

WIRES TO BE CONNECTED					
SN	WIRE DETAILS				Remarks
	Cable No.	Size	From	To	
1.	1131	2.5 mm ²	XH 32A(2) 4	MCB 54.1/1-1	To connect BUR-3 supply to MCB of MRB-1.
2.	1132	2.5 mm ²	XH 32A(2) 5	MCB 54.1/1-3	
3.	1133	2.5 mm ²	XH 32A(2) 6	MCB 54.1/1-5	

(ii) Modification in HB2 Panel

WIRES TO BE REMOVED					
SN	WIRE DETAILS				Remarks
	Cable No.	Size	From	To	
1.	1121B	2.5 mm ²	MCB 53.1/2	MCB 54.1/2	If MRB is being fed by BUR-2.
2.	1122B	2.5 mm ²			
3.	1123B	2.5 mm ²			
4.	1201B	2.5 mm ²	MRB-2 Terminal Box	To tie with Dummy	If MRB is being fed by 1000/415V Auxiliary Transformer.
5.	1202B	2.5 mm ²			
6.	1218B	2.5 mm ²			
WIRES TO BE ADDED					
SN	WIRE DETAILS				Remarks
	Cable No.	Size	From	To	
1.	1131	2.5 mm ²	XH 67A(2) 4	MCB 54.1/2 (1)	To connect BUR-3 supply to MCB of MRB-2.
2.	1132	2.5 mm ²	XH 67A(2) 5	MCB 54.1/2 (3)	
3.	1133	2.5 mm ²	XH 67A(2) 6	MCB 54.1/2 (5)	

4.3 Shifting of ScMRB-1&2 to BUR-3

To achieve shifting of ScMRB-1&2 to BUR-3, modification in HB1 panel and HB2 Panel is required to be carried out as detailed below:

(i) Modification in HB1 Panel

WIRES TO BE REMOVED					
SN	WIRE DETAILS				Remarks
	Cable No.	Size	From	To	
1.	1211A	2.5 mm ²	ScMRB-1 Terminal Box	To tie with Dummy	This is to be done where ScMRB is being supplied by 1000/415V Auxiliary Transformer.
2.	1212A	2.5 mm ²			
3.	1218A	2.5 mm ²			
WIRES TO BE CONNECTED					
SN	WIRE DETAILS				Remarks
	Cable No.	Size	From	To	
4.	1131	2.5 mm ²	XH 32A(2) 4	MCB 56.1/1(1)	Existing 1-pole MCB denoted as 56.1/1 (HB-1) and 56.1/2 (HB-2) shall be replaced by 3-pole, 5 Amps MCB.
5.	1132	2.5 mm ²	XH 32A(2) 5	MCB 56.1/1(3)	
6.	1133	2.5 mm ²	XH 32A(2) 6	MCB 56.1/1(5)	

(ii) Modification in HB2 Panel

WIRES TO BE REMOVED					
SN	WIRE DETAILS				Remarks
	Cable No.	Size	From	To	
1.	1211B	2.5 mm ²	ScMRB-2 Terminal Box	To tie with Dummy	This is to be done where ScMRB is being supplied by 1000/415V Auxiliary Transformer.
2.	1212B	2.5 mm ²			
3.	1218B	2.5 mm ²			
WIRES TO BE ADDED					
SN	WIRE DETAILS				Remarks
	Cable No.	Size	From	To	
1.	1131	2.5 mm ²	XH 67A(2) 4	MCB 56.1/2(1)	Existing 1-pole MCB denoted as 56.1/1 (HB-1) and 56.1/2 (HB-2) shall be replaced by 3-pole, 5 Amps MCB.
2.	1132	2.5 mm ²	XH 67A(2) 5	MCB 56.1/2(3)	
3.	1133	2.5 mm ²	XH 67A(2) 6	MCB 56.1/2(5)	

4.4 Modification in HB2 Panel for shifting of CAB AC to BUR-3

Presently, power feed to CAB AC is given by BUR-2. To shift the same on BUR-3, modification is required to be carried out as per following table:

