

PUBLIC TRANSPORT COMMISSION OF NEW SOUTH WALES

ELECTRIC LOCOMOTIVES

MECHANICAL AND ELECTRICAL MAINTENANCE

MECHANICAL AND ELECTRICAL MAINTENANCE SCHEDULES

MANUAL NO. _____

NAME : _____

LOCATION : _____

INTRODUCTION

This manual contains the Mechanical and Electrical Schedules for trip, A, B, and C inspections for both classes of electric locomotives.

The system adopted, with the introduction of these sheets, is entirely different from the previous method, resulting in all existing mechanical and electrical inspection schedules being superseded.

The new system operates in the following manner:

<u>TRIP INSPECTION</u>	6 DAYS
<u>'A' INSPECTION</u>	45 DAYS
<u>'B' INSPECTION</u>	135 DAYS
<u>'C' INSPECTION</u>	270 DAYS

The sequence of inspections should be AABAAC.

The new sheet designed "M-TRIP" should be issued for each Mechanical trip inspection and when completed, attached to the "GREEN" log book sheets, for filing in the depot records section at Delec.

For A, B and C Mechanical inspections one sheet only is issued, designated 'MI' and printed on blue paper. This "BLUE" sheet, lists all items which require attention on the particular inspection being performed. The Fitter assigned to the job is required to sign for each item individually. The "BLUE" sheet is attached to the "GREEN" log book sheets and returned to the Sub-Foreman for signature.

The sheet 'M1' contains only sub headings of the equipment requiring attention. For a complete explanation of the correct maintenance procedures, reference to the item concerned should be made in the master sheets.

The master sheets are bound in order and the procedure can be found by referring to the master sheet item number corresponding to the item number on sheet 'M1'.

The 'Remarks' section on the sheet 'M1' should contain information relative to the repair or replacement of equipment.

These sheets are then forwarded to the records section at the Delec.

Inevitably changes will take place on inspection schedules, so from time to time amendments will be sent through the mail. It will be your responsibility to replace superseded sheets and so keep this manual current.

This manual is an initial issue and any suggestions towards its improvement would be appreciated, also any enquiry regarding the interpretation or requirements will be dealt with if directed to the Assistant to the Senior Engineer, Electric Traction, Room 5, Chief Mechanical Engineer's Office, Redfern, telephone No. 9.7016.

* * * *

September, 1971
M-Trip

DEPARTMENT OF RAILWAYS - NEW SOUTH WALES
46 CLASS ELECTRIC LOCOMOTIVES
MECHANICAL TRIP INSPECTIONS

Item Numbers correspond to numbers on Master Sheet.

UNIT NO. _____ DEPOT _____ DATE _____

NO.	ITEM	SIGNATURE
1.	Log Book Report	_____
2.	Vigilance Control	_____
3.	Test auto, independent brakes	_____
4.	Wind Hasler Clock and check chart	_____
5.	Check panto pans and condition of pantograph	_____
6.	Examine bogies for loose or broken parts.	_____
7.	Tyres and wheels	_____
8.	Examine brake shoes	_____
9.	Drain reservoirs	_____
10.	Inspect spare equipment box and seals	_____
11.	Suspension bearings and gear case oil level	_____
12.	Compressor oil level	_____
13.	Grease bogie grease points as required	_____

REMARKS:

SIGNATURE OF SUB-FOREMAN

DEPARTMENT OF RAILWAYS - NEW SOUTH WALES
46 CLASS ELECTRIC LOCOMOTIVES
MECHANICAL INSPECTIONS

This sheet issued for Trip - Items 1 - 13
A - Items 1 - 21
B - Items 1 - 33
C - Items 1 - 38

UNIT NO. _____ DEPOT _____ DATE _____

NO.	ITEM	SIGNATURE	NO.	ITEM	SIGNATURE
1.	Log Book report	_____	8.	Examine brake shoes	_____
2.	Vigilance control	_____	9.	Drain reservoirs	_____
3.	Test auto independent	_____	10.	Inspect spare equipment box and seals and detonator containers and seals.	_____
4.	Wind Hasler clock and check chart.	_____	11.	Suspension bearing and gear case oil level.	_____
5.	Check panto pans and condition of pantograph	_____	12.	Compressor oil level.	_____
6.	Examine bogies for loose or broken parts.	_____	13.	Grease bogie grease points as required.	_____
7.	Tyres and wheels	_____			
<hr/>					
14.	Grease pantographs	_____	18.	Check bogies	_____
15.	Lubricate D.B.V. and I.B.V.	_____	19.	Compressor seals and flexible drives.	_____
16.	Door catches and hinges	_____	20.	Traction motor air ducts	_____
17.	Whistle and wiper valves	_____	21.	Check hand brake	_____
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22.	Clean whistle and wiper valves.	_____	28.	Panto hand pump clean and grease.	_____
23.	Clean air strainers	_____	29.	Raise and lower valve.	_____
24.	Check slack adjusters	_____	30.	Check flow indicators.	_____
25.	Examine brake pipe feed valve.	_____	31.	Check compressor governor	_____
26.	Check P and C pressure.	_____	32.	Check control governor.	_____
27.	Check panto spring pressure and operation.	_____	33.	Compressor oil pump and filter.	_____
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34.	Suspension bearing bolts	_____	37.	Brake cylinders	_____
35.	Compressor cylinder heads	_____	38.	Panto three (3) way cock	_____
36.	Examine compressor valves	_____			

REMARKS:

SIGNATURE OF SUB-FOREMAN

Item 1 Log Book Report:

Attend to all work reported by driver. In the event of repairs not being carried out due to shortage of material etc., carry forward the particular booking for attention at the next trip inspection.

