



3 PHASE LOCO



**ELECTRIC LOCO TRAINING CENTRE SOUTH EASTERN RAILWAY
TATANAGAR**

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INDEX

3-PHASE ELECTRIC LOCO OPERATING INSTRUCTIONS

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Technical data Abbreviations

- 1 General features of 3-phase electric loco
- 2 Advantages of 3-phase electric locomotives
- 3 Mechanical features of 3-phase electric loco
- 4 System description
 - Potential transformer
 - Main transformer
 - Traction power circuit
 - Traction converter
 - Line converter
 - DC link
 - Drive converter
 - 4.3.5 Technical data of traction converter
- 4.3.6 IGBT based Traction Converter (SR) –
 - Traction motor:
 - Technical data of traction motor
 - Auxiliary converter:
 - General
- 3-Phase, 415 volt auxiliaries
 - Load sharing
 - Main compressor 1 & 2
 - Single – Ph.415 v/110 v aux. Circuit
 - Cooling concept 25
 - Harmonic filter
 - Battery
 - Brake system
 - Automatic train brake- (A-9)
 - Direct brake -(SA-9)
 - Brakes through blending valve
 - Synchronous Loco Brakes
 - Parking brake
 - Failure of brake electronics
 - Regenerating braking 36
 - An emergency braking operation 37

Miscellaneous:
Pantograph
MCPA
Main reservoir
Memotel
Sanding
Control Electronics
Active functions with Deactivated driver's cab
Resetting of MCB
Flasher light
KNORR'S Computer Control Brake System

4 Do's and Don'ts

5 Protective Measures:

Catenary voltage out of range
Temperature protection
Primary over current protection
Train Parting
Fire Alarm
Alarm chain Pulling

6 Preparation:

Loco preparation and inspection

7 On line movement (Different operations)

How to energise the loco
Operation of BL key
Driving mode
Self hold mode
Switching off - control electronics
Cooling mode
Operation of Reverser
Driving
Braking
Operation of throttle
Failure mode operation
Loco brake testing
How to change the cab
Banking mode
Constant speed controller
Emergency stop push button

Vigilance control device
Passing neutral section

8 Fault Diagnostics

Display screen
Screen structure
Faults with priority-1
Faults with priority-2
Isolation of sub system

Acknowledgement of fault message

Indication and recognition of faults
Status code
Fault message code
Display of subsystem status
Browse of status messages on request
Diagnosis messages
Fault & Isolation message structure
List of subsystems
List of isolation messages
List of information messages

9 Multiple Unit

10 Dead Loco Movement

TECHNICAL DATA

Technical Data	WAP-5	WAP-7	WAG-9	WAG-9H
Type of Service	Passenger	Passenger	Goods	Goods
Axle arrangement	Bo-Bo	Co-Co	Co-Co	Co-Co
Gear Ratio	1:3.65 (17:35:67)	1:3.6 (20:72)	1:5.133 (15:77)	1:5.133 (15:77) (21:107)
Total Weight	78 T	123 T	123 T	135T
Axle load (T)	19.5	20.5	20.5	22.5
OHE Voltage Nominal	25 KV	25KV	25KV	25KV
Minimum	17.5 KV	17.5 KV	17.5 KV	17.5 KV
Maximum	30 KV	30 KV	30 KV	30 KV
OHE Frequency Normal	50 Hz	50 Hz	50 Hz	50 Hz
Minimum	45 Hz	45 Hz	45 Hz	45 Hz
Maximum	55 Hz	55 Hz	55 Hz	55 Hz
Power supply to Aux.	415V±10%	415V±10%	415V±10%	415V±10%
Frequency	0 to 59 Hz	0 to 59 Hz	0 to 59 Hz	0 to 59 Hz
No. of Aux Converter	3	3	3	3
Power Supply to Traction Motors	2180 V	2180 V	2180 V	2180 V
No. Of Traction Converters	2	2	2	2
Type of Traction Motor	Three phase Induction	Three phase Induction	Three phase Induction	Three phase Induction
No. of Traction Motors	4- 6FXA7059	6-6FRA6068	6-6FRA6068	6-6FRA6068
Power of Traction Motor	1563 HP	1156 HP	1156 HP	1157 HP
Horse Power	5440 HP	6120 HP	6120 HP	6120 HP

Transformer rating	7475 KVA	7475 KVA	6531 KVA	6531 KVA
Tractive Effort	258 KN	322.6 KN	458 KN	520 KN
Cont Tractive Effort	220 KN	322.6 KN	325 KN	-----
Maximum Speed	160 Kmph	130 Kmph	100 Kmph	90 Kmph
Braking	Regenerative Pneumatic Parking Anti Spin	Regenerative Pneumatic Anti Spin	Regenerative Pneumatic Parking Anti Spin	Regenerative Pneumatic Parking Anti Spin
Braking Effort	160 KN	182 KN	260 KN	260 KN
Parking Brakes:	Wheel No. 1,4,5 & 8	Wheel No. 2,6,7 & 11	Wheel No. 2,6,7 & 11	Wheel No. 2,6,7 & 11
Main Reservoir	3 nos	2 nos.	2 nos	2 nos
Hotel Load	Available	Available	Not available	Not available
Loco brakes	On Disc 5 Kg/cm ²	On Wheel 3.5 kg/cm ²	On Wheel 3.5 kg/cm ²	On Wheel 3.5 kg/cm ²
Length over Buffer	18162 mm	20562 mm	20562 mm	20562
Overall Width	3142 mm	3100 mm	3152 mm	3152
Maximum Height with Pantograph Locked	4255 mm	4255 mm	4255 mm	4255
Wheel Diameter : New	1092 mm	1092 mm	1092 mm	1092
Worn	1016 mm	1016 mm	1016 mm	1016
Battery Voltage	110 V	110 V	110 V	110V

ABBREVIATIONS

ALG	Drive Control Unit - Drive Inverter and Line converter Control
ASC	Driver Converter Control
ASR	Drive Converter
BL	Key switch
BLCP	Spring-loaded switch for Main compressors
BLDJ	Spring-loaded switch for Main circuit breaker
BLHO	Spring-loaded switch for Hotel load (not active on WAG-9)
BLPR	Switch Headlights
BPCS	Illuminated push-button, green for Constant speed control
BPFA	Illuminated push-button, yellow for acknowledgement fault Messages
BPFL	Illuminated push-button, yellow Emergency flasher light
BPPB	Illuminated push-button, red for parking brake
BPVG	Push-button, green for Vigilance
BPVR	Push-button, illuminated yellow for resetting vigilance
BUR	Auxiliary Converter
BZ-V-O-F	Buzzer for vigilance, over speed and fire
CEL	Central Electronics
CSC	Constant Speed Control
DDS	Diagnostic Data Set
FLG	Vehicle Control Unit
GTO	Gate Turn Off
HB	Cubicle Auxiliary Circuits
HBB	Processor
HRA	Switch Cab blower/heating
LSAF	Indication lamp, red for Train parting
LSCE	Indication lamp, amber for over temperature CEL
LSDJ	Indication lamp, red for Main Circuit Breaker
LSFI	indication lamp, red for Fault message, priority 1(also in some P2 fault)
LSHO	Indication lamp, yellow Hotel load (Not active on WAG-9)
LSP	Indication lamp, yellow for Wheel slipping
LSVW	Indication lamp, yellow for Vigilance Warning

MCB	Main Circuit Breaker
MCE	MICAS-S2 Control Electronics
MEMOTEL	Speed Recorder and Indicator
MR	Machine Room
MUB	Over voltage Protection Unit
NSR	Line Converter
Pan	Pantograph
PCLH	Socket Hand Lamp
PP	Pneumatic Panel
SB	Cubicle Control Circuits
SLG	Converter Control Unit
SR	Traction Converter
SS	Sub-system
STB	Low Voltage Cubicle Control
TE/BE	Tractive/braking effort
UBA	Voltmeter Battery Voltage
VCB	Vacuum Circuit Breaker - Main Circuit Breaker
ZBAN	Spring Loaded Switch- Banking operation
ZBV	Train Bus Administrator
ZLC	Switch for Driver's cab lighting
ZLDA	Switch for Assistant driver's desk Illumination
ZLDD	Switch for Driver's desk illumination
ZLFR	Switch for Marker lights, red
ZLFW	Switch for Marker lights, white
ZLH	Switch for Socket hand lamp
ZLI	Switch for Instrument lighting
ZPRD	Switch for Headlights,dimmer
ZPT	Spring-loaded switch for Pantograph
ZTEL	Switch for Max. Traction limitation
ZK	DC link

Chapter- 1

GENERAL FEATURES OF 3-PHASE AC LOCO

Advanced Technological Features: -

In addition to the provision of latest 3-phase traction drive system; the 3-phase locomotives have certain improved technical features as compared to the conventional locomotives so being used on IR. Some major features are listed below.

Digital electronics based real time traction control System: -

To obtain precise control over tractive effort and speed in the normal mode and constant speed control mode of operation respectively.

Electrical weight transfer control system: -

To automatically reduce the tractive effort in the leading bogie and increase the same in the trailing bogie to take care of weight transfer effect.

On-board fault diagnostics system: -

To eliminate/ elaborate trouble-shooting by engine crew and also to help maintenance staff to trace faults. The fault diagnostics system provides for automatic isolation of faulty equipment/ subsystems.

Simulation mode of operation: -

To facilitate a complete functional testing of the locomotive without raising pantograph.

An exclusive harmonic filter circuit: -

To reduce harmonics in the loco current

Static auxiliary converter: -

To supply auxiliary 3-phase motors. The auxiliary converter, depending on the traction load, operates at an optimum frequency to minimize power consumed by auxiliaries

Electronic speedometer: -

Paperless speed recording system. An over speed alarm system is built in.

Electronic energy meter: -

For information of energy generated and energy consumed

Fire detection and alarm system: -

For the machine room.

Low traction bar arrangement between bogie and body to reduce weight transfer :-

Unidirectional mounting of traction motors to further reduce weight transfer effect.

Ergonomically designed and spacious driving cabs: -

To provide comfort and relief to crew.

Use of inertial filters: -

Pressurized machine room to prevent entry of dust into sensitive equipment in the machine room.

Electronic brake system: -

For precise and fast control of braking effort, blending between electrical brake and pneumatic brake on the locomotive.

Triplet pneumatic brake panel :-

To minimize piping and provide single- place location of all pneumatic equipment.

Use of tread brake units: -

To reduce maintenance

Spring loaded parking brake system

Instead of handbrakes, spring loaded parking brakes are provided on this loco, these brakes can be operated from loco and remain applied without pressure by spring.

Over-charge feature in the brake system for faster release of brakes

For faster release of train brakes after recreation, BP is charged to 5.4 kg / cm² for short time with restricted dropping rate to 5.0 kg/cm².

Electronic controlled vigilance system

To keep the loco pilot alert Vigilance system is provided, As per this system, loco pilot has to do predetermined task once within 60 seconds, otherwise VCD will apply emergency braking.

Under-slung compressors: -

To eliminate oil fumes and oil spillage inside the machine room, which is potential causes for fire hazards.

Chapter- 2

ADVANTAGES OF 3-PHASE LOCOMOTIVES



1. The merits of 3-phase locomotives over D.C.-motored locomotives are summarized below.
2. The size of traction motor for the same output power is much less in case of a 3-phase induction motor compared to DC motor. Therefore, with the permissible axle load and available space in a bogie, realization of a much higher-powered loco motive is possible.
3. Maintenance cost of a 3-phase locomotive is less due to absence of brush gear/commutator in the traction motors and switchgears in the power circuits.
4. Induction motors are very robust. Consequently reliability of a 3-phase locomotive is higher.
5. The rated power of a D.C.-motored locomotive reduces beyond the field weakening range. In case of 3-phase locomotives, full power is available up to the maximum speed.
6. Overload capabilities in 3-phase locomotives are more Liberal.
7. Regeneration of power is available in 3-phase locomotives. Regenerative braking effort is available from the full speed till dead stop. Consequently, the overall efficiency of operation is higher.
8. Due to superior drop characteristics of speed Vs. torque and the fact that the motor speed is limited by the synchronous speed, a much improved

adhesion is available in 3-phase loco motive and thus higher tractive efforts can be realized within permissible axle load limits.

9. 3-phase locomotive operates at near unity power factor throughout the speed range except at very low speeds.
10. Due to lesser weight of the traction motors, the un-sprung masses in 3-phase locomotive are low. This reduces track forces and consequently minimizes wear on rails and disturbance to track geometry.

Chapter- 3

Mechanical features of 3-phase AC loco

The three axles, three motor Co-Co bogie assemblies, is one of the major parts of the Locomotive. Two bogie assemblies support the entire weight of the 3-phase locomotive and provide a means for transmission of the tractive effort to the rails.

The bogies are designed to withstand the stresses and vibrations resulting from normal rolling stock applications. An important function of the bogie is to absorb and isolate shock caused by variations in the track bed. The suspension systems minimize the transmission of these shocks to the locomotive under frame.

The traction motors are suspended in the bogie frame and on the individual axles. The motors transmit their energy to the driving axles through a gearbox mounted on the driving axle. The force from the driving axles is transmitted to the contact point between the wheel tread and the rail. Traction force is, in turn, transmitted through the axle journal boxes and **guide rods** to the bogie frame.

The **push-pull link rod**, connected between the bogie transom and loco under frame, transmits the tractive forces to the loco body. As with the tractive effort, braking effort is transmitted to the bogie frame by the axle journal boxes and guide rods and from the bogie frame to the locomotive by the traction rods. Isolation and absorption of shock loads and vibration is performed by the primary and secondary suspension. Movement between the loco body and bogie is smoothly controlled by the primary and secondary suspension.

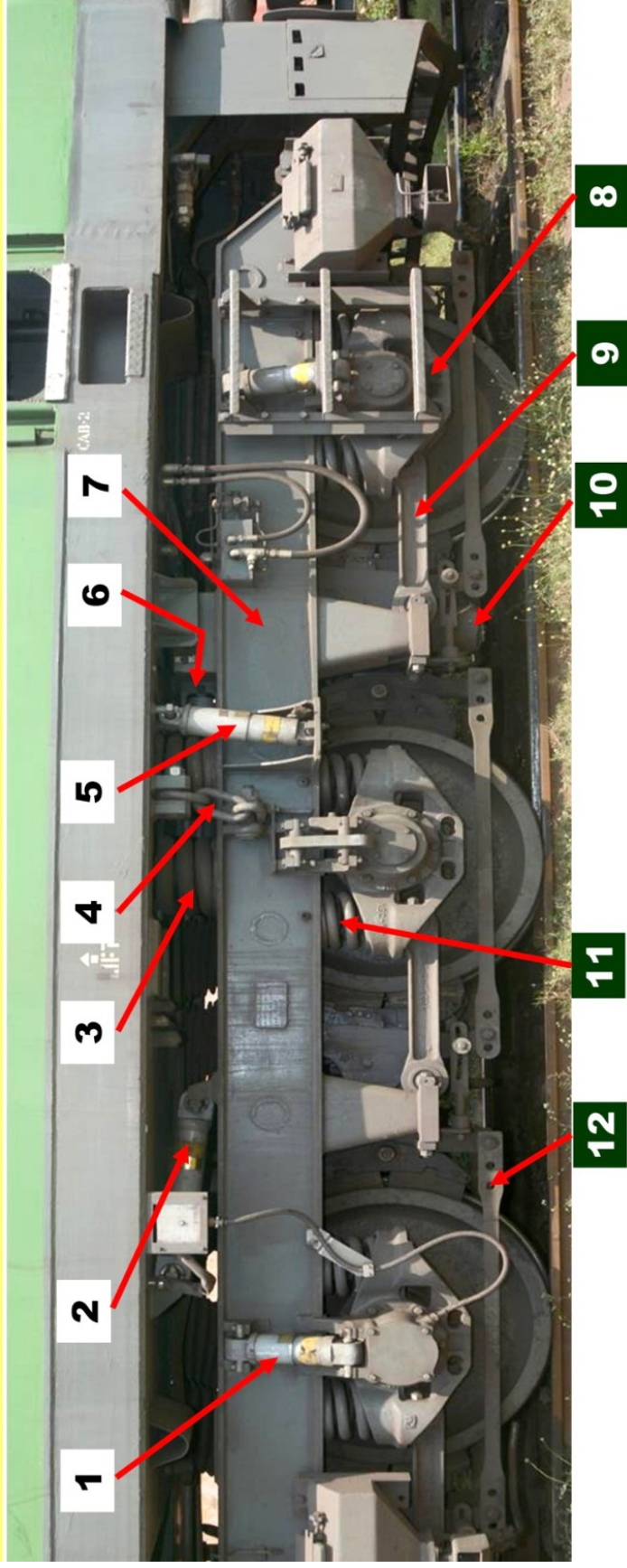
Although the springs permit free movement in any direction, **lateral buffers** and **dampers** limit the amount and rate of lateral movement. **Rebound limit chains** and **vertical dampers** limit the amount the rate of vertical rebound of the locomotive loco body.

Yaw (longitudinal) dampers control the loco body pitch rate. **Guide rods** control the fore and aft movement between the axles and the bogie frame, while the **link rod** controls the fore and aft movement between the bogies and the loco body.

Primary suspension, located between the axles and the bogie frame, is provided by twin coil springs on the axle journal box fore and aft of the axle line. **Vertical hydraulic dampers** are used to dampen the rebound rate of the springs. This "Flexicoil" arrangement permits lateral movement of the axle.

Longitudinal control of the axle, and the transmission of tractive and braking effort to the bogie frame, is provided by **guide rods** connected between the axle journal boxes and bogie frame. Spheribloc rubber bushes in the guide rods allow the axle lateral movement without undue restriction.

WAG-9 LOCO BOGIE PARTS

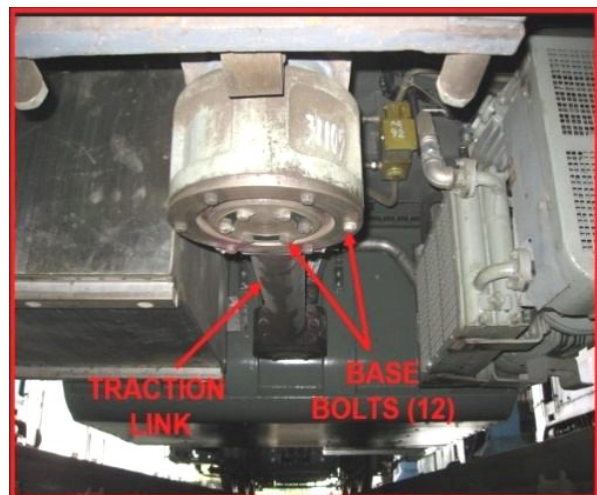
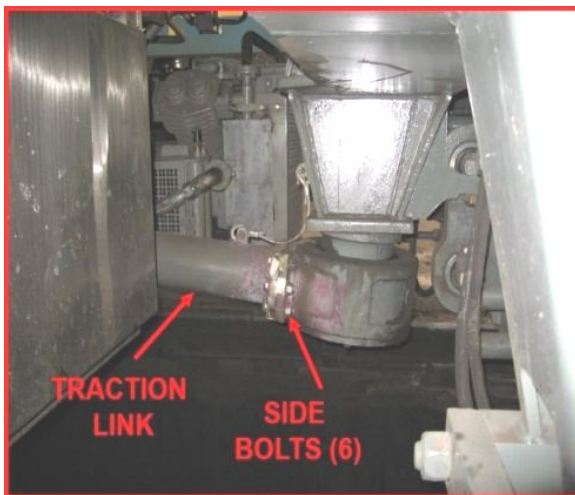


- | | | |
|--------------------|------------------------|--------------------|
| 1- Pri.Susp.Damper | 2- Sec.Susp.Yaw Damper | 3- Sec.Susp.Spring |
| 4- Safety Chain | 5- Sec.Susp. Damper | 6- Horiz.Damper |
| 7- Bogie Frame | 8- Wheel Set | 9- Guide Rod |
| 10- Brake Cylinder | 11- Pri.Susp.Spring | 12- Brake Rod |

Secondary suspension is also provided by coil springs and vertical hydraulic dampers located between the bogie frame and the locomotive under frame on each side of the bogie. The weight of the loco body is carried by the secondary suspension springs. The “Flexi Float” arrangement of the secondary suspension allows the loco body to move both laterally and vertically within certain limits relative to the bogies.

Traction Link –

The traction link transmits traction and braking forces from the bogie to the locomotive super structure (underframe). Although the traction link maintains the relative longitudinal position of the bogie to the locomotive underframe, it permits lateral movement between the two structures. The link rod is situated between two pivots, one on the locomotive underframe, the other on the end transom of the bogie, permitting the lateral movement but restraining longitudinal movement. Under normal conditions the rod is inclined at a 1:10 slope towards the center of the locomotive underframe. It has 24 (6+6+6+6) side bolts and 48 (12+12+12+12) base bolts. If any side bolts are missing then fail the loco and if any base bolts are missing then inform the TLC.



SYSTEM DESCRIPTION

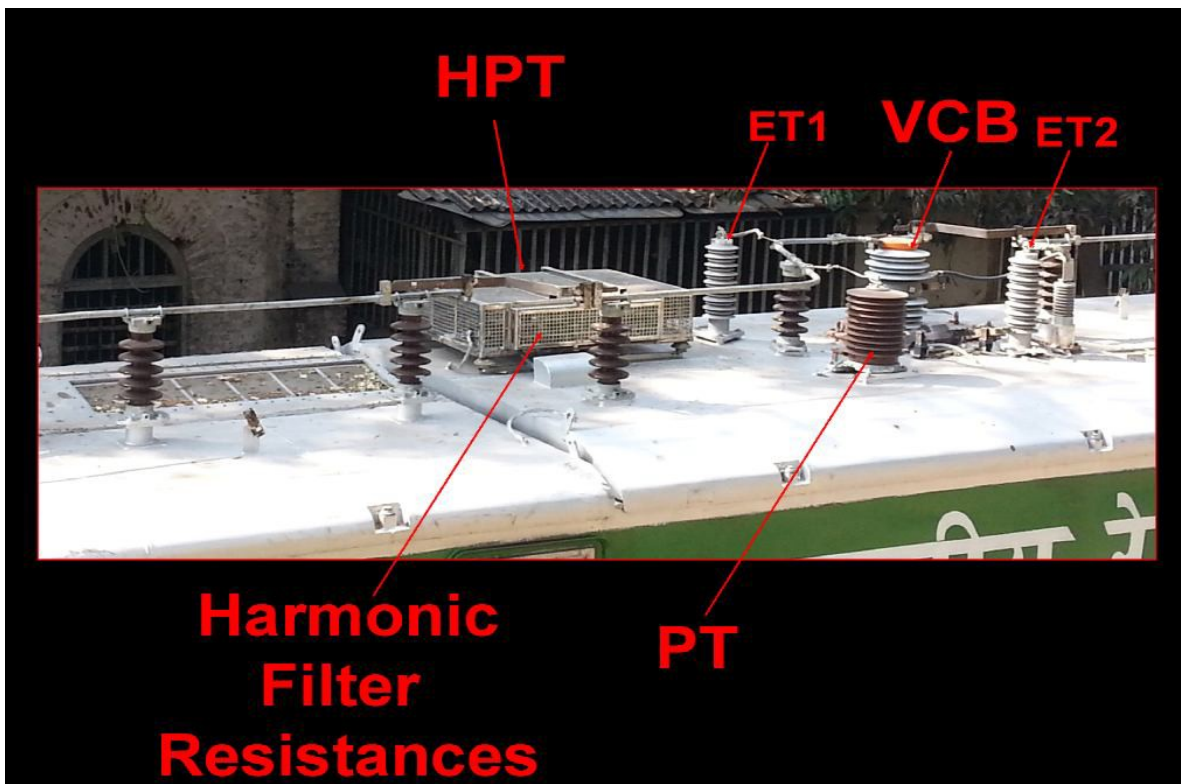
4.1 Potential Transformer –

The primary transformer (PT) is provided on the roof of loco and attached to the pantograph via the roofline. The primary voltage transformer reduces the catenary voltage, approximately 25 KV to 200 V AC.

The output signal is used in three ways –

1. Main converter electronics (SR 1-2) - 4 volts AC
2. Catenary voltmeters on Driver's A panel - 10 volts DC
3. Minimum voltage relay 86 - 200volts AC

When panto is raised this potential transformer feed to U meter through transducer and U meter shows the OHE supply in drivers cab. As such we have an idea of availability of OHE supply before closing DJ. However our responsibility of seeing panto is not finished, we have to check the condition of panto physically. One 2 Amp fuse is provided on output of potential transformer. If this fuse melts then DJ will open & F0104P1 fault message will appear on screen. Check U meter, if it is showing '0' OHE supply then drop panto & raise again to confirm chattering sound. If chattering sound is coming then change the PT fuse with spare one & raise the panto, if U meter shows normal OHE supply then close DJ. If still message displayed "Catenary voltage out of limit" & 'U' meter showing normal OHE, then isolate SR-1/SR-2 through 127.1/1 or 127.1/2 as per the background message.



4.2 Main Transformer –

The main transformer converts the overhead line voltage (25 kV) to the lower operating voltages. There are four secondary traction windings (two on each converter unit, 1269 V), one for feeding the auxiliary circuits (1000 V), one for Hotel load supply (960 V) and one for the harmonic filter (1154 V). The main transformer is installed in an enclosed, oil-tight aluminum tank together with series resonant choke for traction converter & 3 DC link chokes for auxiliary converter. This aluminum tank is divided into two chambers. The larger chamber contains the main transformer; the smaller chamber accommodates the series resonant chokes at the bottom and the auxiliary converter chokes above them. The transformer tank is made entirely of aluminum. This construction saves weight and, above all, exerts a damping effect on high frequency magnetic fields.

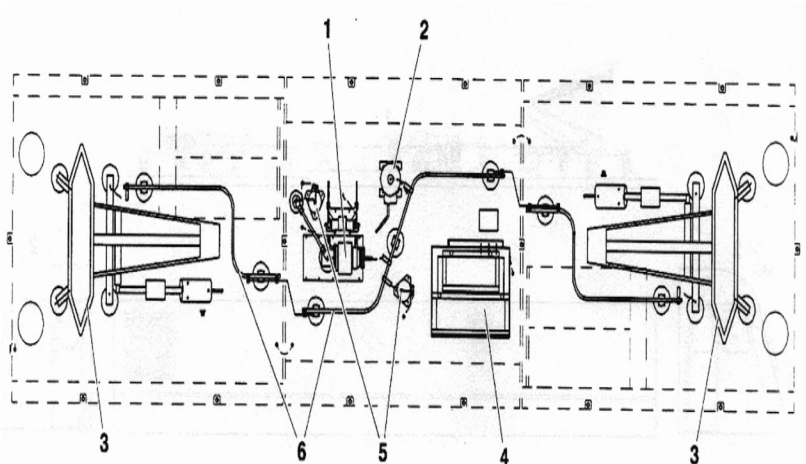
25 KV, 1 phase AC supply is taken from OHE catenary/contact wire through pantograph, roof equipment and VCB (DJ). The same supply is fed to charge the parallel induction transformer where it is stepped down to different operating voltage. The tank is filled with transformer oil, in order to increase the insulation strength so that the arising heat loss can be dissipated through the circulating oil. The two parallel oil circuits with pumps and heat exchangers (radiator) are provided. The cooling oil flows through pipes and barriers in such a way that it first cools the main transformer. The main transformer is subject to a symmetrical flow of oil from a chamber surrounding the middle of the transformer. The oil then flows from the large tank compartment at the top down into the smaller compartment where it flows around the chokes from bottom to top. The transformer unit is filled with 2000 kg of mineral oil. The oil serves as a cooling and insulating agent. A spy glass is provided in each machine room to check the oil level of transformer oil.

There are 3 secondary winding:

- a. Converter secondary winding/Traction winding.(4 nos.)
- b.Aux. Converter secondary windings.(1 no.)
- c. Harmonic filter secondary winding.(1 no.)

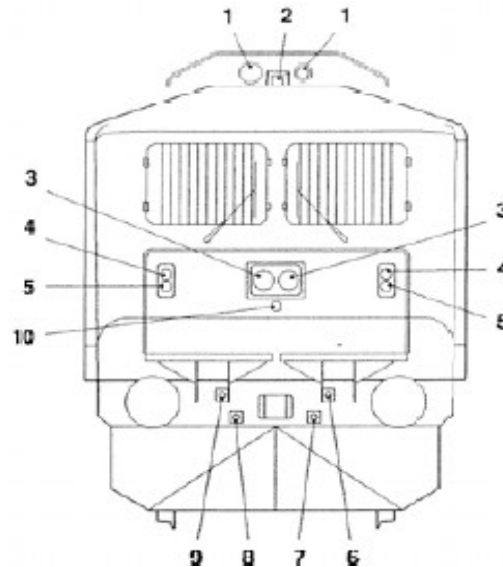
ROOF LAYOUT

- 1 Main circuit breaker
- 1 Potential transformer
- 3. Pantograph
- 4. Resistor harmonic filter
- 5 Surge arrester
- 6 Roof line



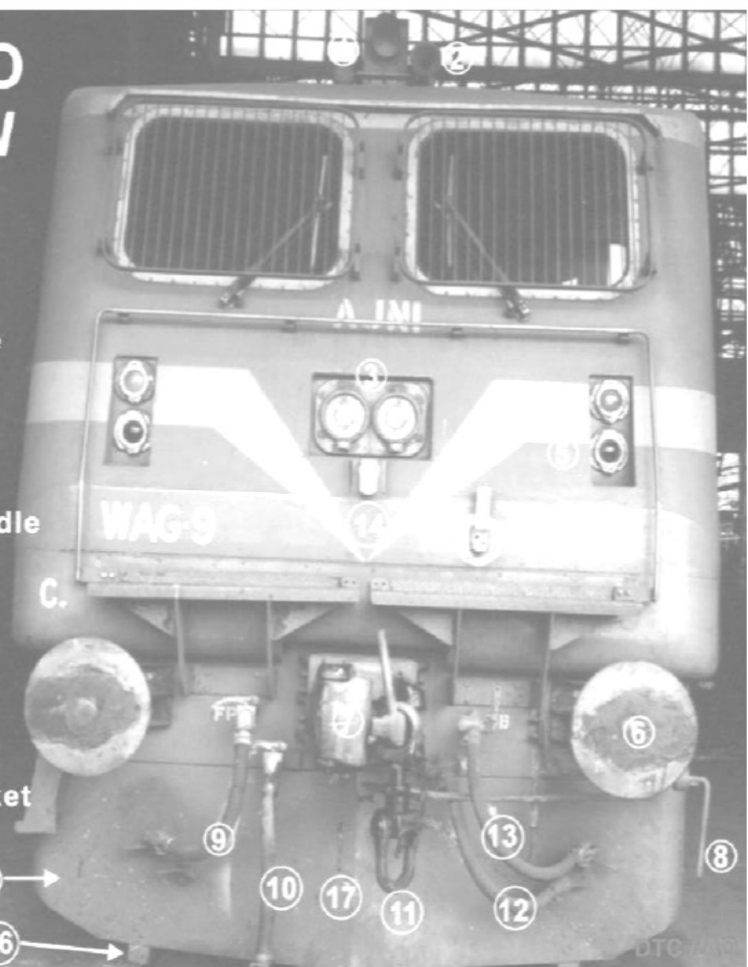
FRONT VIEW :

1. Signal horn
2. Emergency flash light
3. Headlights
4. Marker light, white
5. Marker light, red
6. End cock direct brake (DB, yellow)
7. End cock main reservoir (MR, red)
8. End cock brake pipe (BP, green)
9. End cock feed pipe (FP, white)
10. Coupling, UIC cable



WAG-9 LOCO FRONT VIEW

- 1 Flasher Light
- 2 Horn
- 3 Head Light
- 4 Marker Light White
- 5 Marker Light RED
- 6 Buffer
- 7 CB C
- 8 CBC operating handle
- 9 Feed Pipe
- 10 BP hose pipe
- 11 Screw Coupling
- 12 MR equi. Pipe
- 13 BC Equi. Pipe
- 14 Jumper Cable Socket
- 15 Cattle Guard
- 16 Rail Guard
17. CBC Locking Pin



4.3 Traction Power Circuit:

Power from the overhead Catenary is directed to the main transformer, mounted on the locomotive under frame, via the pantograph. The traction circuit is split into two separate circuits after the main transformer.

The traction converters can conduct current from the Catenary to the traction motors to provide propulsion, or can act in the opposite manner conducting, and rectifying, current from the traction motors to the Catenary. This allows the converter to work in both traction and braking mode. During braking the traction motors act as generators feeding power back into the catenary. The traction converters then act to convert the three phases into single phase for the catenary.

The traction converters provide continuous and automatic control of both speed and torque of the traction motors according to the driver's demand. The converters are controlled by the converter control electronics, and the locomotive central electronics. Three, 3-phase asynchronous traction motors are connected in parallel to each traction converter.

PRE-CHARGE CONTACTOR (12.3)

The pre-charge contactor is used to connect the pre-charging resistor in line with the DC link capacitors on start up. The resistor is required to minimize oscillations in the DC link & to limit the initial inrush of current to the DC link circuit.

Once the DC link voltage has reached the peak secondary voltage of the transformer, the main power contactor for the converter 12.4 is closed & pre charge contactor 12.3 is opened. With contactor energized, its auxiliary contact 12.3 connected & this message is taken by control electronics.

CONVERTER CONTACTOR (12.4)

The converter contactor is operated by the control electronics Activation & Deactivation of the traction converter through the converter contactor. Supply comes to coil of converter contactor 12.4 through control electronics 415 which allows supply to the coil after short delay of closing of pre charging contactor 12.3.

GTO based Traction Converter (SR)

Traction converter converts single phase 25 KV AC supply into 3- phase AC, with Variable Voltage (max 2180V output) and frequency (from 65 to 132/160 Hz) while traction mode and fed it to traction motor group. As such there are two traction converter i.e. Traction onverter-1 for TM 1-2-3 and Traction converter-2 for TM 4-5-6 (in case of WAP-5, traction converter-1 for TM 1-2 and Traction converter-2 for TM 3-4) While electrical braking the traction motor works as a generator and feed generated 3-phase AC supply to Traction converter. This converter now acts in reverse manner i.e. it converts 3 phase AC supply into single phase AC supply and feed it to transformer. Further main transformer steps up this supply and fed back to OHE. In this way 3- phase loco works as a small power house, which generate supply and share the load by feeding it back to OHE. SR is cooled by two separate oil cooling unit.



For circulating oil of traction converter, two oil pumps are provided in each machine room and the oil is cooled by two oil cooling blowers. One spy glass is provided on each SR to check the oil level.

The traction converter has three main sub parts:

- 1) Line Converter,
- 2) Intermediate DC link and
- 3) Drive converter.

4.3.2 Line Converter (NSR) –

The line converter converts the alternating current supplied from the main transformer into direct current (motoring) and forwards this direct current to the intermediate DC - Link. However, it is also able to convert current from the intermediate DC - Link into alternating current and to supply this alternating current in turn to the main transformer (braking). Both functions are activated by the traction converter control electronics.

4.3.3 DC Link (ZK) –

The intermediate DC link performs two main tasks. Firstly it smoothes the direct current that flows through. Secondly it also performs the storage function, thus covering the peak current demand of the line converter or of the motor. It works as an electrical buffer between ASR and NSR.

4.3.4 Drive Converter (ASR) –

The drive converter converts the direct current from the intermediate DC link into the three phase current for the drive motors (motoring). Conversely, it is also able to convert the three phase current generated by the drive motors into direct current for braking. The complete assembly of line converter No. 1, DC link and driver converter No. 1 is termed as 'Traction Converter No. 1' and line converter No. 2, DC link and driver converter No. 2 is termed as 'Traction Converter No. 2' which in turn converts single phase AC supply of main transformer into 3 phase AC supply with variable voltage and frequency and fed to the 3 phase traction motor.

4.3.5 Technical Data of Traction Converter –

Coolant oil	Shell Diala DX
Input Voltage	2 X 1269 volt
Input Current	2 X 1142 Amp
Input Frequency	50 Hz
DC Link circuit nominal voltage	2800 volt
Output Voltage	2180 volt
Output Current	740 Amps
Output Power	2105 KW
Output frequency	65-132 Hz

4.3.6 IGBT based Traction Converter (SR) –

In the recent past, all over the world the trend has been to switch over from conventional DC drives to 3-Phase AC drives based on Insulated Gate Bipolar Transistor (IGBT) technology. At present, the flagship locomotive of Indian Railways is the 3-phase locomotive. Presently, different variants, viz. WAG9, WAG9H, WAP7 and WAP5 are running over Indian Railways. The heart of the locomotive is traction converter which is responsible for conversion of single phase AC drawn from OHE to 3-phase AC which drives the traction motor. At present, switching device used in the traction converter is GTO. Considering the obsolescence of the GTOs, Indian Railways have embarked on their ambitious plan to migrate from current Gate Turn OFF (GTO) based system to IGBT based traction propulsion system retaining same transformer and traction motors, owing to the advantages offered by IGBT as a power device are available in new variants WAG 9i, WAG 9Hi. GTO being a thyristor device need snubber circuits, resulting in high losses. GTO's are sensitive to failures because of complicated gate drivers. IGBT does not require snubber circuit (because of di/dt and dv/dt control) and belongs to a power transistor family, has lesser losses, better control ability, higher performance and reliability. As the IGBT Traction converter is smaller in size and the liberated space can be utilized for the installation of future new equipments like Hotel load converter, etc.

Salient Features –

- ❖ The existing GTO based traction converter is a group drive, i.e., all the traction motors in a bogie are connected in parallel. While, the IGBT based converter has got single axle drive capability, therefore, in case of any problem with a particular TM, only that particular TM can be isolated unlike in the GTO based converter where the whole bogie has to be isolated.
- ❖ Due to single axle drive it has got better adhesion performance.
- ❖ Because of smaller size of the converter it may be possible to install additional equipment's like hotel load converter in the locomotive.
- ❖ In order to improve the control of the drive, the active type speed sensors have been provided which have better resolution by incorporating sensors which can provide strong signals at 200 pulse per revolution.
- ❖ This converter has taken full advantage of the advancement in the processor speed which has paved the way for less number of PCB cards with better performance at the higher temperatures.
- ❖ Power loss reduction by approx. 50% in comparison with GTO loco equipment.
- ❖ Annual energy saving (considering @ Rs. 4.62 / unit) will be 53% approx. Rs. 34 lakhs assuming loco utilization of 85% service per day.
- ❖ 40% reduction in weight and compact in size compared to GTO equipment.
- ❖ 60% reduction in usage of electric cards (only 3 major cards compared to 17), hence increasing the loco reliability.
- ❖ Sensor less speed control.
- ❖ Water cooled system thus safer vis-à-vis oil cooled system.
- ❖ Better slip / slide controls, because of axle control and modern high speed digital signal processing algorithm.
- ❖ Less harmonics because of high switching frequency.

Cooling system –

The power modules of IGBT are cooled with water and glycol mixture. The cooling system comprises a pump, heat exchanger and a expansion tank. The Heat exchanger is retained from the existing one. Out of two heat exchanger circuit one is used for traction converter cooling and the other is retained for traction transformer water cooling system. In this traction converter cooling circuit the exchange of heat takes place between Water to Air. The pump selected is a magnetic drive pump and suitable for water (glycol) mixture. Also this pump is of continuous duty type.

Cooling agent –

On BHEL make IGBT traction converter mixture of water and propylene glycol is used cooling agent. The propylene glycol is chosen because of the following properties:

- excellent protection against corrosion
- harmless for humans and animals
- environmental friendly

On Bombardier make IGBT traction converter mixture of anti-frozen (44%) & distilled water (56%) is used as cooling agent. The resultant operational coolant provides antifreeze protection down to -250C +20C.

Location of Water cooling system –

The water cooling pump is located in the lower left side wall (viewing from front) of the Traction converter cubicle in such a way that to avoid the dry running of pump and the expansion tank is located at the top of the traction converter (located at the highest point of the cooling system).

