



TECHNICAL TRAINING NOTE APT/8.1

DRIVING CAB CONTROL/INDICATORS

CONTENTS:-

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3. Displays
4. Indicators

RAILWAY ENGINEERING SCHOOL,
BRITISH RAILWAYS, DERBY.

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APT-P TRAIN FORMATION CODES

250 km/h (2+12) high-powered version (prototype)



OPERATORS	DTS	TS	TS	TRB	TF	TBF	M	M	TBF
CODE							←	→	

DTS:-	Drg. Trailer Second	or	Second Drg. (3 axles)	SD3
TS :-	Trailer Second	or	Second (2 axles)	S2
TRB:-	Trailer Rest/Buffer	or	Second Catering (2 axles)	SC2
TF :-	Trailer First	or	First (2 axles)	F2
TBF:-	Trailer Brake First	or	First Van (3 axles)	FV3
M :-	Motor	or	Elect Power (4 axles)	EP4

BRITISH RAILTECHNICAL TRAINING NOTE APT/8.1DRIVING CAB CONTROLS/INDICATORS1. DRIVING CONTROLS Fig. 11.1 Master Selector

The selector has 4 positions OFF, AUXILIARY, FORWARD and REVERSE. In 'auxiliary' battery power is made available for him to lift the pantograph and start the MA sets or DA sets; he can also test the brakes in this position. He cannot demand traction until he selects FORWARD or REVERSE and has inserted his master key to unlock.

1.2 Power Demand Lever

The power demand lever has 9 positions, OFF, notches 1-7 and Boost, the traction power increases incrementally as the handle is notched up.

Boost enables the driver to obtain extra power for about 3 sec. in every 20 sec to overcome difficult hill starting etc. The boost notch is spring loaded to prevent a continuous demand signal.

1.3 Brake Demand Lever

The brake demand lever has 9 positions like the power lever but works in the opposite direction. The levers are so arranged that if they are both pushed forwards - a natural motion for an emergency - the power is cut off and the brakes are switched to give maximum braking effort.

The power demand signal is removed should the brake lever be moved higher than notch 2. This enables hill starts brake application to prevent "slipping back" but prevents power and brakes being applied together unnecessarily. The last notch "EMERGENCY", like the power demand lever is spring loaded to prevent accidental application.

In addition to this normal brake demand lever there is an Emergency Brake Push Button situated in front of the normal control Fig. 2.

1.4 Parking Brakes Fig. 2

The system comprises 4 parking brake packs situated one in each van trailer and power car. Each pack can be operated individually, locally, or as a system from a driving cab. The selector must be in the Forward or Reverse position before control can be taken. This is to prevent accidental parking brake release causing a train running away on a slope without braking effort being instantly available from the running brakes. The cab operating controls consist of 2 buttons APPLIED and RELEASED and an indicator which shows ON, OFF or a cross-hatch meaning partial application.

On van trailer - 2 axles with parking brake
On power car - 4 axles with parking brake

1.5 Driver's Safety Device System (DSD)

On the floor in front of the driver is a foot-pedal which must be depressed whilst the selector is in the 'forward' or 'reverse' positions. Should the pedal be released for longer than a few seconds an emergency brake application is made automatically. Note This is not the 60 s. BR vigilance system.

Should the system fail, it can be isolated by a switch behind the driver's desk front cover.

1.6 Automatic Warning System (AWS)

In principle the AWS for APT-P is the same as that used on current locomotives.

Should the system fail it can be isolated by a switch mounted to the right hand side of the front desk.

1.7 Emergency Brake Loop (EBL)

APT-P has not got an air train pipe; it has an electrical equivalent. In the leading driving cab there is a brake encoder unit (behind front desk). This takes the signals generated by the position of the brake lever and produces voltages to pass down train lines to control the local electronic brake units. It also provides a sinusoidal current which is passed down a train line to the end of the train and returns through each electronic brake unit to the brake encoder unit.