Sign off all mechanical work on green sheets in log book. (Sheets to be removed at Delec only).

Item 2 Vigilance Control:

See instructions C.M.E. 41/66.

Item 3 Test Auto and Independent Brakes:

See Westinghouse instructions.

Item 4 Wind Hasler Clock and Check Chart:

A line appears on chart when paper is approaching the end of reel, replace if this is showing.

Item 5 Check Panto Pans and Condition of Pantograph:

Check (a) shunts on pan, knuckle and frame for tightness, overheating or damage.
(b) Alignment of pans for twist.
(c) Saddles for loose pins and fractures.
(d) Springs for breakage or weakness.
(e) Pan supports for fractures.
(f) Pistons for blowing.
(g) Air hoses for leaking or signs of failure.
(h) Paint with graphite grease M.I. 2684500, thinned with lacquer thinners, Stores item 4348, if copper strips are fitted.

Changing of Pans:

Where copper strips are fitted the pans need changing when worn to condemning edge.

Change carbon strips when wear has occurred to 5/16" thickness from pan surface or if strips are deeply grooved, severely chipped or securing bolts are loose.

Item 6 Examine Bogies for Loose or Broken Parts:

Check sand pipe alignment and discharge, auto couplers and draft gear, coil and leaf springs, compensating link pins and associated equipment for breakage, misalignment, etc.

Item 7 Tyres and Wheels:

Examine for fractures, shelling or flaking in tyres and loose or broken rivets, skidded wheels, deep tyres, sharp flanges, etc.

Item 8 Examine Brake Shoes:

Replace when worn to condemning notch re-adjust rigging as required.

Item 9 Drain Reservoirs:

Compressor intercooler, main reservoir and dirt collectors P & C reservoir, and time delay reservoir. Check for leaks.

Item 10 Inspect Spare Equipment Box and Seals, Check Detonator Containers & Seals:

Replace if necessary using standard seal, and sealing pliers.

Item 11 Suspension Bearings and Gear Case Oil Level:

Inspect and top up if required. Level in bearings, Max. - to bottom of filling pipe, Min - 1-1/2" below maximum. Quantity between maximum and minimum - 3-1/2 pints. Level in Gear Case, Max. - 2-1/2" from floor of sump, minimum 1-1/2" from floor of sump. Quantity between maximum and minimum - 4 pints. Gauges are provided for checking oil level. Bearings - Red Axle Oil, Stores Item 6482B, Gears - Crater No. 2 M.I. 2631998.

Item 12 Grease Bogie as required:

- (a) Axle box guides.
- (b) Draw bar pins.
- (c) Spring hanger pins, and guides.
- (d) Brake hanger pins.
- (e) Compensating beam pins.
- (f) Brake shaft bearings, with Lithium base grease No. 3 S.I. 5285 EA.

Lubricate buffers, draw bars, brake links, brake beam guides, auto couplers, coupler carrier plates and side bearer plates with graphite grease M.I. 2684500 thinned with lacquer thinners, Item 4348.

Item 13 Compressor Oil Level:

Inspect and top up where necessary. The sump is full when oil level is up to the top of the oil strainer in the filler elbow. SAE.30 S.I. oil, stores item 5255C.

Item 14 Grease Pantographs:

All nipples on the following items must be greased. Pan support mechanism top and bottom frame hinges, equalising links, main ball bearings, main outer spring support pins, push down spring spherical bearings at fixed ends, lever end of push rod, push rod roller, cylinder piston rod guide, piston lubricator on cylinder. (Total nipples : 53 per pantograph), lithium base grease No. 3 Stores Item 5285 EA.

Item 15 Lubricate D.B.V. and I.B.V.

As per Westinghouse instructions.

Item 16 Door catches and hinges:

Check for stiffness of mechanism and lubricate, check alignment and security of locks and striker plates, check clearance with floor as door opens. (SAE.30 S.I., oil Stores Item 5255C).

Item 17 Whistle and Wiper Valves:

Check operation, dismantle and clean if necessary.

Item 18 Bogies:

- Check
- (a) Side bearer clearance - 1/32"
 - (b) Bogie side check clearance.
 - (c) End bearers for condition, inspect under metal dust covers and check oil level.
 - (d) Motor nose brackets and lateral link bolts and pins.
 - (e) Motor gear case bolts for tightness, examine gear case for cracks and condition of lubrication covers.
 - (f) Suspension bearing bolts.
 - (g) Four (4) bolts on auto coupling cover and carrier plates. Gauge auto coupling for shape and height (height - 2'10").
 - (h) Bottom yoke plate.
 - (i) Draw gear rubber (Waughgould gear) check for loose plates and deteriorated rubber.
 - (j) Spring stirrup alignment (must be kept from wearing inside of bogie frame). Misalignment may be caused by excessive wear in axle box guides.