4.4 Traction Motor:

There are total 6 traction motors provided in WAG-9 / WAP-7 loco. TM 1-2-3 are mounted in bogie-1 and fed from traction converter -1 where as TM 4-5-6 are mounted in bogie -2 and fed from traction converter -2. In case of WAP-5 there are 4 traction motors in which, Traction con- verter-1 fed to TM-1-2 where as traction converter-2 fed to TM3-4.

Unlike conventional WAG-5/7 individual TM cannot be isolated in this loco only a group isolation is possible. For isolation of TM group one rotating switch No. 154 is provided in SB-1, its normal position is “ Norm”.

In WAP-7 & WAG-9, the traction motor is forced—air cooled and intended for transverse installation in a 3—motor bogie. The power transmission is effected via a spur—wheel gear. In WAP- 5 the TM is fully suspended and connected with gear by hurth coupling by which power is transmitted. Traction motor is suspended on axle, by axle cap at one end and on link at another end.

To check the oil in gear case one spy glass is provided on gear case. To monitor the temperature & speed, sensors are provided in the stator assembly.

4.4.1 Technical Data Of Traction Motor:

WAG-9 / WAP-7

Type	6FRA 6068
Kind of motor	6 -poles/alternating current Asynchronous motor, 3-phase
Cooling	Forced air cooling
Power supply	Current fed converter
Temperature recording	2 thermal resistance elements installed in a stator tooth

OUTPUT P (KW)	Continuous 850 Max. 850
VOLTAGE U (V)	Continuous 2180 Max. 2180
Current Intensity I (A)	Continuous 270 Max. 370
Frequency (Hz)	Continuous 65 Max. 132

WAP-5

Type	6FXA 7059
Kind of motor	6 - poles/alternating current Asynchronous motor, 3-Ph
Cooling	Forced air-cooling
Power supply	Current fed converter
Temperature recording	2 thermal resistance elements installed in a stator tooth
OUTPUT P (KW)	Continuous 850 Max. 1150

VOLTAGE U (V)	Continuous 2180 Max. 2180
Current Intensity I (A)	Continuous 370 Max. 540
Frequency (Hz)	Continuous 65 Max. 80



4.5 Auxiliary Converter –

4.5.1 General

The motors used for the auxiliary circuits are 3 phase squirrel cage motors. The cost of maintenance is therefore low. There are 12 auxiliaries run by 3 phase 415 V AC supply. This 3 phase 415 V AC supply is obtained by auxiliary converter to feed different 3 phase auxiliaries and one battery charger. Auxiliary converter receives single phase 1000 volts AC supply from auxiliary winding of main transformer. This single phase AC supply is fed to rectifier module auxiliary converter where it converts into DC supply. This DC supply is fed to DC link to suppressed AC pulses in DC. The pure DC supply then fed to inverter module auxiliary converter where it converts DC supply to 415 V, 3 phase AC supply with variable amplitude of voltage and frequency and then fed to different 3 phase auxiliaries. There are three auxiliary converters which get single phase 1000 volts AC input supply from common auxiliary winding and fed 3 phase 415 output to different 12 auxiliaries and one battery charger. Auxiliary converter-1 is placed in cubicle called BUR Box-1 situated in machine room no. 1 whereas Auxiliary converter-2, 3 & battery charger is placed in cubicle called BUR Box-2 situated in machine room no. 2. Each auxiliary converter is rated for an

output power of 100 KVA. The output frequency of converters BUR-1 & BUR-2 is available from 0 to 50 Hz and of converter BUR- 3 is 50 Hz (fixed frequency). The auxiliary circuits are controlled as require. The traction motor and oil cooling blowers run only when required. The control electronics adjusts the blower speeds depending on measured operating temperatures, nominal traction values and speed. Transformer and traction converter oil pumps works continuously wherever the auxiliary converters are working.

IGBT Based Auxiliary Converter -

The Auxiliary converter system is powered from an Auxiliary winding on the main transformer. Traction transformer, in addition to traction converter winding, is provided with a separate common winding for feeding the Auxiliary converters 1, 2 & 3. The input voltage to the Auxiliary converter is 1000 V AC with a voltage fluctuation of 760 V to 1200V corresponding to catenary voltage variation of 19KV to 30KV respectively. The control electronics supply is taken from the 110 V DC battery.

The load distribution between the Auxiliary converters 1, 2 & 3 is such that required redundancy is achieved by automatically switching load from one BUR to another in case of failure of any one of the BUR's. BUR 1 and BUR 2 supplies variable voltage variable frequency to the two converter water pumps and two transformer oil pumps, oil cooler blowers and traction motor blowers. BUR 3 supplies fixed frequency to the two compressor motors and scavenge blowers of Traction Motors blower of bogies 1 & 2. In addition to that Aux Conv-3 also feeds the Battery Charger. Load changeover from one BUR to another in case of isolation of any one of the BUR's is done automatically by the auxiliary converter electronics with the aid of contacts as described in the table below.

4.5.2 3-phase, 415 volt Auxiliaries

Following 3-phases, 415-volt auxiliaries are provided on this loco, which are fed from Auxiliary converter no. 1, 2 and 3.

Auxiliary	Power Consumption	location	Function	MCB, location & Rating
Load on Auxiliary Converter No.1 (input fuse- 280 Amps)				
Oil cooling Blower-1 (OCB-1)	25 KW	Machine Room-1	To cool transformer and SR-1 oil in coling unit-1 by taking air from roof	59.1/1 in HB-1 (63 A)
Oil cooling Blower-2 (OCB-2)	25 KW	Machine Room-2	To cool transformer and SR-2 oil in coling unit-1 by taking air from roof	59.1/2 in HB-2 (63 A)
Load on Auxiliary Converter No.2 (input fuse- 280 Amps)				
Traction Motor blower-1(TMB-1)	25 KW	Machine Room-2	To cool bogie-1 TM group by forced air	53.1/1 in HB-1 (63 A)

Traction Motor blower-2(TMB-2)	25 KW	Machine Room-1	To cool bogie-2 TM group by forced air	53.1/2 in HB-2 (63 A)
Transformer oil pump-1	4.7 KW	Under Truck below Machine room-1	To circulate oil from TFP to colling unit-1 & back	62.1/1 in HB-1 (16 A)
Transformer oil pump-2	4.7 KW	Under Truck below Corridor-2	To circulate oil from TFP to colling unit-2 & back	62.1/2 in HB-2 (16 A)
Tr. Converter oil pump-1	15 KW	Machine Room-1 near SR-1	To circulate oil from SR-1 to cooling unit-1 & back	63.1/1 in HB-1 (32 A)
Tr. Converter oil pump-2	15 KW	Machine Room-2 near SR-2	To circulate oil from SR-1 to cooling unit-2 & back	63.1/2 in HB-2 (32 A)
Load on Auxiliary Converter No.3 (input fuse- 280 Amps)				
Main Compressor-1	15 KW	Under truck below Machine Room-1	To create MR pressure to 10.0 kg/cm ²	47.1/1 in HB-1 (63 A)
Main Compressor-2	15 KW	Under truck below Machine Room-2	To create MR pressure to 10.0 kg/cm ²	47.1/2 in HB-2 (63 A)
Scavenging Blower-1	3 KW	Machine Room-1 Near TMB-2	To clean dust from air filters of TMB-1 & OCB-2	55.1/1 in HB-1 (06 A)
Scavenging Blower-2	3 KW	Machine Room-1 Near TMB-1	To clean dust from air filters of TMB-2 & OCB-1	55.1/2 in HB-2 (06 A)
Battery Charger	10 KW	Within Auxiliary Converter Cubical	To charge battery	110 in SB-2 (20A)

4.5.3 Load Sharing

Generally all the 3 Auxiliary converters are loaded equally, but in case of failure of any converter another converter shares its load. In such condition, frequency of aux. Motor drops from 50 Hz to 37Hz.

Load sharing after isolation of any aux. converter.

Aux. Conv.-1 isolate	Load on Aux. Conv.-2	Oil cooling blower 1-2, Traction Moto blower 1-2 & Scavanging blower 1-2
	Load on Aux. Conv.-3	MCP 1-2, Transformer pump 1-2, Converter pump 1-2 & Battery Charger
Aux. Conv.-2 Isolate	Load on Aux. Conv.-1	Oil cooling blower 1-2, Traction Moto blower 1-2 & Scavanging blower 1-2
	Load on Aux. Conv.-3	MCP 1-2, Transformer pump 1-2 Converter pump 1-2 & Battery Charger
Aux. Conv.-3 Isolate	Load on Aux. Conv.-1	Oil cooling blower 1-2, Traction Moto blower 1-2 & Scavanging blower 1-2
	Load on Aux. Conv.-2	MCP 1-2, Transformer pump 1-2, Converter pump 1-2 & Battery Charger

Note: -

1. Machine room blower and scavenging blowers (2+2) are directly supplied and starts as soon as VCB is closed independent of MCE in driving as well as in cooling mode.
2. The oil pump for transformer and converter works continuously during operation of converter.
3. TM blower and oil cooling blower and scavenging blowers are run as per requirement.
4. The control electronics adjust the selected stage of measured operating temperature, nominal traction value and speed range lower-moderate-maximum.

Auxiliary Power Circuit:

125KW

1/1

2.25KW

ENGINE

FTMB-1

3KW

ENGINE

TMB2

3KW

20KW

25KW

FORMER

MP1 4.7KW

FORMER

MP2 4.7KW

CONVERTER

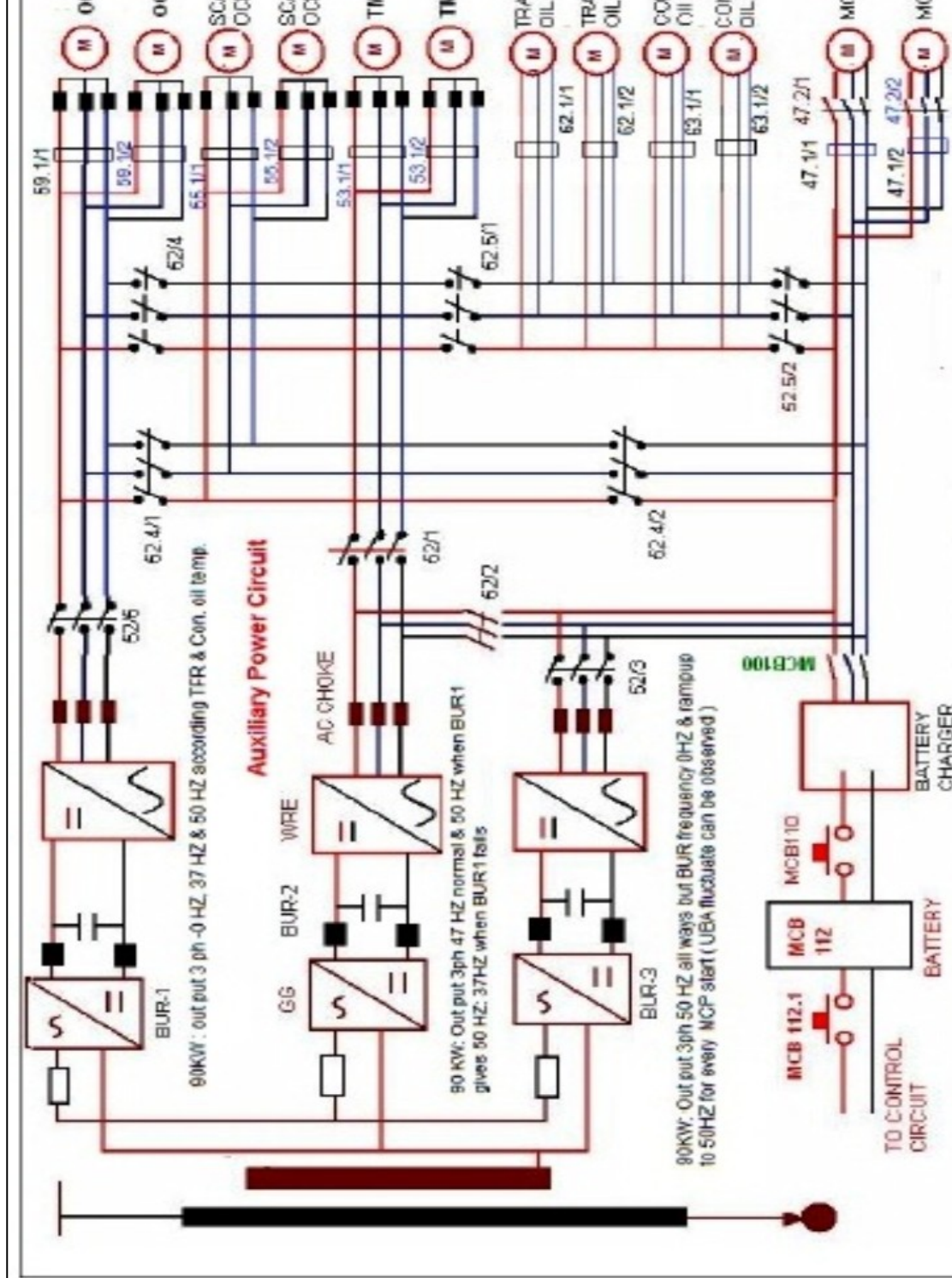
MP 111KW

CONVERTER

MP2 111KW

15KW

15KW



4.5.4 Main Compressor 1 & 2 Starting:

For starting the main compressor a spring-loaded switch (BLCP) is provided on panel, 'A' which is having 3 positions.

1. **'OFF'** position - For stopping compressors.
2. **'AUTO'** Position - Both Compressor 1&2 will work according to cut in and out of cycle.
3. **'MAN'** Position – Both Compressors work continuously irrespective of MR pressure. This is spring-loaded position.

Auto Position:-

1. Air pressure goes below 8 kg/cm² :- Both compressor start up to 10 kg/cm² (Through pressure switch 172.2 & 172.3).
2. Air pressure goes below 5.6 kg/cm² :- "Low pressure, main reservoir" message appears on the screen through 269.4 with priority-1 fault (F1002P1) along with LSFI indication. No TE/BE is possible till MR pressure reaches to 6.4 kg/cm². Both compressors will start till MR pressure reaches to 10 kg/cm².
3. After getting the start command, compressor starts but it takes 25 seconds to ramp up and unloading and start actual pumping there after. During this delay, pressure drops by 1 to 1.5 kg/cm². So if we see the gauge cut in cut out setting will be appear as 7 to 10 kg/ cm² instead of 8 to 10 kg/cm².

4.5.5 SINGLE - PHASE 415 V/110 V AUX. CIRCUIT:

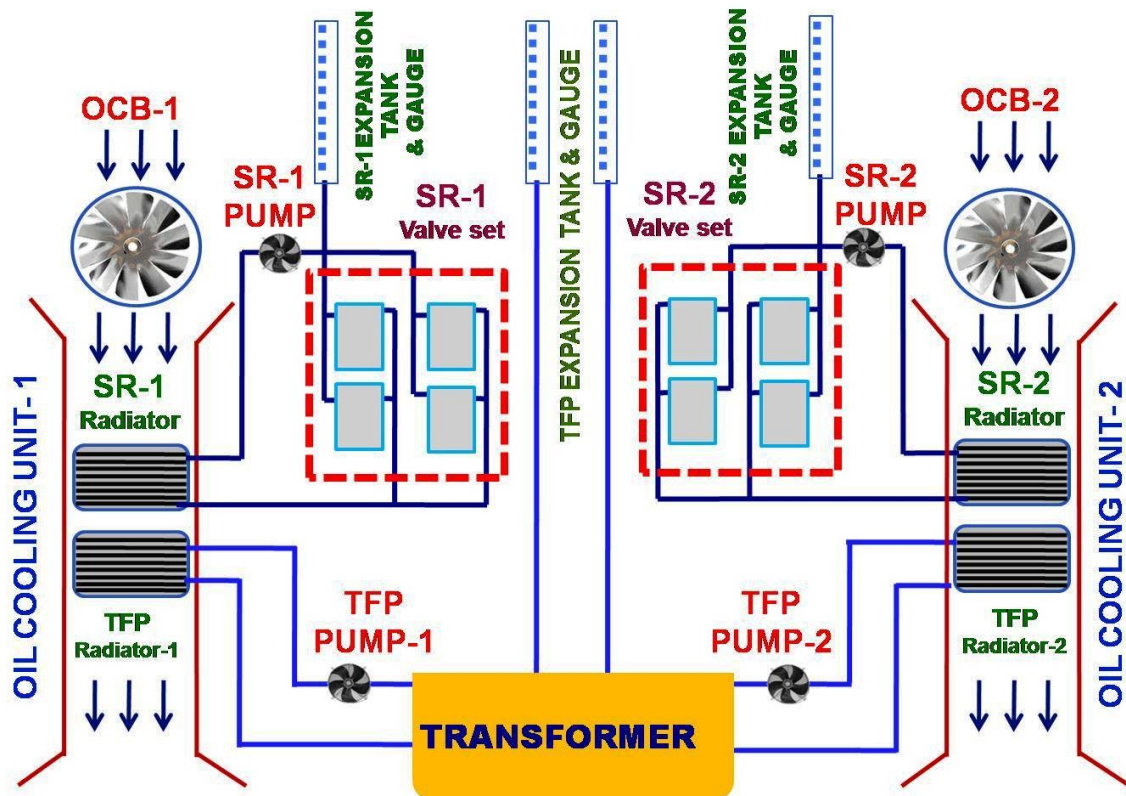
The auxiliary transformer is located in cubicle-1(HB-1) and supplies following systems with 1-phase power. This circuit is independent of CE and all these auxiliaries work in Driving as well as cooling mode and start as soon as VCB closed.

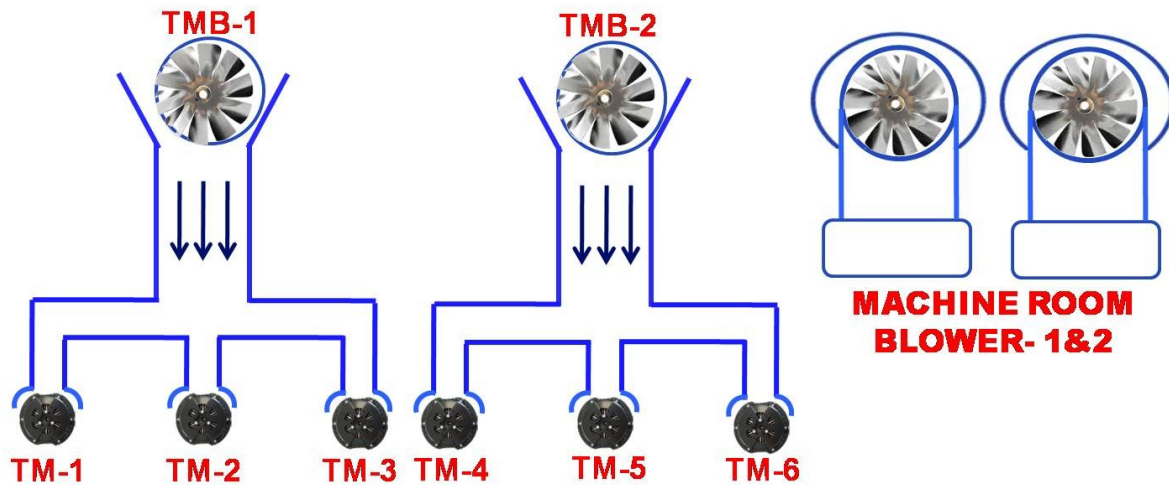
Auxiliary	Location	Use	MCB
Single phase 415 Volts (Input fuse 40 amps)			
Machine Room Blower-1	Machine Room-1	To cool machine room by ducting and limit the temperature of control electronics parts below 70° C	54.1/1 in HB-1 (20 A)
Machine Room Blower-2	Machine Room-2	-do-	54.1/2 in HB-2 (20 A)
Scavenging Blower for Machine Room Blower-1	Machine Room-1	To clean dust from air filters of Machine Room Blower-1	56.1/1 in HB-1 (06 A)
Scavenging Blower	Machine Room-2	To clean dust from air	56.1/2 in

Handbook on 3-Phase Locomotive, ELTC, SER, TATA - 36

for Machine Room Blower-2		filters of Machine Room Blower-2	HB-2 (06 A)
Heater Element	One in both cab inside desk	To deliver heat for keeping the cab warm	69.62 in HB-1 (16 A)
Single phase 110 Volts			
Crew Fan;-4 nos	2 nos in Both Cabs	Crew ventilation	69.71 in HB-1 (06 A)
Cab Ventilation Blower-2 nos	One in Both cab inside Desk	To expel heat of heater element into the cab	69.61 In HB-1 (06 A)

4.6 COOLING CONCEPT





4.7 Harmonic Filter:

Line harmonic filter is connected with primary winding of main transformer which consist of resistances and capacitor. This harmonic filter reduces/suppressed the high frequency harmonics to avoid disturbances in signaling.

If the harmonic filter get bypassed by the system, the speed of the loco / train will be automatically restricted up to max 40 KMPH by CE.

CONTACTOR FILTER ON/OFF (8.1)

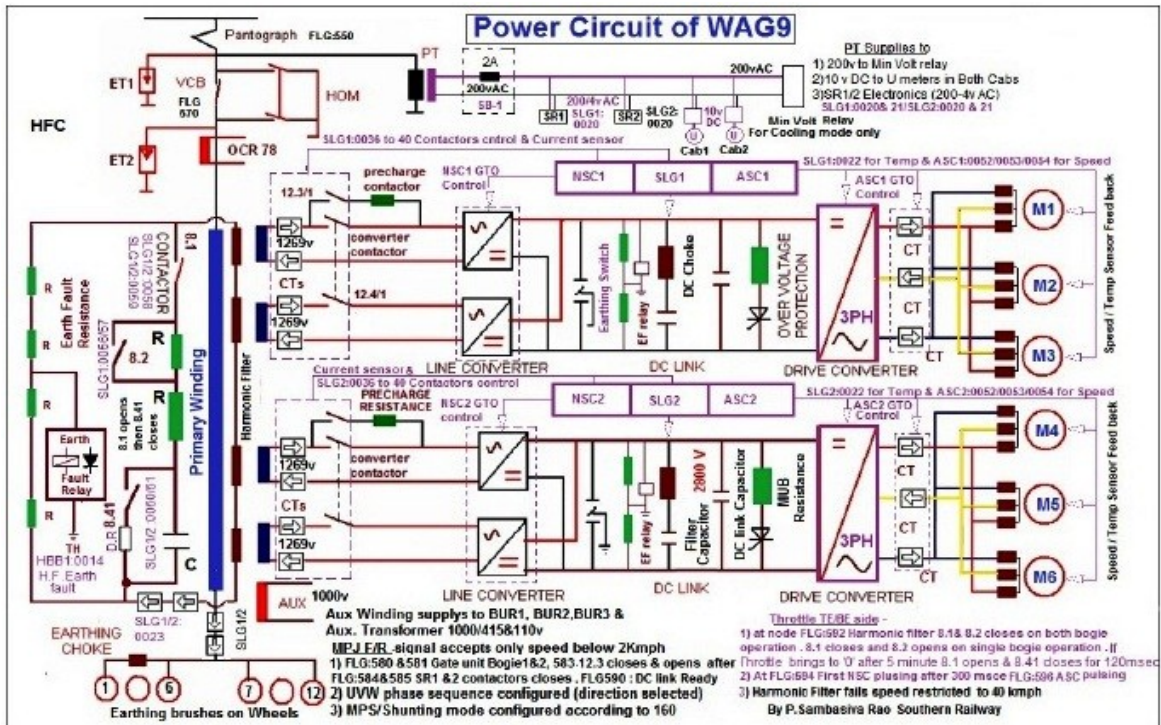
With VCB closed & reverser position selected , the filter On/Off contactor (8.1) will close. Afterwards whenever throttle is brought to zero with VCB closed the filter contactor remain closed. If this situation persists for more than 5 minutes , then filter contactor opens & discharge contactor 8.41 closes for 120 millisecond. Filter contactor 8.1 will remain open & will close when TE/BE throttle is again moved.

CONTACTOR FILTER ADOPTION (8.2)

This contactor is closed when both the bogies are in operation . It is open when one bogie is isolated. Contactor coil is energized through converter control electronics 415 and will allow supply to the converter coil only when one traction converter is isolated.

CONTACTOR DISCHARGING RESISTOR (8.41)

This contactor is closed to discharge harmonic filter capacitors(8.4) through discharge resister 8.42 & Supply comes to coil of contactor 8.41 through control electronics 415. Normally contactor 8.41 is closed when contactor 8.1is open.



4.8 Battery

In ABB loco NiCD Battery is used. There are total 78 cells in the batteries which are placed in 2 boxes at either side of the locomotive. Each box contains 39 cells and each battery has 3 cells. Capacity of battery is 199 A-H and output is 110 V. To charge the battery, one battery charger is provided with circuit breaker no. 110 situated in SB2. Main switch for battery is 112 which is placed in a box provided near battery box no. 2. For control circuit supply 1 MCB no. 112.1 is provided in SB2. There is another MCB no. 100 (HB-2 & in some locos on BUR-2) provided for battery charger input.

To show the battery voltage UBA is provided in either cab.

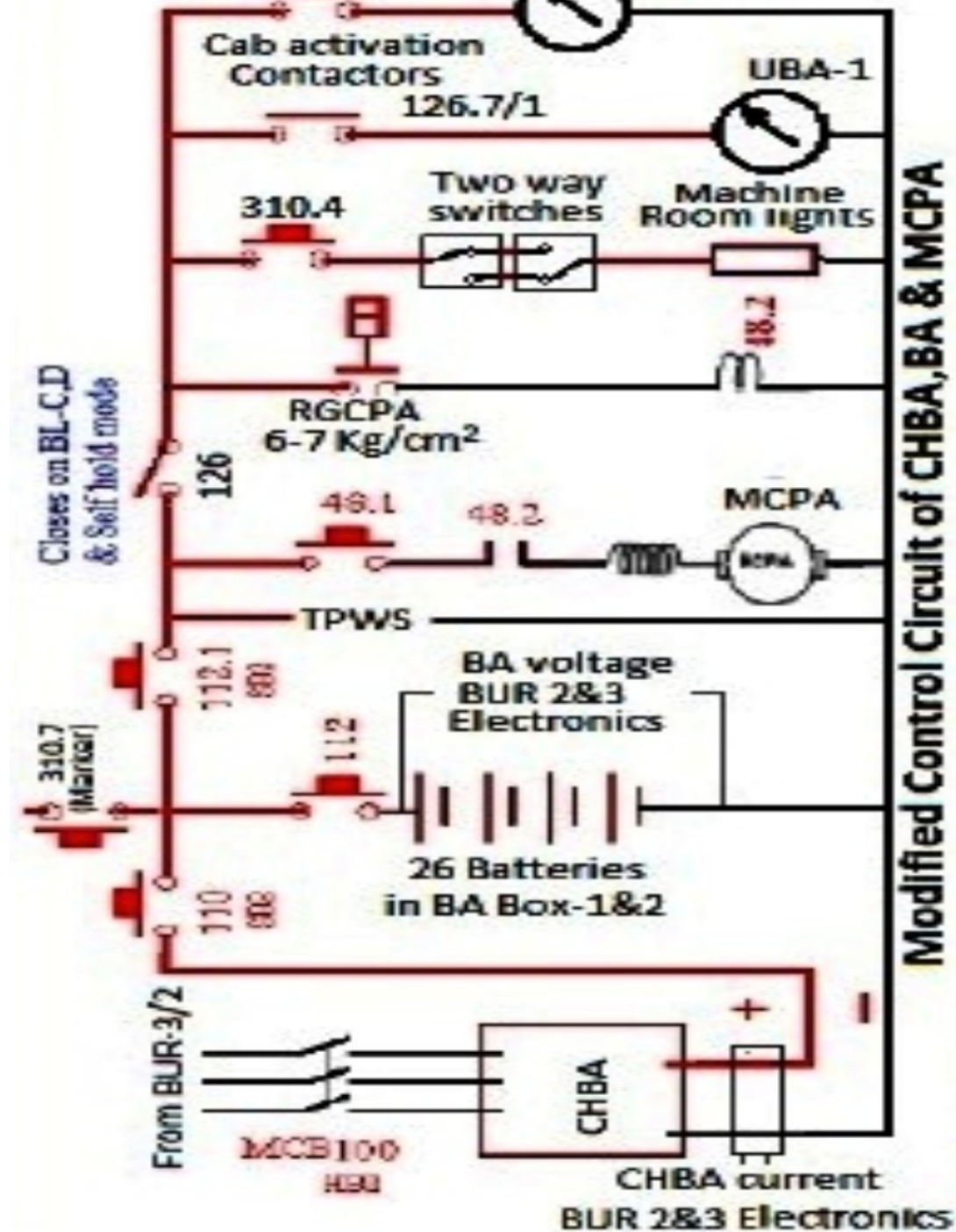
Note:-

- 1.If battery voltage is 92 V for more than 30 seconds, P-2 Fault will appear on the screen.
- 2.If charging current is reduced by 10 A, P-2 fault will appear on screen.
- 3.If battery voltage is reduced below 82 V, P-1 message with shutdown of loco will appear.
- 4.If cab is activated and panto is lowered than 10 minutes CE will switch off automatically.
- 5.Loco CE get power supply directly from battery and can supply upto maximum 5 hours.
- 6.For machine room light power supply is given directly through MCB 327.4.

Technical Specification:

Cell model	= SBL-199
Cell type	= Nickel/Cadmium
Number of cells per battery	
13 Number of battery boxes	= 2
Total nominal capacity	= 199 Ah
Nominal voltage of each cell	= 1.4 V
Total battery voltage	= $1.4 \times 3 \times 26 = 110$ V

= 3 M



Fault

Messages:-

Fault No	Status
F0901P2	Warning Low Battery Voltage (92v for 30 Sec) – Check MCB 100 & MCB 110, if OK clear section.
F0902P2	Battery Charger MCB OFF- Check MCB 100 in HB-2, reset only after opening VCB.

F0903P2	Low Battery Charging Current – Check CHBA working/MCB 110 – Reset only after switching OFF MCE.
F0901P1	Battery Voltage Too low (82 V & Loco will shutdown) – If Voltage below 82V – Ask for relief loco.
F0902P1	Battery Voltage Low (86 V & TE/BE – '0') – Check MCB 100/110, If OK clear section with Coasting.
Note: If MCB 112 located beside battery box No. 2 or MCB 112.1 is tripped, then all cab and machine room lights are switched OFF. Display screen also become blank. Emergency shutdown & brakes will apply automatically. In such case, LP should check MCB 112 & 112.1, if tripped, then reset the MCB, energize the loco and resume normal traction.	

4.9 Brake System:

There are 5 types of brakes available on this loco.

- 1.
2. Direct Brake (Pn)
3. Parking Brake (Spring Loaded)
4. Anti Spin Brake.(Pn)
5. Regeneration Brakes.(Elect)

Note: All the brake system functions are monitored by brake electronics and if there is any wrong configuration, the brake electronics do protective action along with P-1 message on screen. One circuit breaker is also provided in SB-2 for this brake electronics. In case of failure of brake electronics, crew should check this MCB.

4.9.1 Automatic Train Brake (A-9)

In both the cabs one Drivers Brake Controller (DBC) is provided which is the electrical switching equipment. The function of the driver's brake controller is to generate a variable voltage code in accordance with the position of the controller handle and to perform a number of ancillary electrical functions. A pneumatic valve is incorporated to provide a pneumatic emergency brake function in addition to the electronically controlled emergency brake.

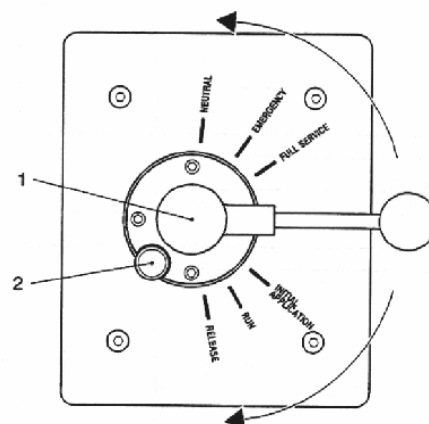


This brake is utilized for charging and discharging the B.P. Pressure to apply/release train brake and also loco brakes in conjunction working.

This valve has following 6 positions. A-9 is remaining active in active cab only. Once the BL key is rotate from D to OFF, this handle will not functions, but its emergency position will act.

Handle position Pressure (kg/cm²)

Release	5.4 ± 0.05 (LPO)
Running	5 ± 0.05
Initial Application	4.60 ± 0.05 Variable
Full Service	3.35 ± 0.10
Emergency	0
Neutral	0



Running:

When the handle of the brake controller is placed in the 'Running' position, the 'Running' E.P. valve energised the E-70 valve and allow the 5 kg / cm² pressure to go in brake pipe via cock no.70. As such A-9 gives electrical command to valve E-70 and E-70 allows 5 Kg / cm² pressure to enter in BP. The system for charging the brake pipe is fully self-maintaining.

Note: COC 70 performs the function of A-8 (L&T) COC as in WAG-5/7 locos). This COC is provided with electrical switch due to which its position is monitored by brake electronics and if there is wrong configuration of COC, concerned P-1 message appears on the screen.

Braking:

When the handle of the brake controller is placed in a apply position the control circuits will produce the pressure to give the relevant brake pipe pressure. The brake signal from the brake controller causes the control pressure to fall to the level demanded by the particular brake code which in turn causes the Air from the brake pipe now flows past to atmosphere through E-70 valve. The brake pipe pressure is then held constant at a reduced level, which corresponds to the particular braking requirement, against any normal leakage by the self-maintaining feature.

Emergency:

When the handle of the brake controller is placed in the EMERGENCY' position one of the cam operated switches within the controller opens to cut off the power supply to all E.P. valves of E-70, except the 'Isolate' E.P. valve which is already de-energized. At the same time the pilot valve in the driver's brake controller opens venting the operating air from above the piston in the emergency exhaust valve located in the driver's cab. This valve then opens to vent the brake pipe direct to atmosphere at the emergency rate.

In addition to direct exhaust as all the electrical supply switched off the 'Release' and 'Applica- tion' E.P. valves are de-energized causing the valve E-70

lifts and therefore vents the brake pipe to atmosphere. In emergency, brake of 2.5 kg/cm² is applied through C3W valve.

Neutral:

When the handle of the brake controller is in the 'Neutral' position the cam operated switches within the controller cut off the power supply to all the E.P. valves (except 'Isolate' E.P. valve which is already de-energized) as for the 'Emergency' position.

Release:

When the handle of the brake controller is held in the spring loaded 'Release' position, the 'Full Bore' and 'Running' E.P. valves (of E-70) are energised. In this condition the system operates as described for the 'Running' condition, except that the 'Full Bore' E.P. valve is energised. This valve allows a lowpressure overcharge in BP pipe.

Low pressure over charge is achieved by raising the normal brake pipe pressure of 5 kg/cm² to a pressure of 5.4 kg/cm² and holding this for a limited period after which the overcharge is arranged to bleed down at a prescribed rate.

The pressure of 5.4 kg/cm² in the brake pipe is held for a short period by an electronic timing device on the low-pressure overcharge circuit board. At the end of this period the 'Low Pressure Overcharge' release E.P. valve is deenergised in a controlled manner which thus reduces the pressure in the control reservoir and hence the brake pipe at a predetermined rate towards a level of 5 kg/cm². Even overcharging up to 5.4 kg/cm² for short time and normalized with restricted rate, there will be no brake binding in load as overcharging feature of DV will prevent DV to overcharge.

Note:

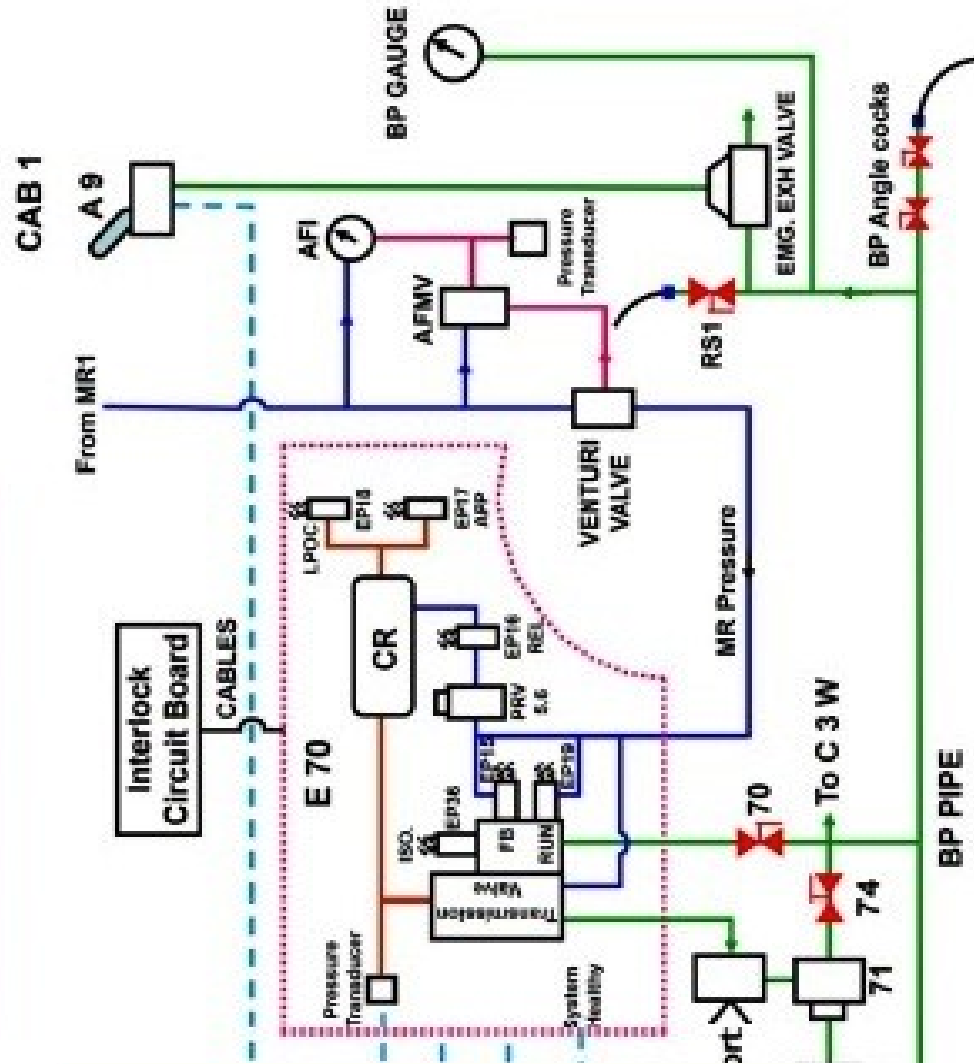
- can be locked by locking device.
- display on the screen and an emergency brake is triggered.

