

BRITISH RAILWAYS

WORKSHOP OVERHAUL SCHEDULE

DIESEL MULTIPLE UNITS

ELECTRICAL CONTROL SYSTEM

WORK

WORKSHOP OVERHAUL SCHEDULE

DIESEL MULTIPLE UNITS

ELECTRICAL CONTROL SYSTEM

C4	REPAIR	-	SHEETS 1 - 3
C3	REPAIR	-	SHEETS 4 - 8
C1 & 2	REPAIR	-	SHEETS 9 - 17
DATA SECTION		-	SHEETS 1 - 4

ASSOCIATED SCHEDULES

ENGINES INCLUDING FLUID COUPLINGS, TORQUE CONVERTORS, FREE WHEELS AND AIR COMPRESSORS

1. AEC/LEYLAND 150/200 hp
2. ROLLS ROYCE 180/238 hp

GEARBOXES AND FINAL DRIVES (INCLUDING CARDAN SHAFTS)

ANCILLARY TRACTION EQUIPMENT



COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>Electrical Equipment (General)</u>	<u>Disconnect all Electronic Equipment before testing.</u>  With a 100 volt megger make the following insulation tests before and after repair:-  (a) Local control to earth. (b) Through control to earth. (c) Lighting to earth.  All necessary disconnections to be made to separate individual circuits, and all connections to be bonded as required to ensure that no cable or equipment is omitted from the test.	See Standing Order No. T.&.R.S./2 G.  Special investigation to be made into cause of any readings below $\frac{1}{2}$ megohm.

www.railcar.co.uk

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>Battery Isolating Switch</u>	Remove and examine contact strips. Clean and examine contacts, renew as necessary. Set contacts to maximum contact area with contact strips. Examine switch operating mechanism and repair as necessary. Check condition of spring and renew as necessary.	
<u>Air Pressure Switch</u>	Remove from vehicle and fit reconditioned switch. Displaced switch to be stripped and cleaned. Examine fixed contact carrier, renew if cracked or defective. Examine moving contact assembly and ensure that contact pressure spring is satisfactory, renew defective items as necessary. Check condition of operating spring and renew as necessary. Renew operating diaphragm. After re-assembly, switch must be set to correct operating pressure.	See Data Section Item 3.

www.railcar.co.uk

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>Electrical Control Jumpers</u>	<p>Examine jumper cables, heads and receptacles and replace if damaged or defective.</p> <p>Check all contacts for signs of damage or overheating and renew on condition.</p> <p>Check the operation of lids and latches and lightly lubricate. Lubricate the sliding surfaces of jumper heads using grease to BR.Cat. No. 9/27/1350. Ensure that all jumpers are correctly housed and secured.</p> <p>If multi-way jumper connections are remade or renewed they must be checked for short circuits and correct connections.</p>	<p>When renewing cables, special care to be taken not to damage insulation when replacing in conduit.</p>
<u>Cables, Connections and Insulations</u>	<p>On semi-permanent jumpers examine the jumper cables and terminations. Examine lid and cable sealing arrangements and renew on condition.</p> <p>Open up all connection boxes on trailer cars and those located within the vehicle on power cars. Examine and clean all connection bars and connection Nuts, check for security and repair or renew as necessary.</p> <p>Thoroughly examine cable ends for signs of ingress of dirt and oil, any showing signs of damage to the insulation must be pulled out and renewed. Examine cable connections for mechanical defects and defective crimping or sweating of joints; repair or renew as necessary. Renew box lid seal.</p> <p>Open up all connection boxes located on the underframe of power cars. Remove &amp; clean all connection bars &amp; connections. Repair or renew as necessary.</p> <p>Thoroughly examine cable end for signs of ingress of dirt and oil, any showing signs of damage to the insulation must be pulled out and renewed. Examine cable connections for mechanical defects and defective crimping or sweating of joints, repair or renew as necessary. Renew box lid seal.</p>	<p>_____ " _____</p>