- (k) Coil springs are not broken or compressed.
- (l) Articulating gear pins and beam for wear.

Item 19 Compressor Seals and Flexible Drives:

Check compressor seals for leaking, replace compressor if leak is excessive. Examine flexible drives for wear or deterioration of rubber inserts, replace if necessary.

Item 20 Traction Motor Air Ducts:

Check ducts for splits and broken springs, replace if necessary.

Item 21 Check Hand Brake:

Wind hand brake and check for stiffness, chain linkage is in good condition and releases freely. Lubricate with Red Axle Oil, Stores Item 6482B.

Item 22 Clean Whistle and Windscreen Wiper Valves:

Dismantle valve, check seats and clean.

Item 23 Clean Air Strainers:

Dismantle and clean.

- (a) Compressor suction.
- (b) M.R. Dirt collector.
- (c) Distributing valves (2)
- (d) Time delay reservoir, and P and C reservoir.

Item 24 Check Slack Adjusters:

As per Westinghouse Instructions.

Item 25 Examine Brake Pipe Feed Valves:

As per Westinghouse Instructions.

Item 26 Check P and C Pressure:

70 lb./in² adjusted by reducing valve between M.R. supply and P and C reservoir.

Item 27 Panto Spring Pressure and Operation:

This is measured with a spring balance and should be 22 lb. with new copper or with new carbon strips. Adjustment is made by increasing or decreasing the length of the two main springs (equally both sides).

The time of raising panto should not exceed 20 seconds with a 3 ft. max. lift. This is controlled by the choke under the top nut of the control valve. (Located at the end of the main cylinder).

If the time is exceeded, the orifice in the control valve should be cleaned.

When falling the pantograph should leave the wire quickly to reduce the effect of arcing. At a height of about 6" from the down position cushioning should check the speed of the pantograph.

If cushioning begins too soon the adjustment washer should be replaced by a thicker one, if too late, by a thinner one. (Diagram in 46 class instruction Book Vol. 1 page 50).

Item 28 Panto Hand Pump:

Remove pump from locomotive. Remove cap of non-return valve, examine valve seat and clean valve chamber. Replace valve cap. Remove suction valve cap examine valve and seating, clean with cloth dipped in solvent. Renew seating if worn or hard. Replace valve cap. Remove top cover handle assembly and piston. Clean cylinder and piston and lubricate with lithium base grease No. 3, Stores Item 5285E. Examine piston leather and renew if cracked or perished. Reassemble and test by using pump to raise pantograph.

Item 29 Raise and Lower Valve:

Check that latch tongue and ledge are clean and sharp with no undue wear.

Adjustment

- (1) Push rod should protrude 1/32" below armature plate when latched up. Renew push rod when less than 1/64".
- (2) Manually push horizontal armature fully up and check clearance of 1/64" between the armature edge and the brass latching ledge on vertical armature.
- (3) Manually push the vertical armature to the right and check the clearance of 1/64" between the falling armature and the brass plate. Correct 2 and 3 by packing under the appropriate hinge plate.

Item 30 Flow Indicators:

Check as per Westinghouse Instructions.

Item 31 Compressor Governor:

Clean and adjust to close at 105 lb./in² and open at 120 lb./in².

Compressor Governor Adjustment.

1. Set the higher pressure by adjusting the position of the top cap on the main (large) spring with the two vertical screws (keeping the plate horizontal), lowering the cap to increase the pressure setting.
2. The lower pressure is next set with the toggle spring, increasing the tension of the spring to increase the difference between the settings. As the bearings wear the amount of tension required in the toggle spring for the 15 lb./in² pressure difference will be reduced. This will reduce the tendency for the contacts to "snap" open and closed. When the toggle spring extension from free length is less than 1/16", wear in the mechanism is excessive and the governor is to be returned to Chullora for repair.

Item 32 Control Governor:

Clean contacts and adjust to open at 50 lb./in² and close at 60 lb./in². Check to see that contacts do not re-open as pressure builds up further.

Item 33 Compressor Oil Pump and Filter:

Check compressor oil pump pressure is 35-40 lb./in² during normal running, adjust pressure relief valve if necessary. Remove oil filter element and container from pump, clean container and reassemble with new filter element.

Item 34 Suspension Bearing Bolts: & Wicks.

Tighten bolts with tension wrench set at 200 lb. if torque multiplier is used, 800 ft. lb. on bolt.

Item 35 Compressor Cylinder Heads:

Clean and decarbonise cylinder heads on both compressors.

Item 36 Compressor Valves:

Examine valves, valve disc and springs, renew if badly worn or distorted. The valve lift is non adjustable but the valve should be free to move its full lift which is .083 inch to .093 inch for suction valves and .069" to .078" for delivery valves.