BP Charging

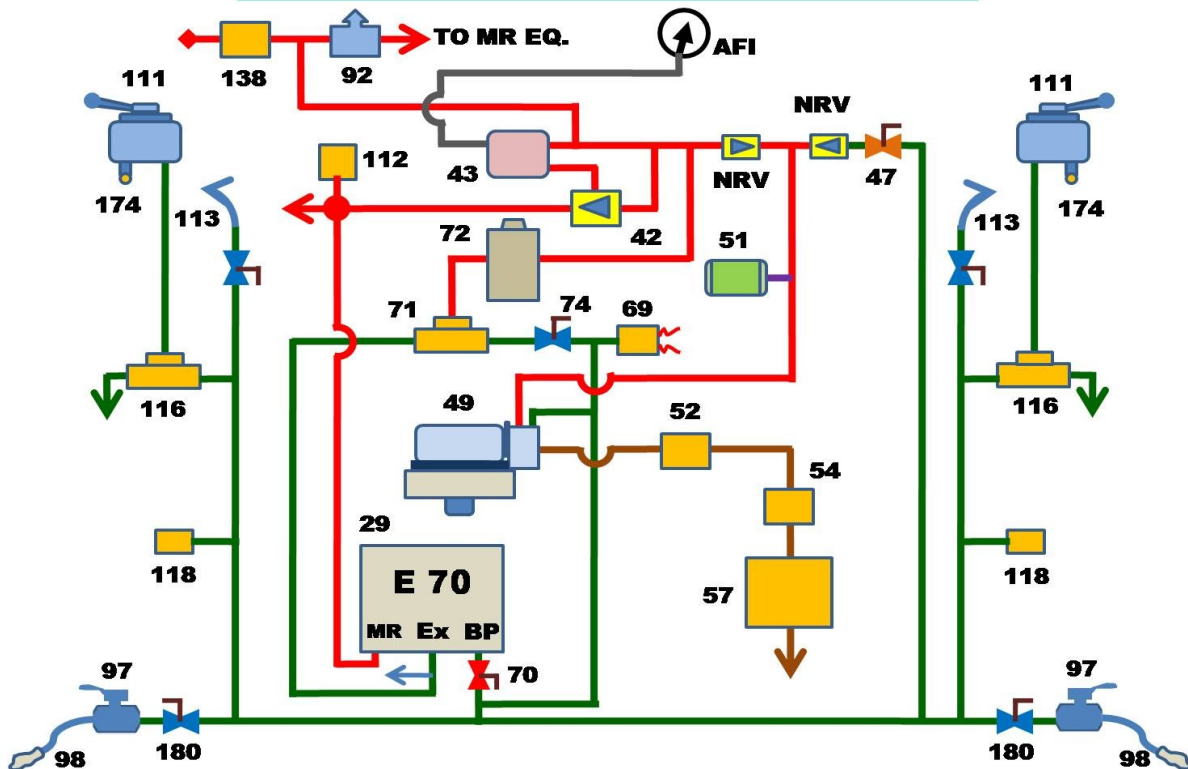
E-70 control unit is a valve which is responsible for charging and discharging pressure of Brake pipe. There are six Nos. of EP valve mounted on E-70 control unit i.e. EP valves. NO- 15, 16, 17,18,19 & 36.According to position of A9 i.e. Release, run, initial application, full service, emergency and neutral. Voltage signal is given to control card of brake electronics.

Accordingly EP NO16 is energized (LED No.3 glowing). MR pressure is received from MR which is reduced by regulator on E-70 (set at 5.6 kg/cm²) and charges control reservoir of E-70 (at the same time pressure transducer on E70 valve monitor the CR pressure and gives feed back equivalent electrical signal to control card of brake electronics).

BP CHARGING CIRCUIT



BP CHARGING CIRCUIT



4.9.2 Direct Brake (SA-9):

To apply loco brakes, Drivers Direct air Brake Valve (SA-9) is provided in both the cabs. The operation of this system is near about same as in case of WAG-5/7. But unlike WAG-5/7 there are no cocks on inlet as well as outlet pipes of Drivers Direct air Brake Valve (SA-9). Instead of cock the EP valves (pilot valves) are provided which keep the Drivers Direct air Brake Valve (SA-9) in service only in active cab automatically.

As a preventive measure, the handle of Drivers Direct air Brake Valve in rear cab should be kept in release position. Unlike WAG-5/7, separate relay valves are provided for loco brakes through Drivers Direct air Brake Valve and loco brakes through conjunction working. So possibility of total

brake failure due to relay valve failure is eliminated. The Drivers Direct air Brake Valve has two positions; APPLY and RELEASE.

Apply:

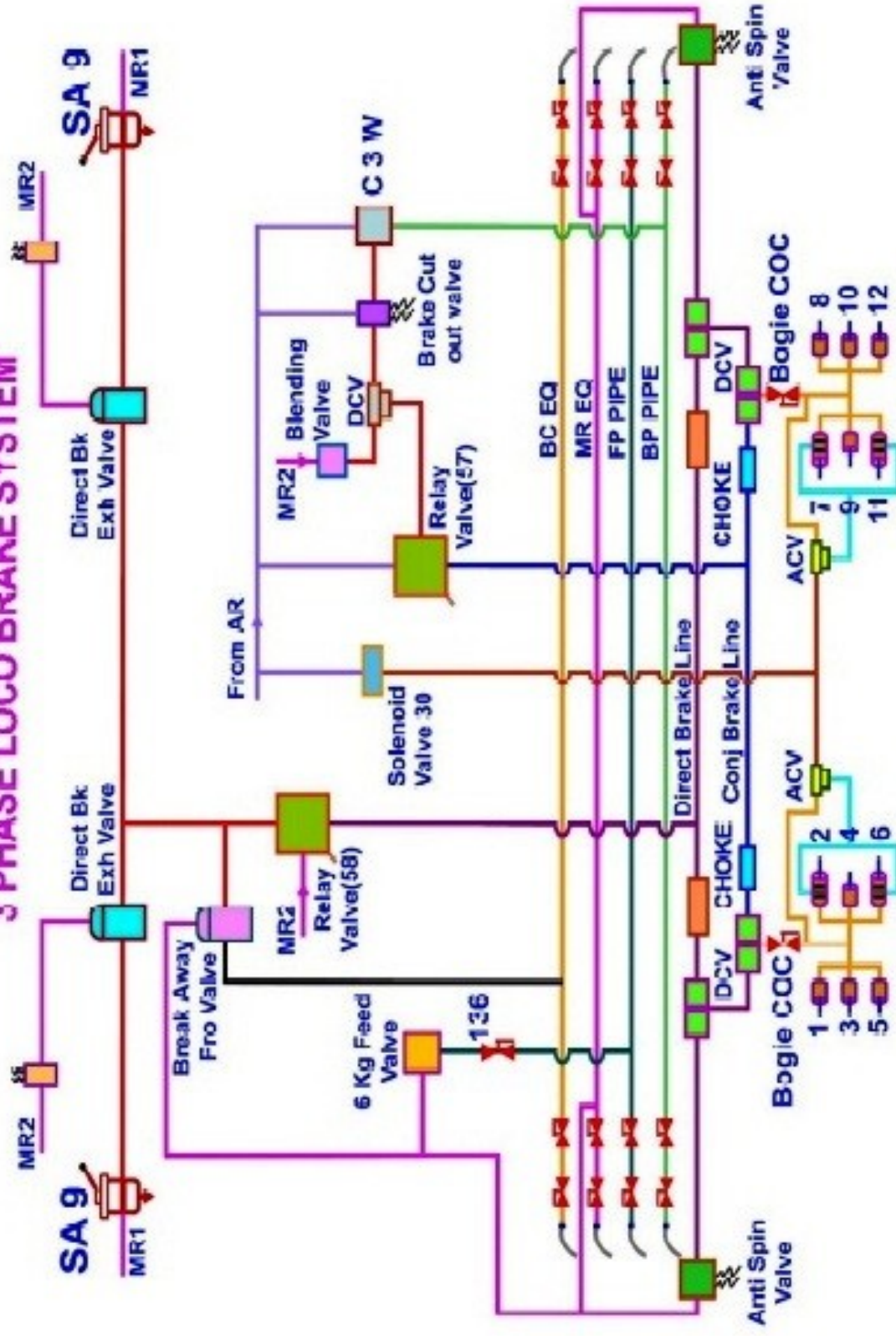
When the driver's control handle is moved to the 'brake on' position, air from the main reservoir admits in the out let pipe which (3.5 kg/cm² max) is further connected to braking relay valve 58. This pressure operates the relay valve so relay valve again allow the MR pressure waiting at its port to the brake cylinders through 2 nos of DCVs and bogie isolating coc. Brake cylinder pressure can be seen in the gauges provided in both the cabs.

Release:

When the driver's control handle is moved towards the 'release' position, it isolates the main reservoir pressure from the relay valve. Simultaneously, allows the pressure from the relay valve to escape to atmosphere through its exhaust port. As the pressure from relay valve get exhausted, relay valve further disconnect the pressure flow from MR to brake cylinder and simultaneously the pressure of brake cylinder get exhausted to atmosphere through exhaust of relay valve.

Any desired releasing stage for the brake cylinder pressure may be obtained according to the position of the driver's control handle. The direct brakes are used to apply loco brakes. In WAP5 direct brake apply on wheel disk with the pressure of 5 kg/cm² whereas in WAG-9/WAP-7 it apply on wheel tyre as conventional loco with the pressure of 3.5 kg/cm². The brake handle remains active only in active driver Cab. Start/running interlock (i.e. regression of TE / BE) is initiated when the speed of loco is above 10 KMPH and BC pressure share in gauge by 0.6 kg/cm² and above.

For isolation of brakes of particular bogie, bogie coc are provided. COC for bogie -1 is provided below machine room -1 above MCP-1 where as COC for bogie -2 is provided below machine room -2 above MCP-2



Brake cylinder gets supply from following:

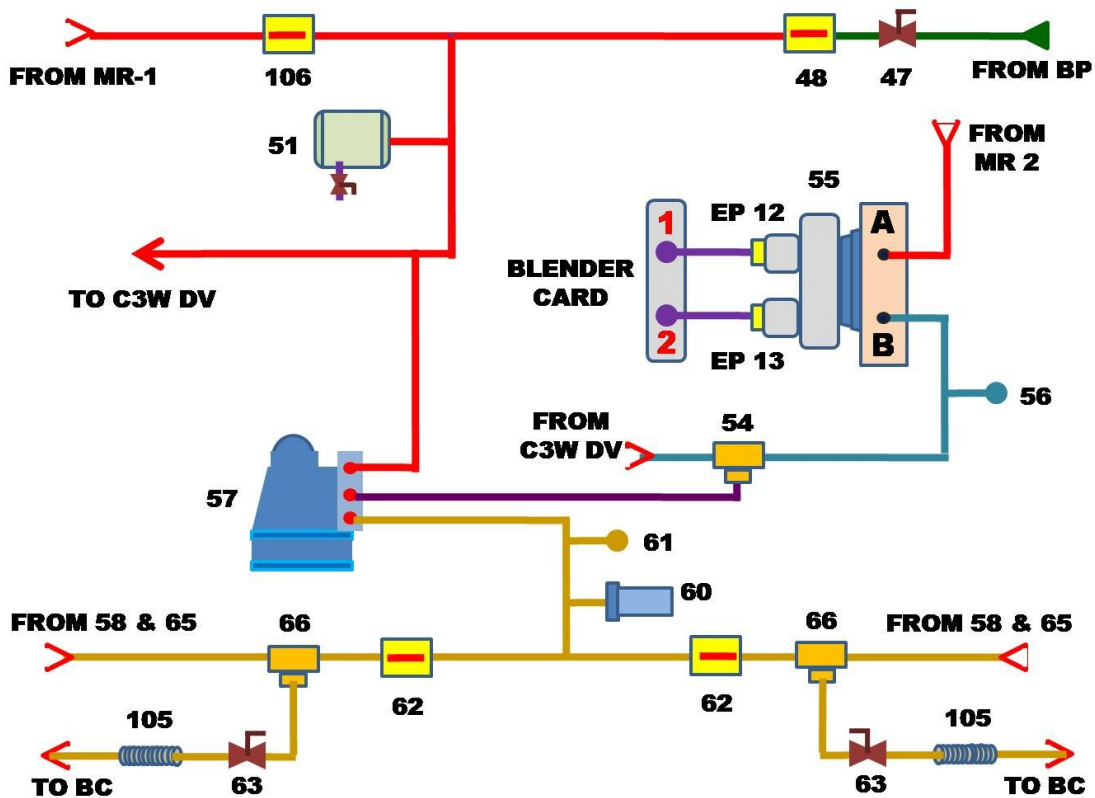
1. From SA-9 through C-2 (58) relay valve (3.5 kg/cm²)
2. From C3W DV in conj. working through C-2(57) relay valve (2.5 kg/cm²)
3. m blending valve (DBR cut off) : in proportion to separate these different pressure paths different DCVs are provided in the path.

To separate these different pressure paths different DCVs are provided in the path.

4.9.3 Brakes Through Blending Valve:

If train is running in regenerative (DBR) mode and suddenly regenerative braking gets cut off automatically due to internal fault or VCB tripping, to compensate regenerative braking, blending valve send the MR pressure in the brake cylinder in proportion. This pressure activates the relay valve (57), further this relay valve allows MR pressure into BC (See figure of loco brake system).

BRAKES THROUGH BLENDING VALVE CIRCUIT



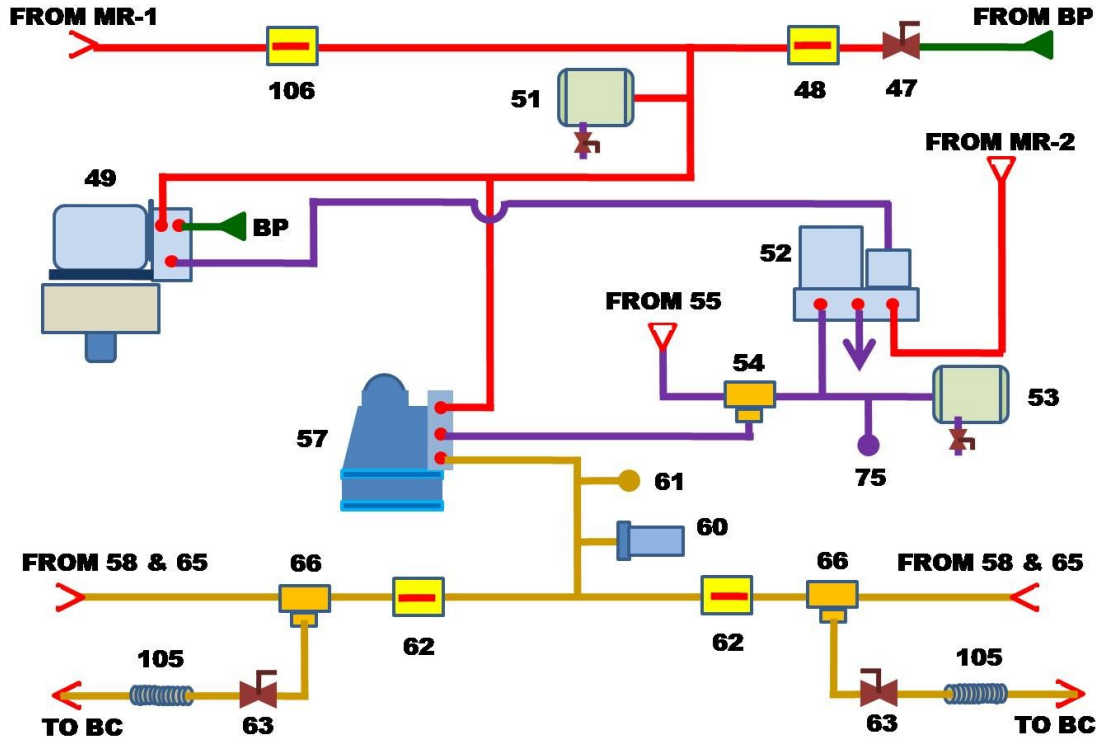
BRAKES THROUGH BLENDING VALVE CIRCUIT

Ref.	Description	Ref.	Description
47	TOWING COCK 3/8"	60	VIGILANCE PRESSURE SWITCH
48	CHECK VALVE WITH STRAINER 1/2"	61	1/2" TEST POINT (VENTED PLUG)
54	DOUBLE CHECK VALVE 1/2"	65	ANTISPIN VALVE
55	EBC/5 BLENDING UNIT	66	DOUBLE CHECK VALVE 3/4"
56	1/2" TEST POINT (VENTED PLUG)	105	HOSE
57	D2 RELAY VALVE (AUTOMATIC BRAKE)	106	CHECK VALVE 1"

4.9.4 Synchronous loco brakes:

Whenever BP pressure drops below its pre- determined value (i.e.5 kg/cm²), distributor valve gets activated and allows MR pressure to activate relay valve (57), further this relay valve allows MR pressure to rush in brake cylinder (2.5 kg/cm²). Like this, when BP restores, DV gets balanced and releases the brakes accordingly.

PROPORTIONATE BRAKE CIRCUIT



PROPORTIONATE BRAKE CIRCUIT

Ref.	Description	Ref.	Description
47	TOWING COCK 3/8"	60	VIGILANCE PRESSURE SWITCH
48	CHECK VALVE WITH STRAINER 1/2"	61	1/2" TEST POINT (VENTED PLUG)
49	DISTRIBUTOR DMD3	62	CHOKE 3/16" BORE
51	BRAKE SUPPLY RESERVOIR 240 LITRES	63	ISOLATING COCK 3/4" VENTED
52	BRAKE CUT OUT VALVE	66	DOUBLE CHECK VALVE 3/4"
53	CAPACITY RESERVOIR 5 LITRES	75	1/2" TEST POINT (VENTED PLUG)
54	DOUBLE CHECK VALVE 1/2"	105	HOSE
55	EBC/5 BLENDING UNIT	106	CHECK VALVE 1"
57	D2 RELAY VALVE (AUTOMATIC BRAKE)		

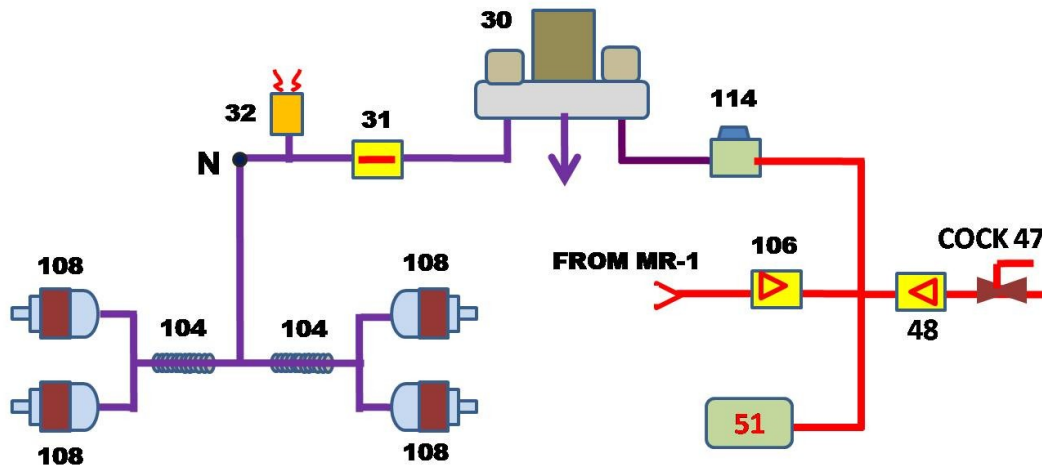
4.9.5 Parking Brake

In 3-phase loco, hand brakes are not provided. For parking the loco a new type brakes are available on this loco, called parking brake. The great feature of parking brake is that, it remains applied to indefinite time as per your requirement in absence of air pressure.

Its function is just opposite to that of conventional brakes. i.e. it remain release when there is 6 kg/cm² pressure in parking activator and get applied when pressure exhausted below 3.8 kg/cm² in parking activator. But the brakes are applied through the same brake block of conventional loco brakes.

Parking brakes are provided on Wheel No.2-6-7-11 (WAG-9) and on wheel no. 1-4-5-8 in WAP-5 loco.

PARKING BRAKE CIRCUIT

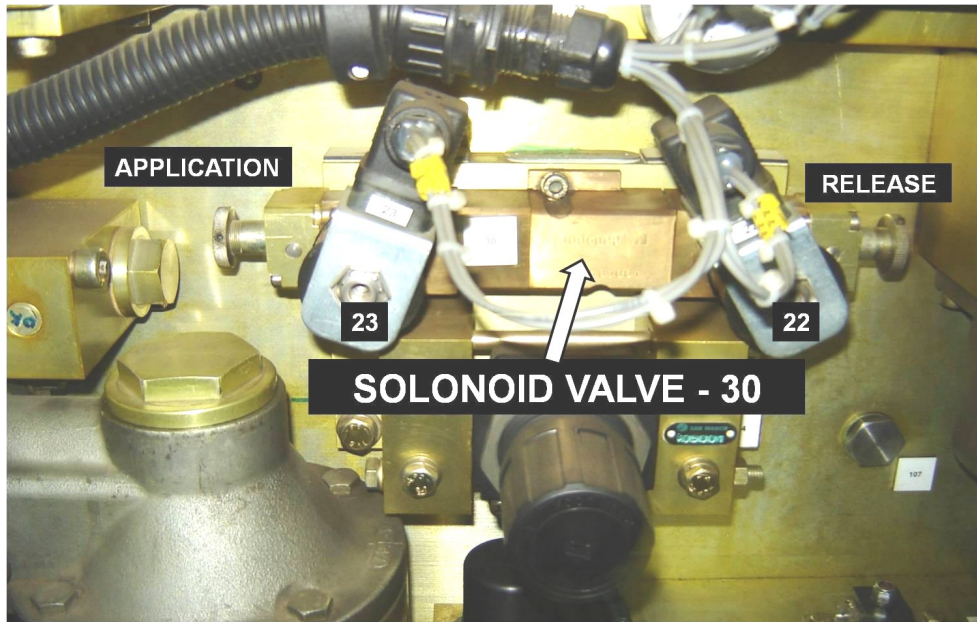


Ref.	Description	Ref.	Description
30	LATCHED SOLENOID VALVE (PARKING BRAKE)	104	HOSE
31	CHOKE	106	CHECK VALVE 1"
32	PARKING BRAKE PRESSURE SWITCH	108	COMBINED BRAKE CYLINDER/PART BRAKE UNIT WITH SLACK ADJUSTER
		114	PRESSURE REGULATOR 1/2"

Applying Parking Brake

1. Press push button BPPB ('A' panel), a red lamp illuminated in it. Due to which 6 kg/cm² air in parking activator get exhausted and the PB gauge show '0' kg/cm² which indicates the application of P.B. (this is possible only when CE is ON) **OR**
2. Press 'Apply' push button on parking brake valve solenoid 30/23, BPPB red lamp will glow, P.B. pressure gauge show '0' kg/cm² and PB get applied. (This is possible when there is MR / AR pressure in the loco and lamp will glow if CE is ON) **OR**
3. When 'BL' key is moved from 'D' to ' OFF ', parking brakes get automatically applied through control electronics. BPPB will not be illuminated since CE in 'SELF HOLD MODE' but P.B.gauge will show "0" kg/cm²

Note:- parking brake can not be activated by BPPB, when speed exceeds 5 KMPH.



Releasing Parking Brake:

1. Press BPPB illuminated red button once red lamp will get extinguished and 6 kg/cm² pressure enter in parking activators which can be seen in PB gauge indicating that PB are released - **OR** -
2. Press "Release" push button (22) on parking brake solenoid 30, BPPB red lamp will be extinguished, air will be admitted in parking activator and gauge will show 6 kg/cm² pressure - **OR** -

3. Pull “parking brake release spindle” provided on parking brake cylinder on wheel No.2,6,7,11. (for WAG-9) and on wheel no. 1-4-5-8 (for WAP-5 locos.) The lock of PB will open and piston return to release position due to resetting spring at that time. releasing sound will be heard.

Note: If PB are released through manual lever, BPPB will not extinguished in Energized loco and driver may get indication of application of PB and throttle will not respond, in such case press BPPB to release PB even though PB are released manually.

- Ensure releasing of PB by physically shaking the brake block.

-
in applied condition , but once the brakes get released , then PB cannot be applied again until the loco takes on pressure. So, while shunting the dead loco and stabling there after, this fact should be kept in mind and loco should be secured properly by wooden wedges as local hand brakes are not provided in the loco.

Locking Of Parking Brakes:

- Parking brakes can be locked in applied or in release condition for this purpose locking arrangement is provided on release and application plunger of solenoid valve 30.
- If plunger is pressed and then rotate, it will be remain in that condition until you unlock it by again rotating it and taking out the plunger out side.
- For locking the parking brake, follow the instructions of the division if any; otherwise don't lock the parking brakes.

Note:- Now a day's some WAG-9 locos are provided with conventional hand brake instead of Parking Brake.

4.9.6 FAILURE OF BRAKE ELECTRONICS:

Whenever brake control electronics get failed a priority-1 message (F1001P1) will appear on the screen with emergency brake application.

One circuit breaker (127.7) is also provided in SB-1, if this circuit breaker is tripped same symptoms will appear.

4.9.7 Regenerative Braking:

This is an electrical braking system in which brakes are applied on loco without physical application or brake block failure.

1. Brake block does not apply on wheel so wheel and brake block wear is eliminated.
2. Reliable braking.
3. Smooth controlling.

4. Energy generated during braking is fed back to OHE i.e. it works just like a small power station and helps in energy conservation.
5. Braking is available up to 0 KMPH.

When throttle is put to BE side, traction motor work as generator and generates 3-phase, AC supply which is converted into DC supply by driver converter and fed to line Converter through DC link. In line converter this DC supply is again converted into single phase/AC supply in such a way that it induces supply equal to line voltage in main transformer through converter, which later on fed to OHE through VCB and pantograph.

At the time of Regenerative braking, the TE / BE meter deviates down ward in RB mode.

- ❖ If the RB fails during braking operation the independent loco brakes automatically takes over its function in proportion to RB force through blending valve.
- ❖ Even if the RB and Pn brakes applied together due to fault in the system, excessive braking of loco is avoided because the anti spin slides control system reduced the electrical braking effort.
- ❖ You can use the regenerative braking from full speed to '0' speed.
- ❖ As train loco can be stopped only by using regenerative braking, there is a possibility of non Application of loco brakes, here one thing should be noted that loco can be stopped but cannot be held by regenerative braking. So, don't forget to apply loco /train brakes at halt/ stop.
- ❖ As already explained it feeds back to OHE during regeneration, so, Use RB as more as possible and generate the energy.
- ❖ Also note the readings at the time of CTO & CHO to calculate energy conservation by you.

4.9.8 An Emergency Braking Operation

Emergency brakes will apply through brake electronics when:

1. Response from the Vigilance module
2. Permitted maximum speed being exceeded
3. Moving of the driver's brake handle to position EMERGENCY [automatic train brake]
4. Actuation of the emergency brake cock on the assistant driver's side
5. Actuation of the emergency stop push button on the panel A
6. Failure of the electronic brake control system
7. Train parting

Note :

The emergency stop button is only active in the activated driver's cab. However its function

is not dependent on the speed of the locomotive. When the emergency stop button is pressed, the VCB opens and the pantograph is lowered along with BP drop and TE/BE "0".

Emergency braking is actuated directly in all cases and is not controlled by the MCE. However, the MCE responds to emergency braking by reducing tractive

effort to 0. If an emergency braking operation is triggered in multiple operation, it is transferred to the slave locomotive also.

4.10 Miscellaneous

4.10.1 Pantograph:

Two pantographs are provided on either end of loco. Design of pantograph is same as other AC locos. For raising and lowering of pantograph one switch 'ZPT' is provided on panel 'A' having 2 positions, UP and DOWN.

When we press switch down ward (i.e position UP) and release - panto will up.

When we press switch upward (i.e position DOWN) and release - panto will lower.

Note: The rear panto will rise automatically.

Selection Of Panto:-

Panto selector switch (85) is provided on Pneumatic Panel in machine Room

Position:

'Auto' - Normal position (only rear panto will raise)

" I " - Panto of Cab-1 will raise (2 will isolate electrically)

" II " - Panto of CAb-2 will raise (1 will isolate electrically)

For isolation of both panto pneumatically, there are two COCKS provided on Pn. Panel. PAN-1 & PAN-2. Normally these coc should be opened (Horizontal).

For isolating particular panto keep that coc on closed position (i.e Vertical) One circuit breaker (127.12 Circuit breaker Pantograph, VCB Control) is provided for panto circuit in SB-1 cubicle.

Key IG-38 is provided on pneumatic panel to control the air pressure to Pantographs. For air passage to pantographs this key should be kept ON (horizontal)

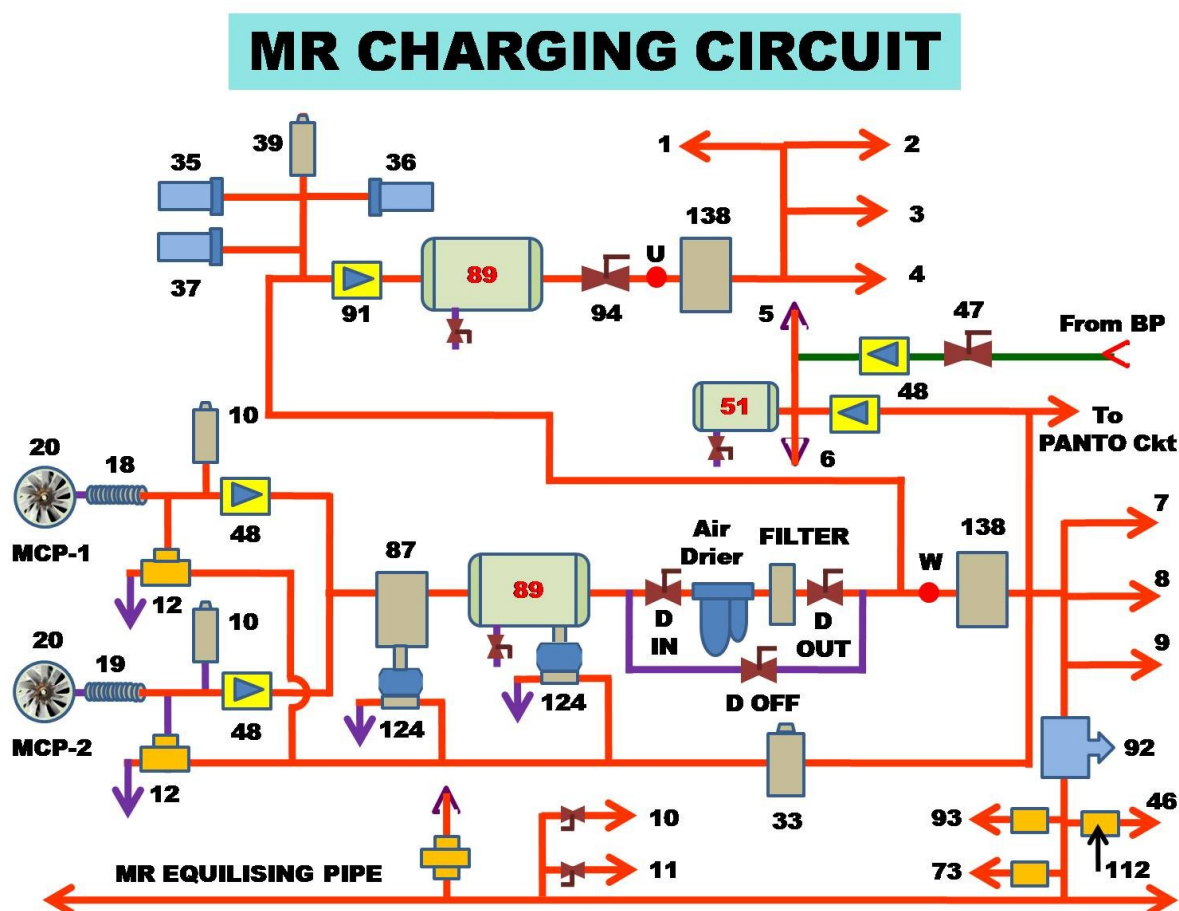
4.10.2 Pneumatic circuit

Two compressors are provided on the loco to build up air pressure. In this system two main reservoirs and one auxiliary reservoir are provided. When BLCP is in 'AUTO' position compressors starts working and build up pressure in the reservoirs (cut in / cut out is 8.0 – 9.5 kg/cm²). During cut in cut out time the compressors are connected to the atmosphere by the unloader valve, CDC and an auto drain valve opens and closes automatically which is connected to MR-1.

Compressed air from the compressors is allowed to pass through a separate after cooler and stored in MR-1, MR-2. Safety valve is set at 11.5 kg/cm² and is provided between each compressor and main reservoirs. To avoid air pressure entering from MR to CP, separate NRV's are provided in the pipe line after the after cooler. A safety valve set at 10.5 kg/cm² is provided between MR-1 and MR-2. Two NRV's are provided one in between MR-1 and MR-2 and another between MR-1 and AR.

4.10.3 Main Reservoir –

For storage of compressed air pressure MR's are provided on this loco. In WAP-7 & WAG-9 loco, two MR's and one AR is provided in machine room in vertical manner. Capacity of MR is 450 litres & AR is 240 litres. Drain COC is provided below each MR, which can be operated from machine room. In WAP-5 three MR's & AR are located in under truck and each MR & AR having capacity of 240 litres.



MR CHARGING CIRCUIT

Ref.	Description	Ref.	Description
10	SAFETY VALVE ¾"	91	CHECK VALVE 1¼"
12	UNLOADER EXHAUST VALVE 1"	92	DUPLEX CHECK VALVE 1¼"
18	COMPRESSOR DELIVERY HOSE	93	PRESSURE CONTROL VALVE
19	COMPRESSOR DELIVERY HOSE	94	LATCHED ISOLATING COCK 1¼"
20	MAIN COMPR'R WITH MOTOR	112	DRIVERS BRAKE VALVE FD1
33	E.P. VALVE UNLOADING	124	AUTO DRAIN VALVE
35	COMPRESSOR PRESSURE SWITCH	138	PRESSURE REDUCING VALE
36	COMPRESSOR PRESSURE SWITCH	➔ 1	TO 115 DIRECT BRAKE ISOLATING VALVE
37	LOW MAIN RESERVOIR PRESSURE SWITCH	➔ 2	MR SUPPLY TO 58 VALVE
39	SAFETY VALVE ¾"	➔ 3	TO BRAKE CYLINDER CUT OUT VALVE 52
46	BREAKAWAY PROTECTION VALVE	➔ 4	MR SUPPLY TO BLENDING VALVE 55
47	TOWING COCK 3/8"	➔ 5	TO SOLENOID 30 VALVE
48	CHECK VALVE WITH STRAINER ½"	➔ 6	TO E 70 VALVE
51	BRAKE SUPPLY RESERVOIR 240 LIT.s	➔ 7	TO AIRFLOW CIRCUIT
65	ANTISPIN VALVE	➔ 8	TO FEED PIPE CIRCUIT
73	SANDING VALVE	➔ 9	TO SA-9 CONTROL PRESSURE
87	OIL SEPARATOR/DRIP CUT WITH AUTO DR. VALVE	➔ 10	TO HORN CIRCUIT
89	MAIN RESERVOIR 450 LITERS LEFT HAND	➔ 11	TO WIPER CIRCUIT
90	DRAIN COCK 3/8"		

Auxiliary Compressor - (MCPA)

The auxiliary compressor is used to raise the pantograph. While the control circuit. is switched 'ON, the auxiliary compressor controlled by pneumatic switch (172.4) starts automatically (independent of MCE) till the pressure reaches to 6 kg/cm². Auxiliary compressor has one drain cock on pneumatic panel. Normally this cock should be parallel to pipe line. (i. e. closed)

Usage of MR-1

Air from MR-1 is taken after Air dryers through a duplex valve set at 5.0 kg/cm² to the MR equalizing pipe and then air is supplied to sanders, wipers, Break away valve & also to the feed pipe (FP) through a feed valve (6.0 kg/cm²) with cutout cock (136). From MR-1 air supply is taken after Air Dryers through to charging BP pressure via E 70, AMV, venturi valve. It also to the panto servo motor through IG 38, panto electro valves and throttle valve.

Compressed air is also supplied to RDJ for the operation of DJ through DJ cock. Pressure switches are provided on panto pipe line to trip DJ and lower panto when the air pressure drops below 4.51 kg/cm² in panto pipe line. Air is supplied to SR-1, SR-2, WFL and FB for the operations of pneumatic contactors after limiting to 6.0 kg/cm². NRV is provided after the line filter of MR-1 to avoid the pressure escaping from RS to the main reservoir whenever on usage. This RS pressure is used for initial energisation. An auxiliary compressor (CPA) is provided with drain

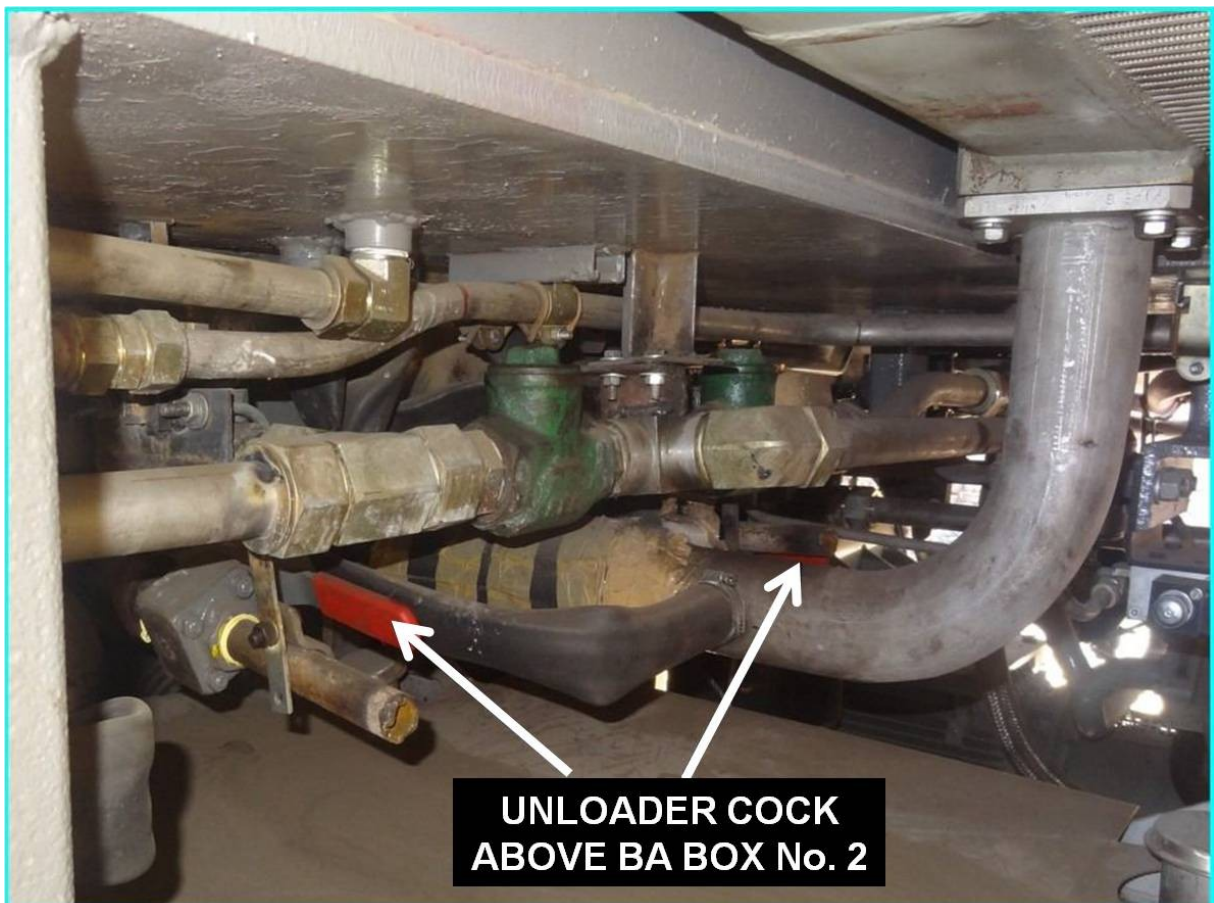
cock and safety valve, to build up pressure in RS (5 litres) for initial charging, for raising the panto and closing DJ. It is provided with a gauge.