WIRES TO BE REMOVED					
SN	WIRE DETAILS				Remarks
	Cable No.	Size	From	To	
4.	1121B	2.5 mm ²	MCB 52.5/1	MCB 64.1	---
5.	1122B	2.5 mm ²			
6.	1123B	2.5 mm ²			
WIRES TO BE ADDED					
SN	WIRE DETAILS				Remarks
	Cable No.	Size of wire	From	To	
4.	1131	2.5 mm ²	XH 67A(2) 4	MCB 64.1/1(1)	Refer Para 4.2 (ii), cable no. 1131, 1132 & 1133 may be obtained from XH67A(2) TBs.
5.	1132	2.5 mm ²	XH 67A(2) 5	MCB 64.1/1(3)	
6.	1133	2.5 mm ²	XH 67A(2) 6	MCB 64.1/1(5)	

4.5 Shifting of ScTMB-1&2 to BUR-2

1. Check the cable continuity between Contactor 52.4/2 terminal 1, 3, 5 to contactor 52.5/2 terminal no. 1, 3, 5. Remove cable no. 1131, 1132 and 1133 from contactor 52.5/2 terminal no. 1, 3, 5 respectively.

2. Rename cable no. 1131 to 1121B, 1132 to 1122B and 1133 to 1123B.
3. Connect the cable 1121B, 1122B and 1123B to contactor 52.5/1 terminal no. 1, 3, 5 respectively.

4.6 Activation of Energy Saving Mode through Software Modification:

- (i) In Energy Saving Mode, power supply of BUR-1 & BUR-2 shall be switched OFF by ramping down the frequency through software logics. Conditions for loco to go in Energy Saving Mode are cited below:
 - a) All BURs are in service;
 - b) Tractive/braking effort is Zero (Reverser in neutral position or Node ≤ 570);
 - c) Loco remains idle (i.e. speed=0) and BC in applied condition;
 - d) Temperature of transformer oil, traction converter coolant and traction motor $\leq 55^{\circ}$ Celsius.
- (ii) If the aforesaid condition prevails for ≥ 5 minutes, then frequency of BUR-1 & 2 shall be ramped down to Zero and Energy Saving Mode shall be activated with a pop-up message on driver display screen that "**Energy Saving Mode Activated**" along with calling the push button lamp of BPFA. Loco Pilot has to only acknowledge by pressing this illuminated push button BPFA.
- (iii) As and when Loco Pilot moves throttle for traction (Node > 570) or BC is released, Energy Saving Mode will be DE-ACTIVATED.

5.0 Material required

To implement the scheme following materials are required:

- (i) Wire of 2.5 mm² (4GKW/1.8kV): Approx. 30 meters.
- (ii) MCB (3-pole, 10 Amps): 02 nos. to be placed at 56.2/1 (HB-1) & 56.2/2 (HB-2)
- (iii) MCB (3-pole, 10 Amps): 02 nos. to be placed at 54.2/1 (HB-1) & 54.2/2 (HB-2)

6.0 Material Rendered Surplus:

- (i) 1-pole MCBs (54.1/1 & 54.2/2) – 02 Nos.
- (ii) Capacitor (54.5/1 & 54.5/2) – 02 Nos.
- (iii) Capacitor (54.8/1 & 54.8/2) – 02 Nos.
- (iv) Timer (54.2/1 & 54.2/2) – 02 Nos.

7.0 Application to the Class of Locomotives:

WAG9/WAG9H/WAG9HC class of locomotives.

8.0 Agency of Implementation:

Electric Loco Sheds Holding WAG9/WAG9H/WAG9HC class of locomotives and PUs/Workshops.

4792787/2026/O/o WM/Design/DMW/PTA

9.0 Periodicity of Implementation:

During Production, Minor Schedule Inspections (IA/IB/IC), Overhauling Schedules (TOH, IOH, POH) and any other unscheduled maintenance.

Encl: Nil.

-sd-

For Director General (Traction)

Copy to:

Secretary (Electrical),
Railway Board, Rail Bhawan,
New Delhi – 110 001

Digitally Signed by Amit
Kumar Saraf
Date: 10-04-2024 18:06:25
Reason: Approved

For Director General (Traction)

[illegible]

R1
TELEGRAM
for
WTRB

82

[illegible]

ANNEXURE-C

 R_1

TELEGRAM

for
WTRB.