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>Electrical Equipment (General)</u>	<p>DISCONNECT ALL ELECTRONIC EQUIPMENT BEFORE TESTING.</p> <p>With a 100 volt megger make the following insulation tests before and after repair:-</p> <ul style="list-style-type: none"><li>(a) Local control to earth.</li><li>(b) Through control to earth.</li><li>(c) Lighting to earth.</li></ul>	<p>See Standing Order No. T.&amp;R.S./2G.</p> <p>Special investigation to be made into cause of any readings below <math>\frac{1}{2}</math> megohm.</p>
<u>Throttle and Gear Controllers including direction Selectors</u>	<p>Remove from vehicle and replace with reconditioned units. Displaced units to be stripped, cleaned and examined. Examine all springs, contacts and operating cams for condition, renew as necessary. Reset contact clearances as necessary, and ensure correct alignment.</p> <p>After re-assembly of the throttle controller, the driver's safety device mechanism must be tested as follows:-</p> <ul style="list-style-type: none"><li>Depress handle and move to the full throttle position. Ensure contacts are made. Release the handle and ensure the quadrant returns to the off position and contacts open.</li><li>Check interlocking of the director selector in the neutral position is effective.</li></ul>	<p>See Data Section Item 1.</p>

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>Battery Isolating Switch</u>	Remove and examine contact strips. Clean and examine contacts, renew as necessary. Set contacts to maximum contact area with contact strips. Examine switch operating mechanism and repair as necessary. Check condition of spring and renew as necessary.	
<u>Low Water Level Switch</u>	Remove from coolant header tank and fit reconditioned switch. Displaced switch to be stripped and cleaned. Examine contacts for condition and renew as necessary. Ensure the movement of float mechanism is free and that operating float is not punctured. Check mounting pillars for security.	Ensure that <u>non-ferrous</u> split pins are used on float mechanism.
<u>Air Pressure Switch</u>	Remove from vehicle and fit reconditioned switch. Displaced switch to be stripped and cleaned. Examine fixed contact carrier, renew if cracked or defective. Examine moving contact assembly and ensure that contact pressure spring is satisfactory, renew defective items as necessary. Check condition of operating spring and renew as necessary. Renew operating diaphragm. After re-assembly, switch must be set to correct operating pressure.	See Data Section Item 3.
<u>Resistances</u>	Remove from vehicle and fit reconditioned resistances. Displaced resistances to be cleaned and examined for loose connections, burns or fractures of resistance elements; repair or renew as necessary. Check resistance values.	



COMPONENT	WORK TO BE CARRIED OUT.	REMARKS
<u>E.P. Valves</u>	Remove from vehicle. Strip, clean and examine and repair as necessary. Check coil insulation and resistance value. After repair, all E.P. Valves to be bench tested.	See Data Section Item 4 See Data Section Item 4 See Test Specification No. A/3.
<u>Speedometers</u>	Remove complete with associated generators and wheel adjustment boxes. Replace with reconditioned sets. Test on vehicle for correct operation. Displaced sets to be stripped, cleaned and examined; repair or renew as necessary.	

www.railcar.co.uk

COMPONENT

WORK TO BE CARRIED OUT

REMARKS

Electrical Control Jumpers

Examine jumper cables, heads and receptacles and replace if damaged or defective.  
Check all contacts for signs of damage or overheating and renew on condition.  
Check the operation of lids and latches and lightly lubricate. Lubricate the sliding surfaces of jumper heads using grease to BR.Cat. No. 9/27/1350. Ensure that all jumpers are correctly housed and secured.  
If multi-way jumper connections are remade or renewed they must be checked for short circuits and correct connections.  
On semi-permanent jumpers examine the jumper cables and terminations. Examine lid and cable sealing arrangements and renew on condition.

www.railcar.co.uk

## COMPONENT

## WORK TO BE CARRIED OUT

## REMARKS

Conduits, Trunking and Clips

Examine all conduits and trunkings for mechanical damage or corrosion. Check security of retaining clips, conduit couplings, locknuts and bushes. Renew all connection box and trunking cover seals. Examine flexible conduits for signs of damage, renew as necessary. If renewals of solid or flexible conduits are made, the replacements must be to the correct specifications.

Cables, Connections and Insulations

Open up all Connection Boxes on Trailer Cars and those located within the vehicle on Power Cars. Examine and clean all connection bars and connections Nuts; check for security and repair or renew as necessary.

Thoroughly examine cable ends for signs of ingress of dirt and oil, any showing signs of damage to the insulation must be pulled out and renewed. Examine cable connections for mechanical defects and defective crimping or sweating of joints; repair or renew as necessary. Renew Box Lid Seal.