Use of Auxiliary Reservoir

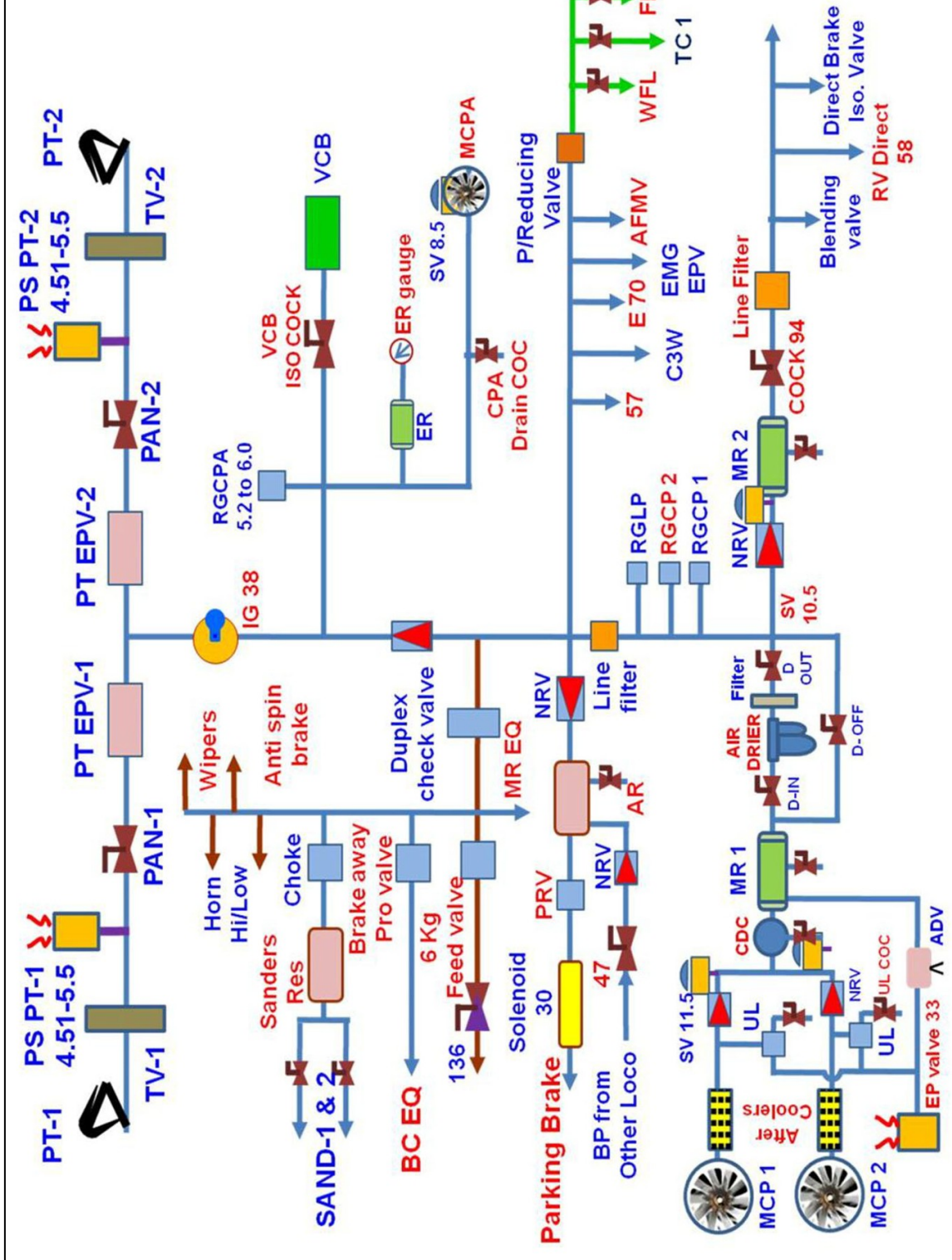
From MR-1 air supply is taken to auxiliary reservoir with NRV. From the control reservoir air pressure is supplied to C3W DV, C2RV for conjunction brake application and parking brakes cylinders through solenoid 30 valve after limiting to 6.0 kg/cm². The AR is also charged with BP pressure through 47 cock during dead loco operation. Normally 47 cock should be in closed condition.

Usage of MR 2

From MR 2 air pressure is supplied to air brake system with 94 cock for air brake operation via C2RV direct brake.



3 Phase Loco Air Circuit



4.10.4 Memotel (Speedometer)

For indicating the speed of the loco, memotel type speedometer is provided in both the cab.

Speed is indicated by both needle as well as LCD screen of SPM.

For Data entry one push button “A” is provided on SPM

When push button ‘A’ is pressed repeatedly following function done. (8 digits) in sequence.

Speed	: kmph
Time	: HH:MM:SS
Date	: DD:MM:YY
Distance covered	: Km
Encoded fault message	: -----

Aprox 10 seconds after push button 'A' is released time or speed is displayed automatically.

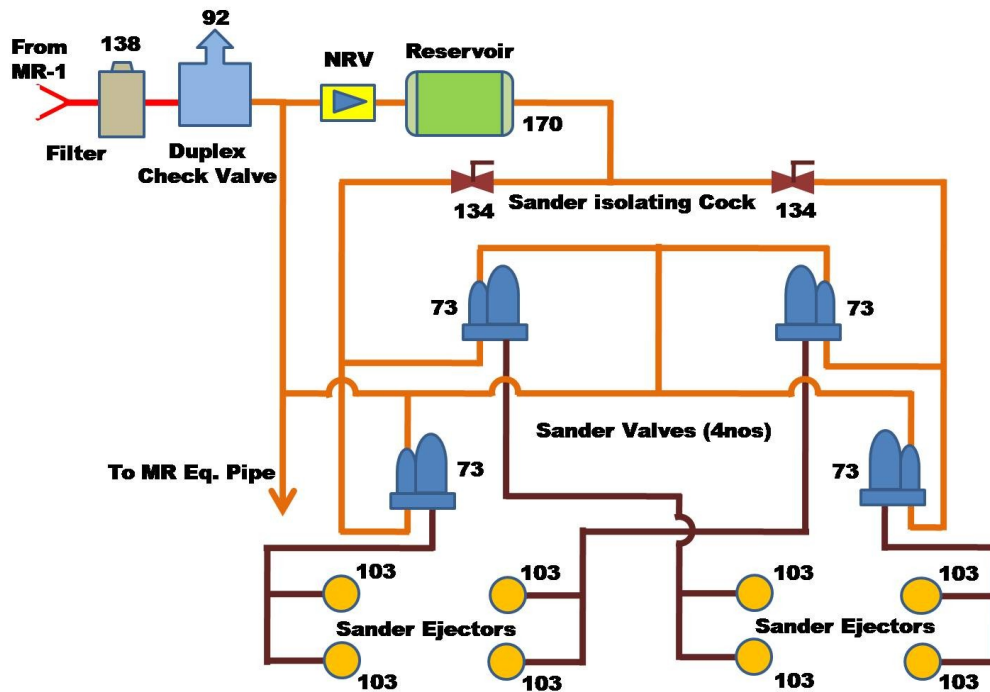
4.10.5 Sanding:

Sanders will work only by pressing foot switch of sander (PSA).

Note :

Don't press PSA continuously, but press and release it. Continuous sanding is not possible, If PSA pressed continuous for 1 minute, then dead mans penalty brakes will apply. 10-12 sec pause is required between two operations of PSA.

SANDING EQUIPMENT CIRCUIT



4.10.6 Control Electronics [Micas-S2]

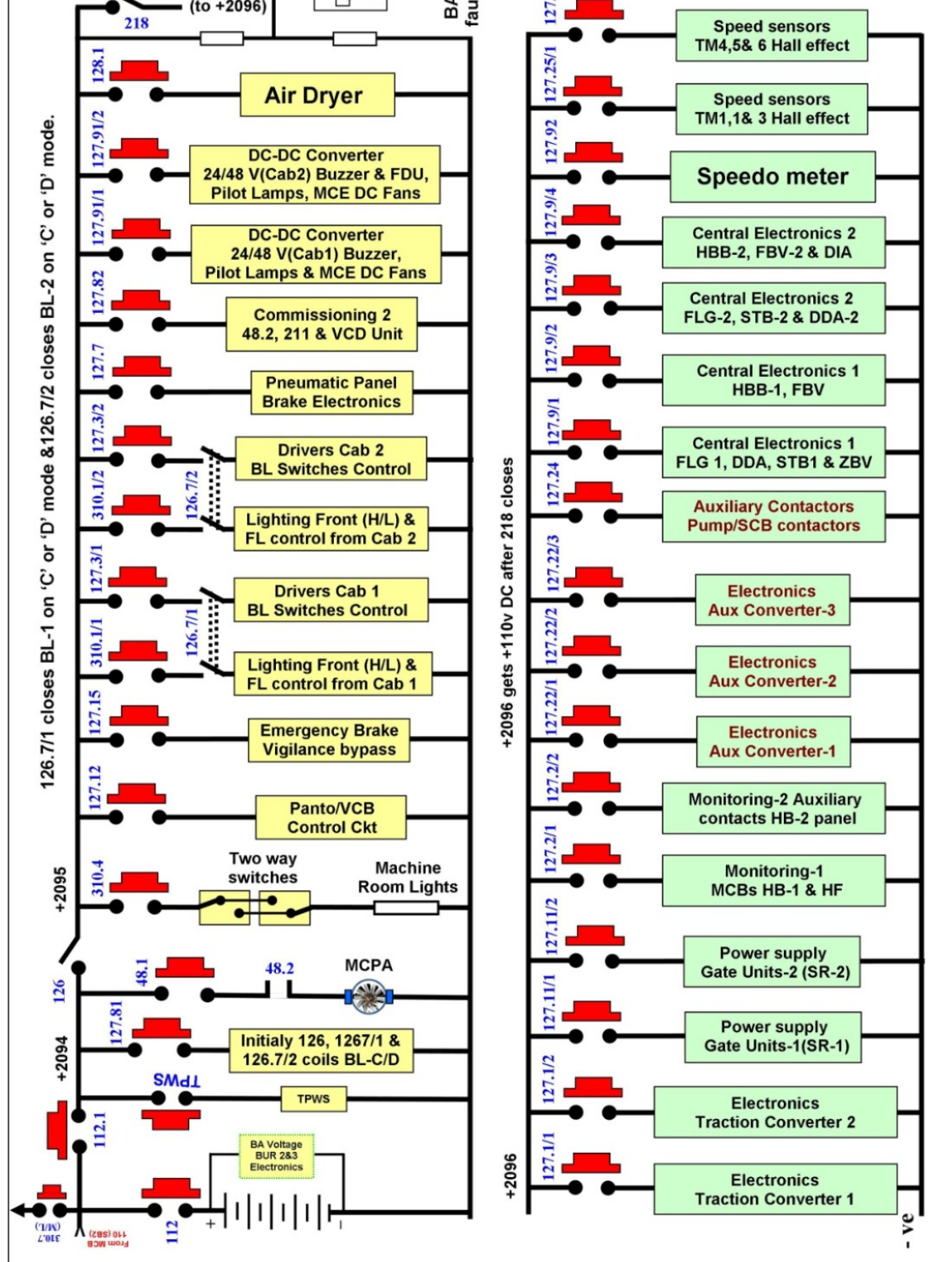
All functions of the locomotive are controlled by the control electronics. It takes the form of bus stations with processors.

The bus stations communicate with each other via fiber optic Cables which are resistant to the effects of Electro Magnetic Interference [EMI]. The diagnostic equipment comprises a diagnosis computer with monitor and keyboard in the driver's cab. This provides an effective support for the duties of the locomotive driver and maintenance personnel.

Control Electronics

The messages in BHEL make (IGBT + TCN based network) Locos will be displayed as given below (Example: ICP1 instead of FLG1).											
SL N O	MICAS	TCN- BHEL	MEDHA	SL N O	MICAS	TCN- BHEL	MEDHA	SL N O	MICA S	TCN- BHEL	MEDHA
1	FLG1	ICP1	MCC1	2	SLG1/2	VIU1/2	LIC1/2	3	STB1	RBU1	Not availabl e (MCC1/2 control)
4	FLG2	ICP2	MCC2	5	NSC1/ 2	DCU1/4	& 3/4	6	STB2	RBU3	
7	BUR1/2/ 3	AC11/2/ 3	ACC1/2/ 3	8	ASC1	DCU2& 3	TIC1/2/ 3	9	HBB1	RBU2	
10	DDA1/2	DDU1/2	DMC1/2	11	ASC2	DCU5& 6	TIC4/5/ 6	12	HBB2	RBU3	

110 Volt DC MCB Control Circuit :



4.10.7

Active functions with deactivated driver's cab

While the cab deactivated [key switch in position 'O'], the following functions remain operative.

4.10.7.1 MEMOTEL functions

- 4.10.7.2 Catenary voltage display
- 4.10.7.3 Emergency brake cock on assistant driver's side
- 4.10.7.4 Cab and desk lighting
- 4.10.7.5 Windshield wipers
- 4.10.7.6 Fault display screen
- 4.10.7.7 Marker lights switches
- 4.10.7.8 Cab venting and heating
- 4.10.7.9 Crew fans
- 4.10.7.10 Hand lamp socket

4.10.8 Resetting of MCB

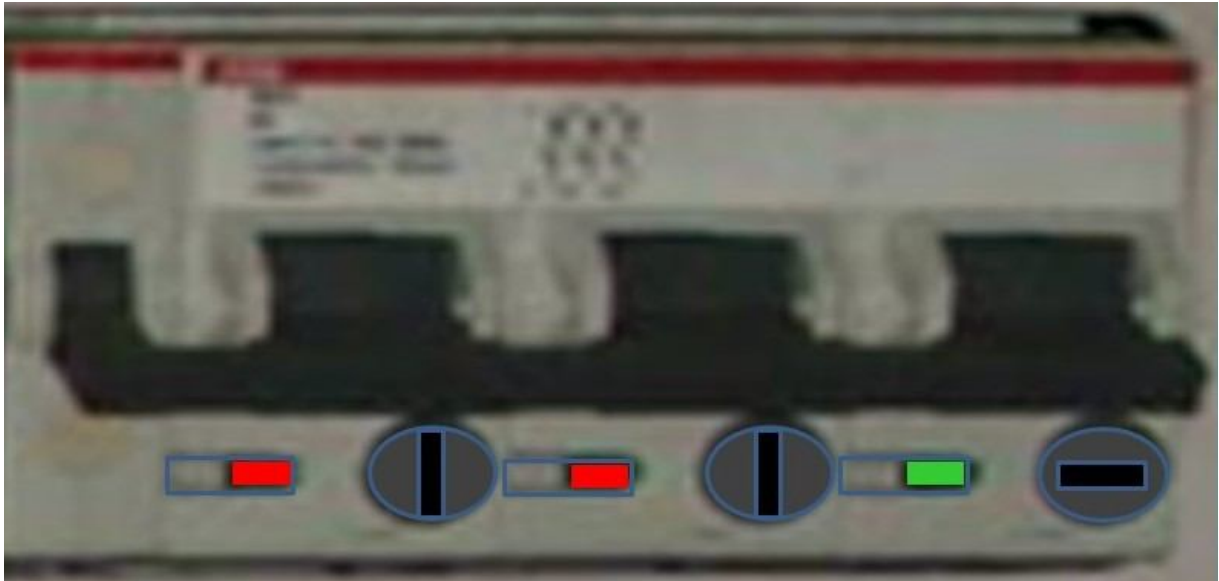
ABB MAKE -

Sometimes MCB trips momentarily without any equipment failure. Loco pilots should try to reset MCB once. While resetting ABB make MCB, resetting screw below the respective circuit breaker turns to horizontal position from initial vertical position. This screw should be turned to vertical position first and then, MCB should be reset by lifting its handle. If it is needed to trip any MCB, trip it with proper procedure i.e. by rotating screw.

SET POSITION



TRIP POSITION



MCB Resetting –ABB Make (BATTERY MCB)



TRIPPED MCB



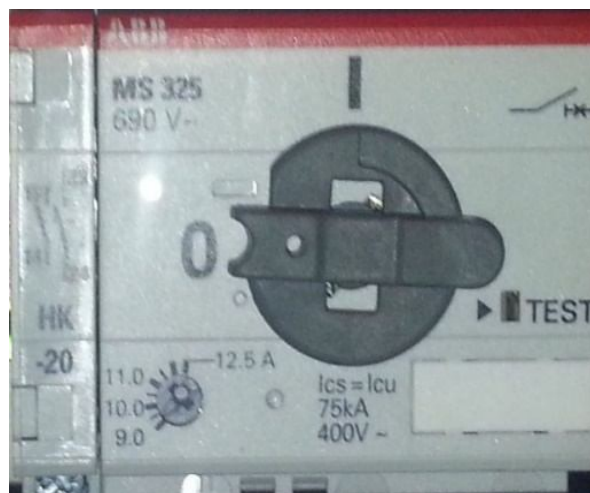
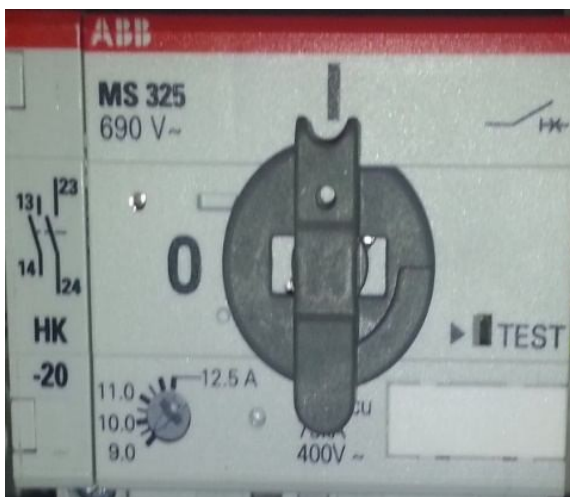
OFF CONDITION

ON CONDITION

Press on white
button to trip
MCB

SET CONDITION

TRIP CONDITION



MG MAKE –

For resetting MG make MCB, handle should be pulled first downward towards OFF side and then in upward direction towards ON to reset the MCB, otherwise the MCB will not hold. If it is needed to trip any MCB, trip it with proper procedure i.e. by pressing tripper knob provided on MCB. Don't trip any MCB directly and in VCB closed condition.



ON

Tripped



OFF

SCHNEIDER MAKE –

SET condition – Green or Black plunger in pressed condition TRIP



TRIP condition – Red plunger in pressed condition



4.10.9 Flasher light

1. Automatic flasher light system is provided
2. One additional flasher light unit is provided in cab at Asstt side, ensure that switch provided on it is at ON
3. To switch on the flasher rotate the switch provided on panel –C
4. Note that flasher glows only when CE is ON or in cooling mode.
5. If on line CE gets off and at the same time if flasher is required then, switch ON it in cooling mode.
6. Note that in panto's down condition, CE remains ON only for 10 minutes after that CE will get off automatically. So, in such cases (like accident), flasher should switch ON in cooling mode.

Testing of automatic flasher light

1. In energize loco, ensure that BP is 5 kg/cm² and Set the reverser as per requirement.
2. Drop the 0.6 to 1.0 kg/cm² BP for 1 minute by opening ALP's emergency brake valve or by opening BP angle coc.
3. Ensure the following indications
 - ACP message of P-2 will appear on screen.
 - LSAF will glow.
 - Buzzer will sound.
 - BPFL light will flicker.
 - Flasher light will flicker.
4. Recharge the BP by closing BP angle coc or ALP's emergency brake valve, all above indication will disappear, acknowledge the fault by BPFA.
5. Apply A-9 to minimum reduction and full service and release, auto flasher light should not glow. If during normal operation of A-9 auto flasher light glows or if it does not glow during above testing, Inform the TLC/TRS staff.

4.11 KNORR's Computer Controlled Brake System (CCB 1.5)

In some WAG-9 locos KNORR type brake system is provided which is different from conventional brake system of WAG-9 locos. In conventional loco, loco get failed in case of brake electronics failure. But in this loco, block section can be cleared by 10 KMPH in case of failure of brake electronics.

CHANGES IN CAB

1) Pilot lamp panel

One panel of 6 pilot lamps is provided beside panel-C which is as under:

- a) Exclusive Flow:** This is a Red colored pilot lamp, glows when MR pressure is less.
- b) PCR open:** This is a Red colored pilot lamp, glows when BP pressure is less.
- c) PER action:** This is a Green colored pilot lamp, glows when PTDC (Pneumatic Time Dependent Control) is in service.
- d) EAB fail:** This is a Yellow colored pilot lamp, glows when brake electronics failed and PTDC in service.
- e) P-16 action:** This is a Green colored pilot lamp, glows when DV is isolated.

f) SIFA cut off: This is a Yellow colored pilot lamp, glows when COC- 74 is closed

2) Changes in Auto brakes and Direct Brakes:

In case of conventional system, A-9 / SA-9 handle has to be operated from left to right, but in this system handle has to be operated forward and backward like throttle. Both valves are provided on left side of loco pilot on control stand.

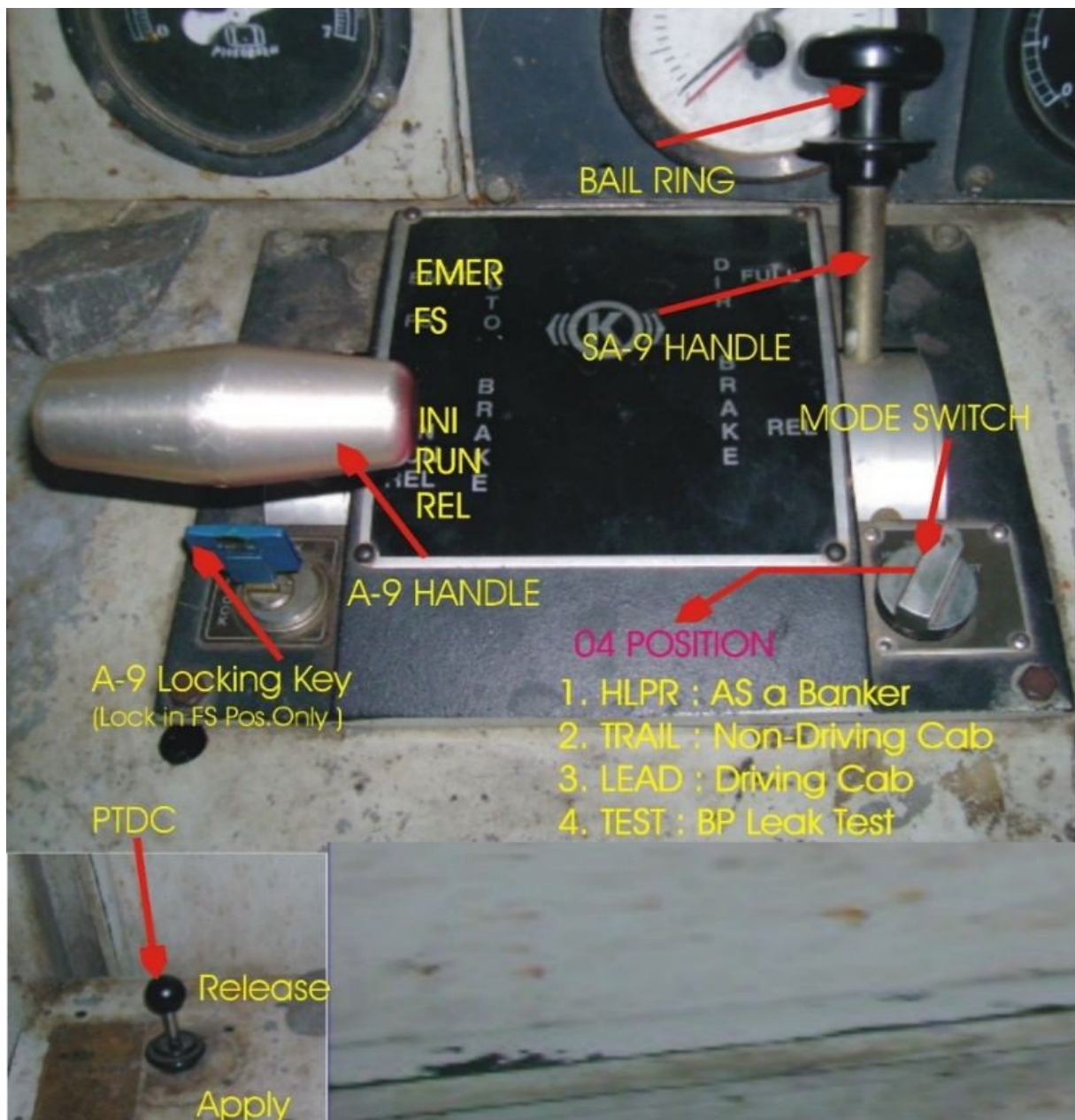
a) SA-9 Direct Brake:

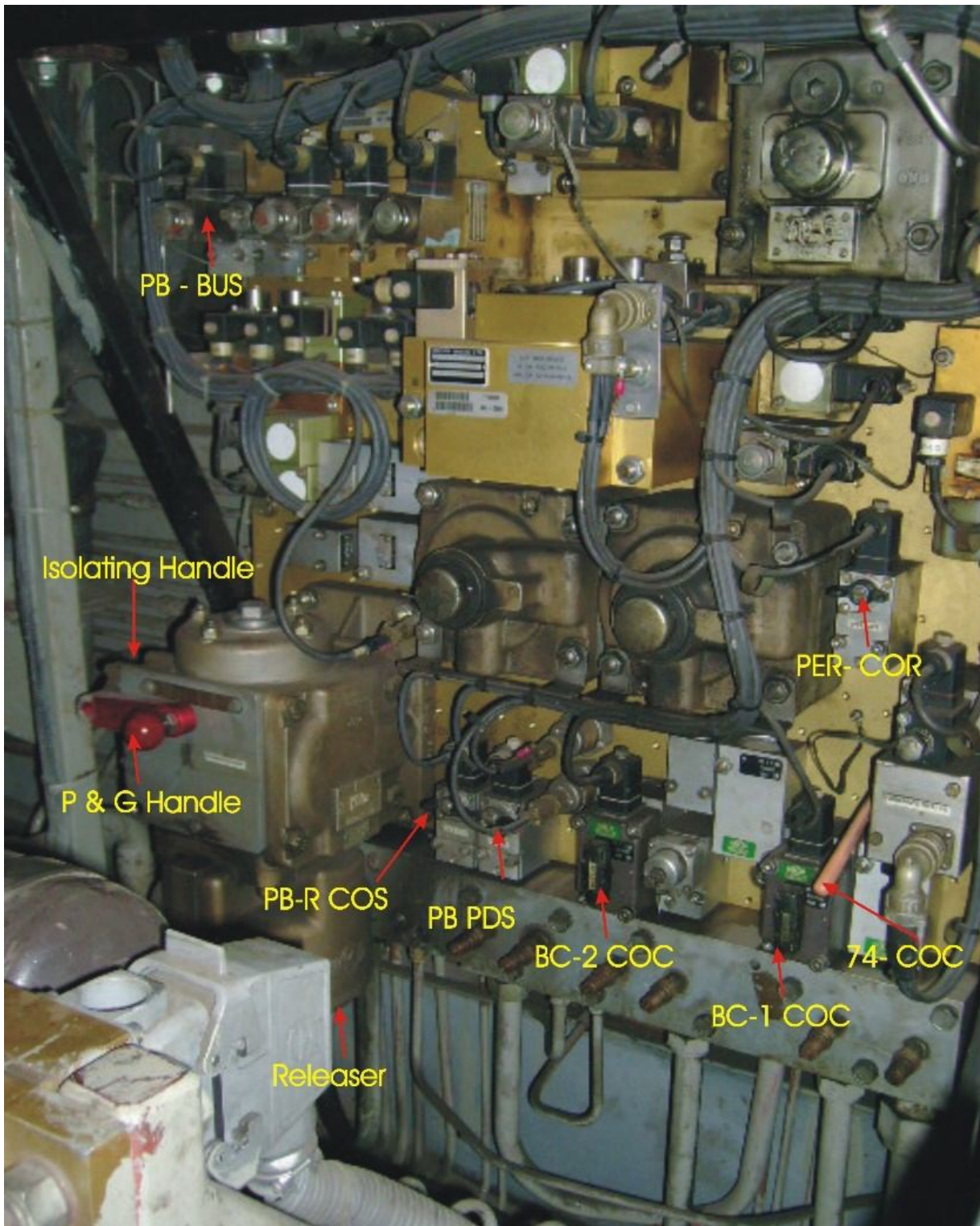
SA-9 has two positions; Applied and Release. One spring loaded clip called “Bail Ring” is provided below the handle of SA-9. If this clip pressed and released, synchronized brakes get released very fast where as brakes get released gradually if PVEF is pressed.

b) A-9 Auto brake:

handle can be locked or unlocked in FS (Full service) position by a key provided in each cab and coupled with a chain. Non-driving cab A-9 is kept on FS-locked condition where as driving cab A-9 is kept in RUN condition. While clearing loco as dead both A-9 are to be kept on FS-locked condition. A-9 handle has following 5 positions.

- i) REL-Release:** In this position BP pressure is over charged to 5.5kg/cm² and drop down automatically after some times with restricted flow to 5.0 kg/cm². This position is used for quick releasing of BP.
- ii) RUN:** This is the normal position of A-9 on which BP is charged to 5.0 kg/cm². At the time of recharging after application, BP is overcharged by 0.2 kg/cm² at this position for short time.
- iii) MIN.(Minimum Reduction):** BP pressure remains 4.5 kg/cm².
- iv) FS (Full Service):** BP pressure drops to 3.0 kg/cm². A-9 handle can be locked or unlocked in this position.
- v) EMER. (Emergency):** BP drops to zero kg/cm² on this position.





a) Mode switch:

One rotating switch called mode switch is provided in each cab below SA-9 valve. This is spring-loaded switch and can be operated by pressing downward. This switch has following 4 positions.

- i) HLPR:** While using loco as banker, this switch should be kept at Help position on this mode in addition to ZBAN at ON.
- ii) TRL (TRAIL):** In non-driving cab (SU / MU), this switch should be kept on TRL position.
- iii) LEAD:** In driving cab (SU / MU), this switch should be kept on LEAD position, then BP will be charged 5.0 kg/cm².
- iv) TEST:** In this position BP leakage test is done. When this switch is kept on TEST position, Loco brakes get applied. This switch should be kept on lead position immediately after testing.

b) Pneumatic Time dependent Control (PTDC):

In this loco SA-9 and A-9 are governed by brake electronics. In case of failure of brake electronics train can be worked by max.10 KMPH by PTDC. This is provided in each cab near A-9 / SA-9 and has following 2 positions.

- i) Release and ii) Apply.
- PTDC is having one coc, which should always be in open condition.

PROCEDURE of clearing block section by using PTDC:

-
- Open the DJ, Lower the panto and switch OFF CE.
- Trip the MCB 127.7 (SB-2) and ensure that MCB 127.15 (SB-2) is in ON condition.
-
- vertical position.
- Keep A-9 of working cab on RUN.
- If BPFA is glowing, then acknowledge the fault.
- Switch ON to CE and raise Panto, close VCB (DJ)
- Keep PTDC on release position and ensure that BP is 5.0 kg/cm² and BC is "0" kg/cm².
- If BC pressure does not come to '0' then release by distributor valve.
-
- per requirement and clear the block section by 10 KMPH.

Bring thr

On Pneu

To apply

CHANGES IN UNDER TRUCK:

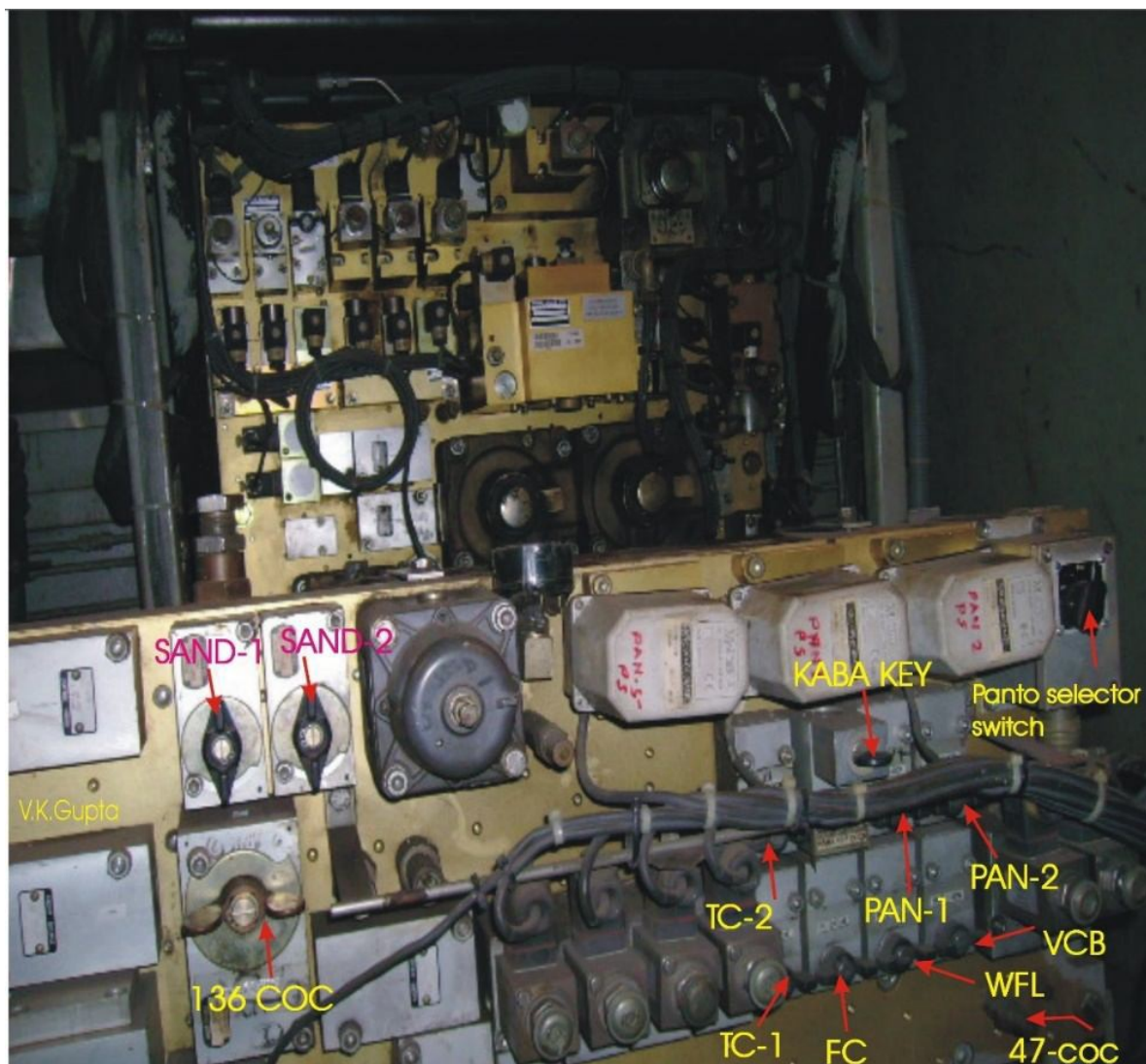
BC-1 & BC-2 cocs are not provided in under truck. These cocs are black in color and provided at the bottom of brake manifold in machine room. Normally these coc should be vertical (Open).

2 CHANGES IN PNEUMATIC PANEL IN MACHINE ROOM:

Pneumatic panel is divided into two parts.

- Air Brake Manifold.
- Auxiliary manifold.

1 Air Brake Manifold:



A) Parking Brake Back Up Switch – (PB-BUS):

This is a black colored switch; normally this switch should be in horizontal condition. But in case of PTDC mode or clearing loco asdead, this switch should be kept closed (Vertical) to release the parking brakes.

B) Pneumatic Equalizing Reservoir Cut Off Switch – (PER-COS):

This is a black colored switch; normally this switch should be in horizontal condition. But in case of PTDC mode this switch should be kept vertical.

C) Parking Brake Reservoir Cut Off Switch – (PBR-COS):

This is a black colored switch; normally this switch should be in horizontal condition. Maintenance staff uses this switch.

D) Parking Brake Pneumatic Disable switch- (PB-PDS)

This is a black colored switch; normally this switch should be in horizontal condition.

In case of parking brakes malfunctioning maintenance staff uses this switch and kept vertical along with PBR - COS.

E) SIFA-74 (Vigilance exhaust coc):

This is yellow colored coc. Normally this coc should be kept down ward but while clearing loco, as dead this coc should be kept upward.

F) BC- & BC-2 coc:

These are bogie-isolating coc.

G) DV (Distributer Valve)

1 Auxiliary Manifold:

Following cocs are provided on this manifold.

a) WFL: Pressure switch for wheel flange lubrication.

b) TC1 & TC2: Pressure switch for traction converter-1 & 2

c) KABA KEY: Loco grounding key.

d) FC: Harmonic filter contactor pressure switch.

e) PAN1&2: Pressure switch for Panto1 & panto2.

f) VCB: Pressure switch for VCB.

g) VESA1 & VESA2: Pressure switch for sanders.

h) 136: Pressure coc for Feed Pipe.

i) 47: cock for dead loco (normally closed)

j) Panto selector switch: for selection of panto (same as conventional)

(coc position of a to f switch should be horizontal. Coc position of h & i should be vertical.)

ITEMS TO BE NOTED:

1 Energizing of cab:

Loco should be energized as conventional 3 phase loco, but ensure following:

- i)** A-9 handle of driving loco should be at RUN, where as that of non driving cab should be at FS in locked condition.
- ii)** Mode switch at LEAD in driving cab, and TRAIL in non-driving cab.
- iii)** Energize the loco as per normal position.
- iv)** For charging BP move A-9 to FS for 10 seconds and then keep it to RUN position. BP will be charged by 3.0 kg/cm²
- v)** Ensure that parking brakes are released, if not then press BPPB.
- vi)** Keep A-9 from RUN to FS. Wait for 10 seconds, then again keep it to RUN and ensure that BP is charged to 5.0 kg/cm² and BC is "0" kg/cm².
- vii)** Every time after recharging BP will overcharge to 5.5 kg/cm² at RUN position and then after some time become normal to 5.0 kg/cm².
- viii)** For overcharging BP to 5.4 kg/cm², operate A-9 to REL position.(If necessary)
- ix)** For releasing synchronized loco brakes use Bail Ring for quick release or use PVEF for normal release.

2. Procedure Of Cab Changing:

- i) Keep A-9 handle in FS and lock it and remove the key out side.
- ii) Keep the SA-9 in release and rotate MODE switch to trail position.
- iii) Open the DJ, lower the panto and switch off the CE. Remove the BL key and go in another cab.
- iv) In another cab, Unlock A-9 handle and keep it on RUN condition. Operate Mode switch from TRAIL to LEAD.
- v) To charge BP, release parking brake and ensure charging of BP pressure.
- vi) Take these precautions every time while changing the cab.

3. Parking brake – application & release.

Whenever parking brakes are applied by CE or manually, every time penalty auto brakes will be applied along with parking brakes in which BP will drop to 3 kg/cm² and loco brakes up to 2.5 kg/ cm² with Priority-1 message on screen.

For recharging BP pressure, first release parking brakes and keep A-9 to FS position for 10 seconds. Again keep A-9 on RUN position and ensure that BP is recharged to 5.0 kg/cm². Acknowledge the fault and work further.

For applying parking brake manually, rotate switch PB-Bus from horizontal to vertical and for releasing vertical to horizontal.

4. Vigilance penalty brakes:

In this loco BP pressure is dropped by 3.0 kg/cm² (in gauge 2.0 kg/cm²) on application of vigilance parking brakes. Do the following for resetting vigilance penalty brakes:

- i) Keep throttle at “0”
- ii) Wait for at least 2-3 minutes.
- iii) Keep A-9 to FS, press BPVR for acknowledging fault message.
- iv) Keep A-9 at RUN and ensure that BP is charged to 5.0 kg/cm² and loco brakes are released.
- v) Acknowledge the fault by BPFA and proceed further after ensuring pressure.

5. Action to be taken after Emergency Brake Application:

Emergency penalty brakes applied when, emergency push button is pressed or due to over speeding or due to emergency application by A-9 / ALP Emergency valve, in which BP pressure drops to “0”. For releasing this penalty brake, keep A-9 to Emergency (EMER) for 10 seconds and again keep to RUN position, BP will charge to 5.0kg/cm² then acknowledge the fault message and work further.

6. Service penalty brakes:

Service penalty brakes apply automatically in following condition in which, BP is dropped to kg/cm².

- i) If BC-1 & BC-2 are isolated in locos "LEAD" mode.
- ii) If any one coc of PB-PDS, PB-BUS, PB-R-COS is isolated. If all these switches are in isolated condition and BPPB is pressed then also penalty brakes will apply.