286

[illegible]

ANNE XU RE-C

Q2

TELEGRAM

for
WTD

Abt

285

[illegible]

ANNEXURE - C

82

TELEGRAM

for

ωTB

Form No. 3571 in per. distributed in MDM				
Sigcode	MTS effect	MT effect	Data Type	Source Processor
99-00000000	0	0	GM/COM/MT	99-00000000
99-00000000	2	0	GM/COM/MT	99-00000000
99-00000000	4	0	GM/COM/MT	99-00000000
99-00000000	6	0	GM/COM/MT	99-00000000
99-00000000	8	0	GM/COM/MT	99-00000000
99-00000000	10	0	GM/COM/MT	99-00000000
99-00000000	12	0	GM/COM/MT	99-00000000
99-00000000	14	0	GM/COM/MT	99-00000000
99-00000000	16	0	GM/COM/MT	99-00000000
99-00000000	18	0	GM/COM/MT	99-00000000
99-00000000	20	0	GM/COM/MT	99-00000000
99-00000000	22	0	GM/COM/MT	99-00000000
99-00000000	24	0	GM/COM/MT	99-00000000
99-00000000	26	0	GM/COM/MT	99-00000000
99-00000000	28	0	GM/COM/MT	99-00000000
99-00000000	30	0	GM/COM/MT	99-00000000
99-00000000	32	0	GM/COM/MT	99-00000000
99-00000000	34	0	GM/COM/MT	99-00000000
99-00000000	36	0	GM/COM/MT	99-00000000
99-00000000	38	0	GM/COM/MT	99-00000000
99-00000000	40	0	GM/COM/MT	99-00000000
99-00000000	42	0	GM/COM/MT	99-00000000
99-00000000	44	0	GM/COM/MT	99-00000000
99-00000000	46	0	GM/COM/MT	99-00000000
99-00000000	48	0	GM/COM/MT	99-00000000
99-00000000	50	0	GM/COM/MT	99-00000000
99-00000000	52	0	GM/COM/MT	99-00000000
99-00000000	54	0	GM/COM/MT	99-00000000
99-00000000	56	0	GM/COM/MT	99-00000000
99-00000000	58	0	GM/COM/MT	99-00000000
99-00000000	60	0	GM/COM/MT	99-00000000
99-00000000	62	0	GM/COM/MT	99-00000000
99-00000000	64	0	GM/COM/MT	99-00000000
99-00000000	66	0	GM/COM/MT	99-00000000
99-00000000	68	0	GM/COM/MT	99-00000000
99-00000000	70	0	GM/COM/MT	99-00000000
99-00000000	72	0	GM/COM/MT	99-00000000
99-00000000	74	0	GM/COM/MT	99-00000000
99-00000000	76	0	GM/COM/MT	99-00000000
99-00000000	78	0	GM/COM/MT	99-00000000
99-00000000	80	0	GM/COM/MT	99-00000000
99-00000000	82	0	GM/COM/MT	99-00000000
99-00000000	84	0	GM/COM/MT	99-00000000
99-00000000	86	0	GM/COM/MT	99-00000000
99-00000000	88	0	GM/COM/MT	99-00000000
99-00000000	90	0	GM/COM/MT	99-00000000
99-00000000	92	0	GM/COM/MT	99-00000000
99-00000000	94	0	GM/COM/MT	99-00000000
99-00000000	96	0	GM/COM/MT	99-00000000
99-00000000	98	0	GM/COM/MT	99-00000000
99-00000000	100	0	GM/COM/MT	99-00000000

