

**B.R. AND B.R.-W.R.
A.W.S. MANUAL**

**RM & EE TECHNICAL TRAINING CENTRE
THE MILL,
BRISTOL STREET
SWINDON**

B.R. & B.R.W.R. (DUAL) A.W.S. MANUAL

The contents of this manual are to assist staff in understanding B.R. and B.R.W.R. (Dual) - A.W.S. It must not be regarded as substituting instructions issued for the maintenance and reporting of A.W.S. faults.

Staff are reminded that the diagrams contained in this manual are typical and are for instruction purposes only; they should not be used when fault finding.

IMPORTANT

THE CURRENT INSTRUCTIONS MUST ALWAYS BE REFERRED TO WHEN DEALING WITH A.W.S. EQUIPMENT AS THE INFORMATION CONTAINED IN THIS MANUAL MAY BE SUPERSEDED.

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PADDINGTON

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AUTOMATIC WARNING SYSTEM (A.W.S.)

INTRODUCTION

The automatic warning system fitted to locomotives and multiple units is provided as an aid to the driver. It provides an audible and visual indication in the driver's cab in accordance with the signal aspect.

The audible indications received by the driver are:-

1. Bell ringing for approximately one second to denote the signal is clear.
2. Horn to denote the signal is at caution or danger.

The horn indication when received can be acknowledged by the driver by pressing and releasing a reset button. This action silences the horn. If the reset button is not pressed and released the horn will continue to sound and after a short time delay the train brakes will be automatically applied.

The visual indication is provided by an indicator unit in the driver's cab which displays either an all black indication or black and yellow indication. The operation of this unit is described later.

The aspect of the signal being approached is transmitted to the A.W.S. equipment fitted to the traction unit by means of signal equipment fitted between the running lines.

Types of A.W.S. Equipment

There are two basic types of A.W.S. track equipment in use:-

W.R. steel contact ramp set in between the running lines.

B.R. magnetic inductors set in between the running lines.

NOTE:- The W.R. ramps are being progressively removed and replaced by B.R. inductors.

Some traction units are required to work only over track where B.R. inductors are fitted. These units have a B.R. receiver mounted beneath the locomotive or D.M.U. which passes over the B.R. inductors fitted between the running lines. The A.W.S. system fitted is in this case B.R. - A.W.S. and will give no indication when passing over a W.R. ramp.

Many traction units are required to work over track fitted with either B.R. inductors or W.R. ramps. These units have a W.R. - A.W.S. shoe mounted beneath the locomotive or D.M.U., in addition to the B.R.

receiver so that the A.W.S. equipment fitted to the traction unit will respond to either type of track equipment. The A.W.S. system fitted in this case is B.R. - W.R. (dual) A.W.S.

There are four systems which can be fitted to traction units:-

1. B.R. A.W.S. - Vacuum braked.
2. B.R. A.W.S. - Dual braked.
3. B.R. - W.R. (dual) A.W.S. - Vacuum braked.
4. B.R. - W.R. (dual) A.W.S. - Dual braked.

In all cases the A.W.S. brake application is applied by the operation of an electro-pneumatic (E.P.) valve. This either admits air to the vacuum brake pipe of vacuum braked traction units or releases air from the air brake pipe of dual braked traction units. The E.P. valves are slightly different for vacuum or air use and are described later.

The electrical circuitry of the A.W.S. is the same for either vacuum or dual braked units. The circuitry for B.R. - W.R. (dual) A.W.S. differs from B.R. - A.W.S. since additional electrical connections are required for the W.R. shoe.

All A.W.S. components except the relay panel and, of course, the W.R. shoe, are identical and interchangeable between B.R. - A.W.S. fitted units and B.R. - W.R. (dual) A.W.S. fitted units, provided the brake systems are compatible.

A.W.S. Equipment

Relay Panel

Two units are available. They differ in size and are not interchangeable.

The B.R. relay panel is painted green.

The B.R. - W. R. (dual) relay panel is painted blue.

Both units contain the relays, resistors, capacitors etc. for the operation of the equipment.

B.R. Receiver

This unit is mounted on the underside of the traction unit and is operated by the inductors fitted between the running lines.

W.R. Shoe Assembly

This unit is mounted on the underside of the traction unit and is operated by the W.R. ramps fitted between the running lines.

Cab Indicator

Two types available. One bulkhead fitting, the other flush mounted. Indication displayed is either "all black" or "black and yellow".

Bell

Provides audible warning to the driver at a clear signal.

Horn

Provides audible warning to the driver at a caution or danger signal.

Reset Button

Provides means of resetting the A.W.S. system following a caution or danger signal.

E.P. Valves

Two types available and are not interchangeable. One type for vacuum braked system and one type for air braked system (dual braked system)

Converter

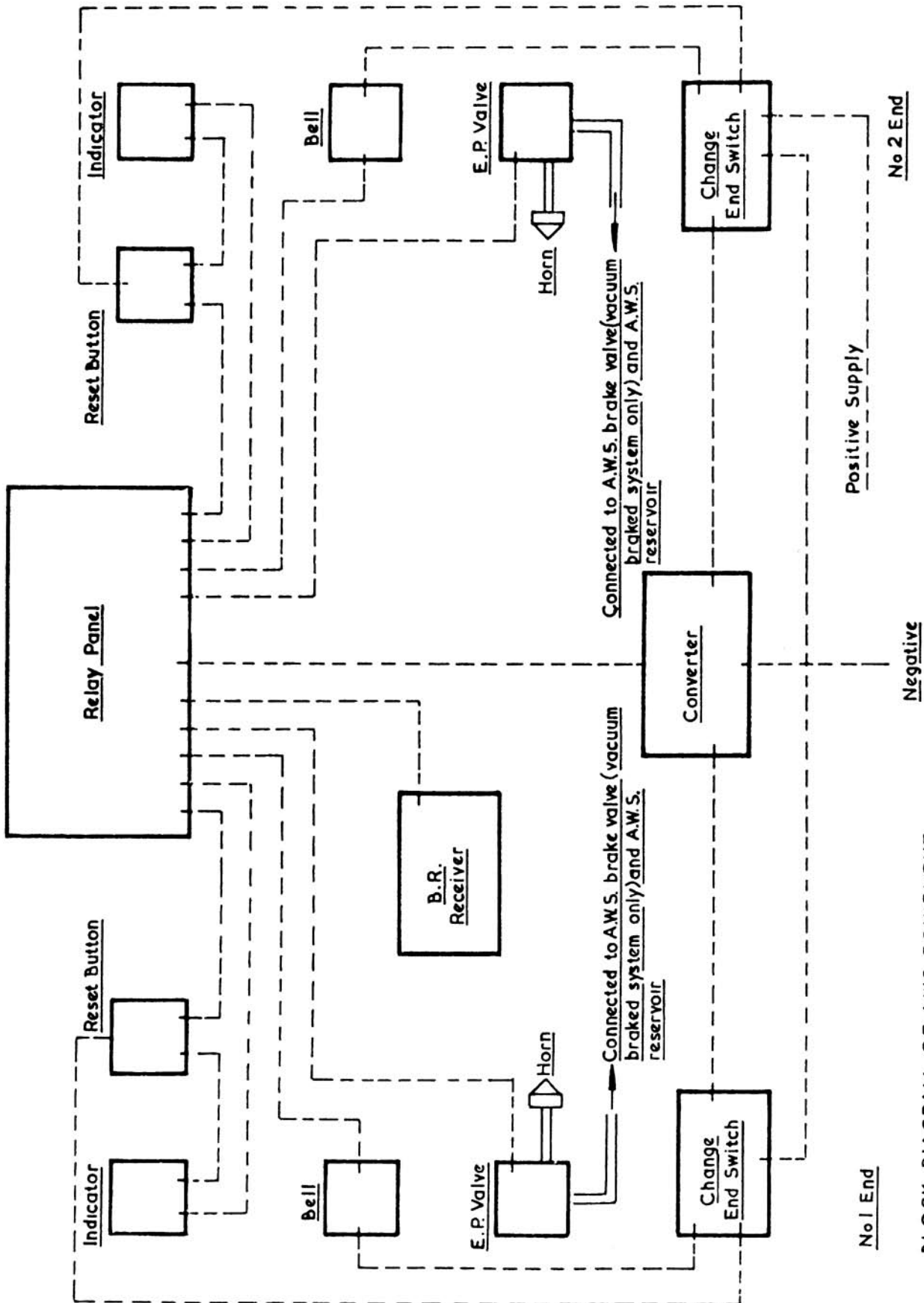
Two units are available. One 110v painted grey and one 24v painted green. The 24v unit is interchangeable with the 110v provided the special voltage dropping resistance unit is fitted to the locomotive.

Change End Isolating

Two types available and are not interchangeable. One for vacuum braked system and one for air braked system (dual braked system).

A.W.S. Brake Valve

Fitted to vacuum braked system and applies the brakes following initiation by the E.P. valve.



BLOCK DIAGRAM OF A.W.S. EQUIPMENT

B.R. A.W.S. SYSTEM

B.R. Inductors

These are basically two magnets, the centres of which are 2' 6" apart, housed in appropriate containers and fitted in the centre of the track at rail level and 200 yds. on the approach side of each signal.

The magnets are designed with their axes in the vertical plane, hence each magnet presents only one pole to influence the vehicle apparatus. The first magnet encountered is of the permanent type with its "South" pole uppermost, whilst the second is an electromagnet which when energised has a "North" pole uppermost. (see page 7)

It will be found that when the signal displays a green aspect (clear) both the permanent and electromagnet will be in use and when the signal displays either a yellow or red aspect (caution or danger) only the permanent magnet will be in use. Therefore, should the electrical supply to the electromagnet fail when the signal is clear, the driver will receive a horn indication, which he must acknowledge, instead of the correct bell indication. Thus the system fails safe.

B.R. Receiver

This consists essentially of a changeover switch whose contacts are in one position if it passes over a "North" pole of a magnet, and in the other position if it passes over the "South" pole of a magnet.

The receiver is bolted to a stretcher plate which is carried on rubber mountings fixed to a bracket. Its position is such that the base of the receiver is at a designed height of between $5\frac{3}{4}$ " maximum and $5\frac{1}{4}$ " minimum above rail level. Since the track inductors are extra powerful, this air gap is not critical. Therefore, no adjustment for height is provided to compensate for tyre wear.

Operation of B.R. Receiver Over Inductors Refer to diagrams on page 7

Clear Signal Ahead

- Fig. 1A Shows the receiver in its normal position and not yet under the influence of the track inductors.
- Fig. 1B Shows the receiver under the influence of the permanent "South" pole. The receiver contacts have changed over. (It is explained later that with the "North" contact now open the E.P. valve will not be de-energised immediately. This small delay gives the receiver time to move away from the influence of the "South" pole and into the influence of the "North" pole).

Fig. 1C The receiver is now over the "North" pole which is energised if the signal is clear. The contacts, therefore, change back to their normal position and the electrical feed is restored to the E.P. valve. The bell also sounds for one second.

Fig. 1D Shows the receiver moving away from the track inductors.

NOTE:- The operation described above is explained more fully in conjunction with schematic diagrams on later pages.