If this current fails to be detected at the local electronic brake units it produces an emergency brake application. So, in general terms it operates exactly the same as an air train pipe, should the train break in half both portions would stop. In the driving cab the emergency brake loop is also open circuited - providing emergency braking through the action of:-

- 1.7.1 A.W.S.
- 1.7.2 D.S.D.
- 1.7.3 C-APT
- 1.7.4 Emergency Stop Button
- 1.7.5 Parking Brake
- 1.7.6 Pass Communication
- 1.7.7 Towing Interface
- 1.8 Passenger Communication System

This is a train wire passing along the train through lever operated switches in the coaches. This system replaces the Passenger Communication Chain in existing stock. If any passenger "pulls the cord" the electrical circuit is broken and the EBL is open circuited causing full emergency brakes. The driver can however push and hold a button in on the driver's desk which overrides the brakes until he releases his thumb. This overriding can be done only on the passenger communication system and not on any of the other systems which can cause emergency braking.

1.9 Towing Interface

Under the driver's desk is situated a "towing enable" switch which needs to be operated by the driver to energise the towing circuitry.

The purpose of the towing interface is to enable joint braking when APT-P is being assisted by a locomotive. Firstly, the towing interface is to provide emergency braking on both APT-P and the locomotive, which can be operated from either in any of the normal ways - broken train, passenger communication etc. Secondly, it enables a locomotive driver to have full linear control of APT's brakes, in addition to his own trains brakes, from his automatic brake handle.

2. ELECT. TRAIN SUPPLIES - AUXILIARIES

2.1 M.A. OR D.A. Sets

APT-P can be considered as two half trains or rakes, each identical. Each rake has a motor alternator set (MA) situated in the van trailers and a diesel alternator set (DA) in the driving trailer cars which produce a 3-phase 415 V 50 Hz supply.

The MA sets have the greater outputs of 430 kVA, compared with the DA's 250 kVA, and are used as the main source of train power. Should a MA set fail the back up DA can be switched in with subsequent shedding of some load.

There is a small control panel at the driver's left hand side for control of the MA-DA sets.

It consists of an on and off switch with indicator for each MA set Local/Remote and for each DA set Local/Remote (4 on's and 4 off's).

2.2 Communication Equipment

Driver/Guard units are fitted in Driving cabs, Guards compartments and at each end of the Power Cars. They can be used as soon as the battery isolating switches are closed. The unit consists of a rectangular box with a standard GPO telephone handset fitted on the fascia, a call button and an electronic horn.

Each vehicle other than the power cars has a public address amplifier which drives up to 10 loudspeakers. In each Catering vehicle and Guards compartment a microphone unit is fitted which provides the whole train with Guard's comments and calls for meals and refreshments.

2.3 Horn Controls

APT-P has 2 air horns which are situated in the nose cone. The pitches are different from other locomotives, however, being E_b and C_b. Each horn has 2 valves one to produce full volume and the other to provide a softer sound. The loud valves are inhibited until 'forward' or 'reverse' is selected to limit the chance of maximum volume being applied in a depot or station.