Form No. 3571 in per. distributed in MDM

Source Processor

Data Type

MT effect

MTS effect

Sigcode

99-00000000

99-00000000

99-00000000

99-00000000

99-00000000

99-00000000

99-00000000

ANNEXURE-C
TELEGRAM
NO. 3571
for DPWCS

444

283

Port No. FIG1, 3572 and FIG2 3573 as discussed in MOM

Signal	Byte offset	Bit offset	Data Type	Subprocessor	Source Processor	Remarks With Resolution	Reference Signal
98-1/LineIn	0	0	GAATCH	DPWCS	FIG1 and FIG-2	Life sign of VCB (0 to 100%)	Counter till 5535 with increment of 1
98-2/LineIn	2	0	ANALOG	DPWCS	FIG1 and FIG-2	Value from angle transducer (100% - 100%)	01-44/LineIn
98-3/BatteryVol	4	0	ANALOG	DPWCS	FIG1 and FIG-2	Value of Battery Voltage	21-10/Battery
98-4/AutoBrake	6	0	ANALOG	DPWCS	FIG1 and FIG-2	Value of Auto Brake Line Pressure	45-44/AutoBrake
98-5/VCBON	8	0	BIT	DPWCS	FIG1 and FIG-2	Command for VCB ON	07-BRCH On
98-6/VCBOFF	8	1	BIT	DPWCS	FIG1 and FIG-2	Command for VCB OFF	07-BSO VCB-Off
98-7/ANDOW	8	2	BIT	DPWCS	FIG1 and FIG-2	Command for Pantograph Down	07-BSO-panDown
98-8/PAU/P	8	3	BIT	DPWCS	FIG1 and FIG-2	Command for Pantograph Up	07-80/PAU/P
98-9/Forward	8	4	BIT	DPWCS	FIG1 and FIG-2	Command for Movement in Forward Direction	47-BRCH-Dirct
98-10/Reverse	8	5	BIT	DPWCS	FIG1 and FIG-2	Command for Movement in Reverse Direction	47-BRCH-Dirct
98-11/Stopping	8	6	BIT	DPWCS	FIG1 and FIG-2	Command for Stopping	24-10/Stopping
98-12/Master	8	7	BIT	DPWCS	FIG1 and FIG-2	This is Master of DPWCS	40-PWCS-99 Master
98-13/Slave	8	8	BIT	DPWCS	FIG1 and FIG-2	This is Slave of DPWCS	40-PWCS-99 Slave
98-14/Motoring	8	9	BIT	DPWCS	FIG1 and FIG-2	Command for Motoring	26-20/MTRING
98-15/Braking	8	10	BIT	DPWCS	FIG1 and FIG-2	Command for Braking	26-20/MTRING
98-16/CompOn	8	11	BIT	DPWCS	FIG1 and FIG-2	Command for Compressor ON	63-MWSCOn
98-17/CompOff	8	12	BIT	DPWCS	FIG1 and FIG-2	Command for Compressor OFF	63-MWSCOff
98-18/CompOn	8	13	BIT	DPWCS	FIG1 and FIG-2	Command for Compressor in Off	63-MWSCOn
98-19/CompOff	8	14	BIT	DPWCS	FIG1 and FIG-2	Command for Compressor in Off	63-MWSCOff
98-20/Parcing	8	15	BIT	DPWCS	FIG1 and FIG-2	Command for Parcing	44-WPCHOn
98-21/Whetling	8	0	BIT	DPWCS	FIG1 and FIG-2	Loco wheels are slipping	90-MTRCOn
98-22/Whetling	8	1	BIT	DPWCS	FIG1 and FIG-2	Command for Fault Acknowledge	Sum of (24-10/PAU/P, 04-MWSCOn, 2, 13, 15, 80-PAU/P, 24-10/PAU/P, 99-PAU/P)
98-23/VCBON	10	3	BIT	DPWCS	FIG1 and FIG-2	Status of VCB	07-PAU/P On
98-24/VCBOFF	10	4	BIT	DPWCS	FIG1 and FIG-2	Status of VCB	07-PAU/P Off
98-25/LineIn	10	5	BIT	DPWCS	FIG1 and FIG-2	SN interface is happening	5101-M5/LineIn
98-26/LineIn	10	6	BIT	DPWCS	FIG1 and FIG-2	Command for Throttle to 1/3	24-17/BSO/1/3
98-27/LineIn	10	7	BIT	DPWCS	FIG1 and FIG-2	Command for Throttle to 2/3	24-17/BSO/2/3
98-28/LineIn	10	8	BIT	DPWCS	FIG1 and FIG-2	Command for Failure Mode operation	5447-BF-Mode
98-29/LineIn	10	9	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	Sum of 24-10/PAU/P, 99-PAU/P
98-30/LineIn	10	10	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	54-44/LineIn
98-31/LineIn	10	11	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	23-MC-Active
98-32/LineIn	10	12	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	23-MC-Active
98-33/LineIn	10	13	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	54-44/LineIn
98-34/LineIn	10	14	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	5448-MC-Mode
98-35/LineIn	10	15	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	45-44/LineIn
98-36/LineIn	10	16	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn
98-37/LineIn	10	17	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	5001-44/LineIn
98-38/LineIn	10	18	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	39-44/LineIn
98-39/LineIn	10	19	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn
98-40/LineIn	10	20	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn
98-41/LineIn	10	21	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn
98-42/LineIn	10	22	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn
98-43/LineIn	10	23	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn
98-44/LineIn	10	24	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn
98-45/LineIn	10	25	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn
98-46/LineIn	10	26	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn
98-47/LineIn	10	27	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn
98-48/LineIn	10	28	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn
98-49/LineIn	10	29	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn
98-50/LineIn	10	30	BIT	DPWCS	FIG1 and FIG-2	Command for ZTL switch ON	00-44/LineIn