To release service penalty brakes , normalize the above switches, keep A-9 to FS for 10 seconds and then again keep to RUN position and ensure BP to charge at 5.0 kg/cm².

7. Clearing loco as DEAD.

- i) Keep the throttle at "0". Open the DJ, lower the panto, and remove the BL by switching OFF CE.
- ii) Keep the A-9 of both the cab in FS and remove the key after locking it.
- iii) Keep both SA-9 handle at release and keep MODE switch at TRAIL.
- iv) Open coc 47 (Dead loco) and close coc136 (FP) provided on auxiliary manifold.
- v) Keep PAN-1 & 2 (Auxiliary manifold) coc on vertical position.
- vi) Close coc 74 SIFA (Vigilance) provided on pneumatic manifold by keeping upward.
- vii) Switch OFF MCB 112.1 (in SB-2). Drain out the MR & AR.
- viii) Couple the energize loco with dead loco and couple BP/FP pipes and open their angle cocks.
- ix) BC pressure should be '0' and if not then release the distributor valve.
- x) For application and releasing of brakes in dead locomotive rotate PB-BUS (air brake manifold) from horizontal to vertical. Ensure 5 kg/cm² pressure in parking brake gauge.

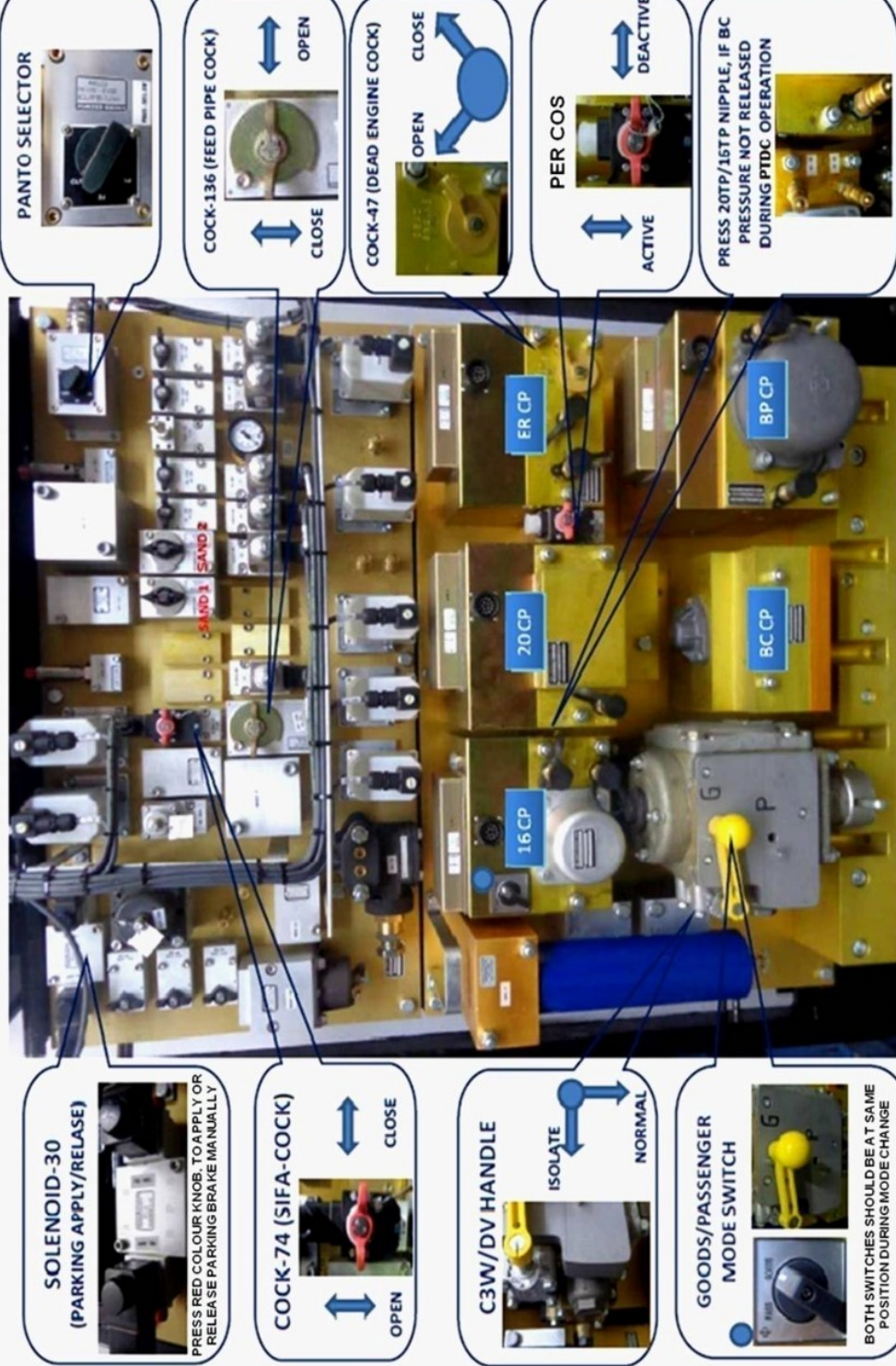
NOTE :-

- a. COC number 70 of BP is not provided in this loco.
- b. Solenoid valve no. 30 is not provided in this locomotive.

Before clearing loco as dead ensure that parking brakes are released fully and parking brake gauge is showing 5 kg/cm² pressure. Also ensure the same on run.

KNORR'S CCB (2.0) BRAKE SYSTEM

KNORR CCB PNEUMATIC PANEL



CCB-Electric Brake Rack Assembly

The Brake Rack Assembly is a vertical, wall mounted rack arrangement which is comprised of the following elements:

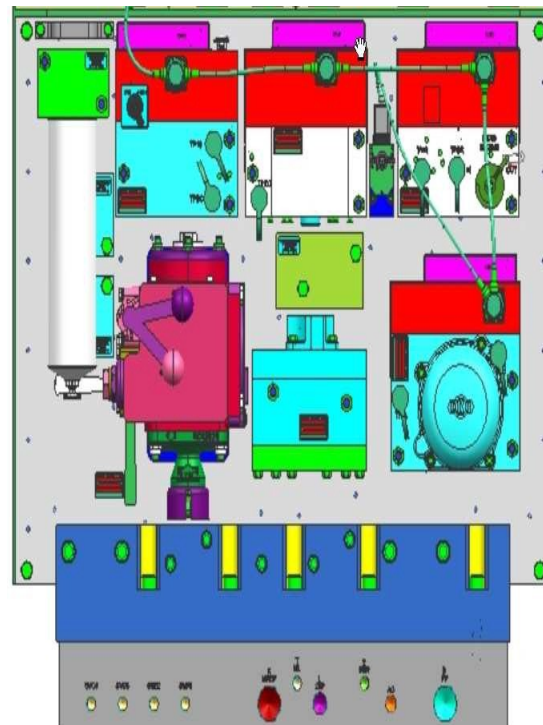
1. Electro Pneumatic Control Unit (EPCU)
2. Auxiliary Panel including Park Brake Functions
3. Mounting Frame
4. EPCU Header Bar
5. Locomotive Interface Header Bar
6. Electronic Vigilance Computer (EVC)
7. Relay Control Portion (RCP)
8. MPIO
9. PSJB
10. Electrical Junction Box



CCB- Electro Pneumatic Control Unit (EPCU)

The Electro Pneumatic Control Unit along Performs the following functions:

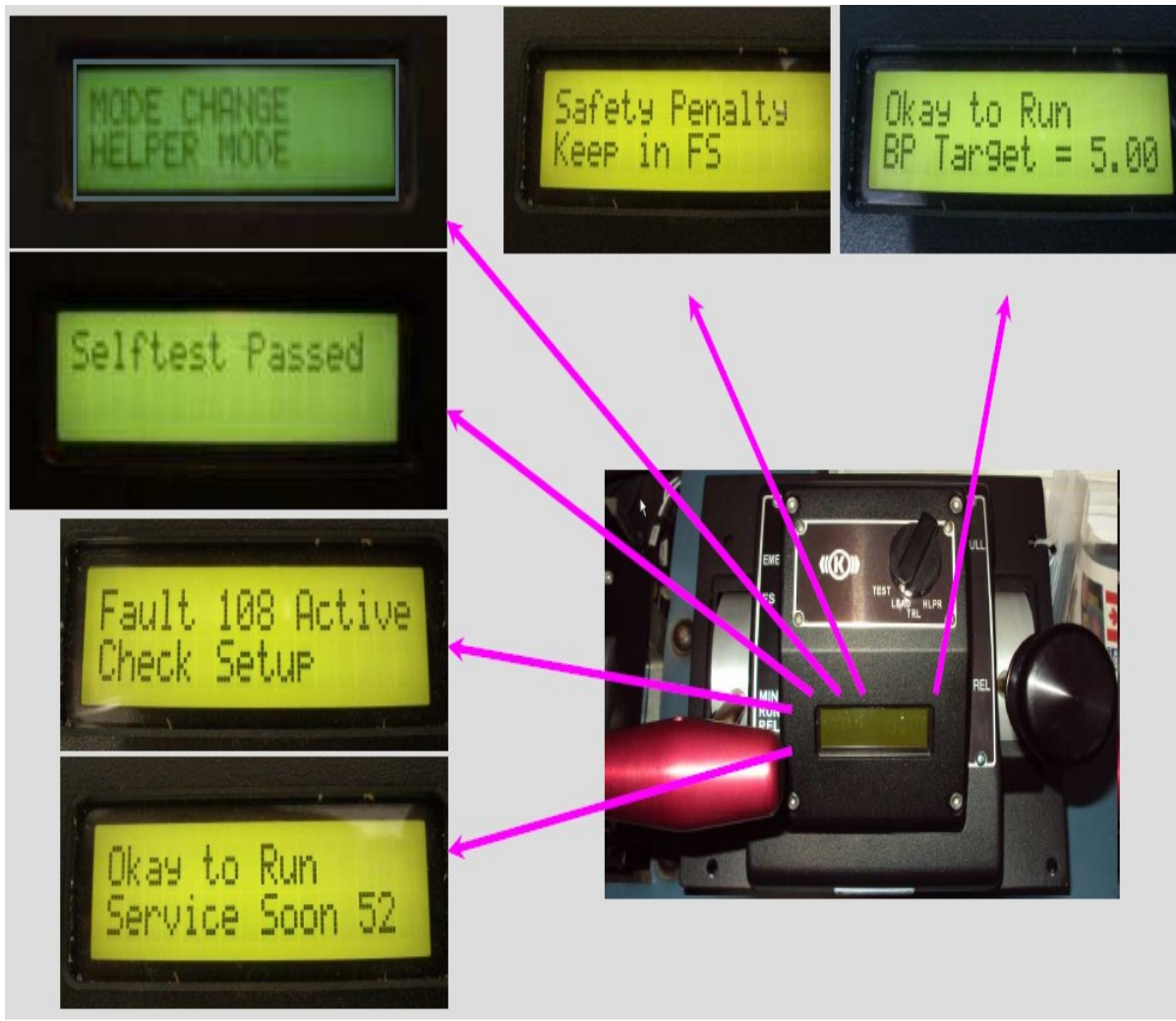
- ER/BP functions (Electronic and Pneumatic)
- 16/BC functions (Electronic and Pneumatic)
- Blending functions
- 20 (Independent/Direct) Pipe control (Locomotive(s) BC's only)
- Bail-Off control (Locomotive Auto BC's only)
- KE valve for Pneumatic Back up in case of failure of 16CP.
- PER Valve in case of failure of ERCP or any other critical failure which does not allow the CCB system to power up



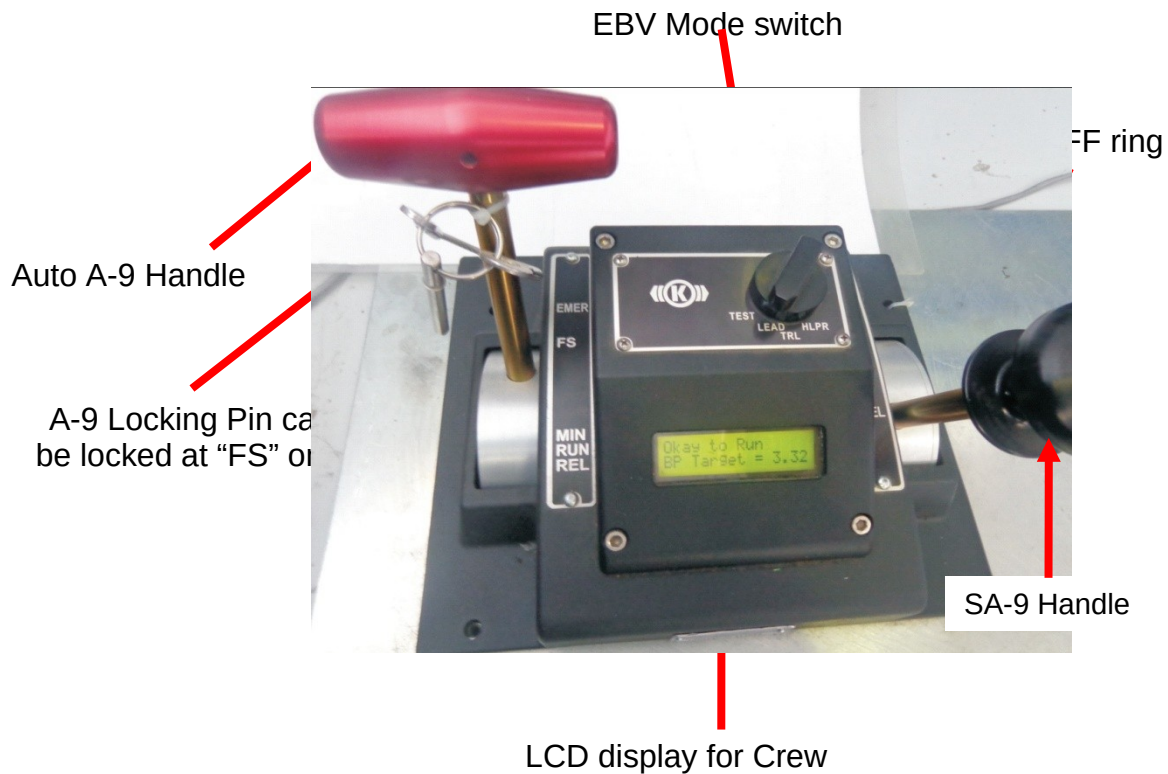
EBV- Simplified Crew Messaging

The CCB II-IR EBV contains a 2 line 16 character display.

The EBV contains an LCD to provide feedback which displays the target Brake Pipe pressure and limited crew advisory and diagnostic messaging.



BRAKE CONTROLLER (EBV)



**CORRECT POSITION OF LOCKING PIN:
HANDLE AT "FS" POSITION**



**INCORRECT POSITION OF LOCKING PIN: HANDLE
AT "EMER" POSITION**

'EBV' MODE SELECTOR SWITCH

LEAD - For loco operation in lead

TRAIL - For multiple and trail operation

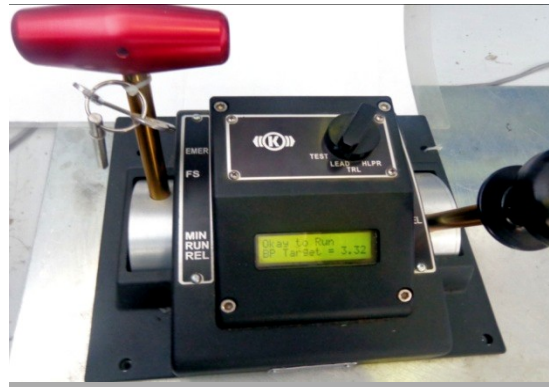
TEST - BP leakage testing

HELPER - For banking operation



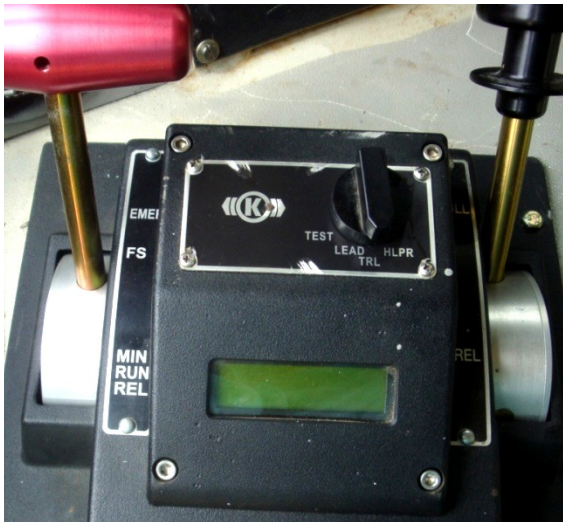
CAB SET UP

- ❖ **LEAD Loco:-** Operative cab EBV Mode-switch in Lead and Auto/A-9 handle unlocked. In-operative cab, EBV Mode switch in TRL(Trail) and Auto/A-9 handle locked at FS using Lock Pin.
- ❖ **TRAIL Loco:-** For Loco in TRAIL, mode switches of both brake controllers should be in TRAIL position.
- ❖ **BANKER Loco:-** For Loco in Banking, 'ZBAN' switch on driver desk in 'ON' position and EBV mode switch in HLPR position before node information reaches at '550' after opening VCB.
- ❖ **TEST:-** To check BP leakage test (For safety this would apply 3.5 Kg/cm² BC pressure on locomotive till mode switch is in TEST position only). After test is over, move Mode switch back to LEAD to come out from test mode. BC will reduce to '0'.



Auto/A-9 Operation

- (i) During energisation keep A-9 on 'FS' position.
- (ii) After energisation message will display on LCD of A-9 "OKAY to RUN", then move A-9 handle to RUN. BP would charge to 5Kg/cm² and BC will reduce to '0'.
- (iii) To initiate overcharge BP to 5.5Kg/cm² move A-9 'REL' position for more than 3 seconds.
- (iv) To release loco brake applied due to A-9, lift 'BAIL RING' provided in SA-9 or press PVEF foot switch.



Cab Changing Procedure

- (i) Stop the loco by A-9/SA-9.
- (ii) Move A-9 to FS position and lock it.
- (iii) Change position of mode switch to trail.
- (iv) Open VCB and lower the panto.
- (v) Move BL from 'D' to 'OFF'.
- (vi) Keep SA-on release position.



In the other cab

- (i) Change position of mode switch to lead.
- (ii) Unlock A-9.
- (iii) Insert BL and move to 'D', raise panto and close VCB.
- (iv) Bring A-9 from FS to RUN and charge BP pressure.
- (v) Move SA-9 to release before movement of loco.



Recovery of Penalty Service brake

- (i) Penalty brake will be applied by dropping BP to 3Kg/cm².
- (ii) To recover this penalty brake— move A-9 to 'FS' and back to 'RUN'.(Follow the message on LCD)
- (iii) BP pr. will charged to 5Kg/cm².

Recovery of Penalty emergency brake

Penalty emergency brake will apply due to—

- (i) Over speed
- (ii) By pressing emergency stop button
- (iii) Opening of BP angle COC after EOT

To recover the Penalty emergency brake—

- (i) Put A-9 to emergency & back to 'FS' (Follow the message on LCD)
- (ii) Then put A-9 to 'RUN', BP will be charged to 5Kg/cm²

Recovery of Vigilance Penalty brake

Due to Vigilance Penalty, BP drops to '0'Kg/cm², BC also applied.

- (i) Bring TE/BE to '0', Wait for 32 seconds.
- (ii) Move A-9 to Emergency and press BPVR. Then move A-9 to RUN.
- (iii) BP will restore to 5Kg/cm², then press BPFA and resume traction.

PTDC (Pneumatic Time Dependent Control) Set up & Procedure

- (i) Open pneumatic panel MCB '127.7' in SB-2 panel.
- (ii) Ensure vigilance circuit breaker 127.15 'ON' in SB-2 panel.
- (iii) Acknowledge fault by BPFA.
- (iv) Turn PER-COS switch to vertical in brake panel.
- (v) Release parking brake by pressing manual plunger on PB release magnet valve.
- (vi) From active cab move & hold PTDC handle in release position. BP should be charged by 5Kg/cm² and BC to '0'.
- (vii) If BC not comes to '0', release the C3-W DV.



NOTE:- If BC not releasing, Press '20 TP' on '20 CP' & '16CP' in '16 TP' In pneumatic panel to release BC pressure to '0'.

(vii) Apply and release auto brake through PTDC handle as per requirement.

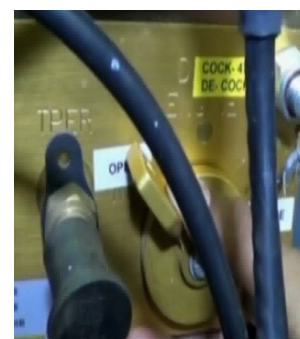


Banking operation

Open DJ put ZBAN in ON position , A-9 in FS , MODE switch in HLPR ,close COC-136 ,close DJ . Fault message F1001P2 will display ,press BPFA ,put MPJ in 'F' before movement of train.

DEAD LOCOMOTIVE OPERATION

- ❖ Switch off control electronics.
- ❖ Close Vigilance SIFA cock (74) on Auxiliary panel (Move horizontal to close), connect BP hose to other loco or train,
- ❖ Open Dead Engine cock (47) provided on ERCP (Rotate anticlockwise to IN written on ERCP) and allow to charge BP & 240 ltr. Reservoir.
- ❖ Close FP cock (136) on the auxiliary manifold (Turn to VERTICAL position to close).
- ❖ Auto/A-9 handle in both the cabs should be kept locked in FS position.



- ❖ (Insert Pin to lock the A-9 handle), Direct/SA-9 Brake handle in both cabs should be in 'REL' position.
- ❖ Verify (after charging of BP pressure to normal level) brakes are fully released and BC pressure is zero in the gauge. If BC is not reducing to zero then give brief pulls to quick release lever at bottom of distributor valve (C3W-DV) ensure BC reduces to '0'.
- ❖ Release Parking Brake by pressing plunger (red color on apply/release solenoid) on Aux panel or by pulling Manual Release Pins of Parking Brake Unit.

Note:- If loco brake remains applied, press 20TP (Test Point) on 20CP and 16TP in 16 CP in Pneumatic Panel to Release BC to Zero.

Chapter-5

DO's and DON'Ts for Loco Pilots

DO's

1. Acknowledge VCD always within every 60 sec.
2. Do maximum use of regenerative braking, it not only control the train but participate in generating the power.
3. In case of any trouble, as a last step, switch off the CE for 5 minutes.
4. In panto down condition and in CE off condition, to switch on the flasher, use cooling mode.
5. In case of heavy airflow, instead of attending the screen, do the protection of train and adjacent track.
6. In case of emergency use emergency stop push button.
7. While deactivating the CSC , check the position of throttle , it should not be opposite to the force.
8. Use throttle gradually.
9. Before regenerative braking, bunch the load.
10. While working dead loco, ensure conjunction working in dead loco.
11. While working dead loco ensure releasing of parking brakes and pneumatic brakes in dead loco.
12. First note down the fault message and then acknowledge the fault.
13. During failure mode operation, use throttle carefully.
14. Before resetting MCB, first rotate the knob provided on it.
15. Keep the SA-9 handle of rear loco at release.
16. Apply parking brakes when stationary.
17. Instead of continuous operation of sanders, use frequently.

DON'Ts

1. Don't operate BL when loco is in motion.
2. Don't believe on U-meter, ensure the panto physically.
3. Don't press PSA continuously.
4. Don't allow any unauthorized person in rear cab, as some functions are remains active in rear cab.
5. Don't declare the loco FAIL, without switching OFF and ON the control electronics.
6. Don't lower the panto for more than 10 minutes otherwise CE will switch off.
7. Don't forget to acknowledge the fault message.
8. Don't use CSC in undulating area.
9. Don't isolate VCD unnecessarily.

10. Don't switch off CE in running train.
11. Don't smoke in the loco.
12. Don't use quick release position of A-9 frequently and unnecessarily.
13. If MR pressure is less than 6.4 kg/cm², don't operate MPJ.

Chapter – 6

PROTECTION SCHEME

6.0 Protective measures by control electronics:

Initiation of protective measure in dangerous situation are controlled by Control Electronics. MCE monitors a range of values such as voltage, current, temperature, pressure and other signals.

6.1 Catenary voltage out of range

When catenary voltage drop down below 17.0 KV and raise above 30 KV VCB will open automatically.

6.2 Temperature protection

When temp of Transformer exceeds beyond 84 degree C, for more than 10 sec, VCB will trip.

6.3 Primary Over Current Protection (QLM)

Reason for over current.

1. Disturbance in measurement of primary current.
2. Fault in converter.
3. Short circuit in transformer winding
4. Check machine room for oil splash/smoke/abnormal.
5. Check OCR.78 is in normal. If any thing is abnormal- fail the loco.
If VCB trips during 'C' mode then check oil level of transformer mer and converter and check relay 78. If any thing is abnormal, fail the loco.

6.4 Train Parting:

Airflow measuring valve is provided in loco. Whenever train get parted, or air flow increased and AFM get activated, resulted into glowing of LSAF and sounding of buzzer. Also message of ALARM CHAIN PULLING will appear on screen.

As due to uncoupling / parting, the BP pressure start expelling at very fast rate, resulting into sudden drop in MR pressure which leads to Priority -1 message on screen " Low Pressure Main reservoir"

So, after parting / uncoupling, the driver will get message of low MR pressure which is counter effect.

So, when ever AFI shoot up with sudden drop in BP pressure, your first duty is to act as in case load parting / accident (like switching ON of flasher light, protection of adjacent track, Securing of load / loco, etc.), After asserting that trailing load is OK, then think about the loco / message.

6.5 Fire Alarm (Fire Detection System)

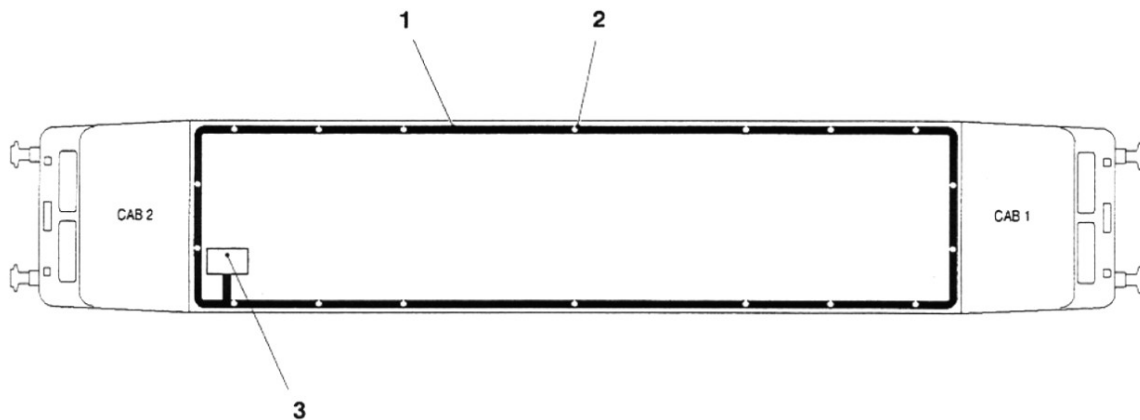
The locomotive is equipped with a fire detection system in the machine room. Through a ring line with apertures at regular distances air in the machine room is extracted with a fan and checked for traces of smoke by a detector.

1. Air intake line
2. Air Suction aperture
3. Fire Detection Equipment in SB2

The fire detection unit is equipped with two smoke sensors.

1. The first detector which detects smoke triggers an alarm: An intermitted signal (1170 Hz) sounds in the driver's cab, from the buzzer BZ-V-O-F. A fault message priority-2 appears on the screen.

Note: The machine room has to be inspected



2. If both detectors detect smoke in the machine room the following actions will be initiated:

A fault message 'Inspect machine room' priority 1 appears on the screen (the red 'LSFI' fault status indication lamp flashes) A Start/Running Interlock (TE/BE becomes '0') will activate.

Note: The driver should take specified course of action

Resetting of Fire Alarm –

1. Inspect the machine room and take necessary action. In case of fire on loco, use big fire extinguisher provided in the rack behind ALP in cab. To operate this fire extinguisher, rotate the adjusting knob until gauge reads 22.5 kg pressure and then open cut out cock, gas (CO₂) will expel and extinguish fire at appropriate places in machine room behind it. Do not forget to close both side corridor door. In addition to this two numbers of portable fire extinguishers are provided on the loco which should be used accordingly as per requirement.

2. To reset the fire detection unit, press the white knob provided on it. To acknowledge the fault press BPFA. Resume normal traction.

Note – In case of defect in fire detection unit, P-2 fault message will appear on the screen. After inspecting the machine room, reset the white knob on the fire detection unit. Acknowledge the fault and keep watch on machine room.

Alarm Chain Pulling:

When airflow increases without initiated by driver or CE i.e. in case of ACP/Gds brake applied/leakage in train/HPD etc. Following indication appears.



1. Air Flow Indicator needle will deviate.
2. LSAF will glow.
3. Buzzer will sound.
4. BPFA will illuminate with P-2 message.
5. Auto flasher will start.

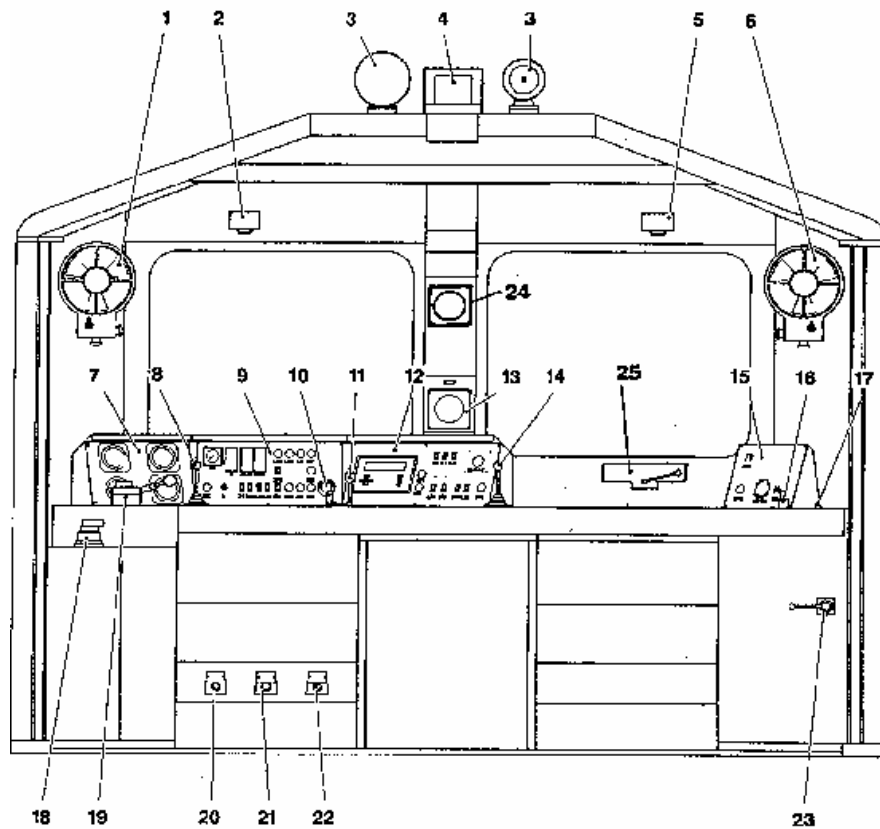
ACP Indication:

1. Put right the ACP/leakage.
2. Buzzer will sound continuously until the leakage/ACP is arrested so to stop sounding, Press BPFA. If ACP/leakage is not arrested buzzer will start again.
3. When ACP leakage is put right, all indications will disappear, but for BPFA indication press it once.

Chapter – 7

CAB OVER VIEW

1	Crew fan	2	Lamp driver's desk illumination
3	Pneumatic horn	4	Emergency flasher light
5	Lamp assistant driver's desk	6	Crew fan
7	Panel - B	8	Control lever for horn
9	Panel - A	10	Reverser
11	TE/BE Throttle	12	Panel -C
13	MEMOTEL	14	Control lever for horn
15	Panel- D	16	Operation of wiper
17	Rotary switch cab heater/fan device illumination	18	Brake handle direct loco brake
19	Brake handle automatic train brake	20	Foot switch SANDING"
21	Foot switch "PVEF" for release of	22	Vigilance foot switch
23	Emergency brake cock	24	PB gauge
25	Wiper motor		

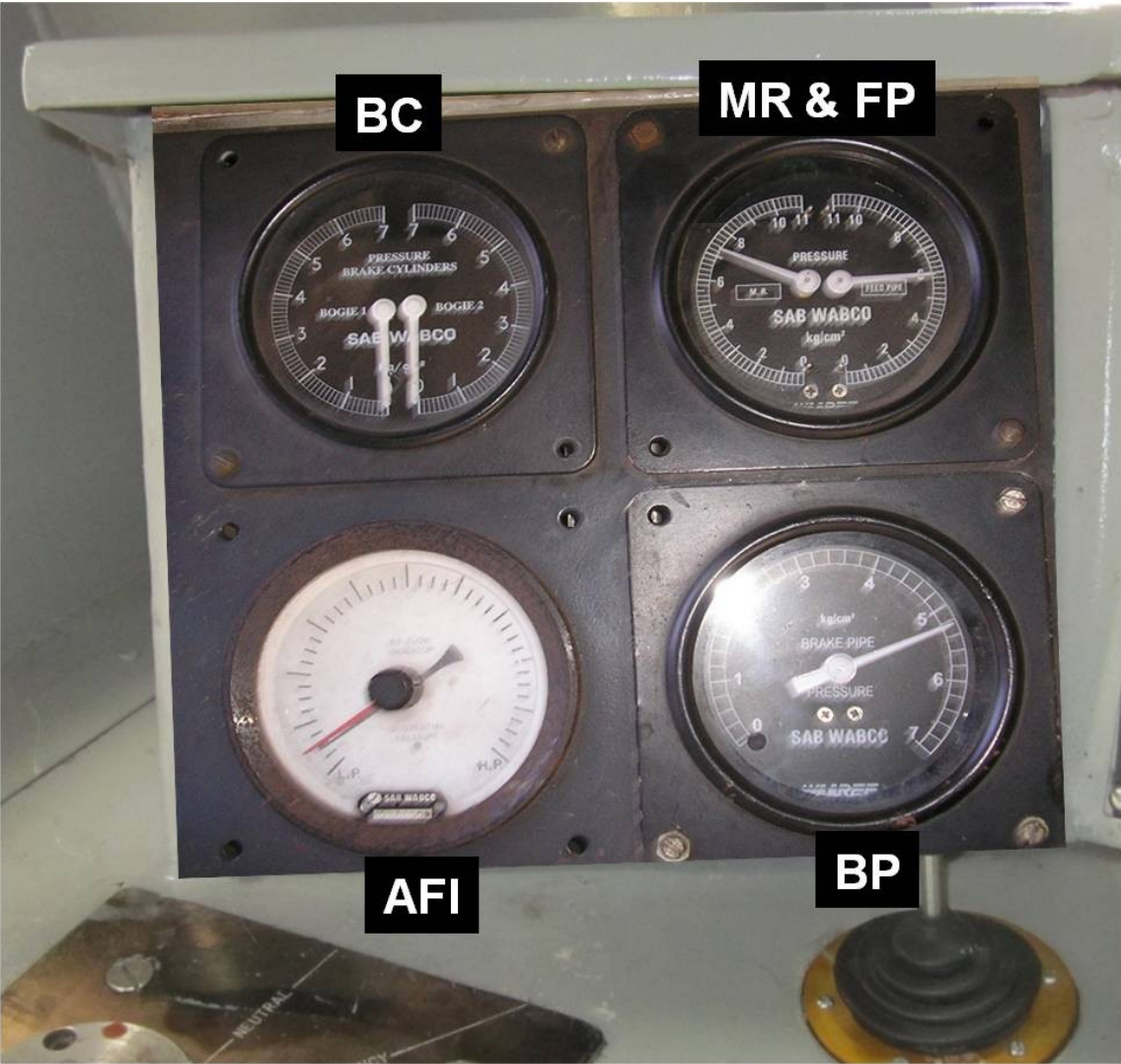


PANEL- A

- 1 UBA Voltmeter Battery voltage
- 2 U Voltmeter Catenary voltage
- 3 BOGIE 1 TE/BE meter - Traction / braking effort, bogie 1
- 4 BOGIE 2 TE/BE meter - Traction / braking effort, bogie 2
- 5 ZBAN Spring loaded switch – Banking operation “ON” / “OFF”
- 6 LSDJ Indication lamp, red - Main circuit breaker “OFF”
- 7 LSHO Indication lamp, yellow - Hotel load “ON” (Inactive on WAG—9)
- 8 LSP Indication lamp, yellow - Wheel slipping
- 9 LSAF Indication lamp, red - Train parting
- 10 LSVW Indication lamp, yellow - Vigilance warning
- 11 LSCE Lamp, amber - Over temperature CEL
- 12 BL Key switch - Activation of Driver's cab
- 13 ZPT Spring—loaded switch - Raise / Lower Pantograph
- 14 BLDJ Spring—loaded switch – Main circuit breaker “ON” / “OFF”
- 15 BLCP Spring—loaded switch - Main compressors AUTO mode “ON” / “OFF”
- 16 BLHO Spring—loaded switch - hotel load “ON” / “OFF” (Inactive on WAG—9)
- 17 ZTEL Switch - Max. Traction limitation
- 18 BPCS Illuminated pushbutton – green-constant Speed control
- 19 BPPB Illuminated push—button- red - Parking brake
- 20 BPVR Push—button, yellow Resetting vigilance
- 21 Emergency Stop - button – red - Emergency stop



GAUGES – PANEL-B



- 1
- 2
- 3
- 4

- Pres
- Pres
- Air
- Pres

PANEL-C

- 1 Screen Display of messages diagnosis
- 2 LSFI Indication lamp, red - Fault message, priority 1
- 3 ZLC Switch - Driver's cab lighting
- 4 ZLI Switch - Instrument lighting
- 5 ZLDD Switch - Driver's desk illumination
- 6 B-Z-V-O-F- Buzzer - Warning signal, 3 frequencies
- 7 BPFA Illuminated push - button, yellow - Acknowledgement all fault messages
- 8 BLPR Switch - Head Light, Bright
- 9 ZPRD Switch - Headlights, Dim
- 10 ZLFW Switch - Marker lights, white
- 11 ZLFR Switch - Marker lights, red
- 12 BPFL Illuminated push - button, yellow - Emergency flash light

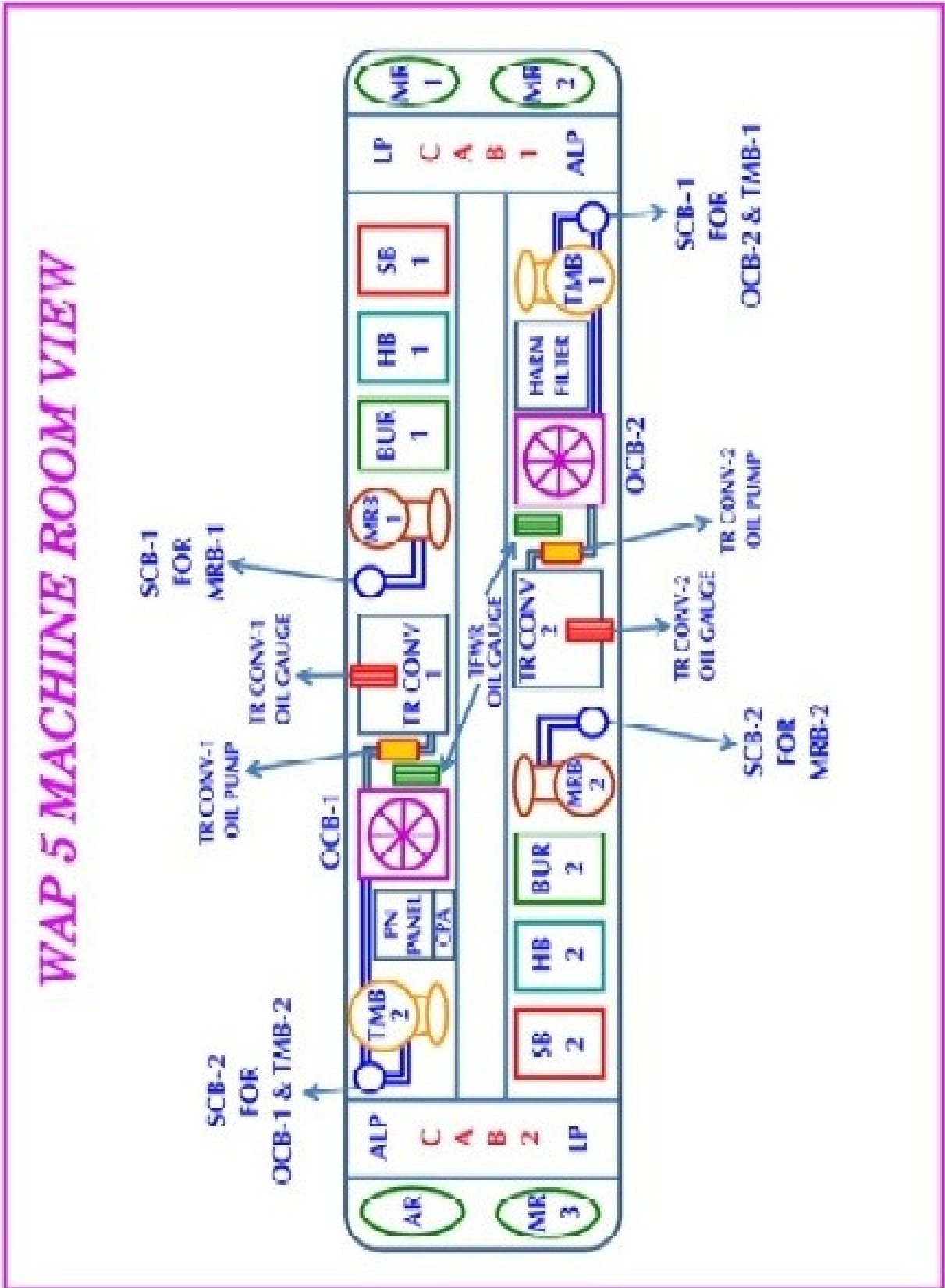


PANEL-D

- ZLDA Asstt Driver Desk Lamp BPVG
- Vigilance Ack push button
- PCLH 110V socket
- ZLH 110 V socket ON/OFF button

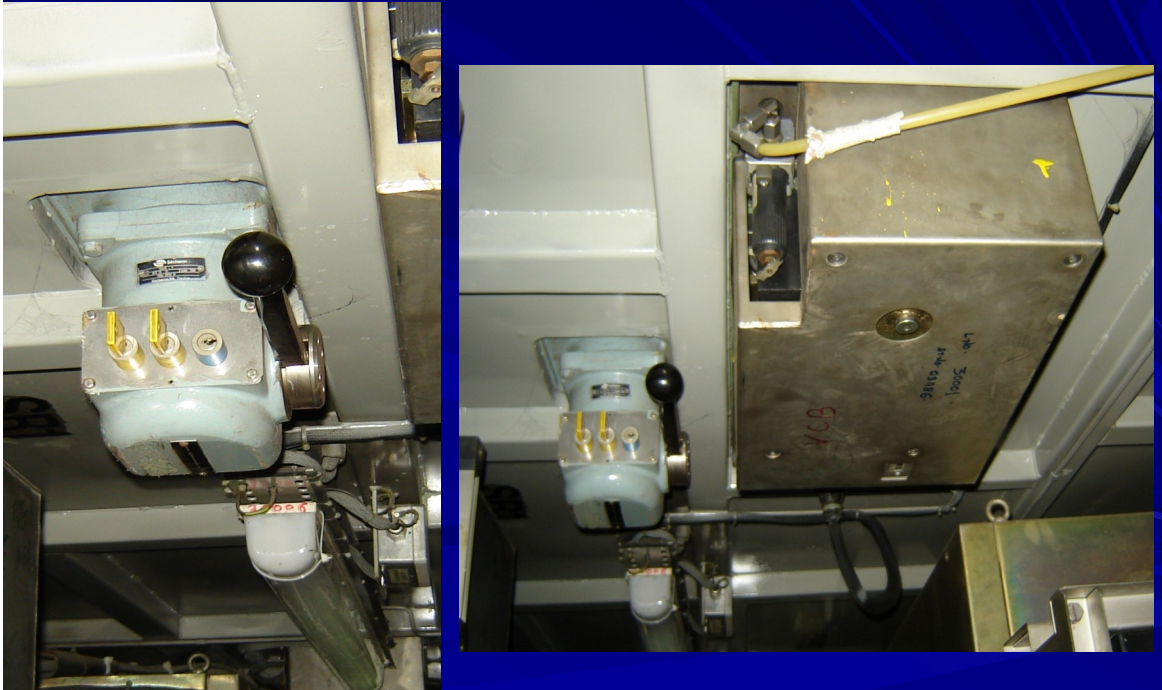


MACHINE ROOM LAYOUT of WAP-5 Locomotive



Procedure of Loco Grounding -

MAIN GROUNDING SWITCH.