Open up all connection boxes located on the underframe of power cars. Remove & clean all connection bars and connections. Repair or renew as necessary.

Thoroughly examine cable ends for signs of ingress of dirt and oil, any showing sign of damage to the insulation must be pulled out and renewed. Examine cable connections for mechanical defects and defective crimping or sweating of joints; repair or renew as necessary. Renew box lid seal.

When renewing cables, special care to be taken not to damage insulation when replacing conduit.

\_\_\_\_\_ " \_\_\_\_\_

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>Electrical Equipment (General)</u>	DISCONNECT ALL ELECTRONIC EQUIPMENT BEFORE TESTING.	See Standing Order No. T.&.R.S./2G.
	With a 100 volt megger make the following insulation tests before and after repair:-	Special investigation to be made into cause of any readings below $\frac{1}{2}$ megohm.
	(a) Local control to earth. (b) Through control to earth. (c) Lighting to earth.	
	All necessary disconnections to be made to separate individual circuits, and all connections to be bonded as required to ensure that no cable or equipment is omitted from the test.	
<u>Throttle and Gear Controllers including direction Selectors</u>	Remove from vehicle and replace with reconditioned units. Displaced units to be stripped, cleaned and examined. Examine all springs, contacts and operating cams for condition, renew as necessary. Reset contact clearances as necessary and ensure correct alignment. After re-assembly of the throttle controller, the driver's safety device mechanism must be tested as follows:-	See Data Section Item 1.
	Depress handle and move to the full throttle position. Ensure contacts are made. Release the handle and ensure the quadrant returns to the off position and contacts open. Check interlocking of director selector in the neutral position is effective.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>Control Boxes and Battery Fuse Board (where Fitted)</u>	Strip out all equipment, including mounting panels. Examine all cables and connections, renew as necessary. Examine control boxes, supporting frames and brackets, covers, hinges and catches ; repair or renew as necessary. Renew sealing strips. Repaint on completion.	
<u>Equipment Mounting Panels</u>	With equipment removed, examine panels for cracks, surface tracking and burning. Renew as necessary. Ensure that all through connections are sound and that all distance pieces and locking washers are fitted and in good condition. Check mounting panel pillars for security.	
<u>Connection Bars</u>	Clean insulators and connections, and check for security. Renew any insulators that are found to have surface tracking or burns.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>Contactors (Electro-Magnetic)</u>		
Operating Coil	Strip down completely, clean and examine. Check condition of coil insulation and connections, renew as necessary. Carry out test to ensure coil resistance is within specified limits.	
Fixed Contact Assembly	Clean and examine insulations, renew as necessary. Clean contact seat and fit new contacts. Arcing horns showing signs of excessive burning or distortion must be renewed.	
Moving Contact Assembly	Examine pivot pins and bushes for condition, renew as necessary. Clean contact seat and fit new contacts. Renew flexible braids as necessary. Check condition of knuckling springs and renew as necessary.	
Auxiliary Contacts (Where Fitted)	Examine operating mechanism, renew pins and bushes as necessary. Clean and examine contact bases and renew contacts (fixed and moving) as necessary. Renew pressure springs. On completion of repair, set contact gaps.  On completion of overhaul, contactors must be tested before re-installation on vehicle or being returned to stock.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>Relays</u>	Remove from control boxes and fit reconditioned relays. Displaced relays to be stripped down completely and all assemblies cleaned.	In the case of 18 way relays, 18 way diode panels are to be refitted for replacement.
18 Way Diode Panels.	Examine and replace as necessary.	
Operating Coils	Check condition of operating coil and coil resistance, renew as necessary. On refitting, ensure coil is secure on its mountings and correctly aligned.	See Data Section Item 2
Fixed Contact Assembly	Examine frame laminations and pivot pins for condition, renew as necessary. Ensure insulations are sound, and clean or renew contacts according to condition. Renew flexible braids where fitted.	
Moving Contact Assembly	Examine contacts, back plates and carrying strips for condition; clean or renew as necessary. Renew calibration spring. On completion of re-assembly, set contact gaps.  On completion of overhaul, relay must be tested before re-installation on vehicle or being returned to stock.	See Data Section Item 2  See Data Section Item 2 Overhauled relays must be stored in dustproof containers