When fitting new suction or delivery valves, check to see that they do not project below the undersurfaces of the cylinder heads and into the cylinders.

For further details see 46 class instruction book Vol. 11, Page 41-42.

Item 37 Brake Cylinders:

Grease leathers with lithium base grease No. 3 Stores Item 5285 EA.

Item 38 Panto 3 Way Cock:

Lower pantographs, remove cap from back of cock, check spring and test that air release hole in cap is free. Remove handle and barrel, clean inside of barrel with cloth dipped in kerosine, dry with clean dry cloth. Lubricate with Lithium base grease No. 3, stores Item 5285 EA. Reassemble and check that cock operates freely.

January, 1972.

DEPARTMENT OF RAILWAYS : NEW SOUTH WALES

46 CLASS ELECTRIC LOCOMOTIVES

ELECTRICAL TRIP INSPECTIONS

Item Numbers correspond to numbers on Master Sheet.

UNIT NO. _____ DEPOT _____ DATE _____

NO.	ITEM	SIGNATURE
1.	Log Book Report	_____
2.	Battery charging current	_____
3.	All lights	_____
4.	Rotating parts	_____
5.	Resistance Blowers	_____
6.	Jumpers	_____
7.	Battery Water Level	_____
8.	High tension compartment	_____
9.	Cab accessories	_____
10.	Spare globes	_____
11.	Speedometers	_____
12.	Vigilance Control	_____
13.	Meters	_____
14.	Jumper Receptacles	_____
15.	Traction Motor Covers & Leads	_____
16.	Traction Motor Air Flow	_____

REMARKS:

SIGNATURE OF SUB-FOREMAN

DEPARTMENT OF RAILWAYS : NEW SOUTH WALES.

46 CLASS ELECTRIC LOCOMOTIVES

ELECTRICAL INSPECTION

Item 1 - 16 Trip Inspection	These sheets are the master sheets to
Item 1 - 36 'A' Inspection	be used as a guide for Electrical
Item 1 - 39 'B' Inspection	Trip Inspection and Electrical
Item 1 - 46 'C' Inspection	Inspection Sheet 46 - E1.

ITEM 1:
Log Book Report.

Attend to all work reported by the driver. In the event of repairs not being carried out due to shortage of material etc., carry forward the particular bookings for attention at the next trip inspection. Sign off all bookings relative to the electrical work and remove green sheets from log book, attach sheet to inspection sheets.

ITEM 2:
Battery Charging Current.

Check battery charging current from the ammeter in low tension panel No.2 end. When batteries are fully charged the ammeter should read zero. Should the ammeter show a discharge or excessive charge on arrival at depot, a check of generator voltage should be made and if necessary voltage adjusted using procedure set out in Item 25.

ITEM 3:
All Lights.

Turn on all lights and check for operation. Examine red shades in all marker lights. Check cleanliness of all marker light lenses inside and out.

ITEM 4:
Rotating Parts.

Check all rotating parts for unusual noise, heat or odour. Unusual noise could indicate brush or bearing defects etc. Excessive heat could be the result of overloading. Compare temperature with surrounding equipment. Unusual odour is characteristic with any item of electrical equipment which is overloaded or burnt out.

ITEM 5:
Resistance Blowers.

Check that the resistance fan motor circuit breakers are switched 'on'. There are four (4) of these switches in each cabinet, also check the fan time delay reservoir cock is open. Turn on motor generator sets and test as follows:

1. Turn control switch off and then back on again to trip Z relay, so that power will not be applied.
2. Open accelerating handle to No.1 notch.
3. After one minute the yellow light should be extinguished indicating all resistance fans are running. Check that air is being drawn into each fan.
4. Move accelerating handle either to notch 20 or off, fans should cease blowing after 3 minutes.

If the times are not as above, the fitter should be asked to adjust the governor.

ITEM 6:
Jumpers.

Check condition of jumper head and couplings observing in particular whether any stretch has taken place.

ITEM 7:
Battery Water Level.

Maintain the electrolyte at the correct level. This level has been determined as 1/2" above the splash barrier immediately below the filler cap. Add clean water only. Do not overfill. If it is necessary to add more than 1 quart of water to the whole battery Item 2 should be reconsidered and the charging current checked. If any water is added note date and quantity with chalk inside battery box door.

ITEM 8:
H.T. Compartments.

1. Check motor cut out switch is in the 'all in' position. If motors have been 'cut out' find the fault which caused the motor to be cut out, repair defects and switch to 'all in' position.
2. Test spare fuses.
3. Check that the required high tension fuses are in circuit and fuse spanner is in position.
4. Visually examine E.P. Contactors and arc chutes.
5. Run sequence test step by step to full parallel listening for closing of each contactor.
6. In notch 20 operate wheel slip relay to check contactors open and time delay (where fitted), buzzer and lights.
7. Shut high tension compartment doors.

ITEM 9:
Cab Accessories.

Inspect hot plate and cab heater elements. This equipment will only work when generator is running.

Turn on for as long as possible whilst working on the locomotive to ensure that the circuit breakers will not trip.