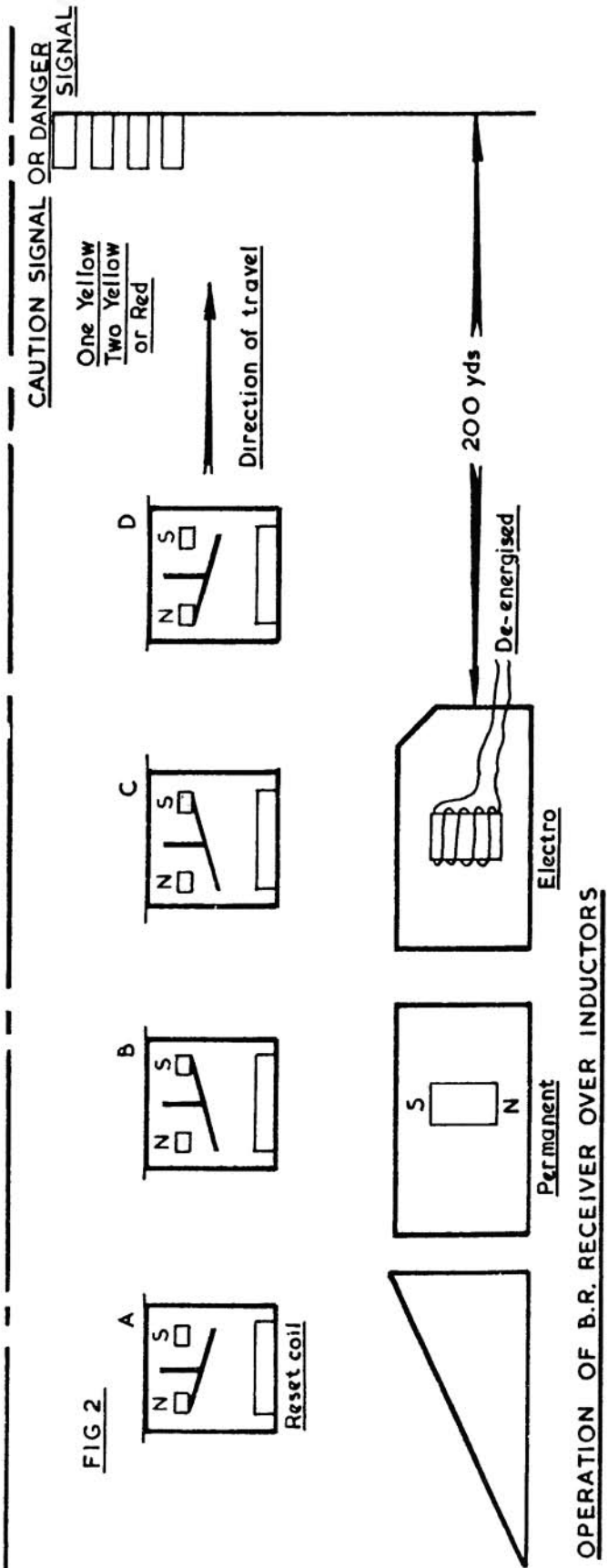
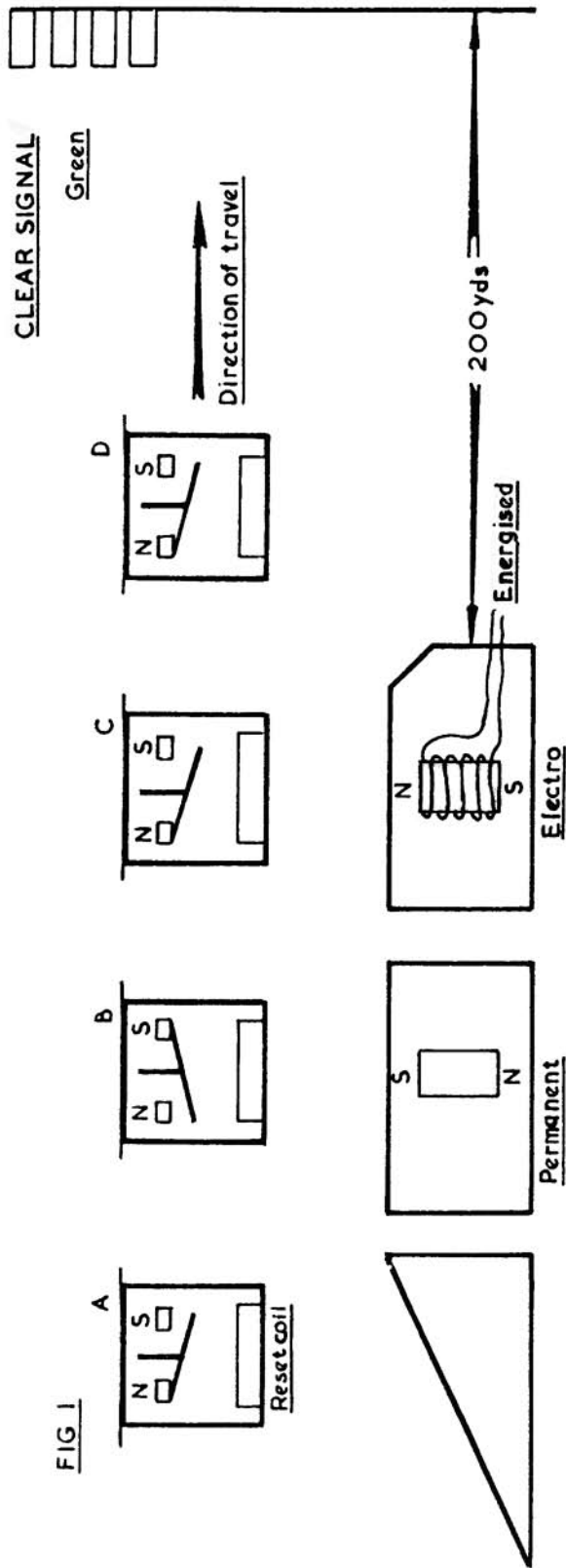
Caution or Danger Signal Ahead

Fig. 2A Shows the receiver in its normal position and not yet under the influence of the track inductors.

Fig. 2B Shows the receiver under the influence of the permanent "South" pole. The receiver contacts have changed over. The E.P. valve is not de-energised immediately, because there is a short delay period.

Fig. 2C The receiver is over the "North" electromagnet, but this is not energised for a caution or danger signal. The contacts, therefore, remain in the "South" position and when the short delay period is expired the E.P. valve is de-energised and the horn sounds. The driver must acknowledge this by pressing and releasing the reset button and this action energises the receiver reset coil situated inside the receiver. This coil causes the receiver contacts to revert to their normal position and restores the feed to the E.P. valve, silencing the horn.

Fig. 2D Shows the receiver moving away from the track inductors.

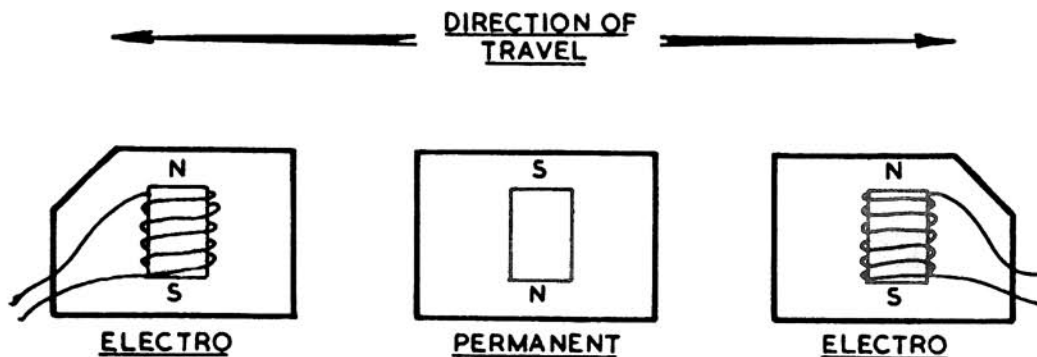


ARRANGEMENT OF INDUCTORS FOR TWO WAY WORKING

IN CIRCUMSTANCES WHERE A TRACTION UNIT CAN TRAVEL OVER INDUCTORS
IN EITHER DIRECTION TWO ELECTRO MAGNET INDUCTORS ARE FITTED
EITHER SIDE OF THE PERMANENT MAGNET INDUCTOR

IF THE SIGNAL IS AT CAUTION OR DANGER THEN NEITHER ELECTRO
MAGNET IS ENERGISED

IF THE SIGNAL IS CLEAR THEN THE ELECTRO MAGNET FOLLOWING THE
PERMANENT MAGNET (DEPENDING ON DIRECTION OF TRAVEL) IS ENERGISED



B.R. A.W.S. CIRCUIT DESCRIPTION

See diagrams on page 13 for locomotives and page 15 for multiple units.

The battery isolation switch must be in the "ON" position for the 24 or 110 volt supply to pass to the voltage converter unit via the change-end-isolating switches.

On two cab vehicles the change-end-isolating switch must be in the "ON" position in the driving cab and "OFF" in the non-driving cab to complete the circuit to the voltage converter unit.

If air pressure (dual braked system) or vacuum (vacuum braked system) is available the horn will sound due to the E.P. valve being de-energised, and if the indicator is displaying "black and yellow" or "all black" it will remain at this indication.

To reset the A.W.S. the reset button must be depressed and released; this action will energise E.P.R. coil as follows:-

A 40 volt positive supply via terminals 7 and 8 in the relay panel to the N/O contacts (1 and 3) of the reset button.

Resetting

Depressing the reset button

When the reset button is depressed NCR coil is energised via the contact of the change-end-isolating switch in use (two cab traction unit only) and EPR (3) contact.

NCR (4) contact closes to provide a maintaining feed to NCR coil via SR (4).

NCR (1) contact closes and this provides a 12 volt positive feed via terminal 11 to energise EPR coil via the "North" contact of the receiver and SR (1).

EPR (1) contact closes to provide a maintaining feed to EPR coil.

EPR (2) contact closes to energise the E.P. valve.

This action prevents a brake application and silences the horn.

EPR (3) contact opens to de-energise NCR coil. Therefore its contacts revert to the position shown on the schematic diagram.

Releasing the reset button

No action at this stage results. However this will not be the case when resetting following a caution or danger signal.

NOTE:-

The receiver reset coil has not been energised during this initial resetting. It can be seen from the schematic diagram that this coil only becomes energised during resetting when the "South" contact of the receiver is made.

The A.W.S. is now reset. The horn is silenced and the indicator remains at whatever indication was showing before resetting.

B.R. Clear Signal

The receiver firstly passes over the inductor displaying a permanent "South" polarity uppermost. Its armature reverses, i.e. "North" contact open and "South" contact closed to energise SR coil via NCR (2).

SR (1) contact changes over to prepare circuit to the bell relay (BR).

SR (2) contact changes over to energise the "black" indicator coil(s). The indicator therefore reverts to "all black".

SR (3) contact closes to provide a maintaining feed to S.R. coil.

SR (4) contact opens.

EPR coil even though de-energised, due to the "North" contact being open does not drop its armature immediately. This is due to the discharge of the 1000 μ f capacitor. Before the capacitor is fully discharged the receiver will come under the influence of the electromagnet with its "North" polarity uppermost, and this action will revert the receiver armature to its normal position.

BR coil is energised via the "North" contact, EPR (1) and SR (1)

BR (1) contact opens to de-energise SR coil.

BR (2) contact closes to energise the bell in the driving cab which will ring for one second.

BR coil will become fully de-energised after the capacitor is discharged.

SR (1) contact changes over to restore the feed to EPR coil.

B.R. Caution or danger signal

When the receiver passes over the inductor displaying the permanent "South" polarity uppermost its armature reverses, i.e. "North" contact open and "South" contact closed.

This action energises SR coil via NCR (2)

SR (2) contact changes over to energise the "black" indicator coil(s). The indicator shows "all black".

NOTE:- EPR will become de-energised only after the 1000 μ f capacitor becomes fully discharged.

When the armature of EPR eventually drops away EPR (1) contact opens.

EPR (2) contact opens to de-energise the EP valve(s) and thus produces the warning horn.

EPR (3) contact closes to prepare the circuit to NCR coil.

The warning horn must now be acknowledged by the driver by re-setting the A.W.S.

Resetting

Depressing the reset button

When the reset button is depressed NCR coil is energised via the contact of the change-end-isolating switch in use and EPR (3).

NCR (4) contact closes to provide a maintaining feed to NCR coil via SR (4).

NCR (1) contact closes to prepare the circuit to EPR coil.

NCR (2) contact opens to de-energise SR coil.

NCR (3) contact opens to prepare circuit to the "yellow" indicator coil(s).

Since SR coil is de-energised SR (2) contact changes over to energise the "yellow" indicator coil(s) via the "South" contact of the receiver. The indicator now displays "black and yellow".

Releasing the reset button

When the reset button is released the receiver reset coil is energised via SR (4), NCR (4), contact of the change-end-isolating switch in use, N/C contacts (1 and 2) of the reset button and the "yellow" indicator contact.

The action of the reset coil is to revert the receiver contacts to normal, i.e. "North" contact made and "South" contact open.

The yellow indicator coil(s) are de-energised, but the indicator continues to display "black and yellow".

EPR coil is energised via the "North" contact, NCR (1) and SR (1).

EPR (1) contact closes to provide a maintaining feed for EPR coil.

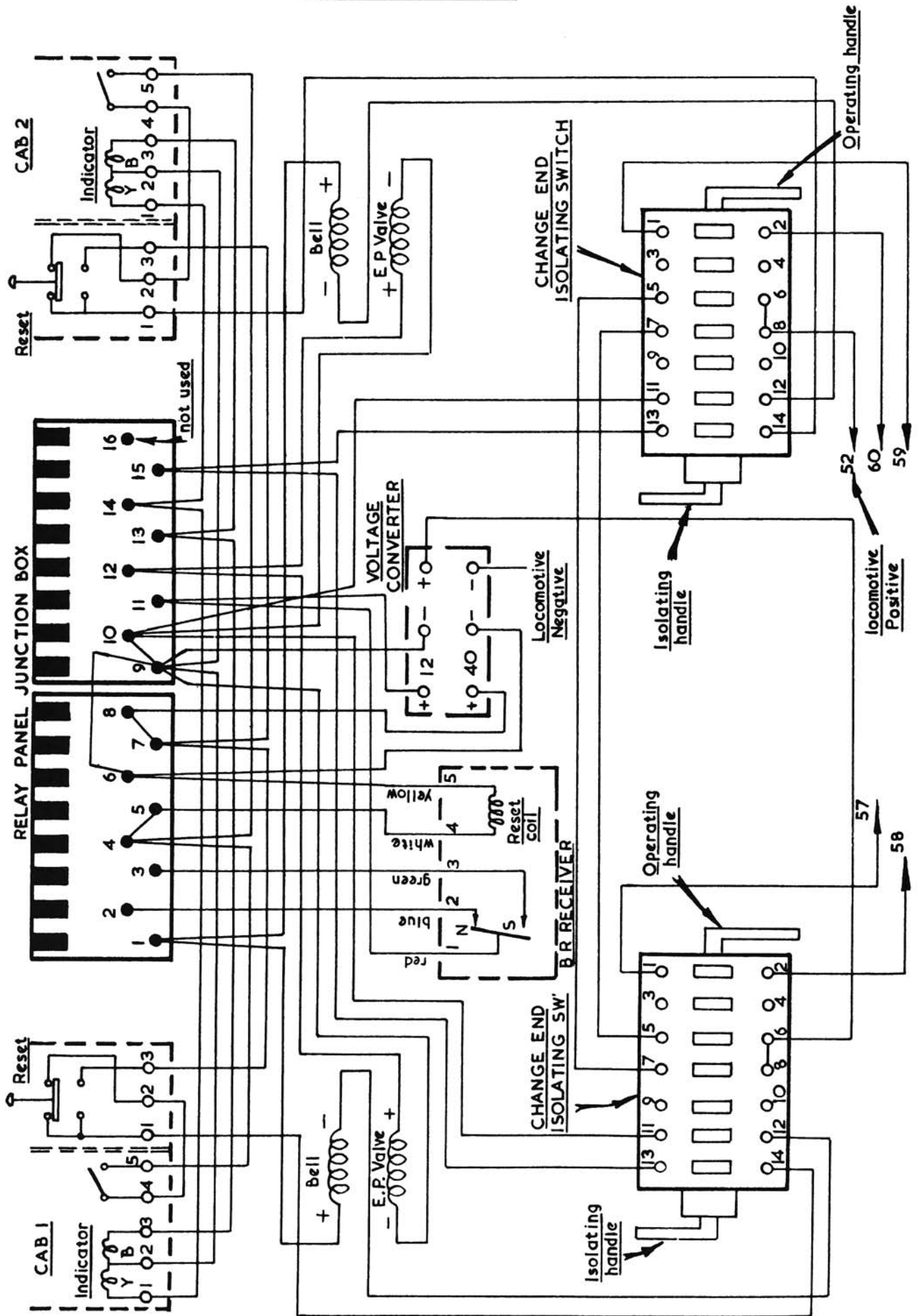
EPR (2) contact closes to energise the EP valve(s).