FIG 1

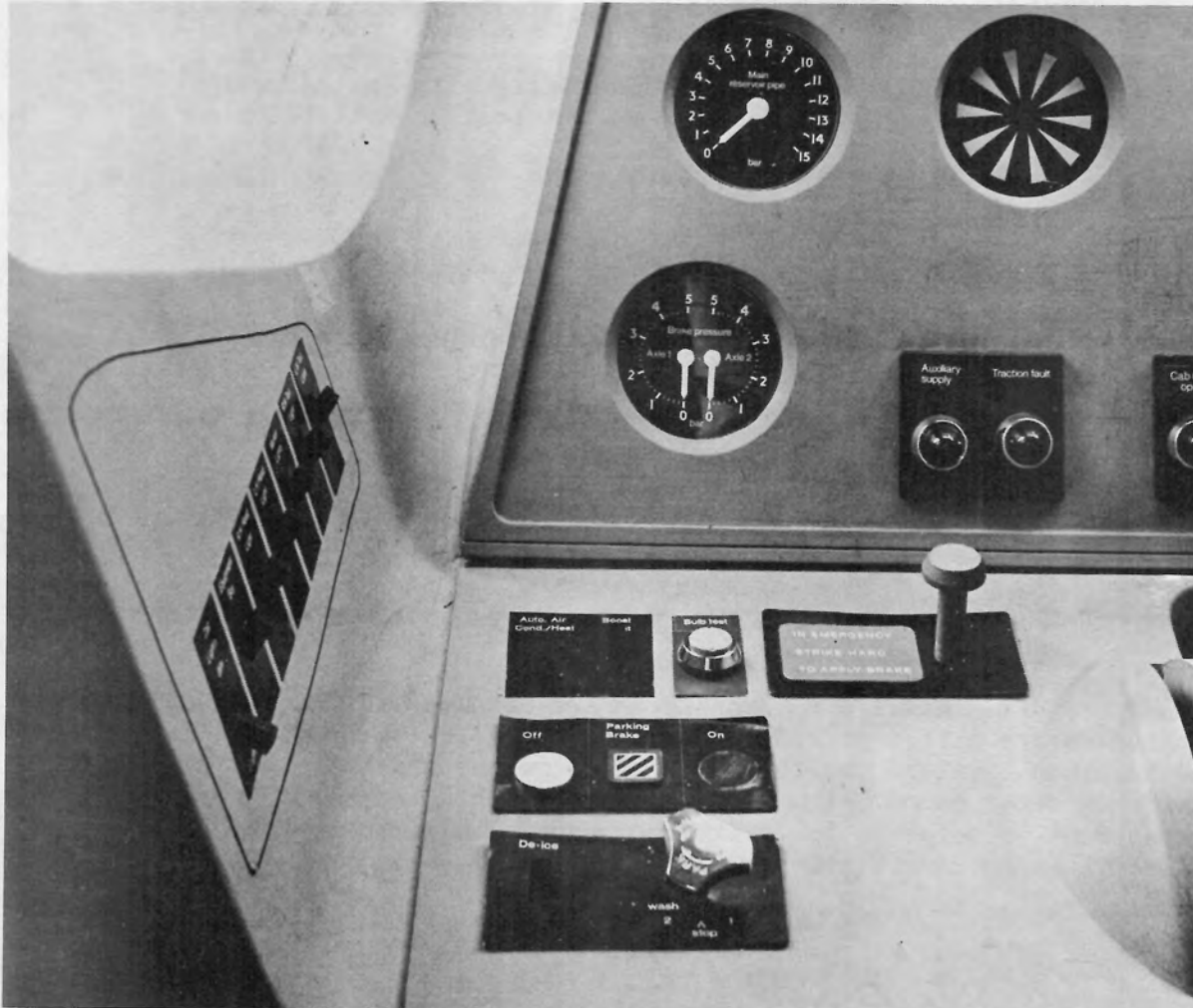
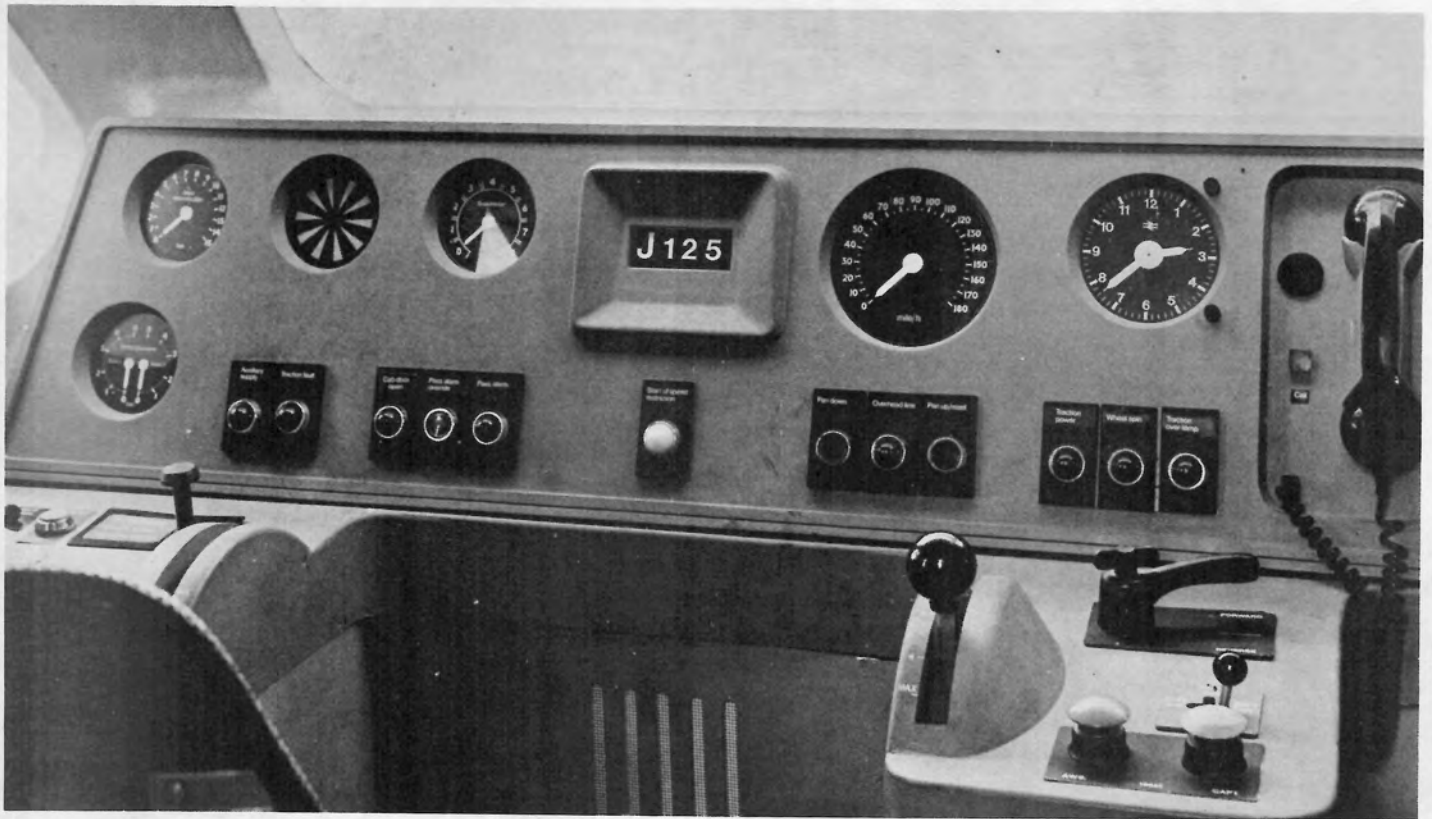