Please Note in KCD there is spare BITS in some of the BYTES like 10 number But NO Spare Bytes

ANNEXURE-C

TELEGRAM

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482

R2
TELEGRAM

Description of control circuits

1. Battery Charger Circuit	2
2. Cab activation circuit.....	3
3. Pantograph circuit.....	5
4. Vacuum circuit breaker circuit.....	8
5. Hotel load contactor (WAP5 only).....	9
6. Contactors for Converters.....	10
7. Auxiliary machines circuit :.....	10
8. Monitoring of earth fault relays	12
9. Contactors for harmonic filters.....	13
10. Aux converter contactors	14
11. Drivers cab and machine room lighting circuit	15
12. Master controller	17
13. Power supplies.....	18
14. Speedometer	19
15. Vigilance control.....	20
16. Fire detection system.....	21
17. Pneumatic system.....	21
18. Actual value detection.....	26
19. Trainbus.....	27
20. Converter Control	28
21. Fault acknowledge	29

FOR INFORMATION

File: B1.2

WILL BE KEPT UP TO DATE

Section:

DATE OF SUBMISSION: 94-10-2113

Rev.	A	94-07-26 PK	Revision	Issued	94-05-30 PK	Doc. type	Format	Lang.	Page	No. of p.
	B	94-10-18 PK		Checked:	94-05-30 AH	TN	A 4	En	1	30
ABB		Office resp	Receiv. office	Std. check:		3EHW 510068				
		BEH-3		Deriv. from/Rept	Released: 94-05-30 AT					
				Replaced by						

NOTE :

It is assumed, in the following description that all MCBs are closed unless otherwise mentioned.

Operations from cab -1 are explained in detail .

1. Battery Charger Circuit

(ADDRESS 04A)

Battery charger is fed normally through auxiliary converter 3 . If converter 3 is isolated due to any malfunction , then charger is connected to converter 2. This is controlled by central and aux. converter electronics through contactors {52/1,2&3}. Normally 52/3 is closed and 52/2 is open. (ADDRESS 02Z)

With cab activated in driving position and VCB closed , closing of contactor 218 (explained later) connects supply to central and aux. converter electronics which switches on the aux. converter and 3-phase supply is available at the aux converter outputs.

This 3 × 415 V AC supply is fed to the battery charger { 107 } which consist of a three phase step down transformer{ 107.1 } , to step down voltage from 415 V to 110 V AC and a diode rectifier { 107 } to convert AC supply to DC.

Independent of the charge/discharge state, battery is charged with a constant voltage of 1.38 V/ cell as soon as battery charger is switched on.

The output of charger transformer is fed to diode rectifier{ 107 }which converts it to DC.The output current of charger is continuously monitored through current sensors (CSs). If the charger is getting supply from converter 3 then CSs connected in rectifier module and when charger is getting supply from converter 2 then CSs 107.2 ,107.3 send the feedback to respective auxiliary converter control .

A capacitor is connected across the output of the charger to smoothen the output and prevent overvoltages due to sudden change in current.

Address 04B

1.1 The output of the charger is fed to the battery (111/ 1&2) through potential 2092 and 2052. MCB (110) is connected at the output of the charger to prevent excessive charging.

Revision:

A 94-07-26 PK

B 94-10-18 PK

Language: En

Page: 2

3EHW 510068



Battery voltage is measured and the feedback is sent to auxiliary converter control 426 / 2&3 through potential 2033A/B and 2031A/B .

1.2 The battery output is fed to the control circuit through battery circuit breaker { 112} .

Address 04C, D, E

1.3 Battery supply is fed to various control circuits through their respective MCBs. The detailed description of these circuits is given in the following sections.