This action prevents a brake application and silences the horn.

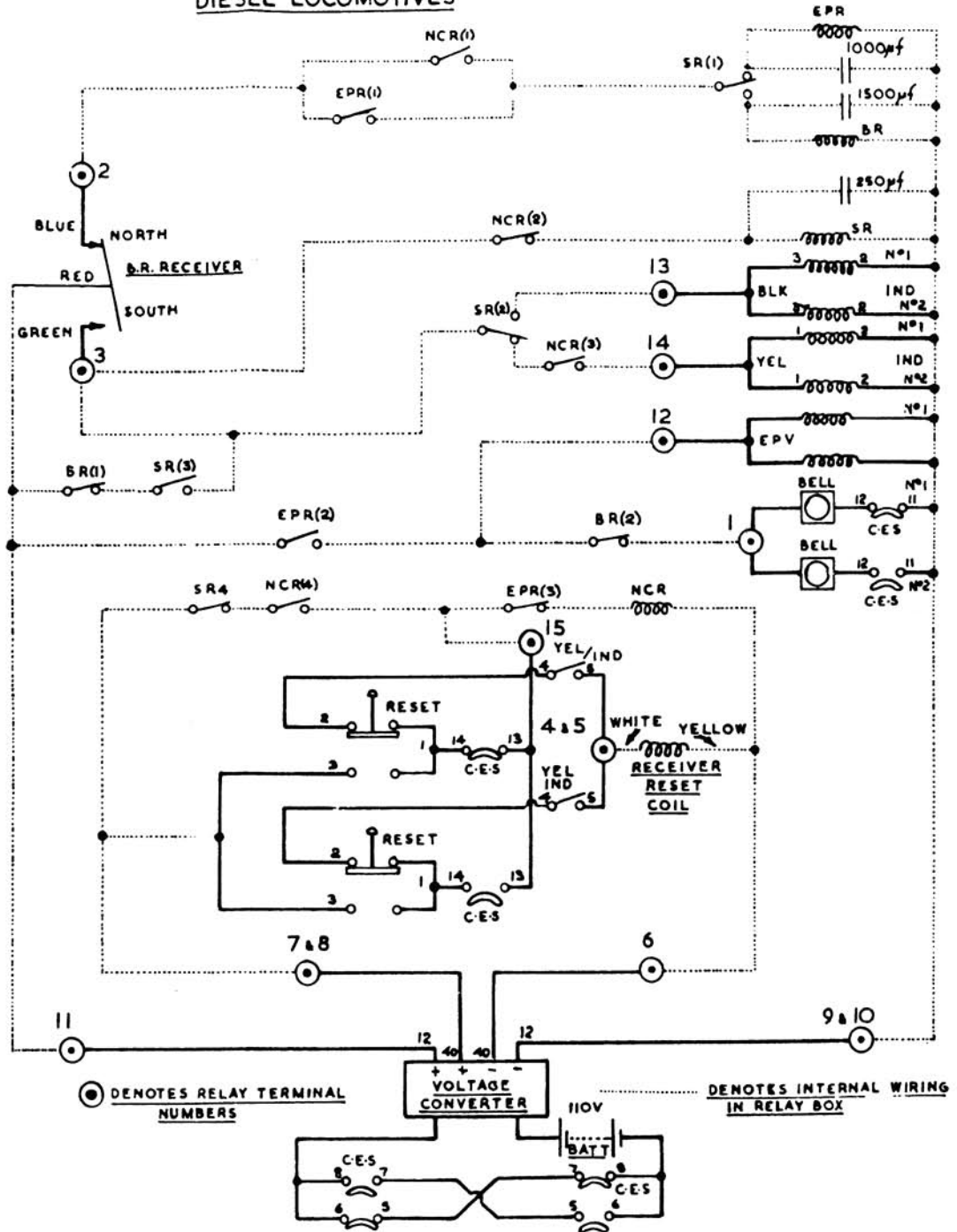
EPR (3) contact opens to de-energise NCR coil, NCR (4) contact opens to de-energise the receiver reset coil.

All other contacts revert to normal.

**B.R.-AWS. WIRING DIAGRAM
DIESEL LOCOMOTIVES**

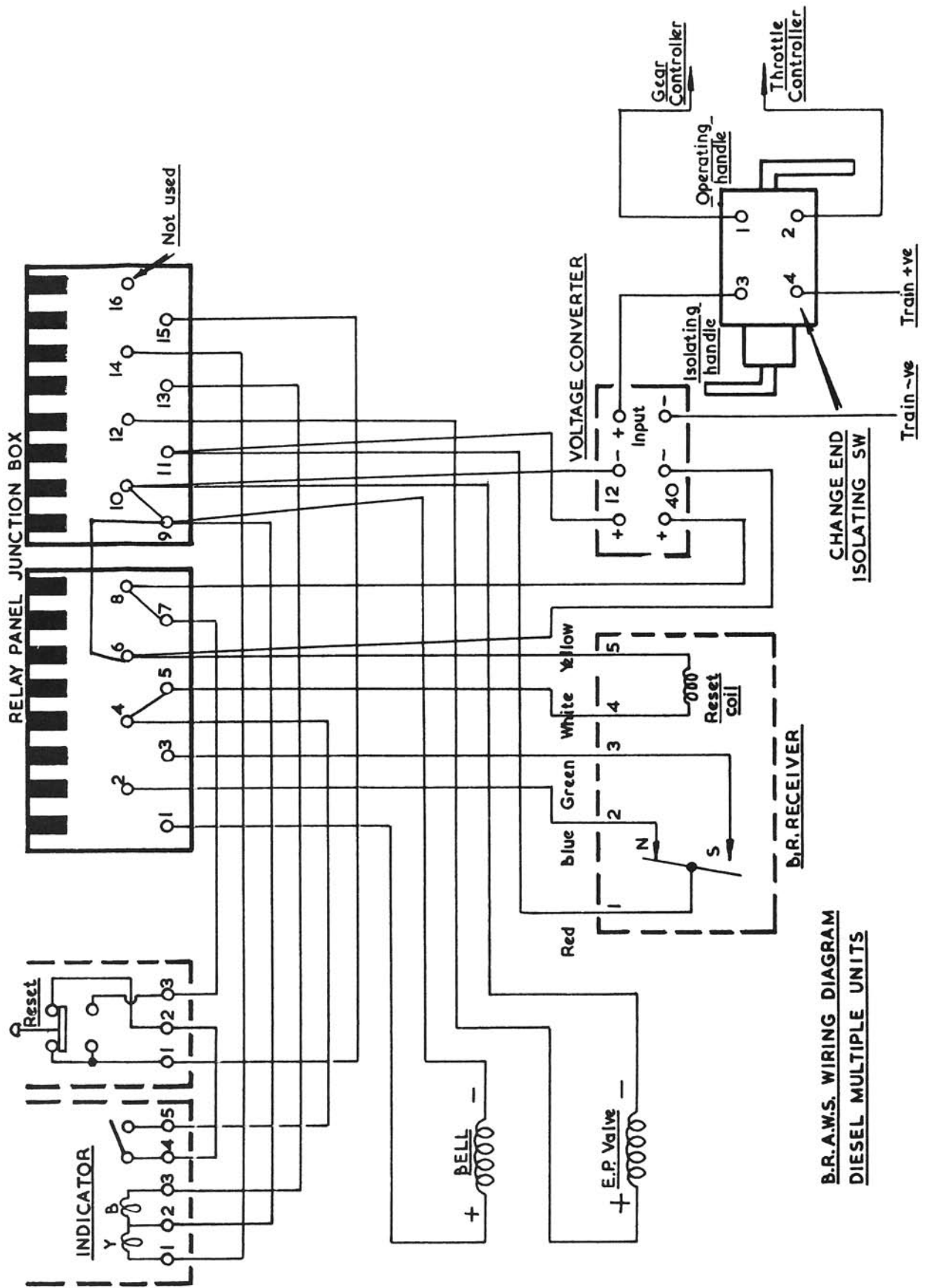


**BR-AWS SCHEMATIC DIAGRAM
DIESEL LOCOMOTIVES**



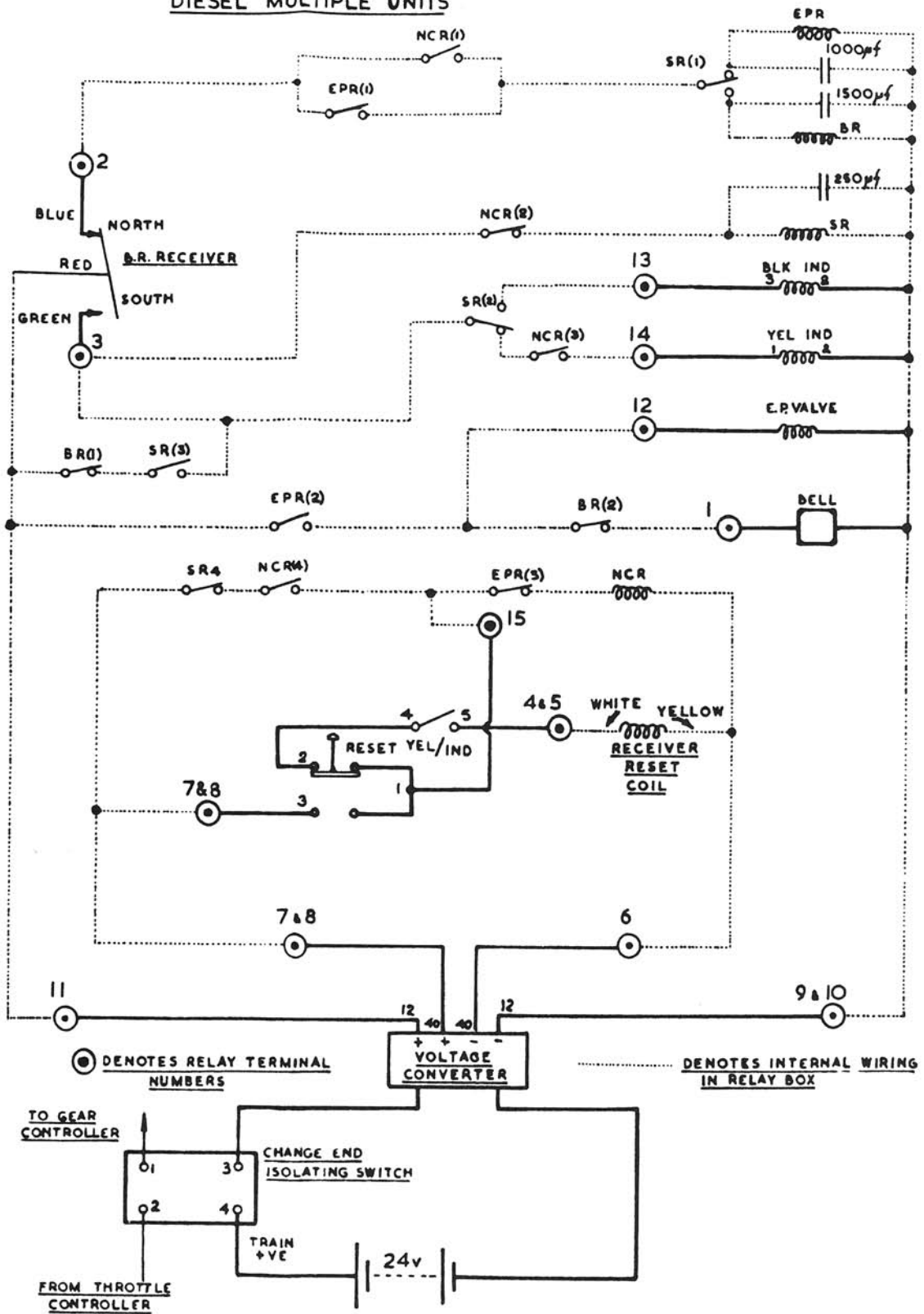
SYMBOL ABBREVIATIONS

- BR Bell relay
- EPR Electro-pneumatic valve relay
- NCR North checking relay
- SR South relay



**B.R.A.S. WIRING DIAGRAM
DIESEL MULTIPLE UNITS**

**BR-AWS SCHEMATIC DIAGRAM
DIESEL MULTIPLE UNITS**



STUDENTS NOTES

B.R.W.R. (DUAL) A.W.S. SYSTEM

When a traction unit fitted with B.R.W.R. (dual) A.W.S. is working over B.R. inductors the receiver and inductor work exactly as described earlier for B.R. A.W.S.

When the traction unit is working over W.R. ramps the following description applies.

W.R. Ramp

This is a 44' long steel ramp, in cross section an inverted T, situated midway between the rails. It is situated some 200 yds in advance of a signal. The height of the top of the ramp rises to $3\frac{1}{2}$ " above rail level. The ramp is made electrically 'live' at 16 - 20 volts D.C. when the signal displays a green aspect (clear) and is electrically 'dead' when the signal displays either a yellow or red aspect (caution or danger). Therefore, should the electrical supply to the ramp fail when the signal is clear the driver will receive a horn indication which must be acknowledged, instead of the correct bell indication. Thus the system fails safe.