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>Battery Isolating Switch</u>	Remove and examine contact strips. Clean and examine contacts, renew as necessary. Set contacts to maximum contact area with contact strips. Examine switch operating mechanism and repair as necessary. Check condition of spring and renew as necessary.	
<u>Low Water Level Switch</u>	Remove from coolant header tank and fit reconditioned switch. Displaced switch to be stripped and cleaned. Examine contacts for condition and renew as necessary. Ensure the movement of float mechanism is free and that operating float is not punctured. Check mounting pillars for security.	Ensure that <u>non-ferrous</u> split pins are used on float mechanism.
<u>Air Pressure Switch</u>	Remove from vehicle and fit reconditioned switch. Displaced switch to be stripped and cleaned. Examine fixed contact carrier, renew if cracked or defective. Examine moving contact assembly and ensure that contact pressure spring is satisfactory, renew defective items as necessary. Check condition of operating spring and renew as necessary. Renew operating diaphragm. After re-assembly, switch must be set to correct operating pressure.	See Data Section Item 3.
<u>Resistances</u>	Remove from vehicle and fit reconditioned resistances. Displaced resistances to be cleaned and examined for loose connections, burns or fractures of resistance elements; repair or renew as necessary. Check resistance values.	



COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>E.P. Valves</u>	Remove from vehicle. Strip, clean and examine and repair as necessary. Check coil insulation and resistance value. After repair, all E.P. Valves to be bench tested.	See Data Section - Item 4.  See Data Section Item 4. See Test Specification No. A/3

www.railcar.co.uk

## COMPONENT

## WORK TO BE CARRIED OUT

## REMARKS

Indicator Light Panel

Remove all switches from mountings, ensure that they are mechanically and electrically sound and that all connections are satisfactory, renew as necessary. Remove plug sockets and check for corrosion and burning of socket interior. Renew switches and socket assemblies as necessary. Strip down lighting fittings, clean and ensure lamp holders are in good condition. Check springs and renew as required. Renew lamps. Ensure that reflectors, where fitted, are clean and in satisfactory condition.

Fuses

Remove all fuses and check mountings, including clips, for security; repair or renew as necessary. Renew or rewire all open wire fuses including spares. Test HRC fuses and renew as required. Ensure that all locating pegs (where fitted) are secure and correspond to the particular rated fuse fitted.

Speedometers

Remove complete with associated generators and wheel adjustment boxes. Replace with reconditioned sets. Test on vehicle for correct operation. Displaced sets to be stripped, cleaned and examined; repair or renew as necessary.

Fuel Gauges, Electric Type  
(Where Fitted)

Remove transmitter from fuel tank and fit reconditioned unit. Displaced units to be stripped, cleaned and examined; repair or renew as necessary.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>Electrical Control Jumpers</u>	<p>Examine jumper cables, heads and receptacles and replace if damaged or defective.</p> <p>Check all contacts for signs of damage or overheating and renew on condition.</p> <p>Check the operation of lids and latches and lightly lubricate. Lubricate the sliding surfaces of jumper heads using grease to BR.Cat. No. 9/27/1350. Ensure that all jumpers are correctly housed and secured.</p> <p>If multi-way jumper connections are remade or renewed they must be checked for short circuits and correct connections.</p> <p>On semi-permanent jumpers examine the jumper cables and terminations. Examine lid and cable sealing arrangements and renew on condition.</p>	

www.railcar.co.uk

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>Conduits, Trunking and Clips</u>	Examine all conduits and trunkings for mechanical damage or corrosion. Check security of retaining clips, conduit couplings, locknuts and bushes. Renew all connection box and trunking cover seals. Examine flexible conduits for signs of damage, renew as necessary. If renewals of solid or flexible conduits are made, the replacement must be to the correct specifications.	
<u>Cables, Connections and Insulations</u>	Open up all connection boxes. Remove and clean all connection bars and connections, repair or renew as necessary. Thoroughly examine cable ends for signs of ingress of dirt and oil, any showing signs of damage to the insulation must be pulled out and renewed. Examine cable connections for mechanical defects and defective crimping or sweating of joints; repair or renew as necessary.	When renewing cables, special care to be taken not to damage insulation when replacing in conduit.