Earth fault relay { 89.7 } is provided to detect earth fault in the control circuit. Two resistances { 90.7/1 & 90.7/2 } are connected across the 110V DC output. Relay is connected in between the two resistances , with its other terminal grounded. Principle of operation is same as that for earth fault detection in aux. circuit.

Address 04F

DC to DC converters { 118.4 & 118.5 } convert 110 V DC from battery to 48V DC and 24 V DC respectively. 48 V DC supply is used to run cooling fans in electronics cubicles and 24 V DC supply is used for drivers desk indication and illumination lamps. The DC - DC converters are protected against surges by means of transorb diodes { 118.41, 118.42, 118.51 & 118.52 }

2. Cab activation circuit

(ADDRESS 08A)

2.1 Key is inserted in the cab activating switch { 125 }, in either of the cabs from which driving is to be done. This switch has three positions - OFF, DRIVING, & COOLING. Normally both the cab switches are in OFF position. The key is inserted in the switch and can be moved to either DRIVING or COOLING position.

(ADDRESS 08B)

When cab -1 is selected then contact of 125/1 between potential 2111A & 2500A, in driving mode, and between 2111A & 4242A, in cooling mode are closed and message goes to control electronics { 411 }

2.2 As soon as key is inserted and either position (cooling or driving) is selected then contactors of cab-1 power supply { 126.7/1 & 126.8/1 } closes through following circuit :

(ADDRESS 08A)

Revision:

A 94-07-26 PK

B 94-10-18 PK

Language: En

3EHW 510068

Page: 3

Tech. Instructions
(contin. sht.)



Contact of 125/1 between potential 2067 & 2503A closes, once driving or cooling position is selected and normally closed contact of cab2 contactor 126.7/2 between potential 2503A & 2504A remains closed. Supply goes to cab1 contactors 126.7/1 & 126.8/1, which closes the contactors. [2093 - 2021 - 2094 - 2067 - 2503A - 2504A]

When cab switch 125 is turned off, contactors 126.7 & 126.8 open.

Once cab1 contactor 126.7 /1 closes, its NC contact between potential 2503B & 2504B opens, which ensures cab2 contactors can not be closed as long as cab1 contactors are closed.

2.3 Also with the selection of 125, control circuit contactor { 126 } closes through the following circuit :

(ADDRESS 08A)

Normally closed contact of control electronics off relay {126.5 } between potential 2505 and 2508 remains closed and supply goes to coil of 126. [2093 - 2021 - 2094 - 2067 - 2053A - 2505 - 2508]

When relay 126.5 picks up (explained later) or cab switch 125 turned off from cooling mode contactor-126 opens.

2.4 Relay control electronics off {126.5 } ADDRESS 08A, is normally de-energised. Turning key switch from driving to off position will not automatically shut down the supply of control electronics (contactor 126). The coil of 126 remains supplied by control electronics [2096 - 4202 - 2509 - 2505 - 2508] untill coil of 126.5 is energised by control electronics [4201 - 2066]. This ensures that the control electronics {411 } remains the master for switching the control circuits off.

With relay 126.5 energised, contactor 126 opens, which trips supply to pantograph, vacuum circuit breaker and other control circuits.

2.5 Safety relay control electronics on {126.6 } closes only in DRIVING position of cab switch through the following circuit :

(ADDRESS 08A01)

With contactors 126 and 126.7 picked up, their contacts between potential 2094 & 2095 (ADDRESS 04C03) and between 2101A & 2111A (ADDRESS 04C04) respectively are closed. Contact of cab switch 125/1 between potential 2111A & 2500A closes in position DRIVING. Hence supply goes to coil of relay 126.6. [2093 - 2021 - 2094 - 2095 - 2101A - 2111A - 2500A - 2501] . With 126.6 closed, message goes to control electronics through potential 4243.

2.6 Relay temperature control electronics {211 } ADDRESS 08B, is normally kept energised through normally closed contacts of thermostat {211.1/1 }. When

Revision:

A 94-07-26 PK

B 94-10-18 PK

Language: En

Page: 4

3EHW 510068

Tech. Instructions
(contin. sh.)

temperature of control electronics increases beyond 70 degree C , thermostat contact between potential 2069 & 2510 open which de-energises relay 211 .