FIG 2

3. DISPLAYS (left to right)

In front of the driver are gauges which display:-

3.1

Main Reservoir Air Pressure Range 0-15 bar.

3.2

A.W.S. Sunflower Yellow-Black/All Black

3.3

Brake Meter Range 0-8

This device is a $4\frac{1}{2}$ " meter calibrated with 0-8. These numbers correspond with the brake demand lever notch position to give an indication as to the effectiveness of the braking system and rate of de-acceleration.

3.4

C-APT (See APT 8.2 for further information)

Range 0 - in 5 mph increments

3.5

Speedometer

This is calibrated from 0-180 mile/h and is a 6" dia meter.

3.6

Time Clock

3.7

Brake Pressure Range 0-5 bar

Note this is a local indication only.

4. INDICATORS (left to right)

4.1

Auxiliary Supply Fault Light

This indicator is to direct the drivers attention to his side indicator panel when a MA or DA fails and requires his action.

4.2

Traction Fault Light

This portrays troubles in the traction equipment.

4.3

Cab Door Open

This indicates if either outward opening cab door is not fully shut.

4.4

Pass. Communication Alarm

Adjacent to it is Pass Alarm Override button.

4.5 Start of Speed Restriction Lamp

This lights up for 4 seconds on commencement of track speed restriction.

4.6 Overhead Line Light

This indicator shows the level of voltage on the pantograph. If it is above 15 kV it glows blue, below 15 kV red and goes out completely on zero volts. The 15 kV changeover was chosen because at lower voltages the acceleration characteristics of APT-P change dramatically.

4.7 Traction Power Light

This shows the driver, when he demands power, that he has more than 100 Amp in 4 or more motors, if there are 2 power cars in APT, or 3 or more motors if there is only one power car in APT.

4.8 Wheel Spin Light

This indicates that excessive traction is being applied for the prevailing track conditions. Normally the power car traction equipment would prevent wheel spin occurring.

4.9 Traction Temperature Light

When the coolant oil, in which the thyristors sit, rises above the normal working temperature it is indicated to the driver for him to reduce his demand otherwise all traction power becomes inhibited at a higher temperature level.