ITEM 10:
Spare Globes:

Located in low tension cabinet No.2 end.

<u>Qty.</u>		
1	Head light globe	250 watt)
2	Interior light globes	60 watt)
2	Marker light globes	40 watt)
2	Pilot light globes	15 watt)

ITEM 11:
Speedometer:

Check for correct illumination.

ITEM 12:
Vigilance Control.

Test in co-operation with the mechanical staff, to C.M.E. Circular 41/66.

ITEM 13:
Meters.

Failure will usually appear on the log book report.

To test - check that both pantographs are raised, apply brakes and notch up in series and series-parallel. Do not delay in notches.

Approximate currents in Series.

<u>NOTCH</u>	1	2	3	4	5	6	7	8	9	10
<u>CURRENT</u>	200	350	500	650	750	850	950	1050	1150	overload should trip.

Approximate Currents, in Series-Parallel.

<u>NOTCH</u>	1	2	3	4
<u>CURRENT</u>	650	720	1000	Overload should trip.

Air brake must be fully applied before attempting this test.

ITEM 14:
Jumper Receptacles.

Examine jumper receptacles for damage to pins, blocks and lids. The pins used on this locomotive are a split pin with an expander in the centre. Rough treatment and faulty insertion of the jumper coupling can result in M.U. short circuits and malfunctions of equipment. Bent pins should be straightened, with care being taken not to break them off. A pin will operate satisfactorily with one quarter missing, but must be replaced if more than one quarter is missing. Examine block for fracture and examine lid for spring tension and ensure retaining dog on the under side of the lid is not broken.

ITEM 15:
Traction Motor Covers and Leads.

Examine all traction motors for condition of top and bottom covers. Ensure that all covers are in position and correctly secured. Check all leads for support, correct any which show signs of rubbing against bogie or motor frames.

ITEM 16:
Traction Motor Air Flow.

With generators running check of air from pinion end of each traction motor. If in your opinion the flow is insufficient bring to the notice of the sub-foreman.

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ITEM 17:
Tests before inspection.

Unknown.

ITEM 18:
Traction Motors (MV.272 and MV.179).

Blow out with clean dry air. Examine commutators, armatures, fields, brushes, shunts and connections. Remove copper and carbon deposits from between commutator bars with stiff brush as required.

Remove dirt and grease from machine frame. Check cover tightness.

<u>Brush Data:</u>	MV.272	MV.179
Grade	EG6749N	?
M.I. Number	?	
Size	2-1/4"x1-3/4"x5/16"	?
Condemn at	1-1/8"	?
Pressure (lbs)	15-1/2	?

ITEM 19:
Motor generators(MG.86, MG.92, ? and ?).

Blow out with clean dry air. Examine commutators, armatures, fields, brushes, shunts and connections. Remove copper and carbon deposits from between commutator bars with stiff brush as required.

Remove dirt and grease from machine frame. Check cover tightness.

<u>Brush Data:</u>	MG.86(mot.& gen.)	MG.92(mot)	MG.92(gen)
Grade	EG.14	EG.14	EG.12M
M.I. Number	?	?	?
Size	1-3/4"x7/8"x1/2"	1-3/4"x7/8"x1/2"	2-3/8"x1-1/4"x1-1/2"
Condemn at	3/4"	3/4"	1-1/4"
Pressure (lbs)	1-3/4 - 2	1-3/4 - 2	6-1/2 - 7

ITEM 20:
Compressor Motors (Types AY.52 and 20 H.P.)

Blow out with clean dry air. Examine commutators, armatures, fields, brushes, shunts and connections. Remove copper and carbon deposits from between commutator bars with stiff brush as required.

Remove dirt and grease from machine frame. Check cover tightness.

<u>Brush Data:</u>	AY.52	20 H.P.
Grade	EG.14	EG 60/3
M.I. Number	0605719	
Size	1-3/4"x7/8"x1/2"	1-5/8"x1"x3/8"
Condemn at	3/4"	1-3/8" (short side)
Pressure (lbs)	1-3/4 - 2	2

ITEM 21:
Resistance Blower Motors (Type DVY.1514B and HEDK 1/5)

Blow out with clean dry air and clean inside machine. Inspect commutator, brush holders, all insulation, connections and give any attention necessary. Wipe over with clean dry rag. Check all covers for tightness.

<u>Brush Data:</u>	DVY.1514B	HEDK 1/5
Grade	Link BO	IM9101
M.I. Number	0606940	
Size	1-1/8"x1/2"x3/8"	1"x1/4"x1/4" approx.
Condemn at	9/16"	1/2"
Pressure (ozs)	6 - 8	

ITEM 22:
Master Controller.

Operate the controller and check for freedom of movement, check the mechanical interlocking mechanism and reverser handle pegs. Wipe all insulation surfaces. Check the contact finger tips for wear and burning. The silver contacts should be renewed before the silver has worn away. Contact gap 1/8".

ITEM 23:
Switches and Push Buttons.

Test operation of push buttons and switches on driver's panel, in H.T. compartments and machinery compartments, check general condition, repair or replace as necessary. Operate panto raise and lower buttons and check operation.