W.R. Shoe Assembly

The shoe assembly is mounted on the centre line of the traction unit so that the wearing portion (slipper piece) is $2\frac{1}{2}$ " above rail level.

As the maximum height of the ramp is $3\frac{1}{2}$ " above rail level the slipper piece will lift 1" when passing over the ramp. This action operates a micro switch mounted in the shoe assembly.

The opening of the micro switch contacts cuts off the electrical supply to the E.P. valve of the traction unit A.W.S. equipment. If the signal is clear then the ramp is 'live' and this electrical supply prevents the operation of the brakes and also causes the A.W.S. bell to ring for about 1 second.

In the event of the signal being at caution or danger then the ramp is electrically 'dead' and the feed from the ramp is not available and so the E.P. valve is de-energised which causes the horn to sound and the brakes to be applied unless acknowledged by the driver.

It is most important that the A.W.S. shoe is fitted at the correct height of $2\frac{1}{2}$ " above rail level and in addition to being checked by maintenance staff at the prescribed intervals, test ramps are provided so that the height of the shoe is automatically checked when the traction unit is leaving the depot. These test ramps are shown on page 18.

STUDENTS NOTES

B.R.W.R. (DUAL) A.W.S. CIRCUIT DESCRIPTION

See diagrams on page 23 for locomotives and page 25 for multiple units.

The battery isolation switch must be in the "ON" position for the 24 or 110 volt supply to pass to the voltage converter unit via the change-end-isolating switches.

On two cab vehicles the change-end-isolating switch must be "ON" in the driving cab and "OFF" in the non driving cab to complete the circuit to the voltage converter unit.

If air pressure (dual braked system) or vacuum (vacuum braked system) is available the horn will sound due to the E.P. valve being de-energised and if the indicator unit is displaying "black and yellow" it will immediately revert to an "all black" indication. This is achieved by a 12 volt positive feed via terminal 8 in the relay panel, EPR (1) and NCR (4) to the "black" indicator coil.

Note that the timing circuit across EPR coil is charged.

To reset the A.W.S. the reset button must be depressed and released: this action will energise EPR coil as follows:-

A 12 volt positive supply via terminal 8 in the relay panel to the N/O contacts (1 and 3) of the reset button via EPR (1) and NCR (1).

Resetting

Depressing the reset button

When the reset button is depressed NCR coil is energised via the contacts of the change-end-isolating switch of the cab in use (two cab traction unit only) and EPR (3).

NCR (4) contact opens to de-energise the "black" indicator coil(s).

NCR (2) contact closes to energise the "yellow" indicator coil; therefore, the indicator reverts to give a "black and yellow" indication, and in this position the yellow indicator contact is closed.

NCR (2) contact also provides a maintaining feed to NCR coil since the original feed via NCR (1) is broken. (Note that NCR (2) contact closes before NCR (1) contact opens).

Releasing the reset button

When the reset button is released NKCR coil is energised via NCR (2), the change-end-isolating switch contact, the N/C contacts (1 and 2) of the reset button, yellow indicator contact and SR (3).

NKCR (1) contact closes to energise the receiver reset coil from the 40 volt supply. The function of this coil is to ensure the receiver armature is in its normal position, i.e. "North" contact closed and "South" contact open.

NKCR (2) contact closes to energise EPR coil via the "North" contact of the receiver, SR (2) and the N/C contacts (1 and 2) of the W.R. shoe switch.

EPR (2) contact closes to provide a maintaining feed to EPR coil.

EPR (4) contact closes to energise the E.P. valve(s). This action prevents a brake application and silences the horn.

EPR (3) contact opens to de-energise NCR coil.

NCR (2) contact opens to de-energise NKCR coil.

The yellow indicator coil(s) is also de-energised, but the indicator will continue to display "black and yellow".

B.R. Clear Signal

The receiver firstly passes over the inductor displaying the permanent "South" polarity uppermost, its armature reverses i.e. "North" contact open and "South" contact closed.

This action energises SR coil via NCR (3). S.R. (1) contact closes to provide a maintaining feed to SR coil.

SR (2) contacts will change over and prepare the circuit to XR coil.

SR (4) contact closes to energise the "black" indicator coil(s). The indicator, therefore, reverts to "all black".

EPR coil even though de-energised, due to the "North" contact being open does not drop its armature immediately. This is due to the discharge of the 1500 μ f capacitor. Before the capacitor is fully discharged the receiver will come under the influence of the electromagnet with its "North" polarity uppermost and this action will revert the receiver armature to its normal position.

XR coil is energised via the "North" contact and SR (2).

XR (1) contact opens to de-energise SR coil.

XR (2) contact closes to energise the bell in the driving cab which will ring for one second. XR coil will become fully de-energised after the timing delay, which is determined by the energy stored in the 1500 μ f capacitor, when discharged. SR (2) contact changes over to restore the feed to EPR coil.

B.R. Caution or Danger Signal

When the receiver passes over the inductor displaying the

permanent "South" polarity uppermost, its armature reverses, i.e. "North" contact open and "South" contact closed.

This action energises SR coil via NCR (3). S.R. (1) contact closes to provide a maintaining feed to SR coil.

SR (4) contact closes to energise the "black" indicator coil(s). The indicator will display "all black".

NOTE:- EPR coil will become de-energised only after the 1500 μ f capacitor becomes fully discharged.

When the armature of EPR coil eventually drops away EPR (2) contact opens.

EPR (4) contact opens to de-energise the E.P. valve(s) and thus produces the warning horn.

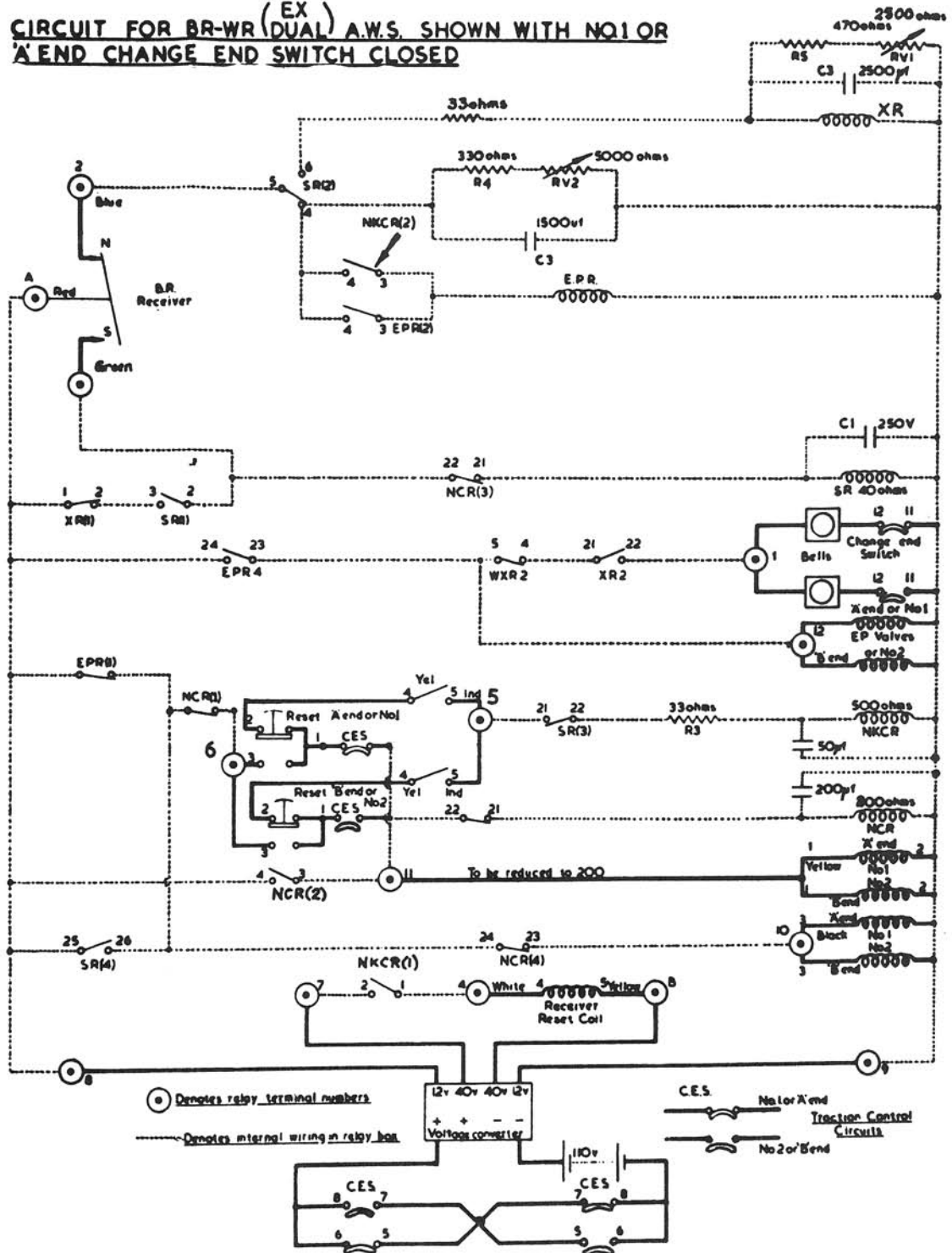
EPR (3) contact closes to prepare the circuit to NCR coil.

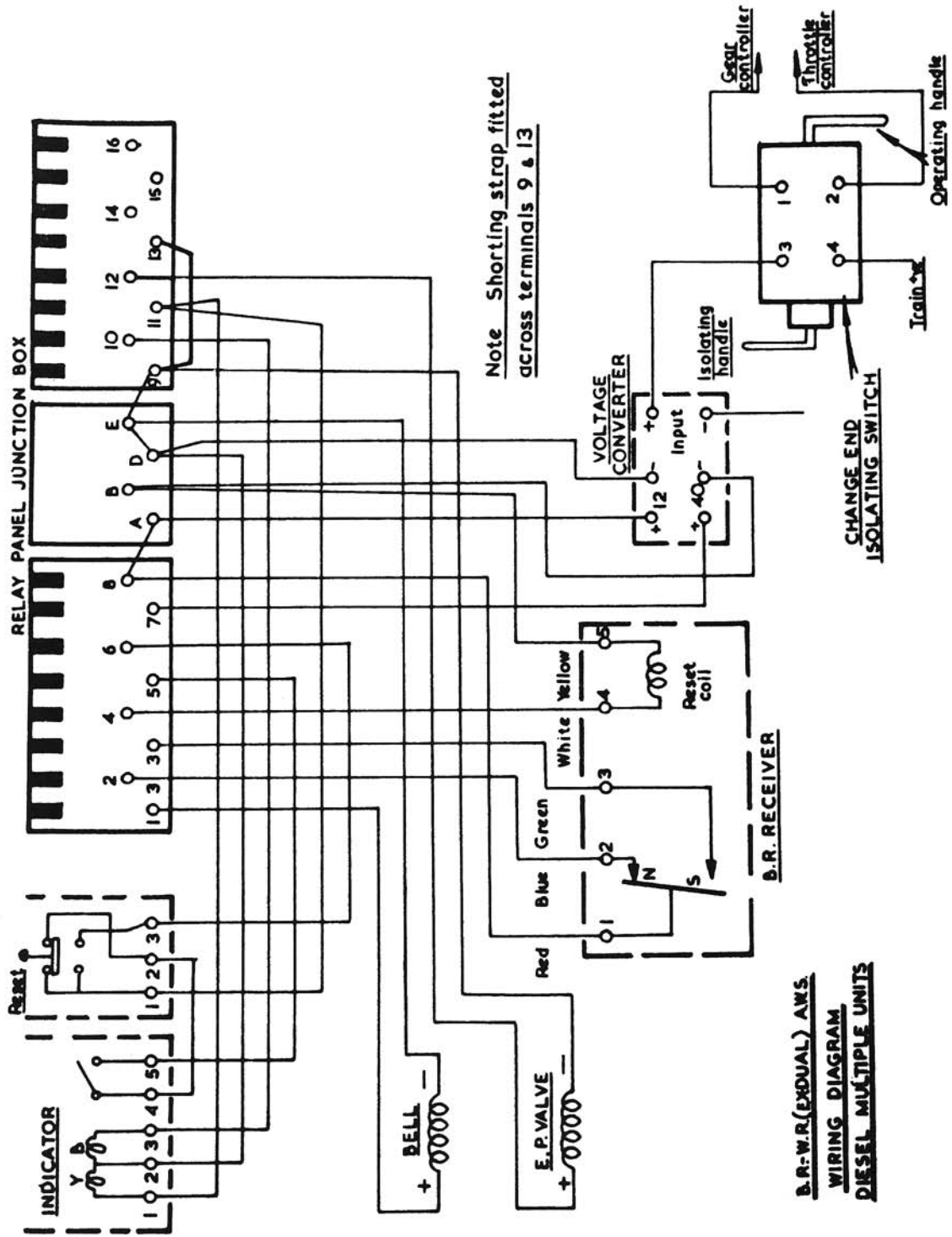
The sound of the warning horn must now be acknowledged by the driver by resetting the A.W.S.