The status of relay 211 is monitored by control electronics through potential 2517 (ADDRESS 08B06)

Lamp {166/1 } on the driver desk lights up when relay 211 is open, through NC contacts of 211. This indicates high temperature of control electronics. [2099A,B - 2514A,B] (ADDRESS 08B)

2.7 Contactor control electronics {218 } (ADDRESS 08B03) , is closed only in DRIVING position of key switch through the following circuit :

Contacts of minimum volt. relay {86 } between potential 2069 & 2511 are closed when catenary voltage is more than 17.5 KV. (They open when catenary voltage falls below 17.5 KV). Contacts of safety relay 126.6 between potential 2511 & 2512 are closed with relay 126.6 picked up. Contacts of relay 211 between potential 2512 & 2515 are also closed. Hence supply goes to coil of contactor 218.[2093 - 2021 - 2094 - 2067 - 2511 - 2512 - 2513]

As soon as contactor 218 is closed control electronics gets supply.(ADDRESS 04D). Contactor 218 remains energised through control electronics {411} [4201 - 2513]

3. Pantograph circuit

(ADDRESS 05A)

3.1 Selection of pantograph :

To select which pantograph is to be raised a panto selection switch { 129 .1 } is provided on the pneumatic panel in the machine room with three positions :

- Position 1 - Panto above cab -1 is raised
- Position AUTO - Panto above the unoccupied cab is raised
(This is the default position of this switch)
- Position 2 - Panto above cab -2 is raised

In each cab a panto raising switch { 129 } is provided. This is a spring loaded switch with two positions panto raising & panto lowering.

With cab activated, through operations described in clause 1 above, when switch 129 connected between potential 2121A & 2300 (05A01) is turned to panto raising position , auxiliary contactor of pantograph { 130.1 } is closed. [2095 - 2101A -

Revision

A 94-07-26 PK

B 94-10-18 PK

Language En

3EHW 510068

Page 5

Tech. Instructions
(contin. sht.)



By pressing emergency switch 244 / 1 ; its contact between potential 2061A & 2063 opens which interrupts supply to coil of contactor 130.1 and it opens. This causes deenergisation of panto valve 130 through opening of contact of 130.1 between potential 2111A,B & 2103A,B . With cab2 unoccupied the cab switch 125/2 contact between potential 2063 & 2064 remains closed bypassing pushbutton 244/2.

4. Vacuum circuit breaker circuit

(ADDRESS 05B)

With cab activated and pantograph raised through operations described above , the main circuit breaker (5) is closed by the following operation :

Switch for circuit breaker {134 } is closed. With contactor 130.1 closed (panto raised) auxiliary relay of VCB {136.4 }is closed. [2095 - 2101A - 2111A - 2334A - 2327 - 2313B - 2310 - 2313A - 2311] . Once this relay is closed, it is held closed by its contact between potential 2314 & 2312. [2062 - 2064 - 2314 - 2312 - 2310 - 2313 - 2311]

In cooling mode :

With aux relay 136.4 closed its contact between potential 2314 & 2312 (ADDRESS 05B06) closes, which in turn closes time relay {136.3 }as safety relay 126.6 is de-energised in COOLING mode and so its NC contact between potential 2312 & 2326 remains close and normally closed contact of overcurrent relay {78}is closed and contacts of min voltage relay{ 86 }are also closed. [2064 - 2320 - 2314 - 2312 - 2326]

With time relay 136.3 closed supply goes to the closing coil of circuit breaker for 1 second , before NC contact of 136.3 opens (set for delayed opening of one second), which closes the circuit breaker. Once the breaker is closed it is held closed through its holding coil and contact of time relay 136.3 opens disconnecting supply to closing coil of circuit breaker.

In driving mode :

In this mode, closing and opening of circuit breaker is through control electronics.

Relay 126.6 is closed and so its NC contact between potential 2312 & 2326 opens. The control electronics gets feedback on the status of aux relay 136.4 by monitoring status of potential 2312 (05B) Time relay of VCB gets feed through control electronics of converter 1 & 2 [2064 - 2320 - 2322A - 2324A - 2322B - 2324B - 2325] In case converter 1 is isolated then supply is through [2320 - 2323B - 2321B - 2322B - 2324B - 2325] In case converter 2 is isolated supply is through [2320 - 2322A - 2324A - 2323A - 2321A - 2325]

With time relay 136.3 closed through control electronics, supply goes to the closing coil of circuit breaker for 1 second , before NC contact of 136.3 opens (set for



delayed opening of one second), which closes the circuit breaker. Once the breaker is closed it is held closed through its holding coil and contact of time relay 136.3 opens disconnecting supply to closing coil of circuit breaker.