ITEM 24:
Low Tension Panels - In No.1 and No.2 L.T. Cubicles.

Check all connections and equipment. Wipe the panel with a dry cloth and repaint with Berger Hymeg IV.164 enamel where necessary.

ITEM 25:
Voltage Regulator.

Check that all connections are tight and secure, examine carbon contacts for excessive burning, dress or renew as necessary. Draw piece of paper through carbons to remove dirt and grit.

Adjustment.

Allow to warm up on full load.

No Load Voltage.

With the battery contactor open and lights off, measure the voltage between the terminals on the regulator. Adjust control spring to give 118 volts (38 volts for locomotive 7100) - (Increasing the spring tension will increase the voltage).

Full load Voltage.

With the battery contactor closed and lights on, check that the voltage falls under load to 116 volts (or 36-37 volts). If the voltage rises under load, check the connections to both the fixed coil and moving coil.

For further details see 46 class instruction book Volume 1, Pages 89 - 95.

ITEM 26:
Fan Relay Panels.

Check all MCB's and examine electromagnetic relay contacts and connections.

Settings: with relay in the coil energised position, the adjusting screws of the contact fingers should be set to give a contact gap of 1/32". With the relay in the coil de-energised position, the armature adjusting screw should be set to give a gap between the screw and striker board of 0.020".

ITEM 27:
E.P. Switches.

Remove all switch group covers. Manually operate each magnet valve including those on the reverser. Check that magnet valves are holding air both in the 'On' and 'Off' positions and that unit switches are not sluggish in operation but close and open smoothly and quickly. Check that air is not blowing past the pistons and that the reverser operates correctly. If the valve blows in the 'Off' Position the bottom pin valve is not seating and if it blows in the 'On' position the stem valve is faulty. This may be overcome by cleaning the valves. Sluggish or erratic operation may be caused by a dry or tight piston, broken return spring, insufficient pin valve travel or air blowing past the piston. If necessary lubricate piston by inserting the spout of an oil can into the cylinder air release hole and give one squirt of oil (5255C) and check pin valve as in Item 46. Check for broken return spring by using a large screwdriver to lift the piston insulator. If air is blowing past piston change unit switch. Check that cylinder cover gasket does not leak. Clean coil bobbins and terminals with brush and solvent checking flags and heads for security and wipe with dry cloth. Lubricate piston rod, two drops of oil at top of cylinder cover.

(b) Piston Insulators.

Clean piston insulators making sure that the surface is cleaned right around the insulator and paint with Hymeg IV.164 enamel if necessary. Check insulator for any signs of looseness on the spindle.

(c) Contacts, Shunts, Arc Horns.

Check for burnt or worn contact tips and ensure that tips are tight, check contact gap 7/8" min. and contact thickness at 3/4" from heel of contact tip. Renew when worn to half new dimensions. Check that arc horns are in good condition

and secure, change any that are burnt. Check that knuckle pin is in position and is not worn and that there is no sign of high resistance or burnt joints on the blow-out coil connections. Check condition of knuckling spring and that casting is free on spindle. Check for wear on moving contact carrier, casting stop faces and on piston rod guide. Check flexible leads for broken braids and frayed strands, particularly at the mouth of thimbles where braids may break inside thimbles. Change worn, burnt or frayed leads. Check that all connections are tight and that leads do not foul the body of the switch.

(d) Arc Chutes and Barriers.

Remove arc chutes. Examine for deep burns and chipped or broken cheeks. Wipe outside of arc chutes clean. Remove any glazing of the arc plates with emery cloth, replace on unit switches and check that retaining clips are in good condition and that arc chutes are secure.

(e) Insulation.

Clean, the support bars of switches and reverser with solvent and wipe dry with cloth.

(f) Interlocks.

Examine interlock finger contact tips for wear or looseness. Renew interlock finger when all the silver has worn away. Check that fingers are properly secure, connections to the fingers tight and adjust finger pressure (4 -6 ozs.). Check finger lift 1/8" and cam clearance 1/32". For locomotive 7100 finger lift is 1/32" for sliding contacts and 1/16" for bow type fingers. Contact thickness is 5/32" and 1/16" respectively. Lubricate sparingly with 100% absorbed oil. Check finger pressure, 1 - 1-1/2 lbs. and that finger does not touch block.

ITEM 28:
Electromagnetic Contactors H.T. (Type 11 ES).

Remove arc chutes. Check H.T. and L.T. terminals and leads.

Examine contacts, knuckling action and arc chutes, check for free operation by hand. Check alignment of contacts (max. 1/16" lateral play) and slack in mechanism.

File contacts if dirty and rough, replace if worn to half original thickness. Both contacts should be replaced. Renew pins if worn.

Set contact gap 7/8" - 15/16" when open.

Set armature gap 1/16" when closed.

Wipe the insulated support bars and repaint with Hymeg IV.164 if necessary.

For diagram of unit see 46 class instruction Book Vol.1, page 66.

Electromagnetic Contactors L.T. (Types 10 ES & 15 ES).