STUDENTS NOTES

DIESEL LOCOMOTIVES

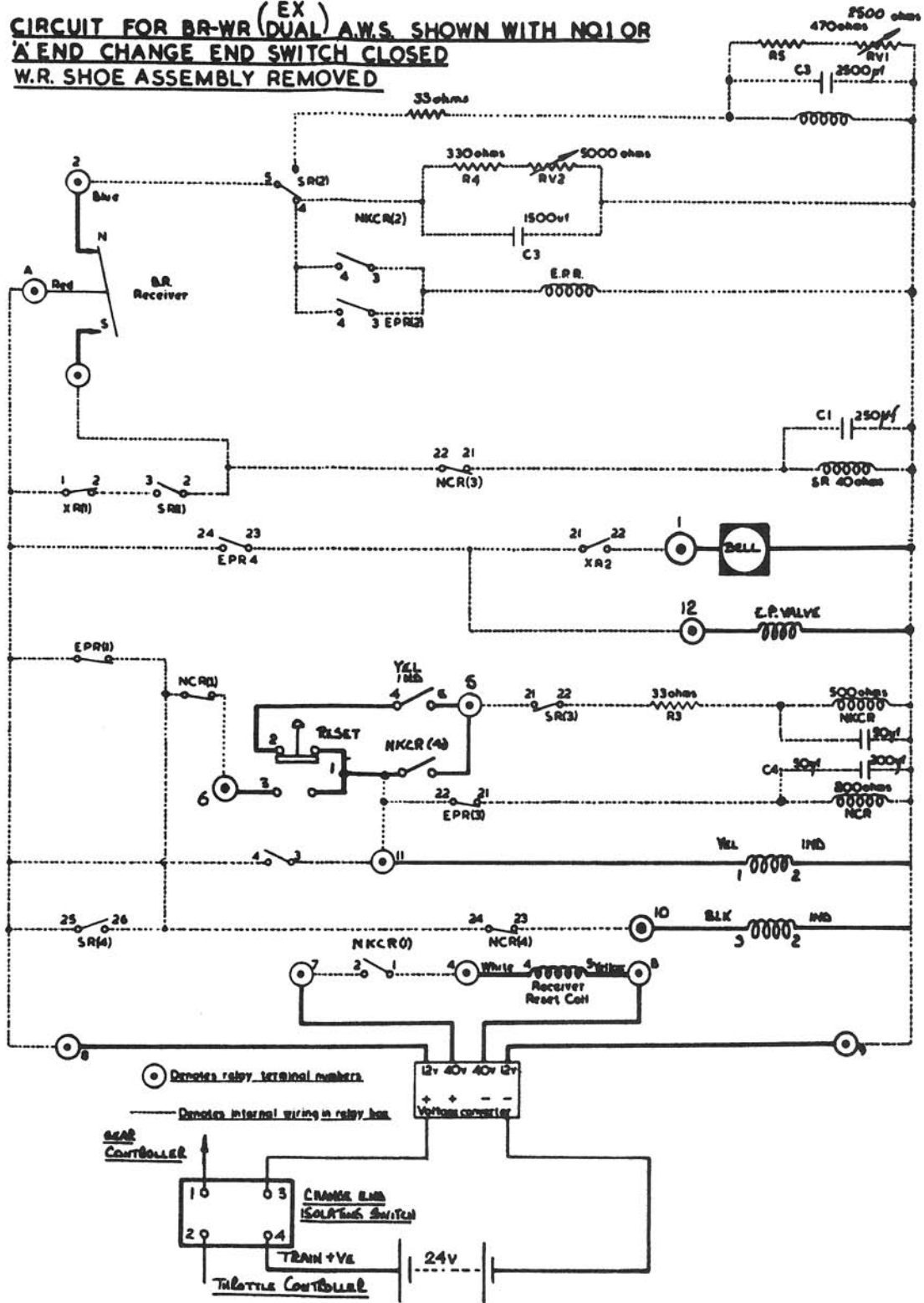
CIRCUIT FOR BR-WR (EX) A.W.S. SHOWN WITH NO1 OR 'A' END CHANGE END SWITCH CLOSED



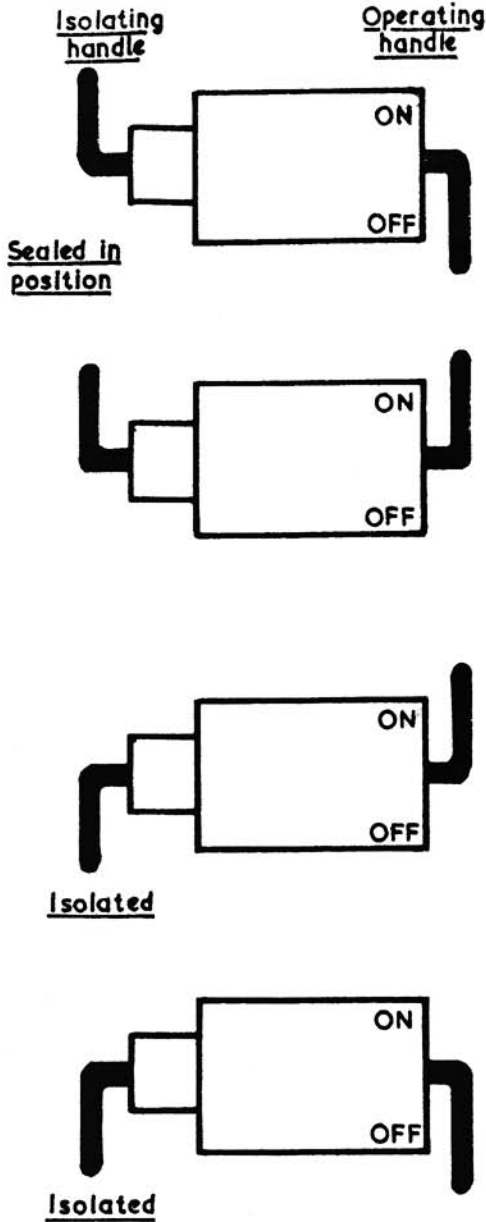


DIESEL MULTIPLE UNITS

CIRCUIT FOR BR-WR (EX) (DUAL) A.W.S. SHOWN WITH NQ1 OR A' END CHANGE END SWITCH CLOSED W.R. SHOE ASSEMBLY REMOVED



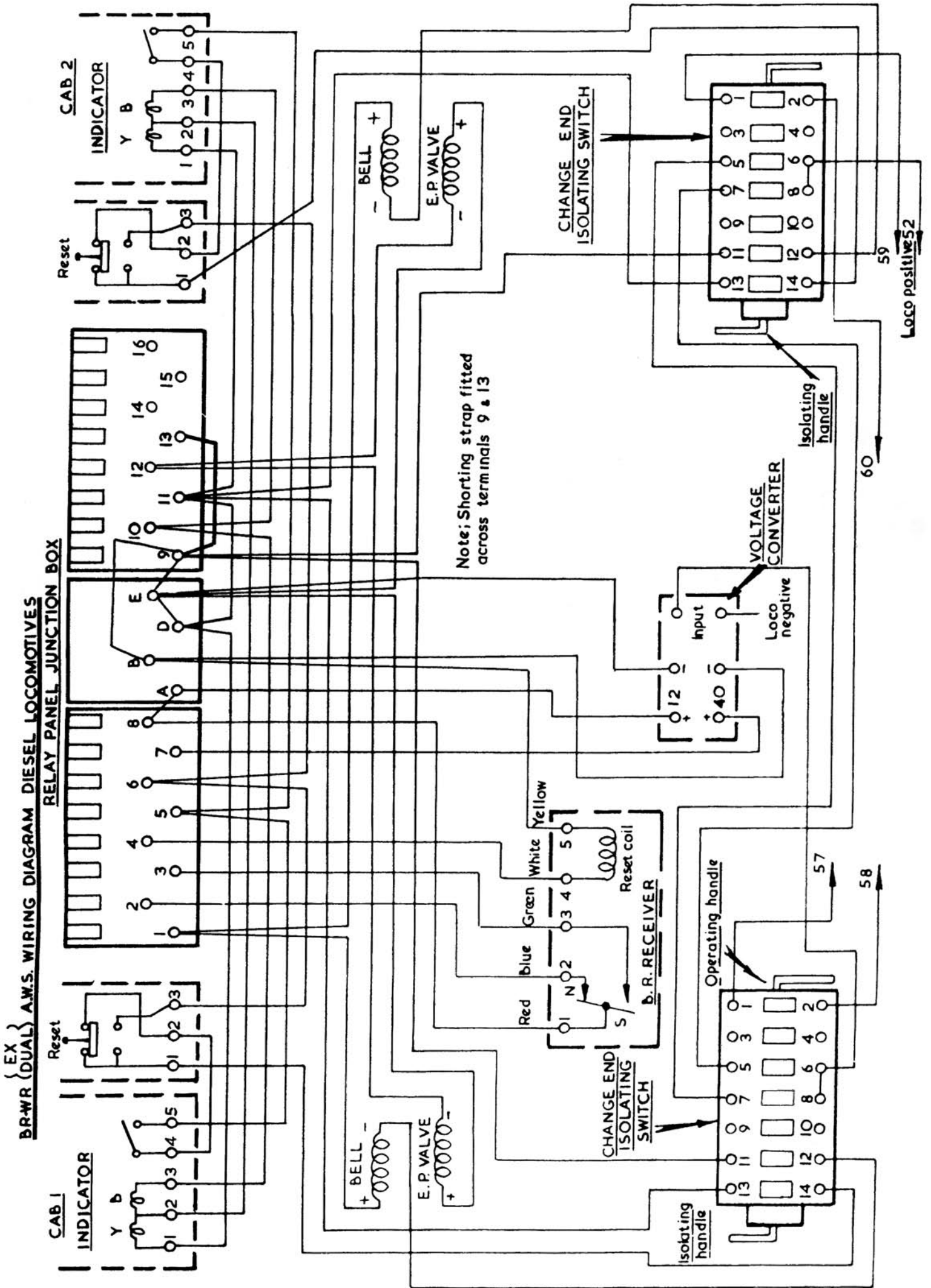
CHANGE-END-ISOLATING SWITCH
OPERATION OF VALVE SECTION

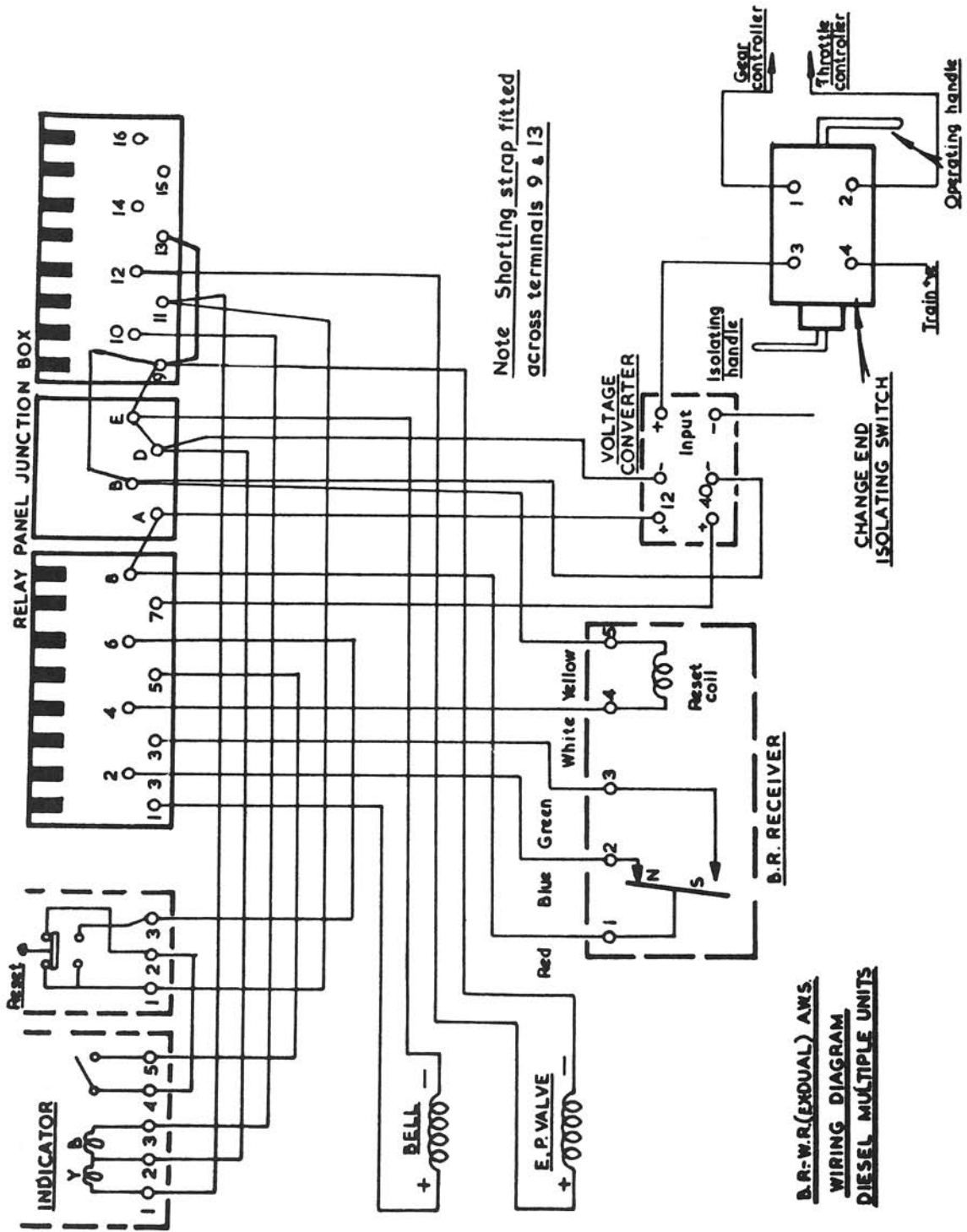


VACUUM	AIR
BRAKE VALVE AND E.P. VALVE ISOLATED FROM BRAKE PIPE	VALVE OPEN TO ALLOW MAIN RES. AIR PRESSURE TO PORT 6 OF THE E.P. VALVE
BRAKE VALVE AND E.P. VALVE CONNECTED TO BRAKE PIPE	VALVE CLOSED E.P. VALVE UNDER CONTROL OF ELECTRICAL SUPPLY
BRAKE VALVE AND E.P. VALVE ISOLATED FROM BRAKE PIPE	VALVE OPEN TO ALLOW MAIN RES. AIR PRESSURE TO PORT 6 OF THE E.P. VALVE
BRAKE VALVE AND E.P. VALVE ISOLATED FROM BRAKE PIPE	VALVE OPEN TO ALLOW MAIN RES. AIR PRESSURE TO PORT 6 OF THE E.P. VALVE