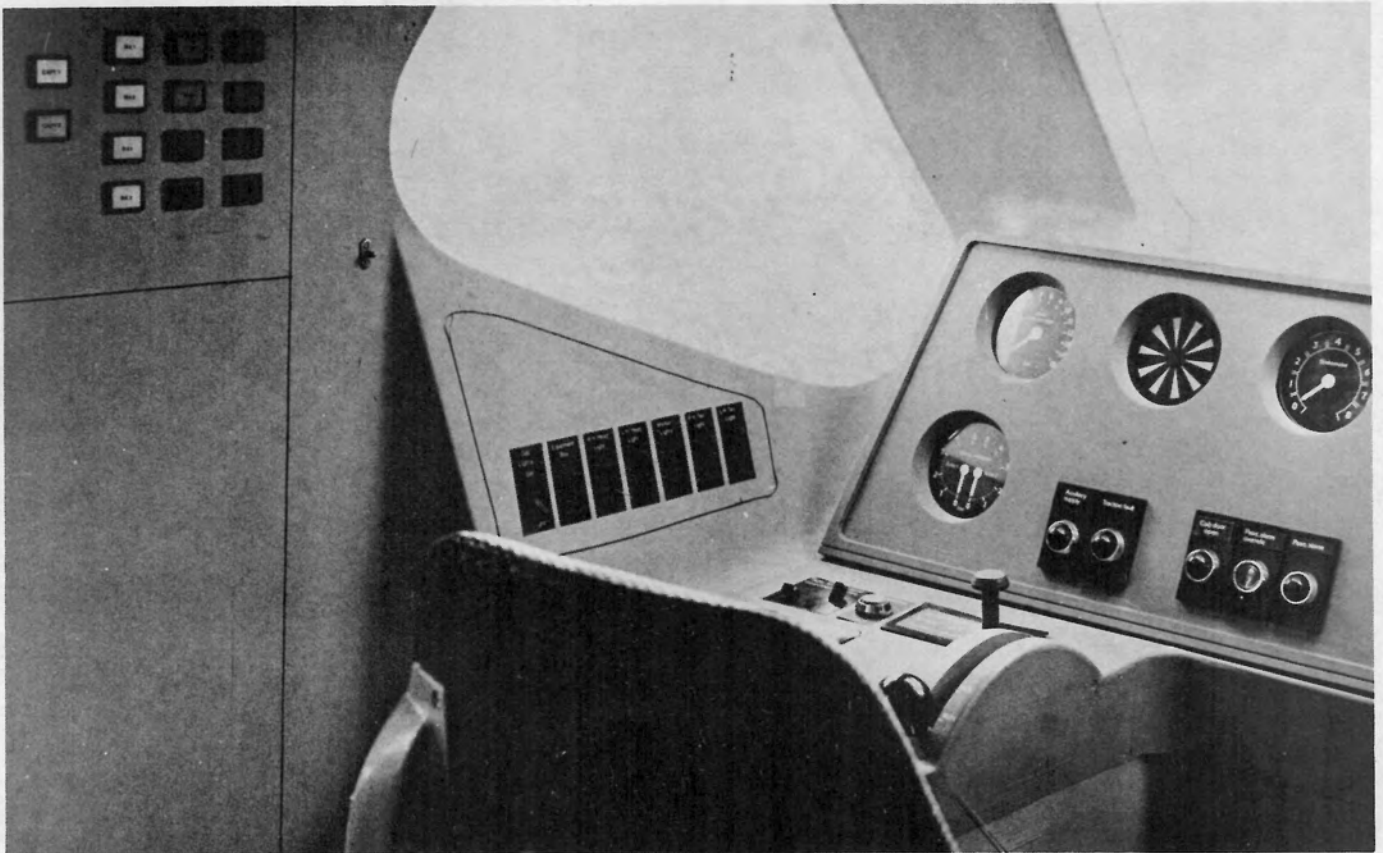
5. PUSH BUTTONS

- 5.1 Pass Alarm Override
- 5.2 Pan Down
- 5.3 Pan Up/Reset
- 5.4 Bulb Test
- 5.5 Call Guard
- 5.6 MA-DA Set Local/Remote No 1 or No 2
- 5.7 Park Brake ON/OFF
- 5.8 Reset for D.S.D. (by foot pedal)

A.W.S.

