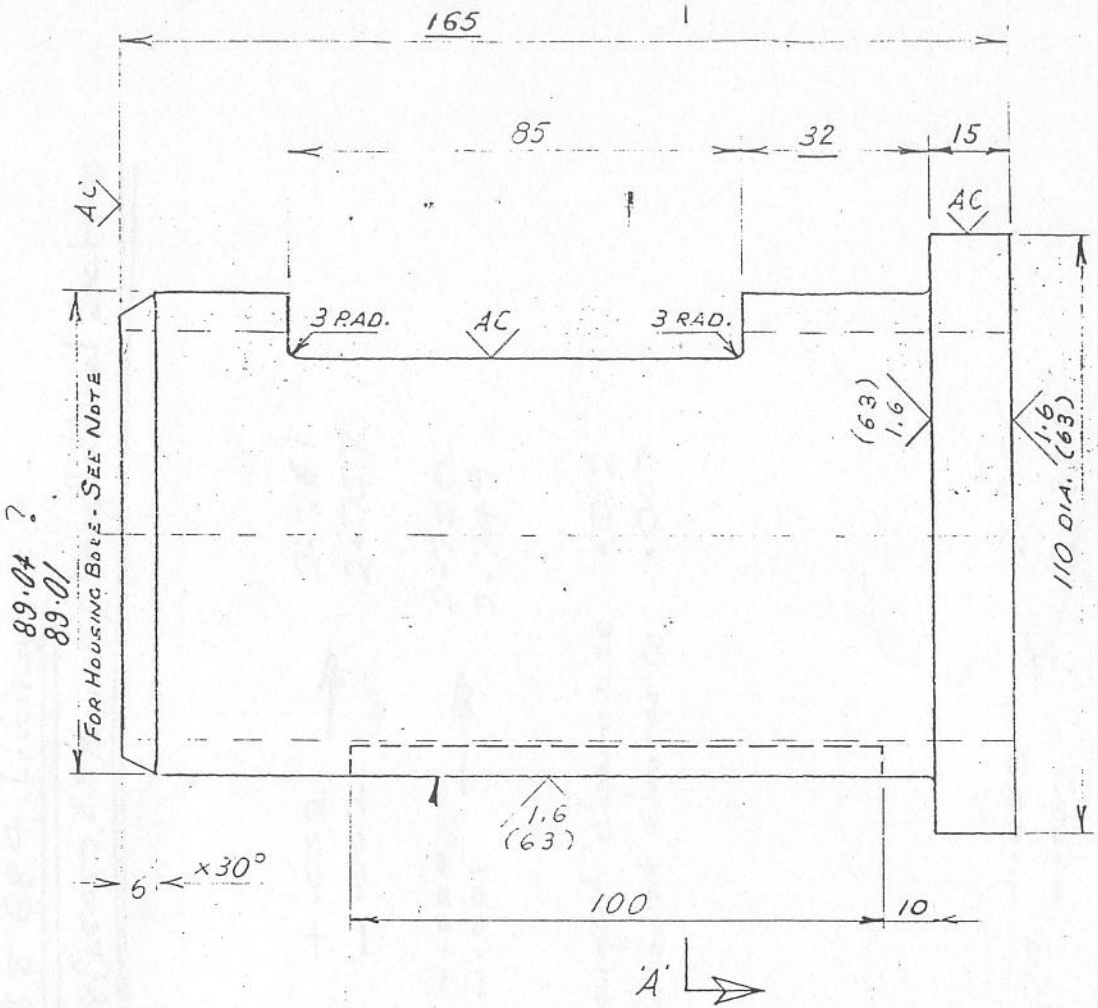
G.E.247 MOTOR - COMMUTATOR END

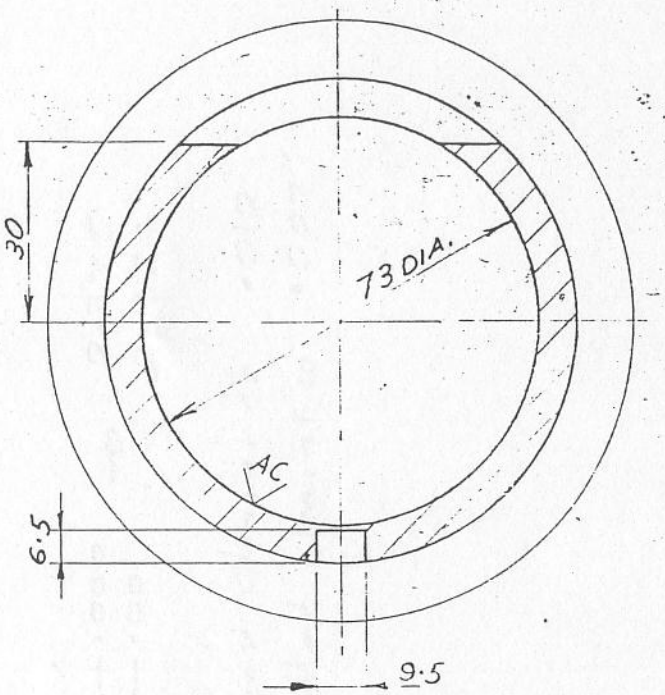
MELBOURNE & METROPOLITAN TRAMWAYS BOARD

DATE 27-11-79 CHIEF ENGINEER

DRAWN	CHECKED	PASSED	APPROVED
HH 26/10/79			27/11/79

R11-627





NOTE - KEYWAY TO BE CAST TO SIZE AND CLEANED UP ONLY

MATL:- GUNMETAL ALLOY 903 C TO A.S. 1565 - 1974

NOTE - SURFACES MARKED AC TO BE 'AS CAST'

NOTE :- HOUSING BORE AS NEW

88.88	3.499"
88.94	3.501"

TOLERANCES — IMPERIAL — FRACT DIMS. ± 1/64" — DEC DIMS ± 0.005] UNLESS OTHERWISE SPECIFIED.
METRIC — ± 0.25 M.M

	REFERENCE	MELBOURNE & METROPOLITAN TRAMWAYS BOARD
A	A.D TOLERANCES 89.02 89.01 WAS 89.00 88.97 G.A.	R 1590 EXISTING BEARING SHELL MOULDED - COMM. END DRG R11-627

SHELL MOULDED ARMATURE BEARING
G.E.247 MOTOR - PINION END

DATE 27-11-79 — CHIEF ENGINEER

DRAWN	CHECKED	PASSED	APPROVED
22-5-79 E.H.	29/11/79	22/11/79	7/12/79

R11-6 A