Loco should be grounded only while climbing on loco roof to attend any trouble on loco roof like removing foreign material, securing damaged pantograph etc.

1. Ensure loco is stopped & secured.
2. Open VCB and lower pantograph.
3. Rotate IG 38 key in anti-clockwise direction and remove key.
4. Insert the key in empty socket of HOM box and rotate in clockwise direction.
5. Operate HOM handle by 180 degree by taking it out from its latch.
6. Rotate yellow kaba key in clockwise direction and remove the key and keep in personal custody.
7. For ungrounding the loco, the procedure is vice-versa.

Interlocking Concept (for Maintenance / Repair)



To prevent high voltage reaching the locomotive while high voltage components are accessible, the locomotive is equipped with a lock and key based interlocking system.

This operates with different coloured keys and starts in the following manner: Key A (light blue) and B (yellow).

By locking the pantograph valve at Pneumatic Panel (PP), key A becomes free. Key A unlocks the earthing switch on the main circuit breaker. If this is moved into earthing position, the locomotive is earthed and both B keys become free.

Key B is used to unlock the key multiplier No. 1 for key C. Key multiplier No. 1 is located in the machine room behind the cab.

Note:

The second B key (yellow) can be kept in the custody of a responsible supervisor for additional safety.

The seven C keys (green) are used for:

- Opening the auxiliary circuit block 1
- Opening the auxiliary circuit block 2
- Opening the auxiliary converter 1
- Opening the auxiliary converter 2
- Opening the filter block
- Unlocking the earthing switch on traction converter 1
- Unlocking the earthing switch on traction converter 2

By actuating the earthing switch on the traction converter, one D key (black) becomes free in each case. With both D keys together, the key multiplied No. 2 for key E (white) is unlocked. Key multiplier No. 2 is located in the machine room behind the cab.

With the 6 E keys, the following doors can be opened:

1004.6 Traction converter 1, door lock 1 - 3

1004.6 Traction converter 2, door lock 1 – 3

Note:

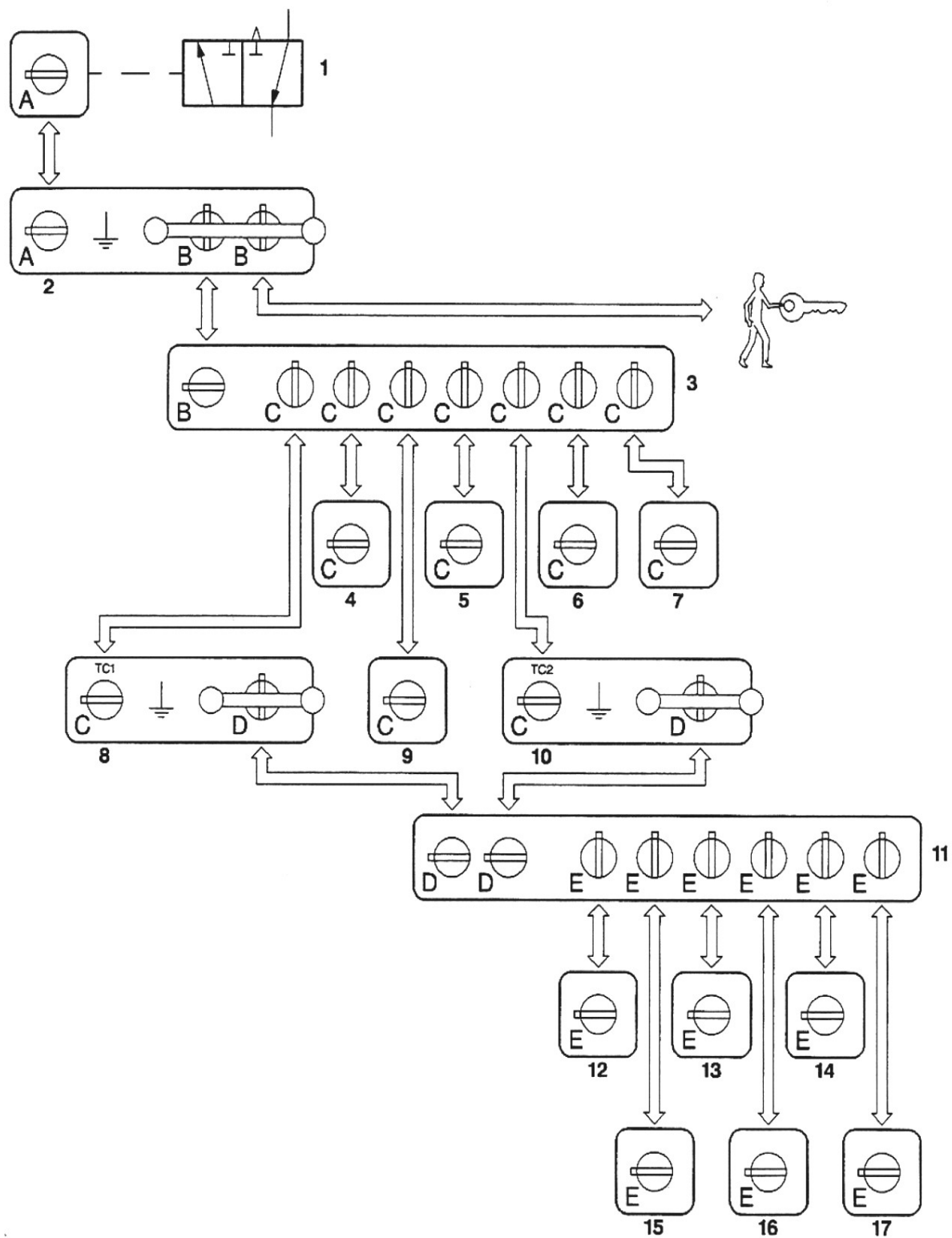
The following actions have to be taken before the above-mentioned procedure is executed:

125 1 set the key switch to the position “O”

112.1 2 set circuit breaker “Control Circuits Locomotive” on SB2 to position “OFF”

To cancel the Earthlings of the locomotive, proceed in reverse sequence.

1004.1	1	Pantograph air supply isolating cock	Blue
4	2	Earthing switch of main circuit breaker	1 blue, 2 yellow
1004.2	3	Key multiplier 1	1yellow, 7 green
1004.4	4	Door lock auxiliary circuits, Block 1	Green
1004.4	5	Door lock, auxiliary circuits, Block 2	Green
1004.4	6	Door lock, auxiliary converter 1	Green
1004.4	7	Door lock, auxiliary converter 2	Green
15.82/1	8	Earthing switch on traction converter 1	1 green, 1 black
1004.4	9	Door lock on filter block	Green
15.82/2	10	Earthing switch on traction converter 2	1 green, 1 black
1004.5	11	Key multiplier 2	2 black, 6 white
1004.6	12	Door lock, traction converter 1	White
1004.6	13	Door lock, traction converter 1	White
1004.6	14	Door lock, traction converter 1	White
1004.6	15	Door lock, traction converter 2	White
1004.6	16	Door lock, traction converter 2	White
1004.6	17	Door lock, traction converter 2	White



PNEUMATIC PANEL PRESSURE SWITCHES & EP COILS



1. Brake Electronics

2. Vigilance Control Device

3. Panto Selector Switch – It has following three positions.

Auto - Rear Panto will go up

I - Cab-1 panto will go up (No. 2 panto electrically iso.)

II - Cab-2 panto will go up (No. 1 panto electrically iso.)

4. PRESSURE SWITCHES & EP COILS –

- 1) PS 44 - 269.41 - Pressure switch for flow indication
- 2) PS 60 - 269.5 - Pressure switch for vigilance control
- 3) PS 34 - 269.42 - Pressure switch for Brake feed pipe
- 4) PS 32 - 269.3 - Pressure switch for parking brake
- 5) PS 26 - 172.4 - Pressure switch for Auxiliary compressor
- 6) PS 69 - 269.1 - Pressure switch for Emergency brake
- 7) PS 9/2 - 130.4/2 - Pressure switch for Pantograph-2
- 8) PS 9/1 - 130.4/1 - Pressure switch for Pantograph-1
- 9) PS 59 - 269.2 - Pressure switch for SA 9 Brake
- 10) EP 12 – 271.5 - BP Emergency
- 11) EP 13 – 271.6 - BP Fill
- 12) EP 14 – 243 - Emergency
- 13) EP 15 – 271.12 - BP Full Bore
- 14) EP 16 – 271.1 - BP Release
- 15) EP 17 – 271.2 - BP Apply
- 16) EP 18 – 271.11 - BP over charge
- 17) EP 19 – 278 - BP Run
- 18) EP 20 – 271 - Loco brake cut out
- 19) EP 21 – 270.1 - Auto brake cut out
- 20) EP 22 – 270.4 - Parking brake release
- 21) EP 23 – 270.3 - Parking brake apply
- 22) EP 24 – 130.1 - Pantograph-1
- 23) EP 25 – 130.2 - Pantograph-2
- 24) EP 26 - 273.3 - Unloader
- 25) EP 27 – 192.1 - Sander Axle-1
- 26) EP 28 – 192.3 - Sander Axle-3
- 27) EP 29 – 192.2 - Sander Axle-2
- 28) EP 30 – 192.4 - Sander Axle-4
- 29) EP 31 – 270.2/2 - Direct brake iso-2 (SA 9)
- 30) EP 32 – 270.2/1 - Direct brake iso-1 (SA 9)
- 31) EP 36 – 270.5 - Isolate E 70

5. Isolating cocks –

- a. Cock No 70 - BP cock, this cock's normal position is horizontal, this cock should be closed during banker operation & dead loco movement.
- b. Cock No 74 - Emergency Exhaust cock, this cock's normal position is horizontal, this cock should be closed during dead loco movement.
- c. Cock No. PAN-1 - Panto 1 Isolating cock, this cock's normal position is horizontal, this cock should be closed for isolating No. 1 pantograph from air side.

- d. Cock No. PAN-2 - Panto 2 isolating cock, this cock's normal position is horizontal, this cock should be closed for isolating No. 2 pantograph from air side.
- e. Cock No. VCB - DJ isolating cock, this cock's normal position is horizontal, this cock should be closed for isolating DJ.
- f. Cock No. 136 - Feed pipe isolating cock, this cock's normal position is vertical, this cock should be closed for isolating feed pipe.
- g. Cock No. 47 - Dead loco cock, this cock's normal position is horizontal, this cock should be open during dead loco movement.
- h. Cock No. Sand-1 - Sanders isolating cock, this cock's normal position is horizontal, this cock should be closed for isolating sanders.
- i. Cock No. Sand-2 - Sanders isolating cock, Sanders isolating cock, this cock's normal position is horizontal, this cock should be closed for isolating sanders.

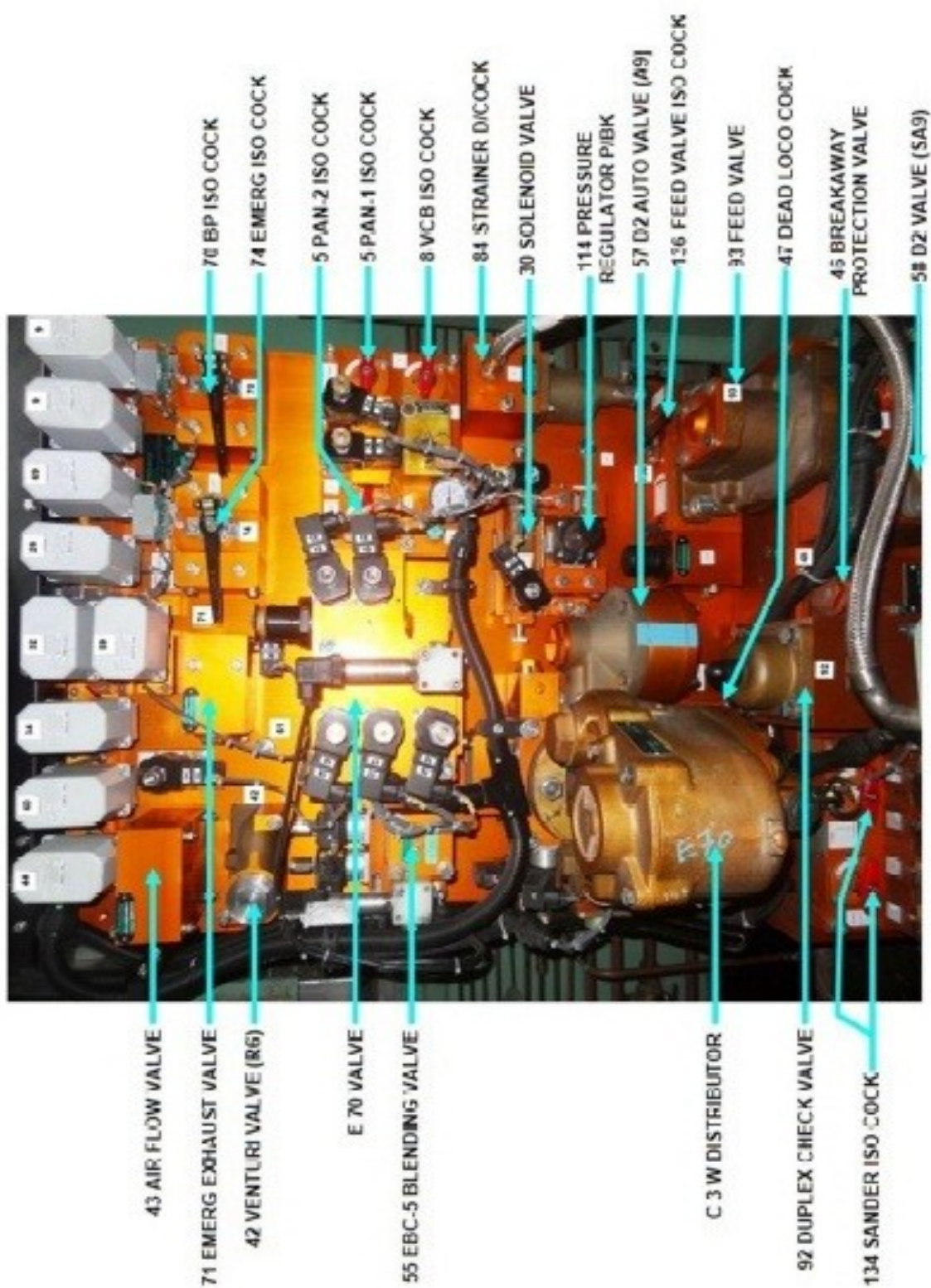
6.Drain cocks –

- a. Strainer drain cock
- b. Auxiliary compressor drain cock

7. Valves –

- a. IG 38 key, normal position is horizontal.
- b. E 70 valve
- c. 5 - Panto Isolating cocks
- d. 8 - VCB isolating cock
- e. 30 - Solenoid valve
- f. 42 - Venturi valve (R6)
- g. 43 - Air flow valve
- h. 46 - Break away protection valve
- i. 47 - Dead engine cock
- j. 49 - Distributor valve
- k. 55 - Blending valve
- l. 57 - D2 Auto valve (A 9)
- m. 58 - D2 valve (SA 9)
- n. 70 - BP isolating cock
- o. 71 - Emergency exhaust valve
- p. 74 - Emergency exhaust cock
- q. 84 - Strainer drain cock
- r. 92 - Duplex check valve
- s. 93 - Feed Valve
- t. 114 - Pressure regulator parking brake
- u. 134 - Sanders isolating cock
- v. 136 - Feed valve isolating cock

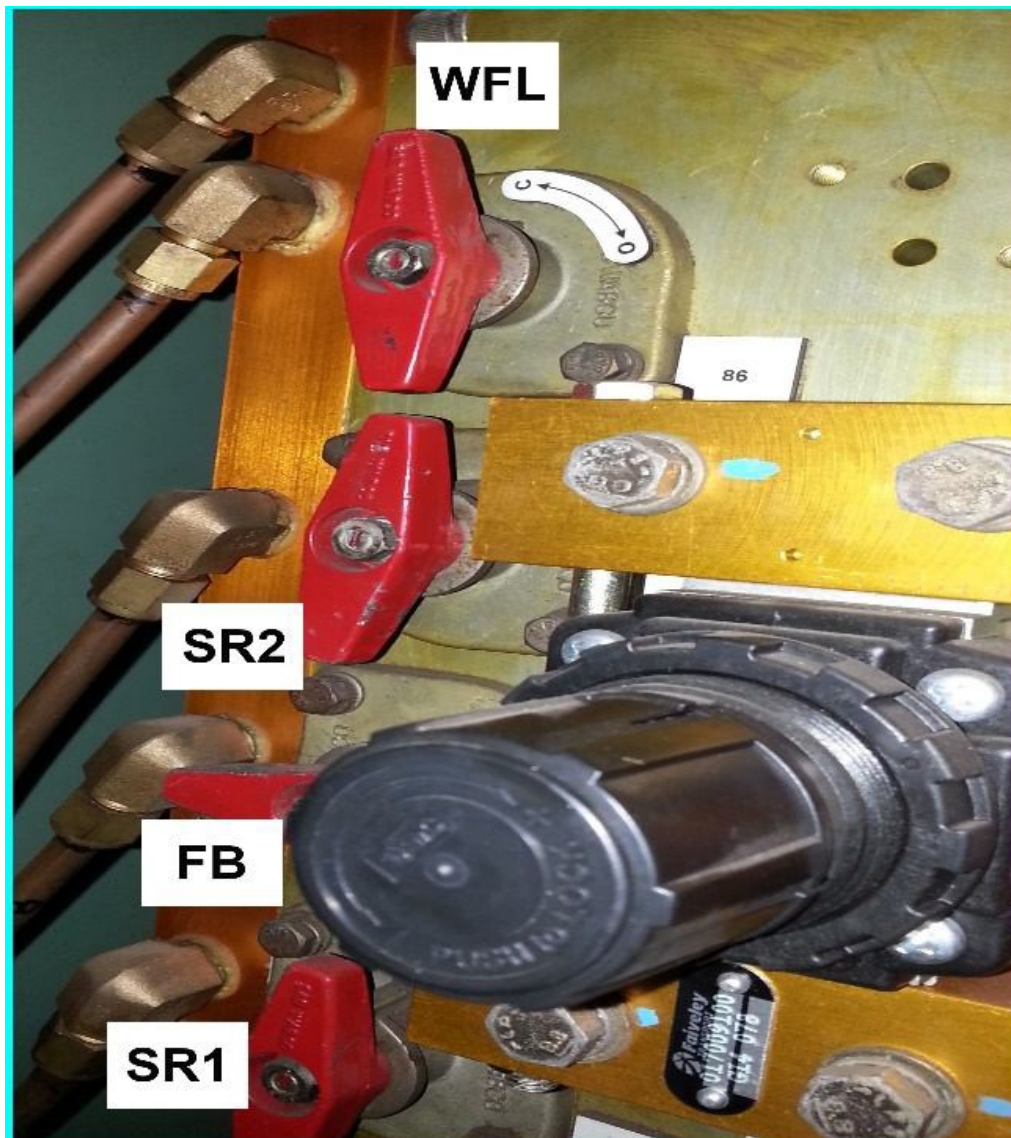
PNEUMATIC PANEL ISOLATING COCKS & VALVES



8. Cocks provided on side wall of pneumatic panel –

- a. WFL – Wheel flange lubrication isolating cock, this cock's normal position is horizontal, but nowadays this is isolated hence this cock remains in vertical position i. e. isolate position.
- b. SR2 – Traction converter-2 (SR-2) contactor isolating cock, this cock's normal position is horizontal.
- c. FB - Harmonic filter contactor isolating cock, this cock's normal position is horizontal.
- d. SR1 – Traction converter-1 (SR-1) contactor isolating cock, this cock's normal position is horizontal.

Note - On GTO based traction converter loco SR 1-2 cock remains in horizontal position and on IGBT traction converter based loco these cocks remains in vertical position i.e. isolated position.

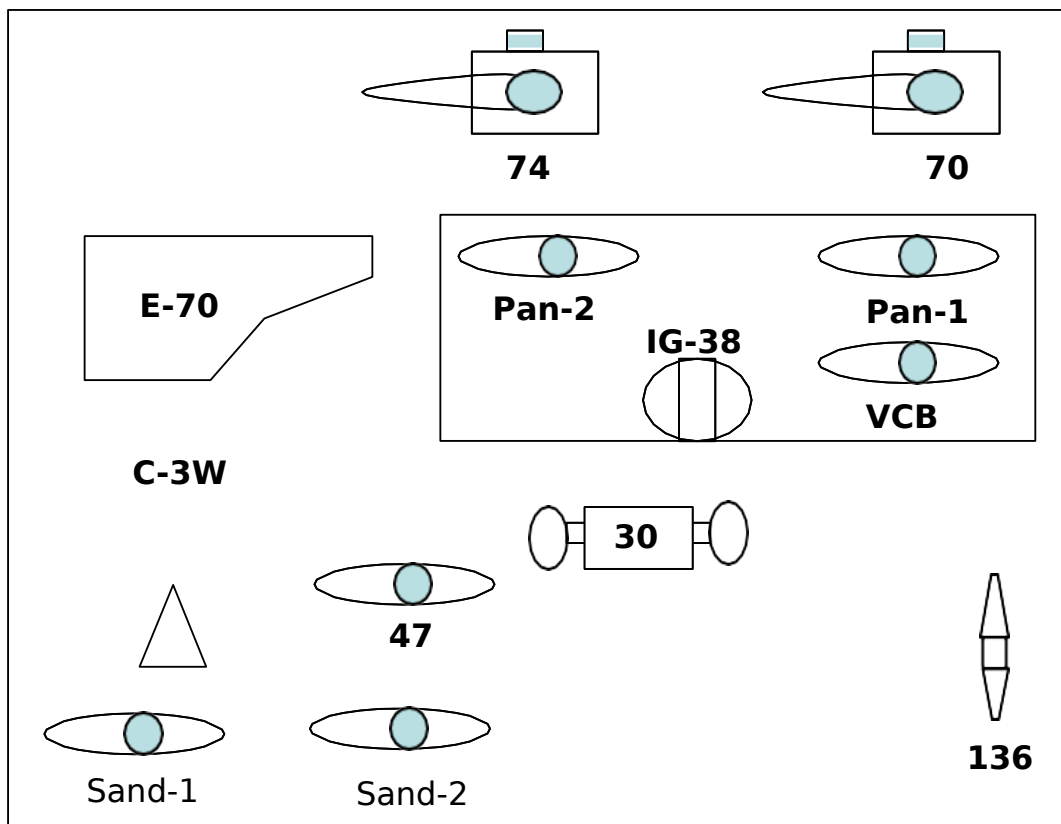


9. Pressure switches provided near auxiliary reservoir –

- a. 269.4 - Low MR pressure
- b. 172.3 - RGCP 1
- c. 172.2 - RGCP 2
- d. 269.6/2 - Pressure switch for brake cylinder
- e. 269.6/1 - Pressure switch for brake cylinder



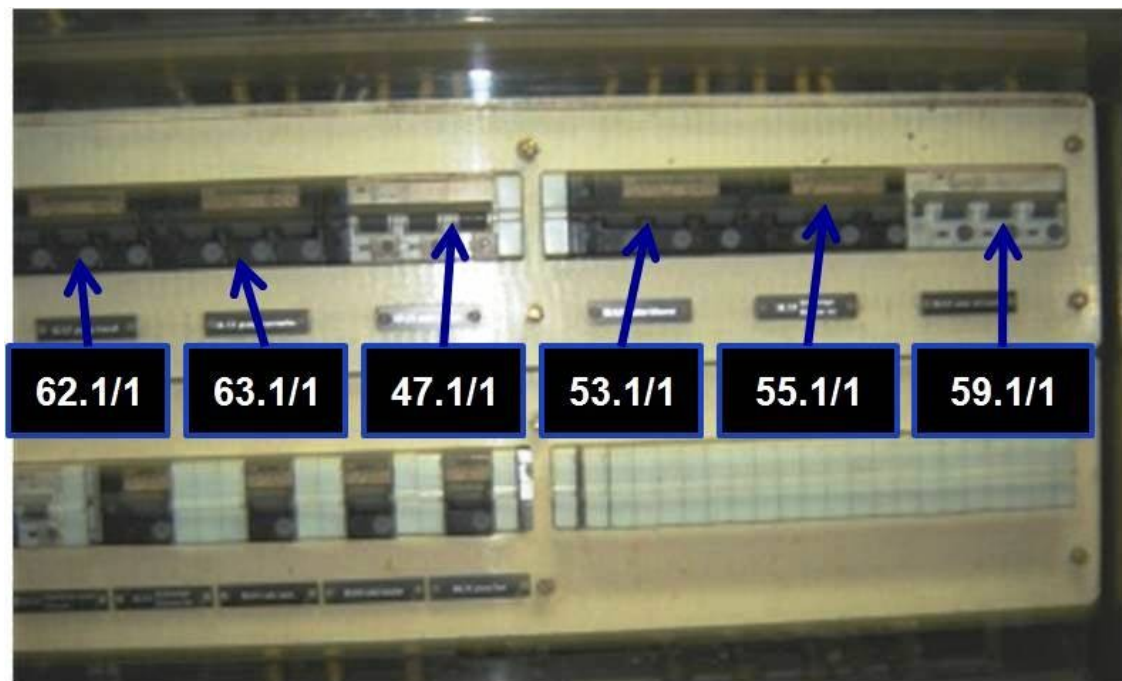
ISOLATING COCK POSITION						
MO DE		47 (Dead Engine)	74 (Emerg ncy Vigilanc e)	136 (Brake Feed Pipe)	70 (E-70 Brake Pipe)	Remarks
Multi ple Unit	Lead (Live)	Closed	Open	Open	Open	When the loco is running SU or as the leading loco in MU configuration
	Trail (Live)	Closed	Open	Closed	Open	When the loco is running as Trailing in MU configuration
	Trail (Dead)	Closed	Closed	Closed	Closed	When the Trailing loco running as dead in MU configuration
Banking Loco		Closed	Open	Closed	Closed	When loco is in rear of double headed configuration or in rear of train
Towed Dead		Open	Closed	Closed	Closed	When the loco is being running as dead and BP pipe is connected



Circuit breakers provided in HB-1

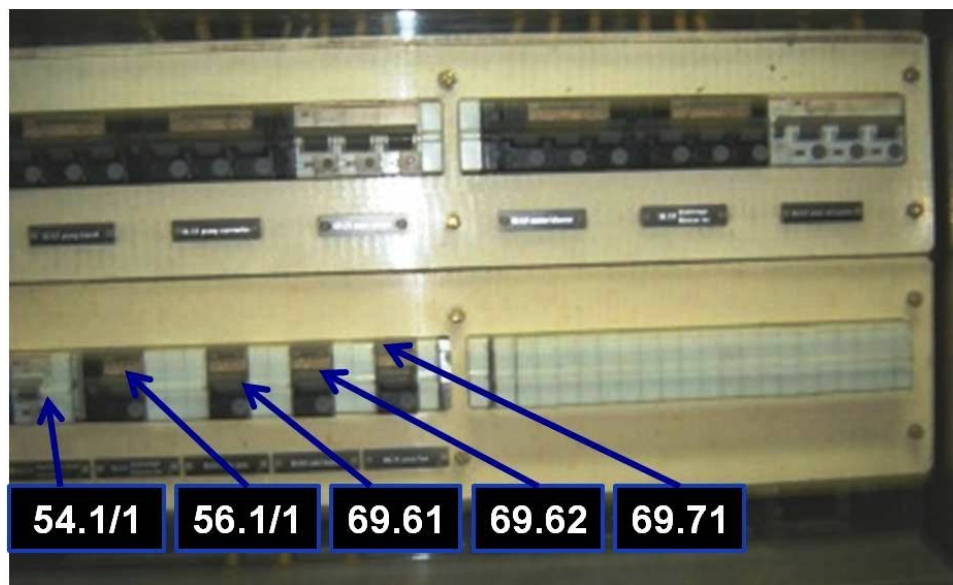
Three phase 415 Volt Aux. Circuit breaker

SI No.	MCB No	Rating	Name
1	62.1/1	16 A	Circuit Breaker Oil Pump Transformer
2	63.1/1	32 A	Circuit Breaker Oil Pump Converter
3	47.1/1	63 A	Circuit Breaker Main Compressor
4	53.1/1	63 A	Circuit Breaker Traction Blower
5	55.1/1	6 A	Circuit Breaker Scavange Blower
6	59.1/1	63 A	Circuit Breaker Oil Cooling unit for Transformer/Converter



Single phase 415 /110 Volt Aux.circuit breaker

SI No.	MCB No	Rating	Name
1	54.1/1	20 A	Circuit Breaker Oil Pump Transformer
2	56.1/1	6 A	Circuit Breaker Oil Pump Converter
3	69.61	6 A	Circuit Breaker Main Compressor
4	69.62	16 A	Circuit Breaker Traction Blower
5	69.71	6 A	Circuit Breaker Scavange Blower



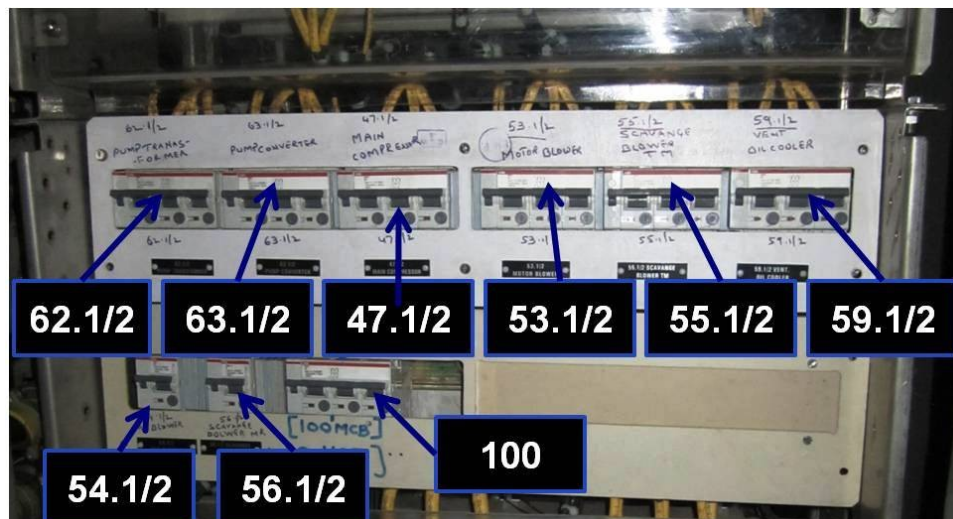
Circuit breakers provided in HB-2

Three phase 415 Volt Aux. circuit breaker

1. 62.1/2 Circuit breaker oil pump transformer
2. 63.1/2 Circuit breaker oil pump converter
3. 47.1/2 Circuit breaker, main compressor
4. 53.1/2 Circuit breaker, traction motor blower
5. 55.1/2 Circuit breaker, scavenge blower for traction motor blower and oil cooling
6. 59.1/2 Circuit breaker, oil cooling unit, transformer / converter

Single phase 415 /110 Volt Aux.circuit breaker

1. 54.1/2 Circuit breaker, machine room blower
2. 56.1/2 Circuit breaker, scavenge blower for machine room blower



SB – 1 PANEL

ROTATING SWITCHES PROVIDED IN SB-1 PANEL

SI No	Switch No.	Name
1	152	Rotary switch for failure mode operation
2	154	Rotary switch for Bogie cut- out
3	160	Rotary switch for configuration
4	237.1	Rotary switch for Vigilance device Cut-OFF

RELAY PROVIDED IN SB – 1 PANEL.

1. 78

OV

PROGRAM SWITCHES

1. 152 Rotary switch for Failure mode operation

Position

- 0 - Normal Position, Fine control throughout the range
- 1 - Failure mode, Fine control in steps through aux. contacts When throttle is not responding then Driver can keep this switch from 0 to 1 and now same throttle will respond, called failure mode operation.

2. 154 Rotary switch for Tr.Bogie cut-out

Position

NORM :- Traction converter-1 & 2 (All TM's) in service

I:- Traction converter-1 (TM 1-2-3 WAG-9/WAP-7) (TM1-2 WAP-5) isolated

II:- Traction converter-2 (TM 4-5-6 WAG-9/WAP-7) (TM 3-4 WAP-5) isolated

I+II:- Traction converter-1 & 2 (TM 1-2-3 & 4-5-6 WAG-9/WAP-7)
(TM1-2 & 3-4 in WAP-5) isolated

3. 160 Rotary switch for Configuration

Position

- 1 : Normal, Normal mode
- 0 : Shunting (Max Speed 15 KMPH) mode

4. 237.1 Rotary switch for Vigilance device cut-off

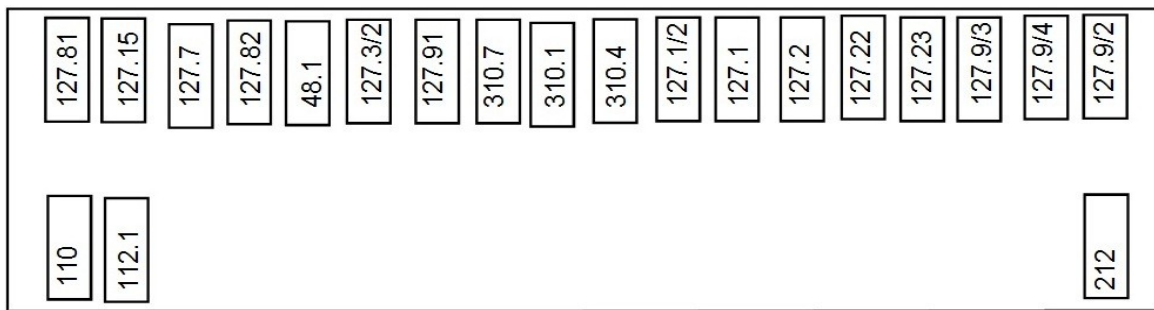
Position

- 1 : Normal VCD is in service
- 0 : VCD is isolated

SB – 1 PANEL

	1		
9	127.9/1	6 A	Circuit breaker Central Electronics
10	127.9/2	6 A	Circuit breaker Central Electronics

Mini Circuit breakers provided in SB-2



SI No	MCB	Name
1	127.81	Circuit breaker Commissioning 1
2	127.15	Circuit breaker Vigilance control
3	127.7	Circuit breaker Pneumatic panel
4	127.82	Circuit breaker Commissioning 2
5	48.1	Circuit breaker Auxiliary compressor
6	127.3/2	Circuit breaker Driver's cab
7	127.91/2	Circuit breaker Power supply 24V/48 V
8	310.7/1	Circuit breaker Marker lights
9	310.1/2	Circuit breaker Lighting front
10	310.4	Circuit breaker Lighting machine room
11	127.1/2	Circuit breaker Electronics traction converter
12	127.1 1/2	Circuit breaker Power supply Gate Units
13	127.2/2	Circuit breaker Monitoring
14	127.22/2	Circuit breaker Electronics auxiliary converter
15	127.22/3	Circuit breaker Electronics auxiliary converter
16	127.9/3	Circuit breaker Central electronics
17	127.9/4	Circuit breaker Central electronics
18	127.92	Circuit breaker MEMOTEL speedometer
19	110	Circuit breaker out put battery charger
20	112.1	Circuit breaker control circuit locomotive
21	212	Fire detection equipment

Chapter- 7

Loco Preparation And Inspection

Preparation of Locomotive and its Inspection:

Before commissioning Journey, perform an inspection check of the locomotive and through the machine room. In particular, check the following items:

In front Of Cab:

1. Ensure that loco is standing on the rail and under the OHE
2. Ensure that both side MRE, BCE BP , FP hoses are connected properly and their angle cocs are as per requirement. Also ensure that hoses are not hanging.
3. Ensure that rail guard, cattle guard, has not any damages
4. Ensure that CBC having no abnormalities and locking pin is available and provided with operating handle.
5. Ensure that UIC connector sockets are covered.
6. Ensure that Flasher light, marker lights, headlights are glowing properly and their glasses are clean.
7. Ensure that both look out glasses are clean and wipers are wiping properly.