THE ABOVE DIAGRAMS SHOW THE POSITIONS OF THE OPERATING AND ISOLATING SWITCH HANDLES AND THE ASSOCIATED OPERATION OF THE VALVE SECTION FOR VACUUM AND AIR TYPE CHANGE-END ISOLATING SWITCH

BR-WR (EX DUAL) A.W.S. WIRING DIAGRAM DIESEL LOCOMOTIVES





CHANGE-END-ISOLATING SWITCH
OPERATION OF VALVE SECTION

	VACUUM	AIR
<p align="center"><u>Operating handle</u></p>	<p>BRAKE VALVE AND E.P. VALVE ISOLATED FROM BRAKE PIPE</p>	<p>VALVE OPEN TO ALLOW MAIN RES. AIR PRESSURE TO PORT 6 OF THE E.P. VALVE</p>
	<p>BRAKE VALVE AND E.P. VALVE CONNECTED TO BRAKE PIPE</p>	<p>VALVE CLOSED E.P. VALVE UNDER CONTROL OF ELECTRICAL SUPPLY</p>
	<p>BRAKE VALVE AND E.P. VALVE ISOLATED FROM BRAKE PIPE</p>	<p>VALVE OPEN TO ALLOW MAIN RES. AIR PRESSURE TO PORT 6 OF THE E.P. VALVE</p>
	<p>BRAKE VALVE AND E.P. VALVE ISOLATED FROM BRAKE PIPE</p>	<p>VALVE OPEN TO ALLOW MAIN RES. AIR PRESSURE TO PORT 6 OF THE E.P. VALVE</p>

THE ABOVE DIAGRAMS SHOW THE POSITIONS OF THE OPERATING AND ISOLATING SWITCH HANDLES AND THE ASSOCIATED OPERATION OF THE VALVE SECTION FOR VACUUM AND AIR TYPE CHANGE-END ISOLATING SWITCH

A.W.S. COMPONENTS

Voltage Converter

Electrical supply for the A.W.S. is provided from the vehicle battery (24 volts for D.M.U's and 110 volts for locomotives) through a static voltage converter unit which supplies a 12 volt d.c. output for the main circuits and a nominal 40 volt d.c. output for energising the receiver reset coil. Both these supplies are electrically isolated from each other and from the battery output.

NOTE: A 24 volt converter may be fitted to a 110 volt system provided the special voltage dropping resistance has been fitted to the locomotive.

Change-End-Isolating Switch

A change-end-isolating switch is provided in each cab to fulfil three functions:-

- (a) To ensure that the A.W.S. is operating in the cab from which the traction unit is being driven.
- (b) To ensure that the A.W.S. is inoperative in the cab not in use (two cab vehicles only).
- (c) To provide a means of isolating the A.W.S. equipment in case of failure.

The change-end-isolating switches are provided with two handles, one of which is sealed in the 'UP' position (RED) and the other must always be in the 'ON' position, i.e. up in the driving cab. The electrical feed to the power control circuit of the traction unit is taken through contacts made when this switch is in the 'ON' position, thus achieving function (a) above.

The change-end-isolating switches are also inter-wired so that one switch must be 'ON' and the other 'OFF' to complete a circuit to the A.W.S. converter. This fulfils function (b) above.

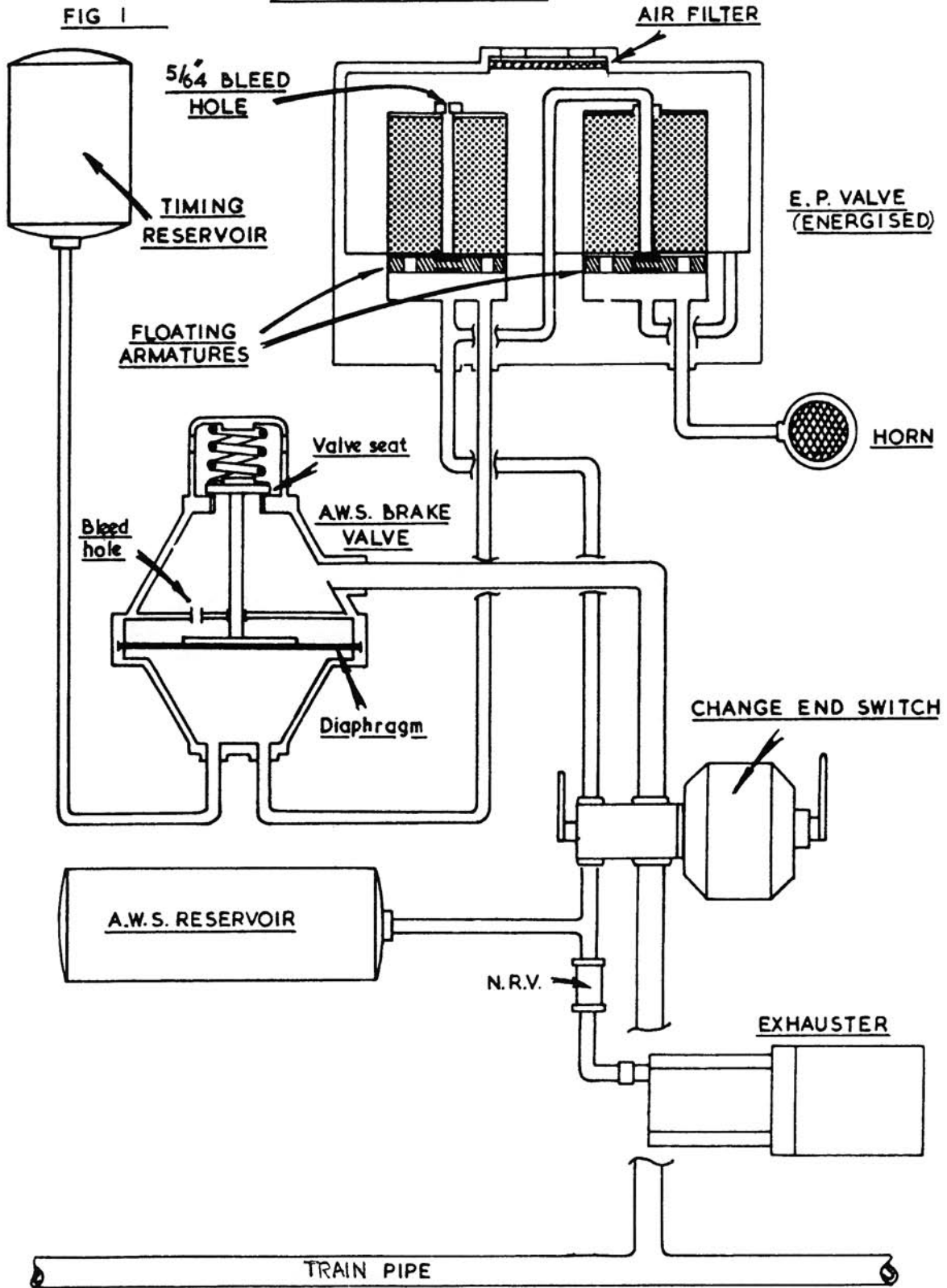
When the seal is broken the (RED) isolating handle can be moved to the "isolate" position when the cab equipment is isolated. The operating handle must remain in the 'ON' position before the traction unit can be driven under power. This fulfils function (c) above.

Two types of change-end-isolating switches are available:-

- (a) a two pipe connection for C.E.S's used on dual air-braked locomotives.
- (b) a four pipe connection for C.E.S's used on vacuum braked traction units.

In the case of D.M.U's with a single cab the change-end-isolating switch is a four pipe connection, and can be distinguished from the type for locomotives or double cab D.M.U's by having only two electrical rotary contacts.

E.P. VALVE & AWS BRAKE VALVE FOR
VACUUM BRAKED SYSTEM
E.P. VALVE ENERGISED



E.P. Valve and A.W.S. Brake Valve for Vacuum Braked System

Refer to diagrams on pages 34 and 36.

The A.W.S. E.P. valve contains two electro-pneumatic units, the armatures of which are free to rise and fall respectively upon energisation, or de-energisation of the unit.

Figure 1

In the energised position the seating of one of the armatures prevents air from entering the timing reservoir, whilst the other isolates the vacuum feed to the horn.

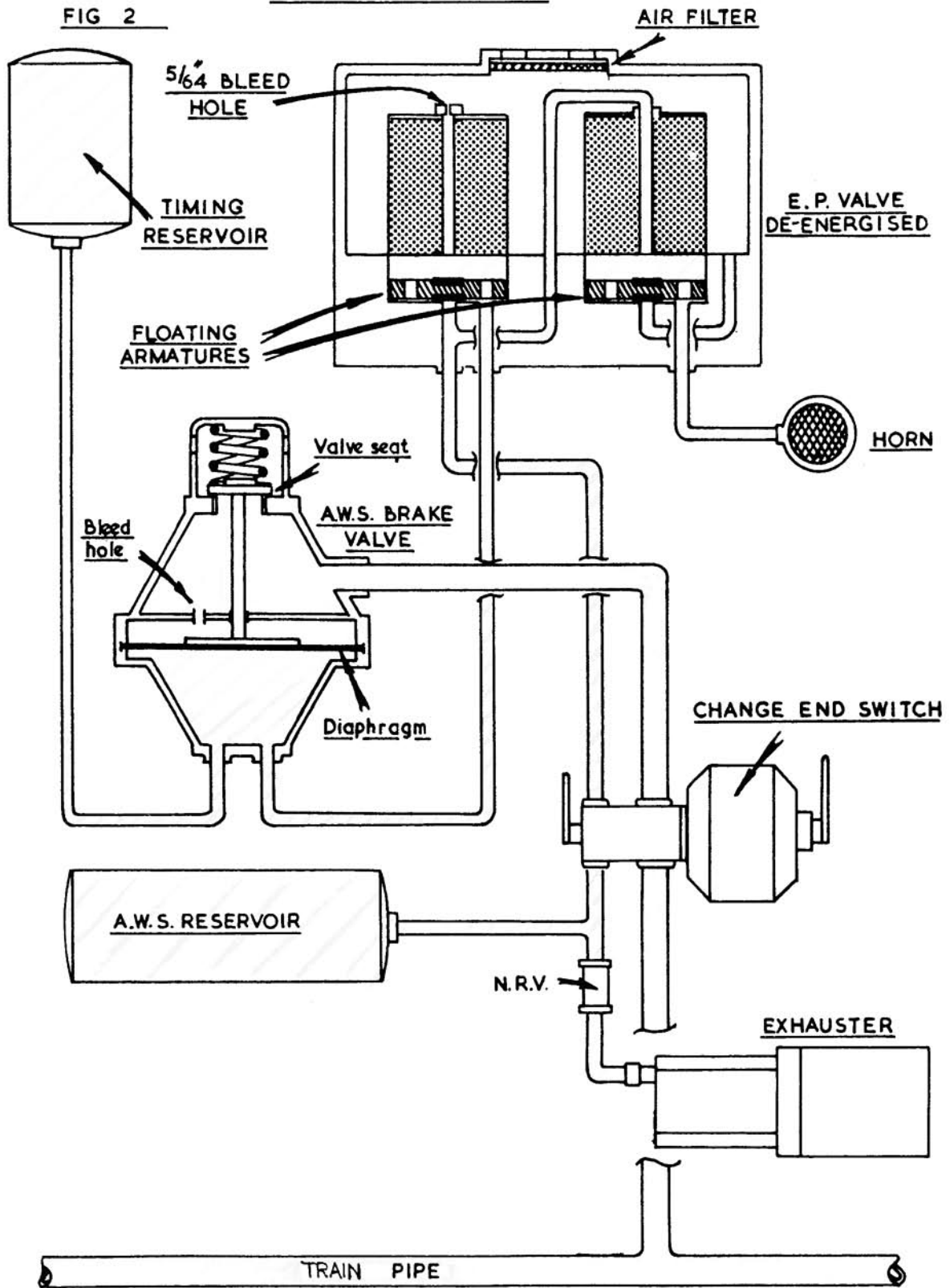
Figure 2

When de-energised, the armatures fall to the lower seatings, and, in this position, one allows air to enter the timing reservoir via the 5/64" bleed hole in the E.P. valve, and the other connects the horn to the A.W.S. reservoir and, in consequence, the horn sounds.

The admission of air into the timing reservoir and the underside of the A.W.S. Brake Valve applies the brakes at a controlled rate.

The bleed hole in the brake valve is to provide a differential pressure between the top and underside of the diaphragm.

E.P. VALVE & A.W.S. BRAKE VALVE FOR
VACUUM BRAKED SYSTEM
E.P. VALVE DE-ENERGISED



E.P. Valve for Air Braked (Dual Braked) System

Refer to diagrams on pages 38 and 39.

The A.W.S. E.P. valve armature is free to rise and fall upon energisation or de-energisation of the unit.

Figure 1

In the energised position main reservoir air pressure acting through port 1 and the E.P. valve seat operates the valve into the position shown.

In this position, main reservoir air pressure supplied through port 1 passes through the valve to the A.W.S. delay reservoir. The horn is vented to atmosphere through port 3 and port 5.