January 1974

ALL CLASSIFIED REPAIRSROLIS ROYCE 238 H.P. ORANGE STAR VEHICLES ONLY

Component	Work to be carried out
Throttle Controllers and Pressure Control Unit	Remove complete unit from vehicle
Throttle Controller	Remove micro-switches and examine. Renew switches that are burnt or damaged. Check all moving parts for wear and replace as necessary. Lubricate in accordance with manufacturer's recommendations. Check internal wiring.
Pressure Control Unit	<p>Dismantle and clean all parts. Check diaphragm for cracks and broken sealing beads. Examine all parts for wear and defects and replace as necessary. Re-assemble and set operating pressure, and check for leakage.</p> <p>On re-assembly of the complete item check the operation of the D.S.D. Switch by depressing the handle and rotating to Full Throttle position, release the handle and ensure that the cam moves upwards and that the switch operates.</p>
Drive/Neutral Selector Switch	<p>Remove from vehicle and strip down. Examine micro-switches for damage and renew on condition.</p> <p>Check tensioning springs for condition and renew as necessary.</p> <p>Lightly lubricate the pivot points.</p> <p>On assembly, the operation of micro-switches to be checked and adjusted in accordance with manufacturer's instructions.</p>

/Continued...

## D.MU . Electrical Control SYSTEM

January 1974

Component	Work to be carried out
Forward and Reverse Selector	<p>Remove from vehicle and strip down for inspection. Examine micro-switches for damage and renew on condition.</p> <p>Check tensioning springs for condition and renew as necessary.</p> <p>Examine safety locks and springs for damage and wear and renew or repair as necessary. Lightly lubricate all pivot points.</p> <p>On assembly check that the safety locks operate correctly and that there is 1/32" clearance between the operating lever pin and the latch plate with the operating lever fully raised.</p> <p>Check also that the electrical wiring is correct.</p>
Isolating Valve Switch	<p>Remove from vehicle. Remove Handle Mechanism and examine all levers for damage and renew as necessary. Examine springs for condition.</p> <p>All pivot points and the toggle linkage should be sparingly lubricated with light grade oil, care being taken not to get oil on the rubber bush.</p> <p>Examine all electrical contacts for damage and burning, renew as necessary. Slight traces of burning may be removed by use of fine glass paper. Check spring tensions. This is checked by the following procedure :-</p>

/Continued...

## D.M.U. Electrical Control SYSTEM

January 1974

Component	Work to be carried out
Isolating Valve Switch (Continued)	<p>With the contact spring fully up against the 'Y' shaped insulator block the contact should withstand a pull of approximately 14 oz. applied at the centre line of the contact. When a pull of approximately 18 oz. is applied the contact spring should move away from the face of the insulator block by approximately 1/16".</p> <p>Remove the two air valve caps and remove valves. Examine the plate valves and check for signs of hardening or cracking. Inspect the valve seats for pitting. Remove the push rods and inspect the circular gaskets and renew as necessary.</p> <p>On assembly of complete item check that the handle mechanism operates correctly, and that the springs snap the mechanism over smartly. Check all electrical circuits are made. Check operation of air valves.</p>
Engine Control Panel	<p>Open panel and check all resistances are intact. Check all connections for tightness and all cables for condition. Check all bulbs are intact.</p>
Final Drive Indicator Panel	<p>Remove from Drivers Desk. Check resistors are in good condition. Check all terminals for damage and security. Check condition of wiring and renew as necessary.</p>

/Continued...

## D.M.U. Electrical Control SYSTEM

January 1974

Component	Work to be carried out
Air Pressure Switch Type L.P.2 Set at 60 p.s.i.	<p>Remove from vehicle. Unscrew the cover retainer from the body of the indicator. Remove the cover and lift out the spring and diaphragm assembly, taking care not to lose the shims. Clean all metal parts in solvent. Examine diaphragm for cracking wear or damage and renew if any are found. Check contacts for pitting and wear. If only lightly pitted clean up, if badly pitted renew. Check spring for tension or damage.</p> <p>On assembly ensure the shims are placed on the upper diaphragm follower. Test switch for correct operating pressure and electrical continuity and leaks.</p>
Compressor Governor Type ES16C set 85 - 100 p.s.i.	<p>Remove from vehicle. Examine electrical contacts for burning and clean or renew as necessary. Check correct operation of switch, i.e. both fixed contacts should spread approximately 1/16" when the circuit is made. Ensure contact is made over the full width of the contacts. Lightly grease switch piston with 'Arctic Paragon' grease.</p> <p>Remove strainer and clean and dry thoroughly. Remove cut in and cut out valves and clean with suitable solvent.</p> <p>Re-assemble and check operation, and check for leakage. Electrical circuit made at 100 p.s.i. and held until 85 p.s.i. is reached.</p>
Relay Type Magnet Valves	<p>Remove from vehicle. Remove solenoid unit and inspect the valve seats, for signs of hardening and cracking, and renew as required. Inspect stainless steel ball valve for pitting and renew if necessary.</p>