Examine contacts, knuckling action and arc chutes for free operation, Contact face should be bright though rough. If surface is dark and oxidised all over dress with file to normal shape. Renew contacts when worn to half new thickness, both contacts to be renewed. Do not lubricate. Contact gap 3/8". Check terminals and leads for tightness and fraying.

ITEM 29:
Reverser.

(a) Check tension of power fingers (8 - 10lb) and that contact tips are tight and in good condition and finger shunts in good condition. Check that finger hinge is in position, lift finger and check that hinge is free and there is free movement of the finger. Check that finger adjusting nuts are in correct

position (1/16" drop) and springs in good order. Check that contact segments on barrel are secure, and screws tight. Clean up any burns or copper blisters using a smooth file. Clean surface of finger support bar and contact drum with solvent and wipe dry, paying particular attention to the insulation between segments. Wipe contact segments and contact tips clean with solvent soaked cloth and then lubricate with a smear of petroleum jelly (Stores Item 5294). Check all electrical connections are tight.

(b) Reverser Interlocks.

Examine interlock finger contact tips for wear or looseness. Renew interlock finger when all the silver has worn away. Check that fingers are properly secure, connections to the fingers tight and adjust finger pressure (4 - 6 ozs). Check that power contacts are made before the interlock contacts close.

ITEM 30:

(a) Overload Relays.

Check for freedom of operation by working the relays by hand. Examine contacts, replace if silver contacts are worn. Examine power and control terminals for tightness, cracked lugs and frayed wires.

Data.

1. When the relay is in the 'coil energised' position the fingers of the normally open contacts must be vertical and parallel with their supports.
2. When the relay is in the coil 'de-energised' position the contact carrier should be adjusted so that the fingers of the normally closed contacts are vertical and parallel with their supports.
3. Normally closed contacts should have a contact gap of 1/16" when open. When the relay is in the coil 'de-energised' position, the armature adjusting screw should be set so that the striker gaps of the normally closed contacts are greater than 1/32" and the contact gaps greater than 1/16". The striker on the trip element armature should be trimmed so that when the trip element is in fully closed position there is a gap of .020" - .040" between the armature of the reset element and the latch. When the armature of the reset element is fully closed the latch casting should be set and dowelled so that the latch sits square on the catch and there is a gap of .015" - .030". Armature air gap .016" (1/64"). For further details see 46 class instruction book Vol.1, page 76 - 77.

(b) No Current Relay.

Examine contacts for burnt or worn tips, dress as required and renew when half worn through. Examine the flexible copper braid connected to the moving contact, check the armature for freedom of movement.

Check the connections for looseness and for overheating.

Check the knuckling action of the moving contact.

Adjustments:

Knuckle clearance when contacts closed = 1/16" - 3/32"

Contact Gap = 3/16"

(c) Differential Relay.

Check for freedom of movement by working the relay by hand. Examine the contacts. Renew as necessary (silver contacts). Check terminals and leads.

Adjustments:

Armature air gap = 1/4"

Striker gap = 1/16"

Contact gap = 1/16" Min.

(d) Motor Generator and Resistance Fan Relays.

Check for freedom of operation by working the relay by hand. Examine contacts. Check terminals and leads.

Adjustments:

With relay in 'coil energised' position the adjusting screws of the contact fingers should be set to give a contact gap of

1/32" inch for the resistance fan relay
1/16" inch for the Motor Generator relay.

(e) Battery relay:

Examine to ensure freedom of movement, contacts are clean and contact lift is correct. Check terminals and leads.

Adjustments:

Contact tip deflection = 1/4"

Further details of adjustment in 46 class instruction book Vol.1 Pages 96-99.

(f) Auxiliary No Current Relay and H.T. Door Interlock Relay.

Check for freedom of operation by working the relay by hand. Examine the contacts and renew if silver contacts are worn. Check terminals and leads.

Adjustments:

Armature air gap = .016" (1/64")

Contact gap settings as for overload relays.

(g) Wheel Slip Relays.

Examine relay operation and contact condition without removing cover. If necessary clean contact tips with stiff cloth while contacts are closed. Take care not to flex contacts or the relay setting may be altered. Do not lubricate any part of these relays.

Settings:

Contact: pressure 3/4 oz. min., gap 0.030" min.
WSR pick up 33-39 volts, drop out 18-22 volts.
DR time delay - 3 seconds. QR delay - nil.

(Old type relays where fitted are inspected as for fan relays except 30 volt pick up. 1200 ohm coil 1/32" contact gap).

ITEM 31:

Motor Cut-out Switch.

Clean contact fingers and cams and check that fingers make. Check contact finger tips for wear and burning, the silver contacts to be renewed before the silver has worn away. Check detent mechanism and check lubrication of cam faces. Apply a light trace of petroleum jelly (5294) if necessary. Contact gap 1/8" contact pressure 8 ounces.

ITEM 32:

Resistances:

Inspect for signs of overheating, loose connections and damaged porcelains.

Blow out with clean dry air and wipe porcelains with cloth. Check copper red connections on Compressor and supply M.G. resistors.