Figure 2

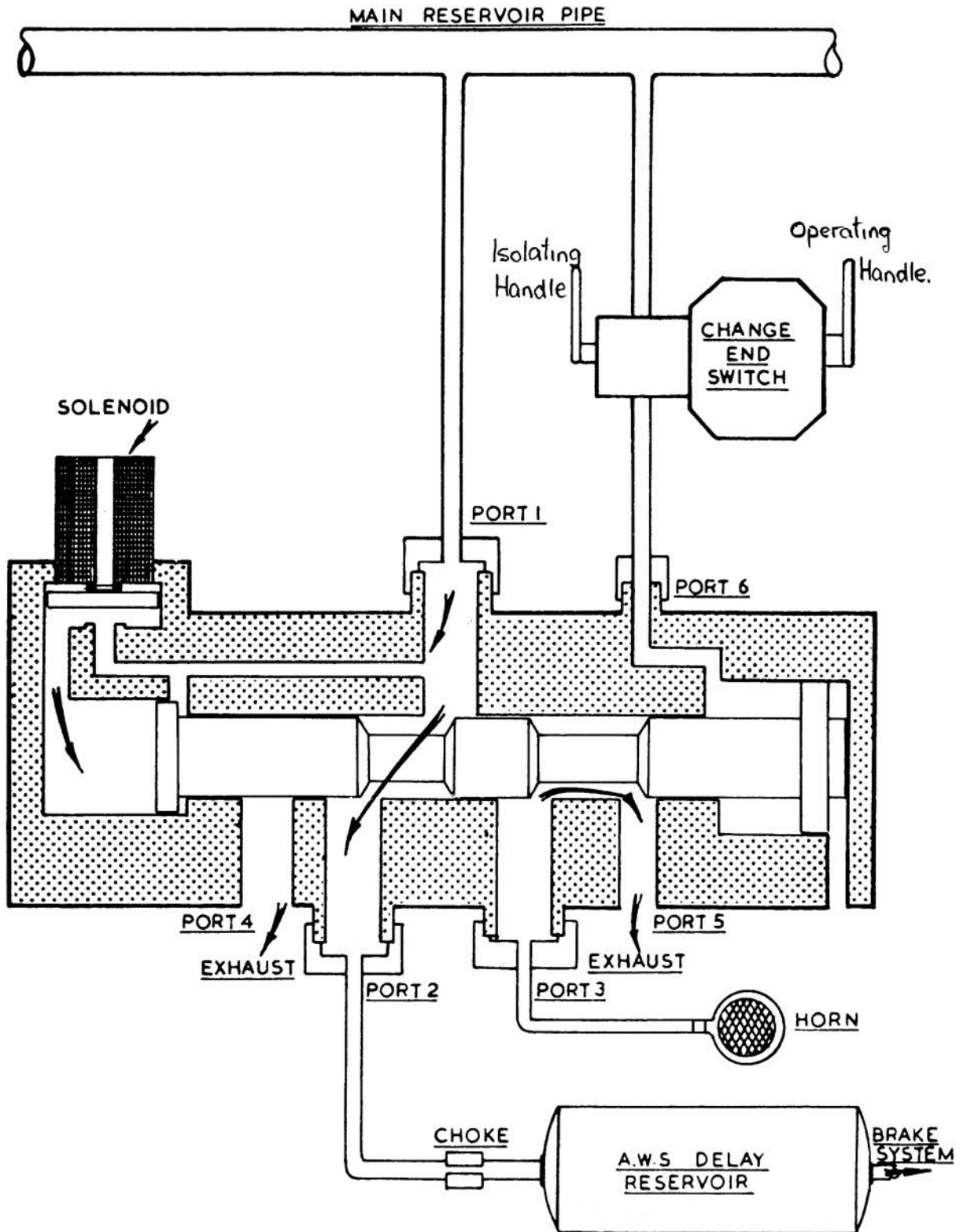
When the E.P. valve is de-energised, air pressure acting on the left hand side of the valve is vented to atmosphere and main reservoir air pressure from port 1 now acting on the opposite side of the valve moves the valve across, connecting the main reservoir air pressure to the horn via ports 1 and 3, and in consequence the horn sounds. The A.W.S. delay reservoir is vented to atmosphere via ports 2 and 4 which applies the brakes at a controlled rate.

In the non-driving cab, with the change end switch handle in the down 'OFF' position, an air supply to connection No.6 holds the A.W.S. E.P. valve unit in its "energised" position, thus supplying air to the A.W.S. delay or timing reservoir.

Should the A.W.S. equipment fail, it is isolated by turning the isolating handle (RED) to the down position in the affected cab. This gives a main reservoir air supply to connection No. 6, thus holding the A.W.S. E.P. valve unit in the "energised" position pneumatically.

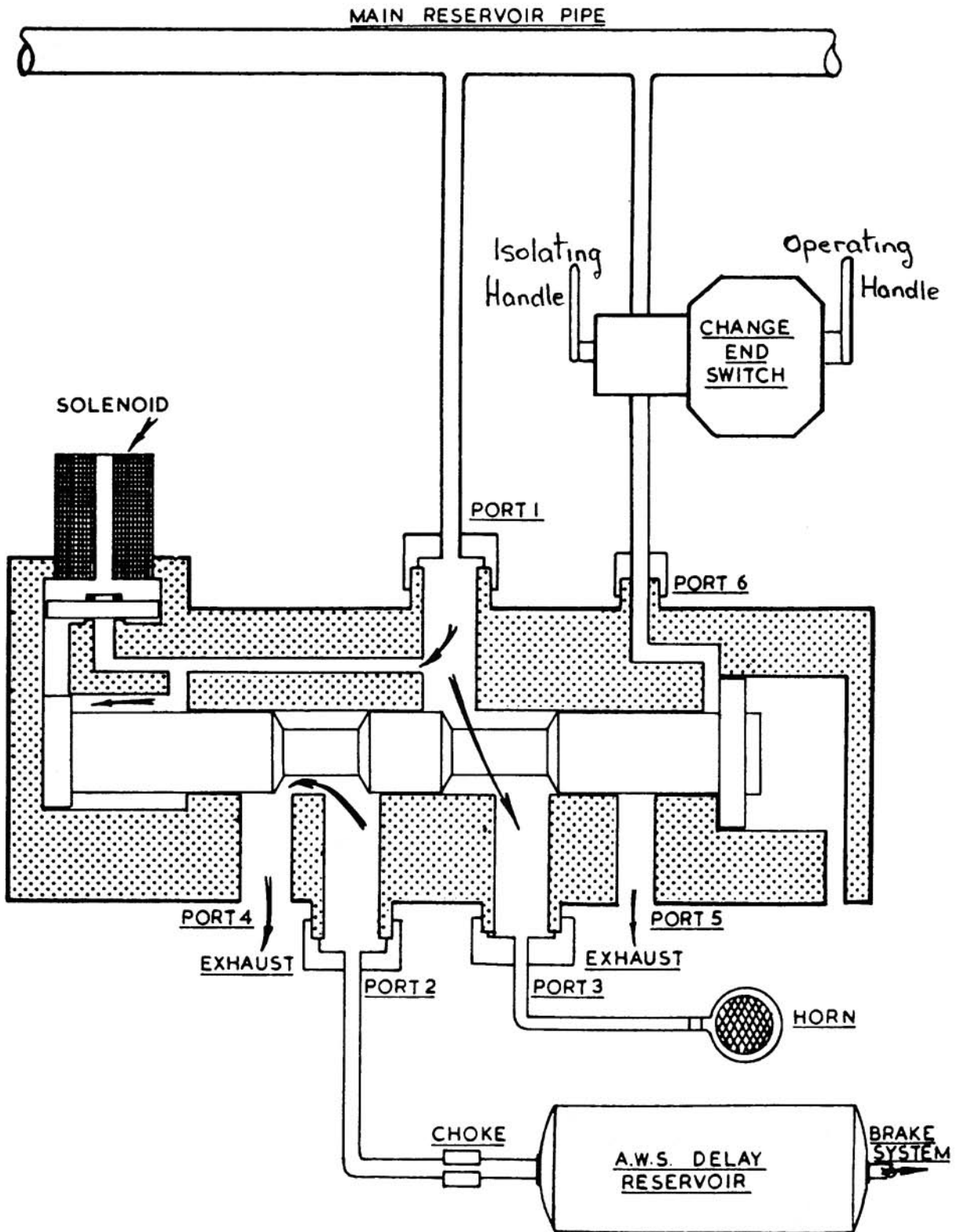
E.P. VALVE FOR AIR BRAKED (DUAL BRAKED)
SYSTEM. E.P. VALVE ENERGISED

FIG 1



E.P. VALVE FOR AIR BRAKED (DUAL BRAKED)
SYSTEM. E.P. VALVE DE-ENERGISED

FIG 2



B.R. Receiver Cable Assembly

The table below shows the different lengths of cable assembly available and the identification for cables having different plug arrangements.

Identification for the R.H. entry type is a 1" wide yellow band at each end of the armouring, whilst that for vertical entry is two 1" wide yellow bands at each end. No identification is provided for the L.H. entry type.

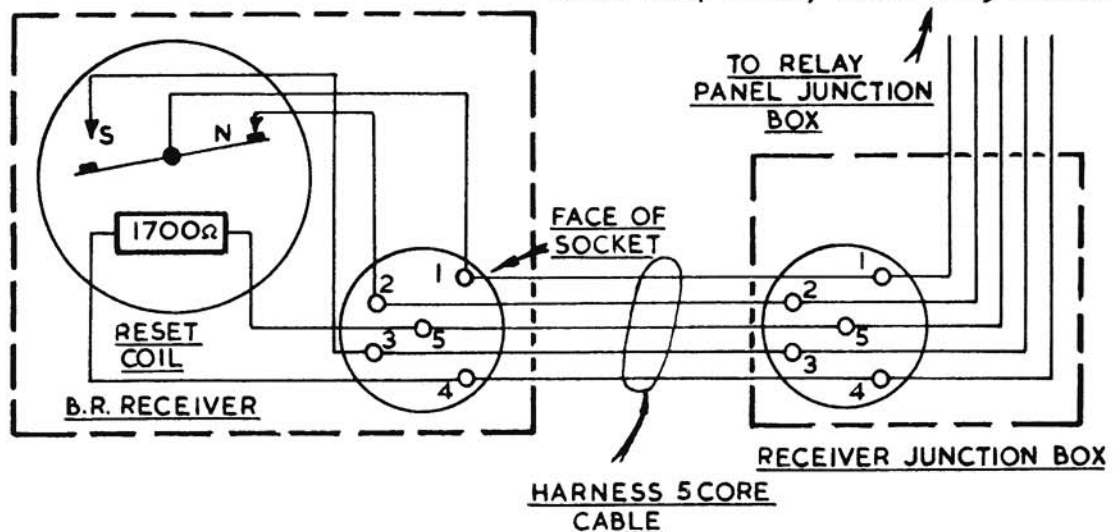
LOCOMOTIVES

CLASS	LENGTH OF CABLE	CLASS	LENGTH OF CABLE
52	72" A	116	30" A
50	30" A	117	30" A
47	72" A	118	30" B
46	30" A	119	30" B
45	30" A	120	48" A
37	30" A	121	30" B
31	30" B	122	30" A
25	30" A	123	48" A
		128	30" A
		130	30" A
		149	30" A

NOTE: A = L.H. CABLE ENTRY B = R.H. CABLE ENTRY

CABLE COLOUR CODE

Cable No. 1 Red; Cable No.2 Blue; Cable No.3 Green
Cable No.4 White; Cable No.5 Yellow



NOTE: It is possible to fit the Niphan plug in one of three positions. To ensure that the plug is fitted in the correct position check that the numbered pins locate with the appropriate numbered sockets.

A.W.S. FAULT GUIDE

A driver will submit a Driver's Report Form B.R. 29957 (see page 50) if an A.W.S. fault is experienced in traffic.

In the event of a 'Wrong Side Failure', code 5 or 7, the procedure detailed in W.R. Standing Order No. 1/K/100 must be followed.

It is the responsibility of the maintenance staff, upon receipt of the Driver's Report Form, to examine the A.W.S. equipment of the traction unit concerned in order to establish, and remedy if necessary, whether the traction unit A.W.S. equipment was responsible for the fault.

Any B.R. A.W.S. equipment found faulty must be replaced and the displaced items returned to workshops for repair. The traction unit must be re-tested and the fault found endorsed on the Driver's Report Form.

Detailed on pages 42 and 43 are the possible faults and remedies for each code fault reported.

STUDENTS NOTES

IRREGULAR WORKING OF A.W.S. EQUIPMENT

With reference to the instructions in the General Appendix under the heading 'B.R. Automatic Warning System of Train Control (A.W.S.)' the following action must be taken when irregular working of A.W.S. equipment is reported:-

1. ALL CODES

- 1.1 The AREA MANAGER or his representative, must, on receipt of a Driver's Report Form BR.29957, advise the Traction Controller, and if the traction unit is to be examined at the same depot the form must be handed to the Maintenance Supervisor. If, however, the traction unit is examined at another location, the report forms must be sent to the Chief Operating Manager (Signalling Section, CP.95).

Note: Forms 29957 should be readily available to Drivers booking off duty. The reporting of AWS irregularities in accordance with instructions must be enforced.

- 1.2 The TRACTION CONTROLLER must advise the Deputy Chief Controller, and give details to the Shift Maintenance Controller.

If the traction unit has worked onto another Region, the Traction Controller must request the appropriate Control Office to arrange for an examination giving sufficient detail to enable a duplicate form BR.29957 to be prepared at the examining depot.

- 1.3 The DEPUTY CHIEF CONTROLLER, on advice of the irregularity, must ensure that advice is given to the S & T Supervisor (Duty Technician if a Panel Box is concerned), or Permanent Way Supervisor if failure occurred at a signal provided for a temporary restriction of speed.

- 1.4 The SHIFT MAINTENANCE CONTROLLER, on advice of the irregularity, will make arrangements as necessary for the traction unit to be examined.

- 1.5 The MAINTENANCE DEPOT carrying out the examination must endorse the result on the Driver's Report Form and send copies to the Chief Mechanical and Electrical Engineer, Paddington, CP.72, and to the Chief Operating Manager, Signalling Section, CP.95. Where the examination is made at a Maintenance Depot other than that where the Driver's Report was submitted, Form BR.29957 must be prepared (see 1.2 above) and endorsed with the result of the examination, and copies sent as above.