C-APT

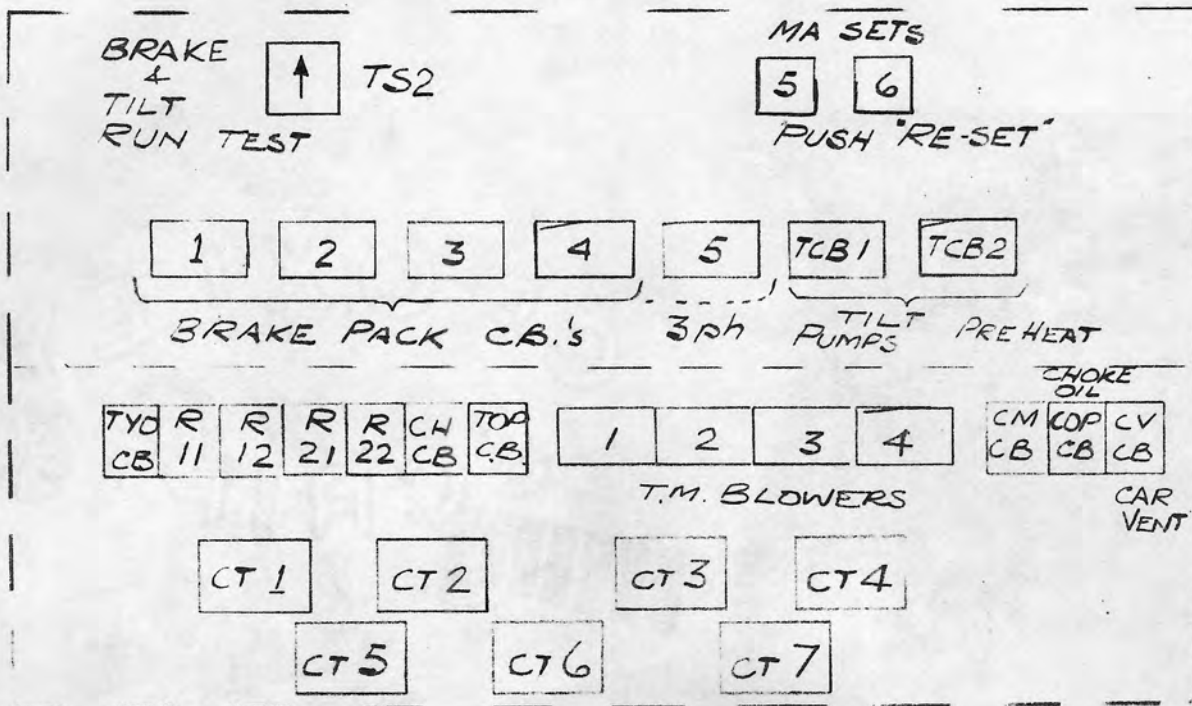
MA-DA SET
CONTROLS



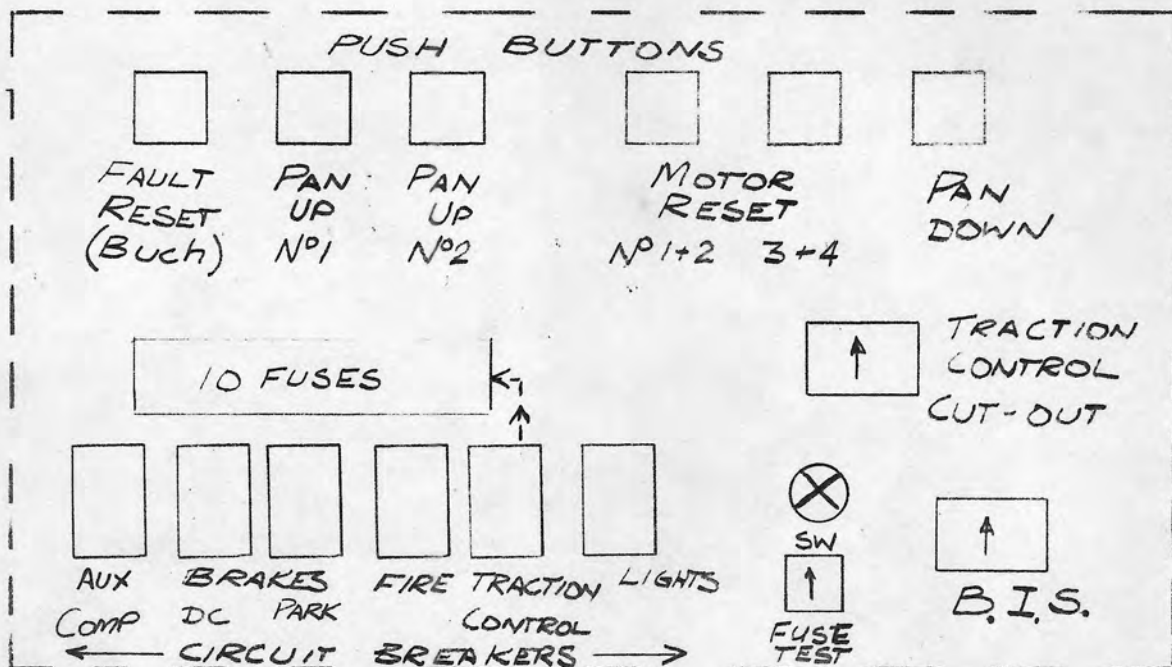
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AUX CONTROL CUBICLE (AH-AO-0415)