/Continued...



## D.M.U. Electrical Control SYSTEM

January 1974

Component	Work to be carried out
Relay Type Magnet Valves (continued)	<p>Remove piston cover and withdraw piston. Inspect the 'O' rings for signs of hardening or cracking and renew if necessary.</p> <p>Clean all parts and before re-assembly ensure all moving parts are smeared with 'Arctic Paragon' grease. On re-assembly ensure the piston cover gasket is in good condition. Check that the small exhaust ports on either side of the valve are clear.</p> <p>Using suitable test rig, check the correct operation of the valve both electrically i.e. pick up and drop out voltage, and pneumatically.</p>
Engine Isolation Switch	<p>Remove cover and check operation of switch. Ensure contacts are clean and in good condition. Refit cover.</p>

DATA

COMPONENT	MINIMUM	MAXIMUM	REMARKS	
<u>THROTTLE AND GEAR CONTROLLER</u>				<u>ITEM 1</u>
Contact Clearance		$\frac{1}{4}$ in.		

www.railcar.co.uk

COMPONENT	MINIMUM	MAXIMUM	REMARKS	
<u>RELAYS</u>				ITEM 2
Tonum Type T3500 Relay				
Voltage to close contacts (Cold)	-	8V		
Coil Resistance (at 20°C)	96.5 ohm	106.5 ohm		
Armature Hinge Gap		0.040 in.		
Armature Core Gap - With Main Contacts closed		0.050 in.		
Air Gap - With Contacts fully 'home'	0.005 in	-		
Tonum Type T.3501, T.3502 & T.3633 Relays				
Voltage to close Contacts (Cold)	-	8V		
Coil Resistance (at 20°C)	96.5 ohm	106.5 ohm		
Armature Hinge Gap		0.040 in.		
Armature Core Gap - With Main Contacts open		0.050 in.		
- With Auxiliary Contacts just touching		0.030 in.		
Air Gap - With Contacts fully 'home'	0.005 in.	-		

COMPONENT	MINIMUM	MAXIMUM	REMARKS	
<u>AIR PRESSURE SWITCHES</u>				<u>ITEM 3</u>
A.E.I. P.G.S. E.12 Type 2				
Cut-Out Pressure	59 lb/in <sup>2</sup>	61.1b/in <sup>2</sup>	Applicable only to twin engined power cars with torque convertor.	
Cut-In Pressure	69 lb/in <sup>2</sup>	71.1b/in <sup>2</sup>		
TYPE TD.8265				
Cut-Out Pressure	59.5lb/in <sup>2</sup>	60.5lb/in <sup>2</sup>		
Cut-In Pressure	74.5lb/in <sup>2</sup>	75.5lb/in <sup>2</sup>		

COMPONENT	MINIMUM	MAXIMUM	REMARKS
<u>E.P. VALVES</u>			<u>ITEM 4</u>
TYPE B.T.H.510A			
Coil Resistance (at 20°C)	49 ohm	51 ohm	
Valve Spindle - Travel	0.034 in	0.038 in.	
- Projection beyond Core at Armature End (Valve open)	0.052 in	0.056 in	
- Projection beyond Core at Armature End (Valve closed)	0.086 in	0.094 in	
TYPE B.T.H. 505B, 505F & 514L			
Coil Resistance (at 20°C)	49 ohm	51 ohm	
Valve Spindle - Travel	0.050 in	0.054 in	
- Projection beyond Core at Armature End (Valve Open)	0.052 in	0.056 in	
- Projection beyond Core at Armature End (Valve closed)	0.102 in	0.110 in	
			Note. All E.P.Valves to be tested in accordance with Test Specification No. A/3.