Below Machine Room No. 1(Cab-1 To Cab-2)

1. Ensure that all sand boxes are filled with dry fine sand and sanders are working properly.
2. Ensure that additional angle coc of MRE & BCE are opened.
3. Ensure that Air dryer unit is in service that (D-in open, D- out open & D-off closed)
4. Ensure that all suspension dampers; helical springs having no abnormalities like, crack etc.
5. Guide rod is fitted properly and its bolts are tightened.
6. All brake rigging; brake block, brake shoe, sleeve rod, assembly hanger arrangement are OK.
7. Wheels are not skidded.
8. Return current bush are connected properly.
9. Parking brakes cylinders are provided with manual releaser hook.
10. Traction link is fitted properly and their all 6+6 bolts are tightened.
11. Oil level in CP is above min mark; also ensure that CP foundation bolts are tightened.
12. Bogie brake -1 coc is in open condition.
13. Battery box cover is locked.
14. Safety chain is intact.
15. BP and FP additional coc are in open condition.

Below Machine Room No. 2(Cab-2 To Cab-1)

1. Ensure that all sand boxes are filled with dry fine sand and sanders are working properly.
2. Ensure that additional angle coc of MRE & BCE are opened.
3. Ensure the all suspension dampers, helical springs having no abnormalities like, crack etc.
4. Guide rod are fitted properly and its bolts are tightened.
5. All brake rigging; brake block, brake shoe, sleeve rod, assembly hanger arrangement are OK.
6. Wheels are no skidded.
7. Return current bush are connected properly.
8. Parking brakes cylinders are provided with manual releaser hook.
9. Traction link is fitted properly and their all 6+6 bolts are tightened.
10. Oil level in CP is above min mark; also ensure that CP foundation bolts are tightened.
11. Bogie brake -2 coc is in open condition.
12. Battery box cover is locked.
13. Safety chains are intact.
14. BP and FP additional coc are in open condition..

In Cab-1:

1. Cab and look out glasses are clean.
2. All switches are normal, ZBAN-OFF, BLCP-AUTO
3. Emergency exhaust cocks are normal.
4. Water is filled up in windshield washer unit.

5. Spare hoses, wooden wedges are provided in side locker.
6. Fixed and handy both fire extinguisher are in good condition and filled with gas.
8. Ensure that emergency push button is released.

In Machine Room

1. Control and power Circuit breakers in cubicle SB-1 / SB-2 , HB-1 and HB-2 are normal
2. Switches provided in SB-1 are at normal position.
3. Oil level of conv-1/2 and transformer-1/2 are above min mark.
4. All fittings and connections are normal.
5. Outer cover of any power equipment is not opened.

Pneumatic Panel

1. Panto selector switch is at “auto” position.
2. COC 70,74,136 are in open condition and COC 47 is in close position.
3. COC of panto 1, panto 2, VCB and sanders are in open condition.
4. Distributor valve is in service.
5. IG 38 Key is inserted and kept ‘ON’.
6. CPA drain cock is in close condition.
7. Parking brake apply/release plungers are not in locked condition.

Chapter – 8

ONLINE MOVEMENT

(DIFFERENT OPERATIONS)

8.1 How To Energise The Loco:

1. Check roof and all under gearing parts are intact
2. Check oil levels of MCPs, traction converter oil level and transformer oil pump level are above minimum mark.
1. Check the machine room and ensure that all Circuit breakers(MCB), rotating switches in cubicle HB-1/2,SB-1/2 panel are in normal position. All the cocks position and key ‘IG-38’ at Pneumatic Panel are in correct position and ensure that is provided on pneumatic panel. Also ensure that panto selector switch is at normal position(Auto).
2. Put ‘ON’ compartment light, it ensures closing of main circuit breaker 112 of battery (provide in BA Box no.-2).
3. Put battery additional circuit breaker No.112.1 to ‘ON’ position in cubicle SB-2. Also ensure that CHBA circuit breaker no. 110 (SB-2) is at ON position.
4. Go in operating cab and apply SA-9.
5. Insert A-9 handles at ‘Neutral’ position and keep it in ‘RUN’ position by lifting the lock.

6. Insert 'BL' key at 'OFF' position and turn it to 'D' position
 - a. Light of screen (panel-C) and Memotel will get ON.
 - b. MCPA will start (if pressure is less than 5.5kg/cm²).
 - c. UBA will deviate up to 110 volts.
 - d. LSDJ will glow .

All above indications indicates that Control Electronics is get 'ON'.
7. The message "Loco is in configuration, please wait" will appear on the screen and self testing is done for **10 seconds**.
8. During testing, all pilot lamps will glow and extinguish, Bogies-1 & 2 meter will deviate both in TE/BE mode and come to -0. LSDJ and BPPB will remains glowing.
9. After testing FLG No. 504, will be displayed on the screen, Now press 'ZPT' in 'UP' mode for raising of pantograph and confirm the touching of panto with contact wire physically. U-meter will also deviate and indicate the OHE voltage.
10. FLG No.550 will display on the screen- now press BLDJ for closing VCB and ensure 'LSDJ' is extinguished. DJ will close, loco will energize and the all auxiliary will get start automatically.
11. FLG No.570 will appear on the screen.
12. Ensure that BLCP is at AUTO position.
13. After MR pressure build up above 6.4 kg/cm², set Reverser to F/R as per requirement. (FLG 590 will show on the screen.)
 Note:- If the reverser is set without confirming the MR pressure i.e above 6.4 kg/cm² , then P-1 message will be there on screen- indicating wrong operation.
14. Now release the parking brakes, Ensure BP pressure to 5 kg/cm²
 Ensure AFI is at Zero.
15. Now operate throttle in TE direction.
16. TE /BE meter will deviate in TE side indicating that traction is available. No. "596" will appear on the screen.
17. Check the loco brake power. Release loco brake.
18. Now you can move the train / loco.

Note:

Priority -1 message will appear on the screen if: -

1. If Reverser is put on position F or R before when MR pressure is below 6.4 kg/cm²
2. If throttle is operated without releasing parking brakes.
3. If throttle is operated without recharging BP to 5 kg/cm².

Information message will appear on the screen if :- If throttle is operated before node information No. 590.

Note :

- 1). When the speed of the train is more than 1.5 kmph, LP to press and release pedal switch for vigilance or Throttle displacement more than 3%, or ALP to press & release BPVG at an interval of 60 seconds.
- 2). Recently hand operated push button switch is provided near LP side

Horn to acknowledge vigilance in some locos as per RDSO instruction.

8.2 Operation Of BL Key

BL key is operated for following mode:

1. DRIVING MODE: (Off - D)
2. SELF HOLD MODE. (D - Off)
3. Switching OFF control electronics: (D - Off - C - Off)
4. COOLING MODE: (D - Off - C - Off - C)

8.3 Driving Mode:

This mode is used to drive the loco. To achieve this mode driver has to:

- 1) Insert BL key in 'OFF' position.
- 2) Turn it clockwise from 'OFF' to 'D'
- 3) By doing this, following indications will confirm the driving mode:
 - a) LSDJ will glow
 - b) UBA will show battery voltage.
 - c) Display screen will activate.
 - d) Memotel screen will activate. Control electronics will get ON.

8.4 Self Hold Mode:

- 1) Open DJ , lower the pantograph
- 2) Rotate 'BL-key' from 'D' to 'OFF': Now control electronics will remain 'ON' for 10 minutes and then it will become 'OFF' automatically. This mode is used while changing the cab.

8.5 Switching Off - Control Electronics:

Driver has to switch off control electronics in many cases like;

- a) Making the loco dead.
- b) During troubleshooting.
- c) For taking the isolated sub system in service.
- d) Before resetting circuit breaker or before rotating any switch.

To switch off the control electronics following sequence should be followed.

- 1) Bring throttle to '0'. Stop the train. Open VCB. Lower the Panto.
- 2) Move the BL key from position 'D' to position 'OFF' and wait for 2 seconds for Automatic application of parking brakes.
- 3) Then move the BL key from position 'OFF' to position 'C' and wait for 5 to 12 seconds to attain FLG node 613.
- 4) Then move the BL key from 'C' to 'OFF'.
- 5) Check the driver display & speedometer, it should become blank. Now electronics has been switched OFF completely.
- 6) Attempt switching ON once again by moving BL key from 'OFF' to position 'D'.

8.6 Cooling Mode:

Whenever temperature of control electronics is increases above 70⁰C then lamp LSCE glows on Pannel 'A' and throttle will not respond.

- ❖ Check MCB's in HB / SB, if found tripped, reset once. (54.1/1 & 54.1/2 in both HB and MCBs 127.91/1 & 127.91/2 in SB panels.).
- ❖ If TE is available then clear the block section by Traction otherwise try to clear the block section by coasting. Acknowledge fault by pressing BPFA.
- ❖ Advice station, regarding inability for 10-15 minutes. A-9 to be kept on Emergency (to save MR pressure) before putting loco on cooling mode.

Procedure to activate cooling mode:

1. Try to stop the train at suitable place.
2. Keep the throttle on '0' & Apply SA9 and A-9 to emergency.
3. Open VCB and lower the pantograph.
4. Switch off CE as per procedure.
5. Again put 'BL key' from 'OFF' to 'C' and ensure that UBA shows battery voltage and LSDJ glows, Screen is Off - no node information.
6. Now raise the panto, close the VCB, LSDJ will extinguish and loco will energies in cooling mode.
7. Machine room blowers & scavenge blowers will start automatically to cool the machine Room. Ensure working of machine room blowers.
8. When the machine room temperature goes below 70⁰C then LSCE will extinguish.
9. Now Open the VCB, lower the pantograph.
10. Put BL from 'C' to 'OFF' and 'OFF' to 'D' and energize loco & resume traction.

8.7 Inching Mode:

Purpose:- For coupling

Activation procedure:-

1. Bring Throttle to '0' stop the loco/train, keep SA-9 in applied condition.
2. Put MPJ in 'F' or 'R' as per requirement; ensure FLG-590 in cab display & release Parking Brake.
3. Bring "INTCHING MODE" in cab display.
4. Now on DDS following will display:

Inching mode information
 Inching mode active-'0'
 Actual speed- 0.0 KMPH
 Set speed- 0.8 KMPH

Modify speed by using UP/DN Key between 0.5 -1.5 kmph

Put ZTEL 'ON'

Now "Inching mode active-0" will change to "Inching mode active-1"

Release SA-9

On screen actual speed will show, TE/BE meter will deviate & train/loco will move.

To stop train/loco put ZTEL –'OFF',

Now "Inching mode active-1" will change to "Inching mode active-0"

Apply SA-9 to stop the train/loco.

Note: INCHING MODE speed will be within 0.5 to 1.5 KMPH

8.7 Operation Of Reverser :

Reverser has following 3 positions.

Position 'F' = Forward

Position 'O' = Neutral

Position 'R' = Reverse

Throttle and reverser are interlocked mechanically.

8.8 Driving:

1. After creating MR pressure above 6.4 kg/cm² and node information no. 570.
2. Move the reverser into desired position.
3. Release the parking brake if applied
4. Put A9 to 'RUN' position & ensure BP 5 kg/cm²
5. Check AFI is not deviating.
6. Set the TE/BE throttle to desire position.
7. Put SA9 handle to 'Release' position.
8. In order to increase adhesion and to avoid wheel slipping use sanders.
9. Bogies 1 & 2 meters will show in TE side and loco started

8.9 Braking:

1. Set the TE/BE throttle to - '0' or move towards braking side as per requirement.

2. Move A9 from 'RUN' to 'Initial Application'. If more brake force is required move the A9 handle to desire position between 'Initial Application' and ' Full Service' & vice versa gradually.
3. Reg. Braking is possible up to 0 KMPH.
4. When train stops, apply SA9.
5. Max. Brake force is 260 KN in WAG-9/WAP-7 & 160 KN in WAP-5.

Note :- Train brakes can be applied with Regenerating brakes but Loco brake can not be applied simultaneously with Regenerating brakes.

8.10 Operation Of Throttle:

TE/BE Throttle

The TE/BE throttle controls traction and the electric braking effort of the locomotive with an angle transmitter and auxiliary contacts.

The TE/BE throttle has the following three end positions:

For Traction

Position 1/3	33% tractive effort
Position 2/3	67% tractive effort
TE max	100% tractive effort
Position "0"	no tractive / no braking effort

For Regenerative Braking effort

Position 1/3	33% braking effort
Position 2/3	67% braking effort
TE max	100% braking effort

NOTE:

If TE doesn't increase beyond 300 KN in WAG-9/WAP-7 & 150KN in WAP-5 then Driver should check ZTEL switch on 'A' Panel whether it is 'ON' or 'OFF', ZTEL should be kept 'OFF'.

The % tractive/braking effort is indicated on the two-tractive/braking meters on panel A.

8.11 Failure Mode Operation

This mode allows the locomotive to operate even if the angle transmitter of the TE/BE throttle has failed. In this mode, driving and electrical braking are controlled by the auxiliary contacts on the TE/BE throttle.

Driving in failure mode

Driving in failure mode becomes necessary if the difference between auxiliary contacts and the absolute value of the angle transmitter is greater than 25% of the full range because of a defective master controller.

The following steps are initiated with a time delay of 2 sec:

1. Traction is set to 0 by the MCE.

2. A priority 1-fault message is displayed. (F1703P1/F1803P1)
3. The driver must now move the rotary switch “152-Failure Mode Operation” in the machine room (SB1) into position ‘1’. This deactivates the angle transmitter.
4. The driver must move the TE/BE throttle into position “0”.
5. The driver must acknowledge the fault message.
6. The driver can now select a new TE/BE throttle value carefully.

Position ‘0’ - Fine control throughout the range by angle transmitter. Position ‘1’ - fine control in steps through auxiliary contacts.

8.12 Loco Brake Testing:

- 1) Apply loco brakes by SA-9
- 2) Ensure that brake cylinders registered 3.5 kg / cm² pressure.
- 3) Release parking brakes and release A-9.
- 4) Operate MPJ to forward.
- 5) Move throttle in traction and give 45 % tractive effort. (TE should not exceed 150KN in WAG9/WAP7 and 100KN in WAP5).
- 6) Loco should not be moved.

Note :- Presently there is no procedure for loco brake testing approved by RDSO. Same to be confirmed by RDSO or CLW.

8.13 How To Change The Cab :

Single Unit

1. Open ‘DJ’ by pressing BLDJ at ‘OFF’
2. Lower the panto by pressing ZPT at ‘DN’
3. Operate BL key from ‘D’ to ‘off’ and remove it. (CE will remain ON for 10 min).
4. Apply loco brakes by SA-9
5. Set automatic brake controller to position ‘Neutral’ and then remove handle
6. Release direct brake handle.
7. Go in another cab and energize it in “Normal” way.

Note:

- * If BL key is taken ‘OFF’ without opening DJ and lowering panto , loco will be shutdown as emergency shutdown will initiate on loco.
- * During normal driving if BL key is kept ‘OFF’, emergency brakes will get applied as emergency shutdown will initiate on loco.
- * After moving the key switch ‘BL’ to position ‘O’, the MCE remains active for 10 minutes.
The change of driver’s cab should take place during this time, If the MCE has to be restarted, it takes longer to set up the locomotive because Peripheral tests have to be carried out.

Multiple unit

1. Move key switch 'BL' on master locomotive into position 'Off' and remove the key.
2. Set automatic brake controller to position 'Neutral'
3. Release direct brake
4. Set the feed pipe cock 136 to the 'Close' Position
5. Change the loco and set the feed pipe cock 136 to the 'Open' position on this previous slave loco.
6. Insert key in driver's cab of previous slave loco.
7. Move key switch "BL" into position "D"

Note:

The change of driver's cab has to take place within this 10 minutes period otherwise the MCE has to be restarted.

8.14 Banking Mode

When it is required to use loco as a banker i.e use of TE / BE without charging BP, at that time loco should be operate in banking mode.

Procedure:

- 1) Trip the VCB and Set switch "ZBAN" "to position "ON" (Panel A).
- 2) Close coc 70 & 136 provided on Pn panel.
- 3) Set up the loco in the normal manner.
- 4) BP pressure will be drop to 0, but when coupled with master loco, its BP will rush into BP pipe of this loco which will seen in the gauge.

Note: During the Set Up, the train driver receives a priority-2 messages that banking mode is active.

8.15 Constant Speed Controller:

This system enables the train to maintain a constant speed automatically and can be activated at any speed above 5 KMPH by pressing illuminated push button 'BPCS'.

The control electronics and GTO controls the constant speed by giving tractive or braking effort to the TM as per requirement irrespective of position of throttle (ATDC-Angle transmission driver Controller) i.e. TE/BE .

The actions of CSC are cancelled in following conditions.

1. Moving of throttle.
2. Pressing 'BPCS' while CSC is active, lamp will extinguished.
3. Drop in 'BP' by 0.25 kg/cm² and above.
4. BC pressure more that 0.6 kg/cm²

CSC is activated only when

1. Speed is more than 5 KMPH
2. Throttle in either TE or BE side.
3. Train Br. and loco Br. are not applied
4. BPCS is pressed once, lamp will lit.

Some thing Important:

- 1) To minimize oscillation, the CSC should be set during a slow acceleration phase.
- 2) CSC will maintain the speed only up to max TE / BE. Speed may vary if required TE / BE is more than loco capacity. So, in an undulating area the speed may vary +/- 10 kmph to preset value. So in such areas BPCS should be pressed at the speed with margin of 10 KMPH. Also in some areas where special driving technique is required, CSC may stall the train. So, in such areas, instead of using CSC, L.P. should use his best driving technique by operation of throttle.
- 3) Also if CSC is used in very frequent up / down grade region, the loco will trigger for TE to BE and BE to TE very frequently with heavy amplitude, which is not good as far as driving technique is concerned.
- 4) While canceling CSC ensure that needle position of TE/BE meter and throttle are not just opposite. If so, first bring the throttle as per needle.
- 5) Don't press BPCS for more than 5 seconds.

8.16 Emergency Stop Push Button

One red colored and arrowed push button is provided on panel 'A' at such a place that driver as well as Asst. driver can operate it. In normal condition it remain projected out. In case of an emergency if drivers/Asst. push this button, button go inside and remain pressed and following actions initiated.

1. VCB get opened.
2. TE/BE comes to '0'
3. Panto lowered
4. BP drops to 0 Kg/cm²- Train/Loco brakes applied.
5. LSFI/BPFA glow with message.

“ Emergency shutdown on the loco” on screen and train will stop with emergency brakes.

Resetting:

- 1) Bring TE/BE throttle to '0'.
- 2) Press “emergency stop push button” slightly and rotate it clockwise as per arrow indication on it, the button will comes out from pressed condition.
- 3) Press BPFA and acknowledge the fault and node information will appear.
- 4) **Flasher light will lit.**
- 5) Energise the loco and work the train as per procedure given.

8.17 Automatic Vigilance Control System:

VCD is meant for checking and keeping the driver alert. It is a safety device. A foot switch of VCD is provided below driver's desk in each cab, also press button 'BPVG' is provided on drivers' desk on Asst. side. Driver/Asst. driver is expected to activate VCD within every 60 seconds interval by one of the following way.

1. Press VCD “Foot switch” OR
2. Press BPVG (Green) OR
3. Operate throttle in TE/BE in different of more than 3% OR
4. Operate ‘Sanders’.

If one of the above exercises is done, the driver is considered alert and the 60 seconds cycle get reset.

If none of the above activities are done once within 60 seconds, then buzzer will sound and ‘LSVW’ will glow for next 8 seconds.

Within these 8 second acknowledge the VCD by pressing ‘vigilance footswitch’ or ‘BPVG’, if not acknowledged, VCD will apply penalty with emergency braking (2.5 – 3.0 kg/cm²). TE/BE will become ‘0’ & BP pressure will drop 2.5 to 3.0 kg/cm².

Note:

For VCD, the speed of train should be more than 1.5 KMPH.

8.17.1 Dead Mans Mode:

If VCD ‘Foot switch’ lies remain pressed for more than 60 second, then the system will go automatically in “Dead Mans” mode, & buzzer will sound, if not released with next 8 second, VCD penalty will be applied with emergency braking. The BP will drop 2.5 to 3.0 kg/cm².

8.17.2 Resetting Of VCD Penalty Brakes:

1. Bring throttle to ‘0’ put A-9 in emergency to avoid MR dropping.
2. Wait for 120 seconds in E-70 brake system & 32 seconds in KNORR/CCB brake system.
3. Press “BPVR” to reset VCD, LSVW will extinguished and buzzer will stop.
4. Press and release VCD “Foot switch”.
5. Press ‘BPFA’ for acknowledging fault message.
6. MR/BP pressure would come back to normal
7. Resume ‘Normal’ traction.

8.17.3 Isolation Of VCD :

If driver is acknowledging VCD correctly as per procedure, but till VCD penalty is applying, in that case it is assumed that VCD is malfunctioning. In such cases stop the train, take safety measures. VCD can be bypassed by keeping switch no. 237.1 (SB-1) on ‘0’ position. Remark should be given in log book, TLC is to be informed and proceed carefully.

Note:- Now a day’s ‘BPVG’ is removed from Panel-D and Hand Operated Push Button Switch is provided near horn in LP side in few locos as per RDSO.

8.18 PASSING NEUTRAL SECTION (SU)

Before approaching neutral section:

1. Ensure that MR pressure is between 8.5 to 10 kg/cm²

2. Bring TE / BE throttle to '0' gradually before 250M board.
3. At DJ open board, open DJ by BLDJ, LSDJ will glow, Aux. sound will stop, but U meter will show OHE supply.
4. At actual neutral section location, OHE meter will comes down to "0" and will shoot up when neutral section over.
5. In PTFE type neutral section, at higher speed, needle will just fluctuate.
6. At DJ close board close VCB (DJ), and resume normal traction.

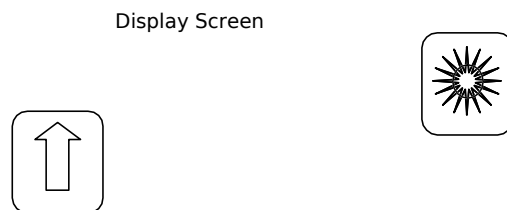
In case OF MU operation

- The command from the master locomotive to switch the main circuit breaker "ON", "OFF" also controls the main circuit breaker on the slave loco.
- The VCB of the slave loco is switched on after a delay of 0.5 seconds following the switch on of the master loco. When switching off, there is no delay.
- While passing neutral section follow the procedure mentioned for SU, but DJ should be closed after passing one mast after DJ close board.

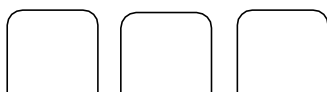
Chapter-9

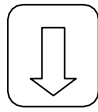
FAULT DIAGNOSTIC

9.1 Display Screen



ClearHomeEnter





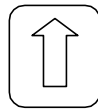
Stand by
screen



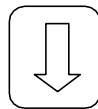
Stand by
screen



Go to sub
menu

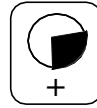


To move
curser up



To move
curser down

Display illumination
On-Off



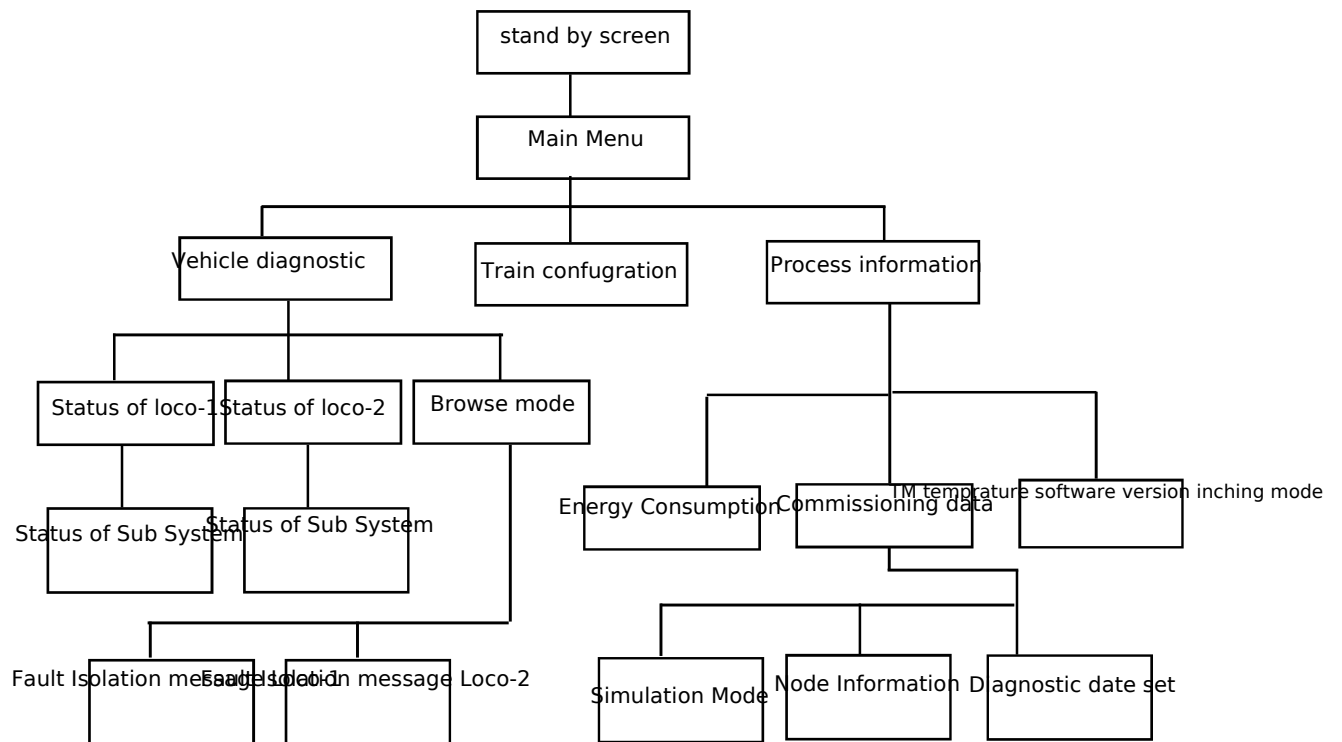
Contrast: Brighter



Contrast : Darker



9.2 Screen Structure



9.3 Faults With Priority-1:

- The action to be taken is entirely clear.
- The action to be taken must be initiated immediately.
- A protective action is initiated
- BPFA will glow.
- LSFI will flicker.
- Priority-1 message will display.

9.4 Faults With Priority-2:

- The action to be taken is not entirely clear.
- The action to be taken does not have to be initiated immediately.
- The faults can be remedied manually by driver.
- BPFA will glow.
- Priority-2 message will appear on screen.

Note

- If a fault message appears on the screen, the yellow illuminated push button “BPFA” lights up. If this is fault of priority-1, the red indication lamp “LSFI” starts flashing at the same time.
- If a fault message with priority-1 is displayed, a fault message with priority-2 is suppressed on the screen.
- A fault message with priority-2 remains on the screen until it is overwritten by a fault message with priority-1 or by subsequent fault with priority-2.
- In some priority-2 fault messages like F0203P2, F0303P2 & fault messages related to Line Converter and TM in IGBT base loco LSFI will flicker and BPFA will glow.

9.5 Isolation Of Sub System:

A constant priority-1 fault or priority-2 fault which occurs twice within one 30 minutes period causes the appropriate subsystem to be isolated.

If sub-system has been isolated it does not issue any more fault message and signals. Only LSFI remains glowing.

9.6 Acknowledgement Of Fault Message:

Priority-1

If a priority-1 fault occurs the fault message must be acknowledged before the loco can travel further, If the train driver fails to acknowledge, the protection measures introduced remain in force. The fault is not remedied.

- Fault message can be acknowledge by pressing BPFA, if after acknowledgement LSFI extinguish then it indicates now loco is normal, but if LSFI glow continuously it indicates isolation of concerned sub-system.

Priority-2

They are also acknowledged by pressing BPFA. Even if this acknowledgement is not forthcoming, the locomotive is still able to operate. The fault message still remains visible on the screen until it is over written by a fault message with priority-1 or by subsequent fault with priority-2.

9.7 Indication And Recognition Of Faults

Illuminated push button (BPFA):

Fault indication/fault acknowledgement (Yellow) On occurrence of any fault, the illuminated push button for fault acknowledgement will light up and fault message will appear on the display. The driver is required to acknowledge the fault through the push button. On acknowledgement, the lamp of acknowledgement push button will go off and the display will be cleared.

Fault status lamp (Red) (LSFI) :

In case of priority-1 fault, the fault status lamp will start blinking additionally. On acknowledgement of fault, the lamp will be off but if there is an isolation of a subsystem persisting, then the lamp will continue to glow.

Automatic display of diagnosis messages

If a fault occurs that needs to be transmitted to the driver by means of a diagnosis message, such message will be displayed immediately. At the same time, the illuminated push-button for fault acknowledgement will light up. All diagnostic messages shall be acknowledged by the driver through the fault acknowledgement push button (BPFA). On acknowledgement, the lamp of acknowledgement push button will go off and the display will be cleared.

In case of priority-1 fault, the fault status lamp (LSFI) will start blinking additionally. On acknowledgement of fault the lamp will be off but if there is an isolation of a subsystem persisting, the lamp will continue to glow.

If the driver fails to acknowledge priority 1 fault, then the loco is shut down.

If the driver fails to acknowledge faults of priority-2 then the fault message will remain on the display screen, unless it is overwritten by a fault message of priority-1.

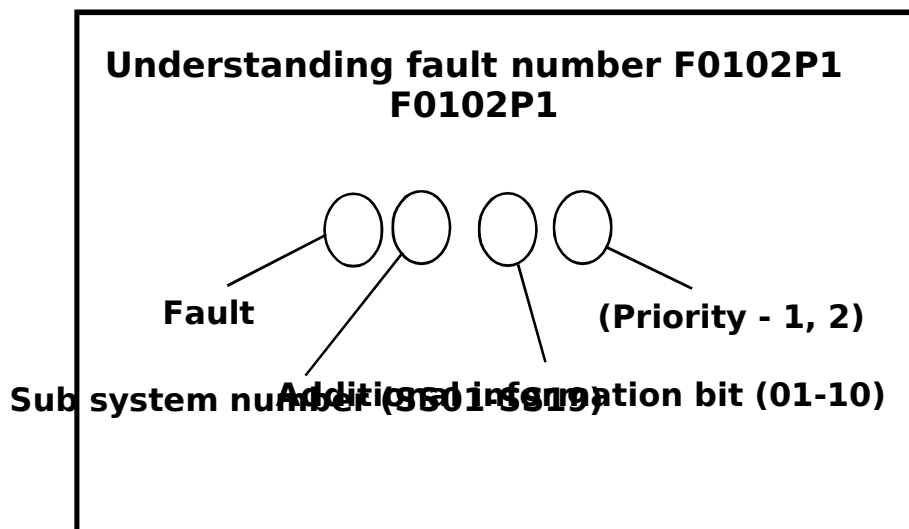
The fault or isolation messages include following information:

- Locomotive number on which the fault or the subsystem isolation respectively occurred
- Name of subsystem being affected (SSO1 to SS19)
- Type of fault /subsystem isolation and related consequences
- Instructions to the engine driver

9.8 Status Code

STATUS CODE	
FIRST DIGIT	SECOND DIGIT
0- No sub system isolated	0- No fault with priority -1 or 2
9- at least one sub system isolated	1- at least one priority -1 fault
	2- at least one priority-2 fault
00 No fault and no sub system isolated	
01 No sub system isolated, at least one priority -1 fault	
02 No sub system isolated, at least one priority-2 fault	
90 At least one sub system isolated, no fault	
91 At least one sub system isolated, at least one priority -1 fault	
92 At least one sub system isolated, at least one priority-2 fault	

9.9 Fault Message Code



9.10 Display Of Subsystem Status

By means of keyboard entry, the driver can display the status of all subsystems of all locomotives within the train composition. Different display levels furnishing more or less detailed information are provided:

- each individual locomotive is indicated by a two-digit numerical code.
- individual subsystem is indicated by a two-digit numerical code.

9.11 Browse Of Status Messages On Request

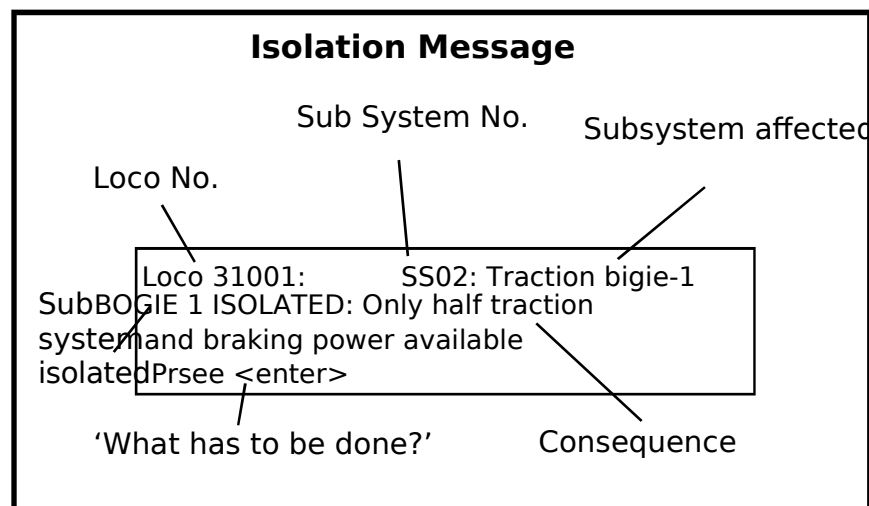
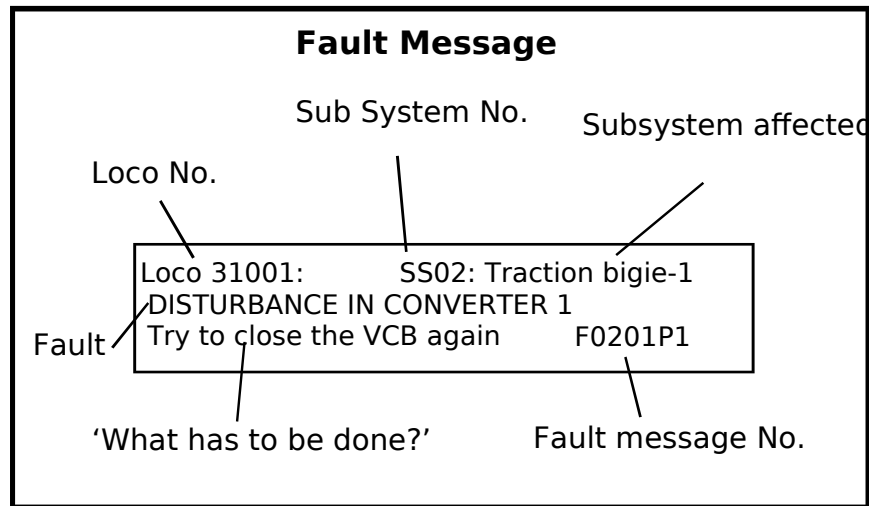
All diagnosis messages that appeared at the display since the last activation of the control system may be repeated on request. In this way, the relieving operating personnel is kept informed on the status of the vehicle. If the train composition consists of two locomotives, the driver can select the locomotive that he wants to process first.

9.12 Diagnosis Messages

There are three types of messages displayed to the driver on the display unit in the cab:

1. Information messages
2. Fault messages
3. Isolation messages

Fault & Isolation Message Structure



List of Subsystems

SS01	Main power
SS02	Traction Bogie 1
SS03	Traction Bogie 2
SS04	Harmonic filter
SS05	Hotel load
SS06	Aux converter 1
SS07	Aux converter 2
SS08	Aux Converter 3
SS09	Battery System
SS10	Brake System
SS11	Auxiliaries HB1
SS12	Auxiliaries HB2
SS13	Cab 1
SS14	Cab 2
SS15	Fire detection
SS16	Speedometer
SS17	Processor FLG1
SS18	Processor FLG2
SS19	Train bus

List Of Isolation Messages

SSO1: Main power

MAIN POWER ISOLATED; VCB inhibited Loco is dead Ask for relief loco

SSO2: traction bogie 1

BOGIE 1 ISOLATED; Only half traction and braking power available Inform maintenance staff

SSO3: Traction bogie 2

BOGIE 2 ISOLATED; Only half traction and braking power available Inform maintenance staff

SSO4: Harmonic Filter

HARMONIC FILTER ISOLATED

Speak to TLC Reduce speed below 40 km/h Inform maintenance staff speaks to TLC

SSO6: Aux. Converter 1

AUXILIARY CONVERTER 1 ISOLATED

Driving still possible Max. Ventilation level will be reduced Inform maintenance staff

SSO7: Aux. Converter

AUXILIARY CONVERTER 2 ISOLATED

Driving still possible Max. Ventilation level will be reduced Inform maintenance staff

SSO8: Aux. Converter

AUXILIARY CONVERTER 3 ISOLATED

Driving still possible Max. Ventilation level 'ill be reduced Inform maintenance staff

SS13: Cab 1

CAB 1 ISOLATED Drive from Cab 2 Change to Cab2 Inform maintenance staff

SS14: Cab 2

CAB 2 ISOLATED Drive from Cab 1 Change to cab-1 Inform maintenance staff

S517: FLG 1

FLG1 ISOLATED

No multiple operations possible, Inform maintenance staff

SS18: FLG 2

FLG2 ISOLATED

No electrical brake power available, Inform maintenance staff

SS19: Train bus

TRAINBUS ISOLATED

Multiple operations not possible, Inform maintenance staff

List Of Information Messages

Information 001

SELF HOLD MODE ACTIVE for 10 mm. MCE will switch off Change cab or repair train or multiple operations within 10 minutes

Information 002

MORE THAN ONE CAB ACTIVE

Deactivate non-driving cab otherwise after 10 mm. MCE switches off

Information 003

Traction MAY NOT BE AVAILABLE ON THIS LOCO OR ON THE SLAVE LOCO
Bring throttle to 0 . then set again Bring TE/BE throttle to "0" and set it again

Information 004

TRAINBUS CONFIGURATION RUNNING Please wait

Information 005

FULL TE/BE RESTORED

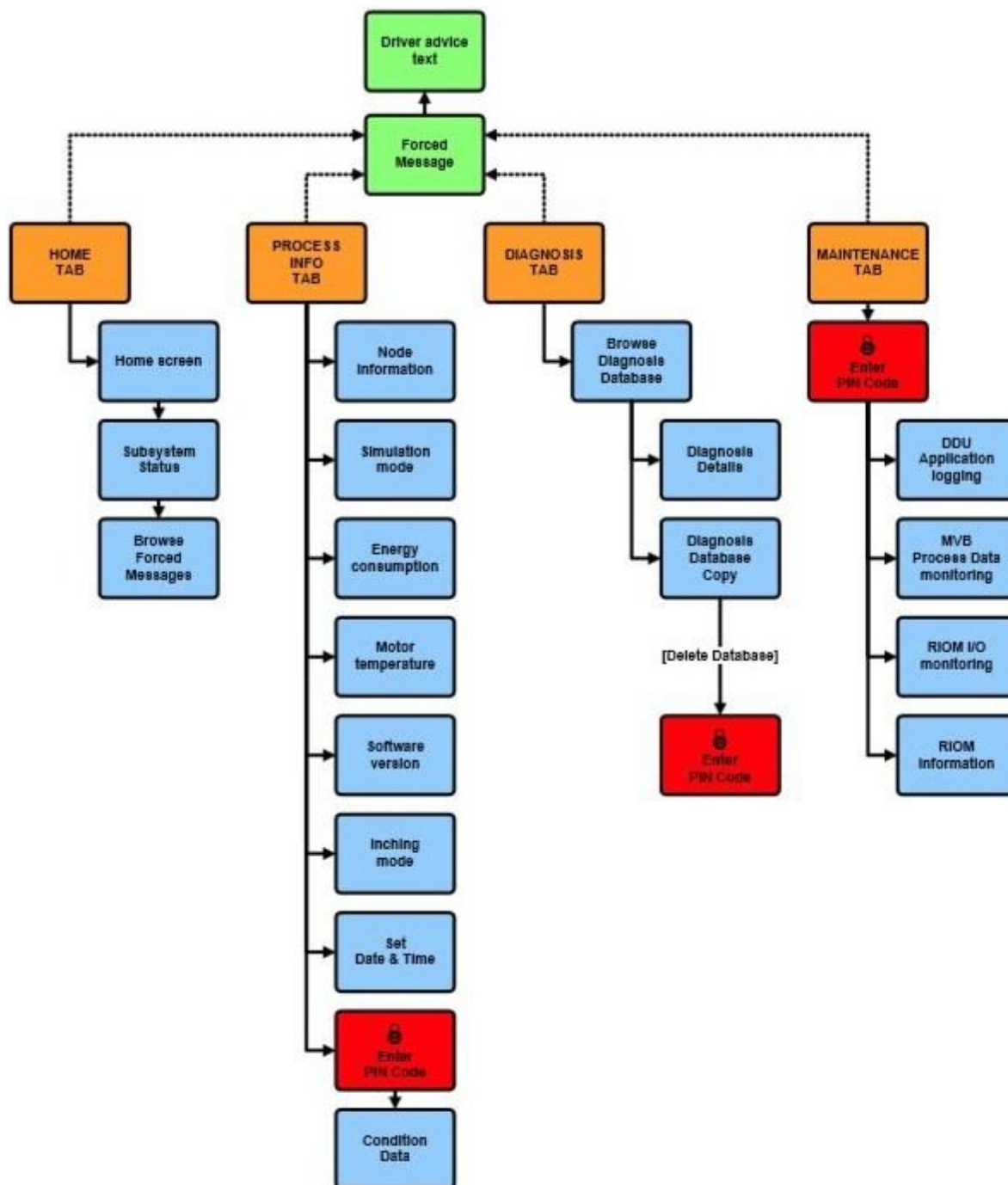
Information 006

PANTO RAISING Please wait

9.17 On some locos touch screen DDS is provided.

Screen structure & operation - The display is positioned in front of the Loco pilot and displays fault, status and diagnostic information. The following description identifies the screen, how they are related to each other and how the Loco pilot uses the display.