In driving mode minimum voltage relay is bypassed by contacts of 126.6 as control electronics monitors the catenary voltage.

Emergency opening of Vacuum circuit breaker

By pressing emergency pushbutton 244 (ADDRESS : 05A05) from the occupied cab the supply to potential 2064 is cutoff. This interrupts supply to VCB coil and it opens. [2064 - 2320 - 2326]

Status of VCB is monitored by control electronics (address 05C01,02). Normally open contacts of VCB are connected between potential 2062 & 2330A,2330B ,which close when VCB is closed and control electronics gets the message.

When VCB is open , indication lamp { 137.3 } in the activated cab lights up. (address 05C 05, 07). 110 V DC supply is converted to 24 V DC through DC - DC converter { 118.5 } (ADDRESS 04F03, 04) and is fed to the indication lamps through normally closed contacts of VCB.[2095 - 2005A,B - 2099A,B - 2331A,B]

5. Hotel load contactor (WAP5 only)

(ADDRESS 05D)

5.1 Hotel load contactor is closed by switching ON hotel load switch {169.1}. Supply to control electronics is through potential 2803A [2095 - 2101A - 2111A - 2803A] , which sends the message to control electronics connected between potential 2801A & 2805 to close contact and supply goes to contactor coil. [2095 - 2096 - 2801A- 2805].

Contactor can be opened by switching OFF switch 169.1. Supply to control electronics is then through potential 2804A [2095 - 2101A - 2111A - 2804A] which in turn sends the message to open the contactor 32. [2095 - 2096 - 2801A- 2805].

The status of contactor is monitored by control electronics through normally open aux contact of contactor, connected between potential 2805 & 2806.[2095 - 2096 - 2801A- 2805 - 2806].

5.2 Monitoring of hotel load contactor

Revision:

A 94-07-26 PK

B 94-10-18 PK

Language: En

Page: 9

3EHW 510068

Tech. Instructions
(contin. sht.)



When hotel load contactor 32 is open, indication lamp { 169.3 } is activated cab lights up. (ADDRESS 05D12,13). 110 V DC supply is converted to 24 V DC through DC - DC converter { 118.5 } (ADDRESS 04F03,04) and is fed to the LED indication lamps through control electronics which monitor the status of contactor { 2095 - 2095A,B - 2099A,B - 2807A,B }

6. Contactors for Converters

6.1 Pre-charging contactor { 12.3 }

With key switch in DRIVING position, control electronics contactor 218 closes and supply comes to potential 5101A,B through MCB 127.1 [2095 - 2096 - 5101A,B] (ADDRESS : 04D01)

(ADDRESS 05E01, 09)

Supply comes to coil of pre-charging contactor 12.3 through control electronics 415. [5101A - 5111A ,B] Control electronics will allow supply to the contactor coil when VCB is closed and there are no faults affecting the circuit.

With contactor energised, its aux contact 12.3 connected between potential 5101A,B and 5112A,B closes and this message is taken by control electronics connected to potential 5112A,B.

6.2 Converter contactor { 12.4 }

(ADDRESS 05E02,10)

Supply comes to coil of converter contactor 12.4 through control electronics 415. [5101A,B - 5113A,B] Control electronics allows supply to the coil after short delay of closing of precharging contactor 12.3.

With contactor energised, its aux contact 12.4 connected between potential 5101A,B and 5114A,B closes and this message is taken by control electronics connected to potential 5114A,B.

7. Auxiliary machines circuit :

7.1 Machine room blowers { 54 }

Machine room blowers and their scavenger blowers get fed from the main transformer through a 1000V / 415V - 110 V transformer. (ADDRESS 03A)

Revision:

A 94-07-26 PK

B 94-10-18 PK

Language: En

Page: 10

3EHW 510068

Tech. Instructions
(contin. sht.)

7.7 Converter oil pump (63)