- 1.6 The S & T SUPERVISOR OR DUTY TECHNICIAN must, on receipt of advice of an irregularity:-

(a) Arrange an immediate examination of the A.W.S. track equipment.

Continued.....

1. ALL_CODES - (Contd)

1.6 (Contd)

- (b) Advise the Deputy Chief Controller the result of the examination.
- (c) Complete Form BR.89711 and send 3 copies to the Divisional S. & T. Engineer.

1.7 The PERMANENT WAY SUPERVISOR, on receipt of advice of an irregularity occurring at a magnet provided in connection with a temporary restriction of speed, must:-

- (a) Arrange for the magnet to be examined immediately in accordance with the procedures outlined in the 'Testing and Storage Arrangements' pamphlet and to be changed if necessary.
- (b) Advise the Signaller and the Deputy Chief Controller the result of the examination.

2. CODE_5_AND_7_(WRONG_SIDE)_FAILURES

IN ADDITION to the procedure detailed above, the following procedures must be followed when an alleged 'wrong side' failure occurs.

2.1 The DEPUTY CHIEF CONTROLLER must, immediately advice is received from a Signaller or any other person of an alleged Code 5 & 7 AWS failure, ensure that:-

- (a) The Traction Controller is advised and that arrangements are being made to take the traction unit concerned out of traffic for examination at the first practicable point.
- (b) The Shift Maintenance Controller is making arrangements for the traction unit to be examined at an appropriate Depot.
- (c) Following S & T/Permanent Way examination, the Shift Maintenance Controller is advised in order to avoid unnecessary examination of the traction unit if the cause has been determined or to proceed with the examination if no other fault found.
- (d) Full details, including results of the examination(s) and time normal working resumed, are entered in the Control Log.
- (e) If the Driver did not stop and report the circumstances in accordance with the General Appendix instructions, the TRACTION AND TRAINCREW OFFICER is advised.
- (f) Arrangements are made as quickly as possible for a Traction Inspector (or where undue delay would arise, a Traincrew Supervisor or Traffic Assistant) to interview the Driver who reported the irregularity and complete a questionnaire (specimen attached).

Continued.....

2. CODE_S_AND_Z_(WRONG_SIDE)_FAILURES (Contd)

- 2.3 The AREA/DEPOT ENGINEER must, if the reason for the alleged 'wrong side' failure is not established, arrange for the following components to be removed and replaced with new or reconditioned items:-

B.R. Receiver
B.R. Receiver Cable
Repeat Relay Box (where fitted)
A.W.S. E.P. Valve) These items need only be removed
A.W.S. Indicator) from the driving position concerned.
A.W.S. Relay unit

The displaced items are to be forwarded under the 'red label' (material for inspection) procedure, for special examination to:-

Chief S & T Engineer's Laboratory
Gresty Road
Crewe

advising full details, including date, time, place and locomotive/unit number, of the alleged 'wrong side' failure. C.M. & E.E. Paddington to be advised when items are sent to Crewe. Details of the above procedure and the tests to be carried out are contained in W.R. Standing Order Nos. 1/K/100 for diesel locomotive and multiple units and K100/P for High Speed Trains.

- 2.4 The CHIEF MECHANICAL AND ELECTRICAL ENGINEER must obtain reports from the C.S. & T.E, Crewe, giving results of the examination of all equipment sent to the C.S. & T.E's laboratory. The Chief Operating Manager must be advised the results of the examination.
-

FORM TO BE COMPLETED BY TRACTION INSPECTOR
(TRAINCREW SUPERVISOR/ELECTRIC ASSISTANT)
WHEN AWS FAILURE - CODE 5 OR 7 - RECORDED

1. Date _____
2. Time _____
3. Fault Code _____
4. Weather conditions _____
5. Place _____
6. Train from _____ to _____
7. Drivers Name _____ Home Depot _____
8. Locomotive/Unit No. _____
9. Speed at time of Incident _____
10. If Locomotive (or Single Power Car) which cab _____
11. Details of signal for which wrong indication received _____
12. If magnet for a permanent, or temporary, restriction of speed involved -
location of restriction _____
13. What audible signal received at Inductor/magnet _____
14. What indication given on visual indicator _____
15. What aspect was received at the signal _____
16. Signal No/Signal Box at which train stopped specially to report
failure _____
17. Whether any staff were seen to be working in area _____
18. If so, were they working on the track, or on Signal Dept.
equipment _____
19. Were any other failures experienced, either before or after incident under
investigation _____
20. Any other remarks _____

Signed _____

Date _____

BRITISH RAILWAYS
Failure of Automatic Warning System (A.W.S.) - Driver's Report Form
(B.R. SYSTEM)

Train..... Date.....

Driver's Name..... Loco or Unit No.....

Home Depot..... Cab or Coach No.....

SIGNAL BOX	SIGNAL WARNING INDICATOR } † WARNING BOARD	FAULT CODE No.*	REMARKS

† Delete as appropriate. Where applicable, mileage of commencement of speed restriction to be stated.

* See other side for list of Fault Code Numbers

If the apparatus has been isolated an endorsement to this effect must be made in the Remarks column.

Defect reported at.....

The completed form must be handed in before leaving duty.

A.W.S. FAULT CODE

Signal Aspect		Speed Restrictions	Cab Indication	Code No.
Semaphore	Colour Light		Type of Fault	
Distant off	Green	X	Horn and Bell	1
			Horn instead of Bell	2
			Nothing received	3
Distant on Stop and Distant on	Double or Single Yellow (Steady or Flashing) or Red	Warning Indicator or Warning Board	Bell and Horn	4
			Bell instead of Horn	5
			Brake without Horn	6
			Nothing received	7
When not at a signal, Warning Indicator or Warning Board			Horn	8
			Bell	9
Unable to cancel horn				10
Indicator not changing to all black				11

B.R. AUTOMATIC WARNING SYSTEM

PROCEDURE FOR DEALING WITH NOS. 5 AND 7 "WRONG-SIDE" FAULTS

The following procedure must apply when an A.W.S. No. 5 or 7 (Wrong Side) fault is reported on a Locomotive/Multiple Unit.

1. A.W.S. "WRONG-SIDE" FAULTS

<u>Fault No.</u>	<u>Signal Aspect</u>	<u>Equipment Indication</u>
5	Caution or Stop	Bell but no horn
7	Caution or Stop	Nothing Received

A Locomotive/Multiple Unit on which a No. 5 or 7 fault has occurred must be taken out of service and sent to a maintenance depot for examination as quickly as possible.

2. DEPOT TESTS

The test must be carried out in the cab at which the incorrect indications occurred:-

- (a) Ensure: The Change-End Handles are in the "OFF" position.
The Isolating Handles are in the "UP" position and sealed.
The Automatic Air Brake Valve Handles (where applicable) are in the shut down position.
The Engine(s) are running and vacuum is fully created or Air Brake Pipe is charged by placing one Drivers Brake Valve in the running position.
- (b) Move the Change-End Handle in the cab to be tested to the "ON" position and press and release the reset button to silence the horn.
- (c) Test for the Caution Signal by passing the South Pole of the test magnet across the face of the receiver. The indicator should show "ALL BLACK" when the Horn starts to sound, press and release the reset button and check that the indicator changes to "BLACK AND YELLOW" and the horn stops. Repeat at least three times.

Continued.....

3. INSULATION TESTING

Procedure

Ensure Battery Isolation Switch is in the "OFF" position. Remove A.W. Relay Unit and Bond terminals at the Junction Box together using fuse wire.

NOTE: Terminal 16 is not used.

Place Change-End switch in the "ON" position in the appropriate driving cab if known, in each driving cab in turn if not known.

Using a 100V Megger check the insulation value of circuits to earth and record.

If an insulation value below 20K Ω is obtained the faulty cables must be located and rectified.

On completion remove bond, refit relay unit and retest as in Section 2.

4. (a) A.W.S. APPARATUS OPERATING INCORRECTLY

Remove defective component and fit new or reconditioned component. Retest and if apparatus operates correctly, return Locomotive/Multiple Unit to traffic.

Fault B.R. component to be sent for 'special inspection' as detailed below.

(b) A.W.S. APPARATUS OPERATING CORRECTLY

In the case of a Code 5 fault (B.R.A.W.S. only) examine the reset button at the cab where the Code 5 fault occurred. Depress the reset button half way and ensure that the moveable contact is not touching both top and bottom fixed contacts simultaneously i.e. the moving contact must break with the top fixed contact before making with the bottom fixed contact. Should the switch be faulty a Code 5 fault could be achieved by the Driver depressing the button in anticipation of a caution or danger signal. Change the reset button and return defective reset button to Crewe under Red Label procedure.

If the reset button is satisfactory, or following a Code 7 fault, the following components must be removed and replaced with new or reconditioned items and the apparatus re-tested to ensure correct operation, before the Locomotive/Multiple Unit is returned to traffic.

Continued.....

Components to be sent for 'special inspection':-

<u>Diesel Locomotive and Diesel Multiple Units</u>	<u>Electric Multiple Units</u>
1 B.R. Receiver	1 B.R. Receiver
1 Receiver Cable	1 Receiver Cable
1 E.P. Valve	1 E.P. Valve (Removed from Air Unit)
1 Indicator	1 Indicator
1 Relay Unit	1 Relay Unit

(Components marked ✘ must be removed from the driving position at which the incorrect indication occurred).

To each component removed for special inspection a "Material for Inspection" label (BR.9409/1) must be affixed and addressed to:-

Chief Signal & Telecommunications Engineer's Laboratory
Gresty Road
CREWE.

Advice Note - 'Article for Inspection' (BR.11300) to be addressed to R.M. & E.E., Paddington (CP.76) and C.S. & T.E. Laboratory, Gresty Road, Crewe using passenger trains or 'Enparts' Services. The following details must be entered on each label (BR.9409/1).

Locomotive or Multiple Unit No.
Date of Fault.
No. of Fault and Location.
Examining Depot.
Owning Depot.

Completed Forms BR.12075/7 and BR.8658/3 (Components for Repair and Advice of Despatch) must accompany the Red Label advice so that C.S. & T.E. Laboratory, Gresty Road, Crewe can forward items for repair after their examination.

Full details of the examination must be entered on the Examination Report Form (see Appendix "A") and the result of the examination entered on the drivers report form. These forms must be distributed as follows:-

Drivers Report Form:

R.M. & E.E., W.R., CP.72
R.O.M., W.R. Signalling & Safety
Section, CP.95, Swindon

Examination Report Form Appendix "A":

R.M. & E.E., W.R., CP.72
C.S. & T.E., Reading, Cp.47A
R.M. & E.E. of owning region for
non W.R. vehicles.
Allocated depot of vehicle (for
record history).

EXAMINATION REPORT - CODE 5 OR 7 WRONG SIDE FAILURE

THIS DOCUMENT MUST BE USED IN CONJUNCTION WITH STANDING ORDERS 1/K/100 AND K100/P ON COMPLETION A COPY MUST BE FORWARDED IMMEDIATELY TO C.M. & E.E., PADDINGTON.

DATE ON WHICH FAULT OCCURRED	
LOCOMOTIVE/MULTIPLE UNIT/H.S.T. NO.	
FAULT CODE 5 OR 7	
SIGNAL NUMBER & LOCATION	
CAB IN WHICH WRONG INDICATION WAS RECEIVED	

TEST RESULTS

ACTION	INDICATIONS		
	HORN	BELL	INDICATOR
2b MOVE CHANGE END SWITCH HANDLE TO 'ON' POSITION/ SELECT E/O POSITION ON MASTER CONTROLLER (H.S.T.)	SOUNDS ()	SILENT ()	• ()
2b PRESS & RELEASE RESET P/B	SILENT ()	SILENT ()	BLK/YEL ()
2c PASS 'S' POLE OF HAND TEST MAGNET ACROSS FACE OF RECEIVER	SOUNDS ()	SILENT ()	BLACK ()
2c PRESS & RELEASE RESET P/B	SILENT ()	SILENT ()	BLK/YEL ()

OR RECORD INDICATION RECEIVED IN ABOVE

* NOTE WITH FX DUAL A.W.S. THE INDICATOR SHOULD DISPLAY ALL BLACK WITH B.R. -
A.W.S. ONLY, THE INDICATOR WILL REMAIN AT WHATEVER INDICATION WAS DISPLAYED
BEFORE THE CHANGE-END SWITCH WAS PLACED IN THE ON POSITION OR WHEN E.O. IS
SELECTED (H.S.T. ONLY).

DETAILS OF FAULT FOUND

INSULATION TESTING - INSULATING VALUE TO EARTH : _____
DETAILS OF RECTIFICATION, IF REQUIRED.

ENTER SERIAL NUMBER OF COMPONENT SENT FOR SPECIAL EXAMINATION
SEND TO :-

C.S. & T. ENGINEER'S LABORATORY, GRESTY ROAD, CREWF.

NOTE : ALL FIVE ITEMS BE CHANGED IF NO FAULT FOUND.

COMPONENT	SERIAL NO.	COMPONENT	SERIAL NO.
B.R.Receiver		M.P.Valve/Repeat Relay Box	
Relay Unit:		Indicator	
Receiver Cable			

} These items
from driving
end only.

if
✓ despatched
ELECTRICIAN'S
CHECK NO. _____
SUPERVISOR'S SIGNATURE
(51)

A.W.S. PORTABLE TEST SETS

Portable test sets have been provided at major maintenance depots for both B.R. A.W.S. and B.R. W.R. (Dual) A.W.S. which, when fitted in place of the Relay Panel, enables all remaining A.W.S. equipment and wiring to be tested.

It is recommended that the test unit be used to locate the faulty item of equipment when normal A.W.S. tests have revealed the reported defect.

Refer to Instruction Book for Portable Test Set for procedure to be followed.