See Drg for Full Details



TRACTION CONTROL CUBICLE



4.5 Fault Indicator Panel (Power Car Type MT)

Located in the power car (LHS) is a panel with 64 windows arranged for easy reference in a grid form as shown in sketch below.

Each window will indicate by two lamps (one for the top half and the other for the bottom half of the display) a specific fault condition

- a) the fault has occurred and persists
- b) the fault has occurred and disappeared

The panel displays can all be tested by a test switch and the memory or record display part can be reset by the second switch.

	1	2	3	4	5	6	7	8
A								
B								
C								
D								
E								
F								
G								
H								

TEST H: ON H: RE-SET

A complete list of the faults displayed is given below.

GRID REF	UPPER DISPLAY	LOWER DISPLAY
A1	Armature Overload	Traction Motor M1
A2	Armature Earth Fault	" " "
A3	Thyristor Fuse Failed	" " "
A4	Thyristor Bridge Fault	" " "
A5	Cooling Fault	" " "
A6	Primary Overload	Main Transformer
A7	Over Voltage Fault	" "
A8	O/V Protection Fuse Failed	" "
B1	Armature Overload	Traction Motor M2
B2	Armature Earth Fault	" " "
B3	Thyristor Fuse Failed	" " "
B4	Thyristor Bridge Fault	" " "
B5	Cooling Fault	" " "
B6	Buchholz Trip	Main Transformer

GRID REF

UPPER DISPLAY

LOWER DISPLAY

B7	Buchholz Alarm	Main Transformer
B8	Traction Earth Return Fault	" "
C1	Armature Overload	Traction Motor M3
C2	Armature Earth Fault	" " "
C3	Thyristor Fuse Failed	" " "
C4	Thyristor Bridge Fault	" " "
C5	Cooling Fault	" " "
C6	Secondary Overload a1 b1	Main Transformer
C7	Secondary Overload a2 b2	" "
C8	Secondary Overload a3 b3	" "
D1	Armature Overload	Traction Motor M4
D2	Armature Earth Fault	" " "
D3	Thyristor Fuse Failed	" " "
D4	Thyristor Bridge Fault	" " "
D5	Cooling Fault	" " "
D6	Secondary Overload a4 b4	Main Transformer
D7	Secondary Overload c d	" "
D8		
E1	Electronics Supply Failed	Auxiliaries
E2	Battery Voltage Low	"
E3	Battery Charger Failed	"
E4	Control Air Pressure Low	"
E5	Choke Oil Level Low	"
E6	Thyristor Oil Cooling Fault	"
E7	Choke Oil Cooling Fault	"
E8	Motor Fields Earth Fault	Traction Motors M1 M2 M3 M4
F1	Transformer Oil Cooling Fault	Auxiliaries
F2	Thyristor Oil Level Low	"
F3	Aux Transformer Overload	"
F4	Aux Transformer Earth Fault	"
F5	Cooling Group 1 Fans Fault	"
F6	Cooling Group 2 Fans Fault	"
F7	Car Vent Fan Fault	"
F8		
G1	Overload	Motor Alt No. 1 (M5)
G2	Earth Fault	" " " "
G3	Thyristor Cells/Fuses Fault	" " " "
G4	Thyristor Bridge Failed	" " " "
G5	Tacho. Fault	" " " "
G6	Overspeed Trip	" " " "

GRID REF

UPPER DISPLAY

LOWER DISPLAY

G7	Emergency Overspeed Trip	Motor Alt. No. 1 (M5)
G8		
H1	Overload	Motor Alt. No. 2 (M6)
H2	Earth Fault	
H3	Thyristor Cells/Fuses Fault	
H4	Thyristor Bridge Failed	
H5	Tacho. Fault	
H6	Overspeed Trip	
H7	Emergency Overspeed Trip	
H8		