ITEM 33:

H.T. Door Interlock and Isolation Switches.

1. Operate by hand and check that all moving parts work freely.
2. Examine operation and contacts of main isolating switch and check that blades do not bottom when closed.
3. Clean and lubricate main isolating switch and contacts with petroleum jelly (5294).
4. Test interlock contacts and check that flags and leads are sound and tight.
5. Clean and lubricate pantograph isolating switches.
6. Check clamps and connections of bus bars on roof for heating etc.

Data.

Contact Gap 1/8"

ITEM 34:

Governors.

Clean and examine contacts on compressor governor, fan time delay, automatic control switch and pressure control switch. Check that terminals are in good order.

Adjustments to be made in co-operation with mechanical staff.

Data.

Contact finger deflection for compressor governor = 1/32"

Entry of moving into fixed contact = 3/16" - 1/4"

ITEM 35:

Jumpers.

Clean each jumper head inside and outside with solvent and wipe dry. Check with gauge that heads are not distorted and check that contact block screws are secure. Plug jumper into test rig and check continuity.

ITEM 36:

Batteries.

(a) Maintain water level 1/2" over splash barrier. If water has been added since last inspection, record details, erase chalk record, check cells and regulator carefully.

(b) Check and record specific gravity of each pilot cell (should be between 1220 - 1260) if not, advise supervisor.

Clean corroded terminals and coat with petroleum jelly (5294).

Clean batteries and battery box, flush with water.

Check for earth leakage and clean any defective calls.

(c) Discharge Test Using Battery Discharge Tester.

Open the battery switch.

Place the tester probes firmly across each cell in a battery in turn. The individual cell terminals may be flush with the battery top. DO NOT put

the tester across complete battery. Polarity need not be observed. Do not keep the tester on a cell longer than is necessary to obtain a reading.

The meter will indicate as follows:-

- (a) 1.4 to 1.8 volts - fully charged good cell.
- (b) 0.4 to 1.4 volts - discharged good cell.
- (c) less than 0.4 volts, or greater than 0.4 volts but falling rapidly to less than 0.4 volts indicates a dead cell. If a battery contains one or more dead cells, it must be replaced.

ITEM 37:
Traction Motors.

Blow out with clean dry air.

Clean brush arm and Vee ring insulation.

ITEM 38:
Power and Control Connections.

Examine connections for looseness or signs of heating, check that flags and lugs are sound and wires not frayed.

H.T. Compartments

Inductive Shunts
12 motor junction boxes
Underframe earth bar
L.T. terminals boards
(both aides)
Motor out-out switch
Back of cab L.T. panel

Machinery Compartment

Supply MG and transformer terminals
Excitor MG
Both compressor motor terminals
Terminal boards - 2 under floor
- 1 on wall
Exciter field resistances
magnet valves - sand
- fan delay
- pantograph (2)
- regen interlock

Cabs

Main terminal boards
Master controllers
Driver's switch panels
Meters and warning lamps
Sand switch
Regen interlock
Buzzer

Resistance Compartment

Fan terminals
through connectors
Terminal boards for H.T.

ITEM 39:
E.P. Switches and Reverser.

Lubricate. Insert the spout of an oil can into the cylinder air release holes and give one squirt of oil (5255C).

ITEM 40:
Traction Motors.

Check clearance between brush holder and commutator 1/16" - 5/32".

Check brush spring tension.

Check arcing horns and replace studs if necessary to restore 1/2" gap.

Record commutator condition on Feinpruuff chart.

Examine earth brush for freedom and wear:-

Brush Data

Grade CM1S
MI. Number 0605210
Size 2-1/2" x 2.248d.
Condemn at 1-1/4"
Pressure 15 lb.

ITEM 41:

Motor Generators.

Check brush tensions Motors = 2-1/4 lb.
 86 Gen. = 2-1/4 lb.
 92 Gen. = 6-1/2 lb.

Check clearance between brush holder and commutator = 1/16" - 5/32".
Clean brush arm and 'Vee' ring insulation.
Record commutator condition on Feinpruuff chart.

ITEM 42:

Compressor Motors.

Check brush tensions = 1-3/4 - 2 lb.
Check clearance between brush holder and commutator = 1/16" - 5/32".
Clean brush arm and 'Vee' ring insulation.
Record commutator condition on Feinpruuff chart.

ITEM 43:

Master Controller.

Lubricate interlocking mechanism on rubbing parts with petroleum jelly (5294).
Check finger pressure = 10 - 14 ozs.
Lubricate finger hinge pins. (oil, stores Item 5255C)

ITEM 44:

Voltage Regulator.

Clean knife edges and blow or brush dust off pole faces.

ITEM 45:

Reversers.

Grease top end bottom main shaft bearings with grease (Lithium base grease No.3 Stores Item 5285 EA).

ITEM 46:

Magnet Valves.

Remove cap from magnet valve and check that coil core is secure.
Clean core and stem valve with solvent. Remove bottom cap, valve spring and pin valve, examine seat, clean and replace. If valve is blowing in OFF grind pin valve with fine emery paste, clean and test.