Screen structure –



The Home screen is the origin of the structure. The desired screen can be reached after pressing one of the following TAB's:

- Home TAB
- Process Info TAB
- Diagnosis TAB
- Maintenance TAB.

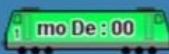
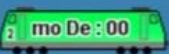


Subsystem status indication Irrespective of which menu is selected, always the status of the locomotives in the configuration is presented in the left down corner. The loco number together with coded information is presented. That coding provides an overview of faults and subsystem isolations existing on two different levels:

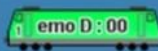
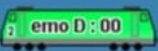
The status code consists of two digits:

- The first digit ('0' or '9') indicates whether a subsystem isolation has taken place within a vehicle or a subsystem
'0' for 'no isolation'. (green/orange or red)
'9' for 'isolation, cut-out', (black)
- The second digit informs on existing failures on a particular vehicle or subsystem:
'0' no failure (green)
'1' at least one failure of priority 1 existing (red)
'2' at least one failure of priority 2 existing (orange)

The status of the different subsystems may be viewed by means of pressing one of the buttons 01 until 20, as shown in the below Figure: Home screen; the next screen will be visible

Home		Process Info		Diagnosis		Maintenance		Fault			
SS01 Main power (Pri 1 Fault)		SS02 Traction bogie 1		SS03 Traction bogie 2		SS04 Harmonic filter		SS05 Hotel load			
SS06 Aux. converter 1 (Pri 2 Fault)		SS07 Aux. converter 2		SS08 Aux. converter 3		SS09 Battery charger		SS10 Brake system			
SS11 Auxiliaries HB1		SS12 Auxiliaries HB2		SS13 Cab 1		SS14 Cab 2		SS15 Fire detection			
SS16 Speedometer		SS17 Processor VCU1		SS18 Processor VCU2		SS19 Trainbus (Pri 1 Fault)		SS20 Spare			
Browse Loco >>>											
Home											
01/02/2013 13:32:56				Loco 1	01	02	03	04	05	↑	CLEAR
					06	07	08	09	10		
 mo De:00  mo De:00				Loco 2	11	12	13	14	15	↓	ENTER
					16	17	18	19	20		

In the above screen it is shown that SS01 and SS19 have a Priority-1 fault, and SS06 has a Priority 2 fault, the other subsystems have no fault. After pressing the button Loco 2, the Status of the subsystems of Loco 2 is shown:

Home		Process Info		Diagnosis		Maintenance		 Fault				
SS01 Main power		SS02 Traction bogie 1 (Isolated)		SS03 Traction bogie 2		SS04 Harmonic filter		SS05 Hotel load				
SS06 Aux. converter 1		SS07 Aux. converter 2		SS08 Aux. converter 3		SS09 Battery charger (Isolated)		SS10 Brake system				
SS11 Auxiliaries HB1		SS12 Auxiliaries HB2		SS13 Cab 1		SS14 Cab 2		SS15 Fire detection				
SS16 Speedometer		SS17 Processor VCU1		SS18 Processor VCU2		SS19 Trainbus		SS20 Spare				
Browse Loco >>>												
										Home		
01/02/2013 13:33:42				Loco 1		01	02	03	04	05		CLEAR
						06	07	08	09	10		
 emo D:00  emo D:00				Loco 2		11	12	13	14	15		ENTER
						16	17	18	19	20		

In the above screen it is shown that SS02 and SS09 of Loco 2 are isolated, and the other subsystems have no fault. Detailed information about the status of the different subsystems may be viewed by means of the menu Diagnosis TAB.

By pressing the Diagnosis TAB the following screen will be presented:

Home Process Info Diagnosis Maintenance									
Position	Time ON	Time OFF	Proc	Sub	Fault Message				
+0013	01/02/2013 13:37:07	01/02/2013 13:37:10	ACI1	SS06	0005: DC-link overcurrent				
+0014	01/02/2013 13:37:07	01/02/2013 13:37:10	ACI1	SS06	0006: DC-link overvoltage				
+0015	01/02/2013 13:37:07	01/02/2013 13:37:10	ACI1	SS06	0007: Frequency disturbance				
+0016	01/02/2013 13:37:07	01/02/2013 13:37:10	ACI1	SS06	0008: Contactor 52/4 will not open				
						Database to USB >>>		Details >>>	
01/02/2013		13:37:11		Loco 1	01	02	03	04	05
					06	07	08	09	10
				Loco 2	11	12	13	14	15
					16	17	18	19	20

Details of a particular DDS-message can be displayed by pressing the DDS-message on the screen; the next screen will be presented:

Home

Process Info

Diagnosis

Maintenance

Time ON	Time OFF	Proc	Sub	Fault Message
01/02/2013 13:37:07	01/02/2013 13:37:10	ACI1	SS06	0007: Frequency disturbance

Signal name

73-_7304-MGG-StFreq

Symptoms

The line voltage frequency is out of range for> 5sec, while the input voltage is ok and the aux. converter is running.

Cause

Advice

Browse

<<<

01/02/2013	13:41:46	Loco 1	01	02	03	04	05	↑	CLEAR
			06	07	08	09	10		
		Loco 2	11	12	13	14	15	↓	ENTER
			16	17	18	19	20		

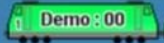
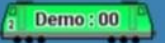
1

mo De : 00

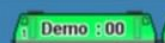
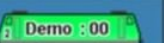
2

mo De : 00

Browse display of all subsystem isolation and fault messages by selecting the loco and after that press Browse Loco, subsystem isolation and fault messages may be displayed. With the scroll-bar all the messages can be shown, see below:

Home	Process Info	Diagnosis	Maintenance	Fault
Messages				
Time	Subsyst.	Code	Messages (ALL)	
01/02/2013 13:49:13	SS01 Main power	F0104P1	Loco 01234 ; SS01:Main power CATENARY VOLTAGE OUT OF LIMITS Watch catenary voltmeter Close VCB when voltage is OK F0104P1	↑↑↑
01/02/2013 13:49:14	SS01 Main power	F0105P1	Loco 01234 ; SS01:Main power TRANSFORMER OIL TEMP. OR PRESSURE NOT OK TE/BE reduction or VCB trip's Try to close the VCB if open F0105P1	↑
01/02/2013 13:49:16	SS01 Main power	F0106P1	Loco 01234 ; SS01:Main power FILTER ON/OFF CONTACTOR STUCK ON VCB will not close again F0106P1	↓
01/02/2013 13:49:18	SS01 Main power	F0107P1	Loco 01234 ; SS01:Main power PRECHARGE OR MAIN CONTACTOR STUCK ON Main converters blocked F0107P1	↓↓↓
01/02/2013	13:49:24	Loco 1	01 02 03 04 05 06 07 08 09 10	↑ CLEAR
 Demo : 00	 Demo : 00	Loco 2	11 12 13 14 15 16 17 18 19 20	↓ ENTER

After pressing the Process Info TAB the DDU opens automatically the submenu Node information, see Figure below: All information shown in the submenus is about the Loco1 in the train configuration. This submenu gives information about the nodes of the several processes in the Loco.

Home	Process Info	Diagnosis	Maintenance	Fault
Node Information				
Node code Master ICP1: 1234				
Node code Master subchart ICP1: 1000				
Node code VIU1: 1000				
Node code Unknown: ALG1: 456Ah				
Node code Master subchart ICP2: 1000				
Node code VIU2: 1000				
Node code Unknown: ALG2: F286h				
Node Information				
Energy consumption				
Simulation mode				
Motor temperatures				
Software version				
Inching mode				
Set Date/Time				
Condition data				
Motor Converter				
01/02/2013	13:50:15	Loco 1	01 02 03 04 05 06 07 08 09 10	↑ CLEAR
 Demo : 00	 Demo : 00	Loco 2	11 12 13 14 15 16 17 18 19 20	↓ ENTER

Energy consumption

This submenu gives information about the Energy consumed and regenerated. This information can be reset in the submenu Condition data (after login).

Home		Process Info		Diagnosis		Maintenance		Fault							
Energy counter <table><tr><td>Loco nr.:</td><td>12345</td></tr><tr><td>Consumed:</td><td>36,530 kWh</td></tr><tr><td>Regenerated:</td><td>0 kWh</td></tr></table>								Loco nr.:	12345	Consumed:	36,530 kWh	Regenerated:	0 kWh	Node Information Energy consumption Simulation mode Motor temperatures Software version Inching mode Set Date/Time Condition data Motor Converter	
Loco nr.:	12345														
Consumed:	36,530 kWh														
Regenerated:	0 kWh														
01/02/2013 13:50:46		Loco 1		01	02	03	04	05	↑	CLEAR					
				06	07	08	09	10							
		Loco 2		11	12	13	14	15	↓	ENTER					
				16	17	18	19	20							

Simulation mode

The screen "Simulation mode" is used for commissioning purpose after maintenance / repairs works. In simulation mode (to be selected by the shed personnel on the switch in the machine room), the operation of pantograph, VCB, contactors etc. can be checked without the locomotive being supplied with the catenary voltage. On the screen following information is displayed: Status grey - simulation mode inactive, green - simulation mode Active UPRIM Catenary voltage (0 -25 KV), simulated value VACT Actual loco speed (0 - 120 KPH), simulated value TE/ BE DEM Demanded TE / BE (-100 until +100 %), simulated value.

ICP1 Node code from ICP1 (corresponds with screen "Node information")
VIU1 Node code from VIU1 (corresponds with screen "Node information")
Screen simulation mode shows in normal operation mode real (not simulated) values.

Home
Process Info
Diagnosis
Maintenance

Fault

Simulation Mode

Status:

UPRIM:	40	kV
VACT:	158.1	km/h
TE/BE DEM:	0	kN
ICP1	1000	
VIU1	1000	

Node Information
Energy consumption
Simulation mode
Motor temperatures
Software version
Inching mode
Set Date/Time
Condition data
Motor Converter

01/02/2013
13:51:16

Loco 1

01	02	03	04	05
06	07	08	09	10

Loco 2

11	12	13	14	15
16	17	18	19	20

CLEAR
 ENTER

Motor temperatures

Home
Process Info
Diagnosis
Maintenance

Fault

Motor temperatures

Motor 1:	-152	°C
Motor 2:	24	°C
Motor 3:	498	°C
Motor 4:	63	°C
Motor 5:	24	°C
Motor 6:	682	°C

Node Information
Energy consumption
Simulation mode
Motor temperatures
Software version
Inching mode
Set Date/Time
Condition data
Motor Converter

01/02/2013
13:51:36

Loco 1

01	02	03	04	05
06	07	08	09	10

Loco 2

11	12	13	14	15
16	17	18	19	20

CLEAR
 ENTER

Software version

This submenu gives information about the installed software versions on the Loco.

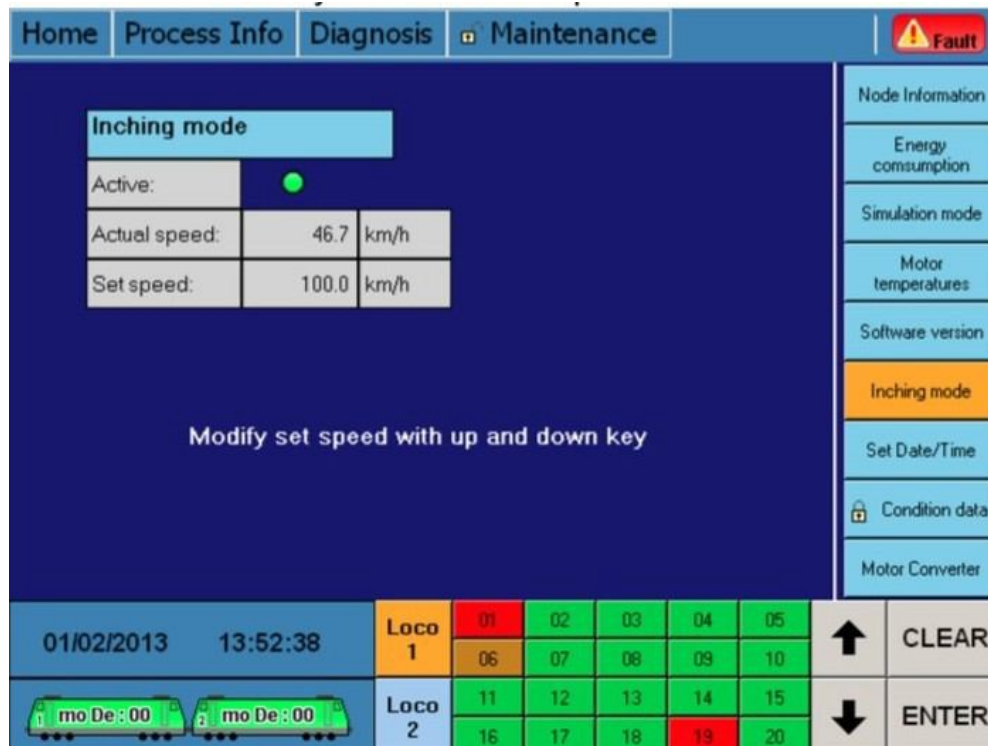
The screenshot displays the 'Maintenance' menu of a locomotive control system. The menu bar at the top includes 'Home', 'Process Info', 'Diagnosis', and 'Maintenance' (highlighted), along with a 'Fault' indicator. The main area shows a 'Software Versions' table with two columns of data. To the right is a vertical list of menu options, with 'Software version' highlighted. At the bottom is a control panel with a date/time display, locomotive status, a 20-button keypad, and 'CLEAR'/'ENTER' buttons.

ICP1	1024.13	ACI1	1367.14
ICP2	3323.04	ACI2	2508.04
VIU1	3361.08	ACI3	1569.06
VIU2	1328.03	Gateway	12.34

01/02/2013 13:52:01		Loco 1	01	02	03	04	05	↑	CLEAR
			06	07	08	09	10		
		Loco 2	11	12	13	14	15	↓	ENTER
			16	17	18	19	20		

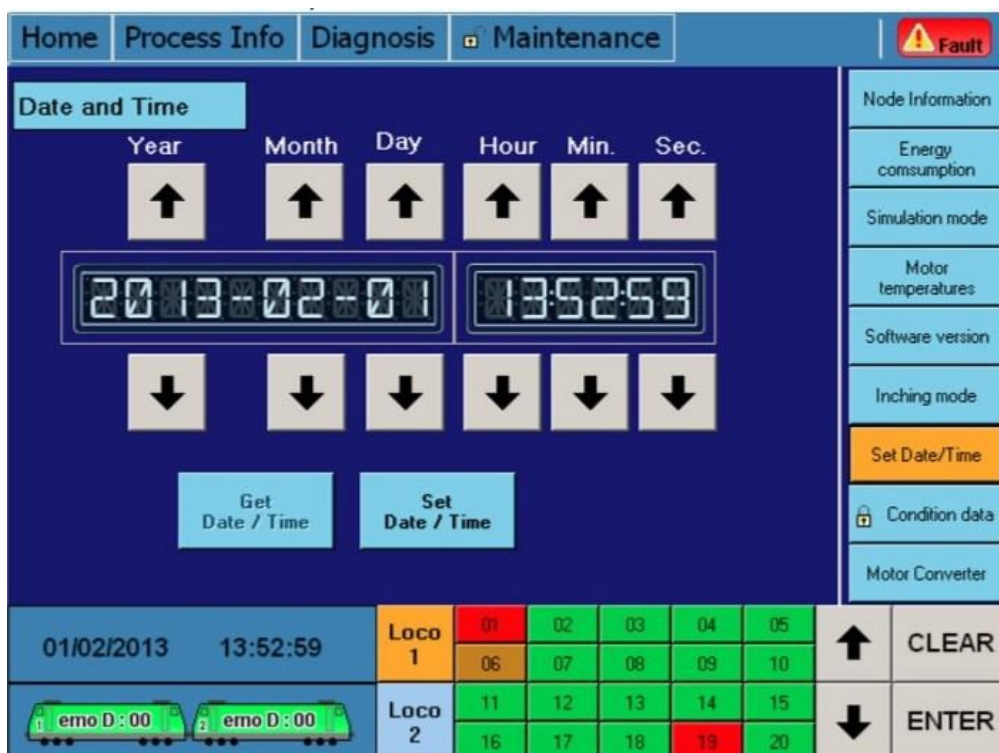
Inching mode

In inching mode the driver can set the vehicle speed to a desired (low) value, this is useful while loading coal when the train needs a very low constant speed.



Set Date/Time

This screen can be used to set the date and time. The button Get Date / Time can be used to get the current time from the processor, actually undo the made changes (before Set Date / Time).



Condition data

This screen can be used to change the locomotive number, to adapt wheel diameters during maintenance when the wheels are worn, or after grinding of the wheels. Also the consumed and regenerated energy can be reset.

Home	Process Info	Diagnosis	Maintenance	Fault																											
<table border="1"><thead><tr><th>Condition Data</th><th colspan="3">Value (press to edit)</th></tr></thead><tbody><tr><td>Locomotive number:</td><td colspan="3">12345</td></tr><tr><td></td><td>Wheel M1</td><td>Wheel M2</td><td>Wheel M3</td></tr><tr><td>Bogie 1:</td><td>1092</td><td>1091</td><td>1091 mm</td></tr><tr><td>Bogie 2:</td><td>1091</td><td>1091</td><td>1090 mm</td></tr><tr><td>Energy consumed:</td><td colspan="2">37,168 kWh</td><td rowspan="2">Reset</td></tr><tr><td>Energy regenerated:</td><td colspan="2">0 kWh</td></tr></tbody></table>				Condition Data	Value (press to edit)			Locomotive number:	12345				Wheel M1	Wheel M2	Wheel M3	Bogie 1:	1092	1091	1091 mm	Bogie 2:	1091	1091	1090 mm	Energy consumed:	37,168 kWh		Reset	Energy regenerated:	0 kWh		Node Information Energy consumption Simulation mode Motor temperatures Software version Inching mode Set Date/Time Condition data Motor Converter
Condition Data	Value (press to edit)																														
Locomotive number:	12345																														
	Wheel M1	Wheel M2	Wheel M3																												
Bogie 1:	1092	1091	1091 mm																												
Bogie 2:	1091	1091	1090 mm																												
Energy consumed:	37,168 kWh		Reset																												
Energy regenerated:	0 kWh																														
Save Changes Discard Changes																															
01/02/2013 13:53:25		Loco 1	01 02 03 04 05 06 07 08 09 10	↑ CLEAR																											
1 o Dem : 00 2 o Dem : 00		Loco 2	11 12 13 14 15 16 17 18 19 20	↓ ENTER																											

Motor Converter

This screen is useful when a motor converter has a problem that cannot be resetted, and permanent gives errors. In that case this screen can be used to permanently disable the motor converter that gives the problems. Also in this screen it is possible to enable motor converters which are permanently disabled, i.e. after maintenance when the problem is solved.

Home
Process Info
Diagnosis
Maintenance

Fault

Motor converter	Actual status	
1		Enabled
2		Locked & Enabled
3		Locked & Enabled
4		Enabled
5		Locked & Enabled
6		Locked & Disabled

Node Information
Energy consumption
Simulation mode
Motor temperatures
Software version
Inching mode
Set Date/Time
Condition data
Motor Converter

01/02/2013
13:54:35

Loco 1

01	02	03	04	05
06	07	08	09	10

Loco 2

11	12	13	14	15
16	17	18	19	20

↑ CLEAR
↓ ENTER

Priority 1 fault:

The corrective action is clear and required immediately.

1. A protective action will be executed (i.e. Power reduction/ traction interlock/ VCB off/ protective shut down).
2. A fault message will be indicated. If a priority 2 fault message is currently displayed, this message will be overwritten by the priority 1 fault message.
3. The fault has to be acknowledged by the illuminated flashing fault acknowledge push button.
4. Isolation counter is activated. The Isolation counter counts the number of times a fault has occurred in a specified time period.
5. If isolation counter has reached a specified limit, then an isolation of the subsystem is performed. The corresponding isolation message will appear on the display. The isolation message has to be acknowledged by pressing the <ENTER> key on the display's keyboard.

Home
Process Info
Diagnosis
Maintenance

Fault

Fault Message
Received 01/02/2013 12:56:16

Loco 01234 ; SS01:Main power
LOW PRESSURE PANTO/FAULTY PANTO
Check Isolating Cock
Check Aux. Reservoir Pressure F0103P1

Driver advice
>>>

01/02/2013	13:00:04	Loco 1	01	02	03	04	05	↑	CLEAR
			06	07	08	09	10		
Demo:00 Demo:00		Loco 2	11	12	13	14	15	↓	ENTER
			16	17	18	19	20		

Priority 2 fault:

A priority 2 fault is generated in the following cases:

1. corrective action to be taken manually by the driver
 2. corrective action not clear
 3. corrective action not required immediately
- If a priority 2 fault becomes active, a fault message will be indicated. The fault can be confirmed by the illuminated fault acknowledge push button or by pressing <ENTER> on the display's keyboard. Otherwise the message will remain on the display until it would be overwritten by a priority 1 fault which may occur subsequently.

Home
Process Info
Diagnosis
Maintenance
 Fault

Fault Message
Received 01/02/2013 13:02:47

Loco 01234 ; SS01:Main power
TRANSFORMER OIL PRESSURE NOT OK
Any oil pump circuit not working
TE/BE will be reduced F0102P2

Driver advice
>>>

01/02/2013 13:03:11	Loco 1	01	02	03	04	05	↑	CLEAR
		06	07	08	09	10		
mo De: 00 mo De: 00	Loco 2	11	12	13	14	15	↓	ENTER
		16	17	18	19	20		

Chapter 10

MULTIPLE OPERATION

1. Multiple loco preparation:

If both loco are dead/de-energised condition:-

- Put 110 & 112.1 in SB-2 panel in ON position of both loco.
- On trailing loco insert A9 handle in neutral position, lift the lock and move A9 handle to release position.
- Insert BL key in 'OFF' position and put it to 'D' mode, wait for self testing of loco and DDS shows 504.
- Move the BL key from 'D' to 'OFF' and remove BL key.
- Put A-9 handle in neutral position & remove A-9 handle.
- Close isolating COC-136, keep COC-70,74 in open condition & ensure COC-47 is in close condition.
- Proceed to leading loco & insert BL key in OFF position and move to 'D' within 10min to avoid MCE OFF.
- Open COC-136, keep COC-70,74 in open condition & ensure COC-47 is in close condition.
- Insert A-9 handle in neutral position and put it in release.
- Insert BL key in 'OFF' position and put it in 'D' mode.
- Wait till self testing completes and Node information 504, then energize the loco as per sequence.

NOTE: 1) Both loco should be in energize condition for BP charging at 5kg/cm² .if any one loco trips and MCE in OFF condition then BP pressure will not charge fully.
2) During MU operation LP advised to keep the DDS in Node information mode to observe the status of Trailing loco.

2. CAB CHANGING E-70 (MU)

- I. Bring throttle to '0' & reverser to neutral.
- II. Apply SA-9/A-9 to stop the Loco/train. Open DJ, lower the Panto.
- III. BL key from 'D' to 'OFF' and then removed.
- IV. Move A-9 from 'RUN' to 'NEUTRAL' and remove A-9 handle.
- V. Release SA-9, close isolating COC-136, proceed to leading cab of Trailing loco with A-9 handle and BL key.

ON LEADING LOCO LEADING CAB:

- I. Apply SA-9, insert A-9 in 'Neutral' and move to 'RUN' by lifting locking pin
- II. Insert BL key in 'OFF' and move to 'D' and wait for Node information FLG-504
- III. Open isolating COC-136 & Energize the loco as per normal procedure

NOTE:- a) Cab changing to be done within 10 min to avoid MCE 'OFF'.
b) During MU operation DDS (Master loco) must be kept in "NODE INFORMATION" to view the status of Trailing Loco.

3. Procedure for single loco operation during failure of rear unit in 'WAG-9 MU' operation:-

- If trailing loco trips with any fault then fault message with rear loco no will be displayed in master loco which has to be noted and acknowledged for getting the corresponding node information about the nature of failure in rear (SLAVE) locomotive. If node information of slave loco comes similar as leading loco automatically proceed with normal operation and if not then **slave loco node to be made 504 physically** by going to the rear loco by operating BL Key 'OFF' to 'D' Mode. Further remove the BL key operating 'D' to 'Off' position in rear loco and then proceed to leading loco, make the node 504 inserting BL Key and follow the sequence for the MU operation.
- If not succeed to make the rear loco node 504, then made the rear loco "**TRAIL DEAD**" to work from leading (single loco) and clear the block section or full section as per load.

4. TRAIL DEAD PROCEDURE:

- First switch "OFF" MCE of both loco.
- Put OFF MCB 110 & 112.1 in SB-2 panel of trailing loco.
- Close isolating cock 70 (E-70 Brake pipe isolating cock)
- Close isolating cock 74(Emergency vigilance isolating cock)
- Close isolating cock 136 (Feed pipe isolating cock)
- Close isolating cock 47 (Dead engine cock)
- Manually release the parking brake.
- Now switch "ON" MCE of leading loco only and energise the loco.

5. TRAILING MODE PROCEDURE:

Trailing mode means that on the master locomotive in a multiple unit no tractive effort is available. If both Traction bogies are electrically isolated. The LP's cab of the master locomotive still controls the slave locomotive.

Stop the loco. Open VCB and lower the panto. Switch OFF MCE.

- Put switch 154 on "I & II".
- Isolate PAN-1 & PAN-2.
- Energize the Trailing loco from leading loco working cab.
- Fault message "**LOW PRESSURE PANTO/FAULTY PANTO (F0103P1)**" will display with glowing of LSFI.
- Acknowledge the fault by pressing BPFA.
- Release the parking brake by pressing BPPB.
- Put reverser in desired direction and take TE.
- Now the tractive effort of trailing loco will display on leading loco TE/BE meter and also on simulation screen.
- Release SA-9 and work the loco.

- Note-**
1. All equipment on the master locomotive are supplied by the battery and are functional for a maximum of 5 hours, if battery is fully charged.
 2. In the event of MU operation is not working normally due to distress in one of the loco/ system, LP/ALP should inform TLC immediately for attention/relief of the locomotive on first opportunity.

Multiple operation with two locomotives

In multiple operations a maximum of two locomotives can be operated. Both must be directly coupled to one another. They must not be separated by a carriage. While in motion, the front driver's cab is usually activated.

When linking up or in unusual situations, it is also possible to control the locomotives from another driver's cab.

The train bus configuration for multiple operation is only possible from the driver's cab at the uncoupled end. A configuration from a rear driver's cab is referred to as single-unit traction. The train bus automatically checks the configuration.

The leading manned locomotive is called the master locomotive and the other one is called the slave locomotive.

The two locomotives are correctly linked together once the mechanical and pneumatic systems and the UIC cable have been connected.

Commands are transmitted down the UIC cable.

Pantograph

In multiple operation, both the most distant pantographs are raised if "pantograph selection switches" in both the locomotives are in position "AUTO".

The train bus connections define the free end of each locomotive. The command from the master locomotive to raise/lower the pantographs also controls the pantographs on the slave locomotive.

Note : Whenever the simulation key switches on the master and slave locomotives are not in the same position, the pantograph are not active (fault message).

Main circuit breaker (VCB)

The command from the master locomotive to switch the main circuit breaker "ON/OFF" also control the main circuit breaker on the slave locomotive.

The VCB on the slave locomotives is Switched ON after a delay of 0.5 seconds following the switch on of the VCB on the master locomotive. When Switching OFF, there is no delay.

Note : If the VCB on the slave locomotive cannot be closed due to a fault, an appropriate fault message appears on the screen.

Regenerative brake

During multiple operation, there is a limitation on the regenerative brake on the slave locomotive. This limitation reduces forces on the loco buffers (prevention of derailing).

Constant Speed Control (CSC)

During multiple operation, the constant speed control of the slave locomotive is inactive. The train bus transmits the selected tractive/braking effort from the master locomotive to the slave locomotive. The master loco performs speed controlling function, demanding TE/BE on master and slave loco.

Anti-spin protection

The anti-spin protection of the slave locomotive is independent of the master locomotive.

Compressor control

The compressors are able to operate in three different operating modes. These modes can be selected with the spring-loaded switch “BLCP”, (Panel A).

Position. “OFF” Compressor switched off.

Position. “AUTO” Automatic pressure monitoring.

Position. “MAN” Compressor switched on (manual monitoring).

The selected position of the compressor switch is transmitted to the slave locomotive. In the “Man” and “Off” positions, all main compressors in both locomotives are controlled directly. In the position “Auto”, there are the following options:

1. A main reservoir pressure below 8 kg/cm² on the master or slave locomotive activates both compressor on both locomotives up to 10Kg/cm².
2. When ‘MPJ’ on ‘F’ or ‘R’ and MR pressure drops to 6.4Kg/cm², a fault message **F1002P1** “LOW PRESSURE MAIN RESERVOIR” will display and throttle will not respond.
3. When MR pressure drops to 5.6Kg/cm², a fault message **F1002P1** “LOW PRESSURE MAIN RESERVOIR”.

Parking brake

The multiple unit cannot drive if one of the parking brakes is applied.

Note :

An activated parking brake on the master or slave locomotive is indicated in the activated driver’s cab of the master locomotive by the red illuminated push button “BPPB”.

Emergency Brake

An emergency brake on the slave locomotive can only be initiated in the following manner:

1. By actuating the brake handle of the automatic train brake to “Emergency” position.
2. By actuating the emergency brake cock on the assistant driver’s side. If the pressure switch 269.1 on the master or slave locomotive registers actuation of the emergency brake, the ensuing command for emergency braking applies to both locomotives. The master for all other emergency braking commands is the master for all other

emergency braking commands is the master locomotive in the double (multiple) unit.

Other Brake functions

If the pressure switch (269.6) registers a pressure in the brake cylinder of any bogie, and if speed exceeds 10 km/h, tractive effort is set to 0.

Note :

If the electrical brake on one of two locomotives fails, the electrical brake on the other locomotive remains functional.

Coupling

1. Both locomotive must be deactivated. The key switch must be in position "0"
2. Couple both locomotives mechanically, pneumatically and connect the UIC cable.
3. Close the isolating cock on the brake supply line of the slave locomotive.
4. Move the key switch on the slave locomotive into position "D" and, as soon as the light test starts, turn back to position "0". The MCE on the slave locomotive is now in self-hold mode.
5. During the self-hold mode of the slave locomotive, move key switch into Pos. "D" on the master locomotive. The control electronics starts to configure the train bus.
6. After the configuration procedure, screen on the display shows the serial numbers of the master and slave locomotives.

Example :

Train configuration

Loco 31001Loco 31002

Note :

If configuration proves impossible, (or if no locomotive is available) locomotive number 00000 appears.

If more than one driver's cab is activated in both locomotive, one is shutdown and a corresponding message appears on the displays in both locomotives.

Uncoupling

Starting position :

Master and slave locomotives are available and both are ready.

1. Shut down both locomotives in accordance with regulations (VCB switched off, pantograph lowered).
2. Remove the UIC cable and disconnect the locomotives pneumatically and mechanically.
3. Both the locomotives are now ready for setting up as a single locomotive.

Note :

If for any reason the train bus link is interrupted, or if both locomotives are set up or in motion, the system protection initiates a monitored shut down of the slave locomotive.

Reaction :

The pantograph of the slave locomotive is lowered and a corresponding fault message appears on the screen of the master locomotive.

Sanding

Sanding on both locos can be initiated by the driver by pressing the sanding foot switch on the master loco.

Fire alarm

A fire detection on the slave locomotive initiates an audio signal on the master locomotive. In addition, the VCB on the slave locomotive is switched off and a priority 1 fault message appears on the displays of both locomotives.

Trailing mode

Trailing mode means that on the master locomotive in a multiple unit no tractive effort is available, if both bogies are electrically isolated. The driver's cab of the master locomotive still controls the slave locomotive.

The status of the master locomotive is as follows :

1. VCB switched off.
2. Pantograph is lowered.
3. Train bus is working correctly.
4. Pneumatic brake system is working correctly.
5. Brakes are controlled from the master locomotive.
6. The TE/BE meters show the values for the slave locomotive.

Note :

All equipments on the master locomotive are supplied by the battery and are functional for a maximum of 5 hours, if battery is fully charged.

Cab Changing procedure in 3 phase locos

1) In MU locos

A) Loco provided with FTIL (E-70) brake system:-

- i) Apply parking brake. (Ensure BPPB glows and PB gauge indicates "0"Kg/cm²).

- ii) Take out A-9 handle by moving it to **Neutral** position (Ensure BP '0' Kg/cm²).
- iii) Open VCB, lower the pantograph.
- iv) Move BL Key from **"D"** to **"OFF"** position & take it out.
- v) Release SA-9.
- vi) Keep feed pipe cock **"136"** in **"Close"** Position.
- vii) Proceed to other (**Master to Slave**) loco with A-9 handle and BL key.
- viii) Apply SA-9.
- ix) Insert A-9 handle in **"NEUTRAL"** position, lift the lock and move it to **"RUN"**.
- x) Keep feed pipe cock **"136"** in **"Open"** position.
- xi) Insert BL key in **"OFF"** position and turn it to **"D"** position.
- xii) Energise the loco as per procedure and resume traction.

B) Locos provided with KNORR CCB brake system:-

- i) Apply parking brake. (Ensure BPPB glows and PB gauge indicates "0"Kg/cm²)
- ii) Move A-9 handle to **"FS"** position and lock it.
- iii) Change position of mode switch from **"LEAD"** to **"TRL"** (trail).
- iv) Open VCB, lower the pantograph.
- v) Move BL key from **"D"** to **"OFF"** and remove it.
- vi) Release SA-9.
- vii) Keep feed pipe cock **"136"** in **"Close"** Position
- viii) Proceed to the other (**Master to Slave**) loco with BL key.
- ix) Keep feed pipe cock **"136"** in **"Open"** position.
- x) Change position of mode switch from **"TRL"** to **"LEAD"**.
- xi) Apply SA-9 and unlock A-9 handle.
- xii) Insert BL key in **"OFF"** position and turn it to **"D"** position.
- xiii) Energise the loco as per procedure.
- xiv) Move A-9 handle from **"FS"** to **"RUN"** (follow the **EBV** display message), charge BP pressure and resume traction.

Note: i) The control electronics remains in **"self-hold mode"** for **'10'** minutes after putting BL key in **"OFF"** position. Within this time cab changing is to be completed.

ii) Parking brake not provided in WAP-7 loco, hence during cab changing application of loco brake must be ensured.

Chapter-11

DEAD LOCO MOVEMENT

(FOR DETAILS, REFER R.B. LETTER No. 2000 /M (L) /466/803/Pt. dated 28.06.2006)

Hauling 3-Phase loco fitted with E-70 brake system as a dead loco.

These locomotives are fitted with electro pneumatic E-70 brake system. These locomotives in dead condition can be hauled both by locomotive fitted with IRAB-1/28LAV-1 brake system and locomotive fitted with E-70 brake system.

If these locos are coupled with conventional A.C. locos as a dead, then direct loco brake application is not possible by SA-9 since MRE & BCE can not be coupled but if BP is dropped from live loco, conjunction loco brakes application will take place in dead loco.

A)Hauling dead WAP-5/WAG-9 electric locomotive fitted with E-70 brake pipe control system in a train.

1. Switch off BLDJ and lower the pantograph of the loco to be sent as dead. Isolate the pantograph through panel isolating cock on pneumatic panel.
2. Switch off CEL as follows:
 - a) Operate BL-key from 'D' to 'Off' (wait for 2 sec.)
 - b) Operate BL-key from 'Off' to 'C' and wait until display screen, LSDJ, and UBA goes off.
 - c) It indicates that CE is get 'OFF' and now rotate BL from 'C' to 'OFF'. Switch off the 'circuit breaker control circuit locomotive' (112.1) in SB2 panel.
3. Couple the dead loco in the train.
4. Put auto brake controller (A9) in "Neutral" position in both cabs of dead loco.
5. Put the direct brake controller (SA9) in "Release" position in both cabs of dead locomotive.
6. Drain the Main and Aux. reservoirs of dead locomotive completely. After draining out, close the drain cock of main reservoir and aux. reservoir.
7. If loco brake in the dead locomotive have not got released, which can be verified by observing the BC pressure gauge, then release the same in the following steps.
 - i) Manual handle of distributor valve at pneumatic panel should be operated manually to release control pressure. BC pressure shall automatically vent through D2 relay valve to release loco brakes.
 - ii) In case residual BC pressure remains in brake cylinder line, the BC pressure should be released through bogie isolating cock of both bogies. Make bogie- isolating cocks in 'Normal' position after releasing the BC pressure
8. In the dead locomotive, ensure isolating cock position in the pneumatic panel as follows.

9. (Towed dead):

Cock	47	74	136	70
Name	(Dead engine)	(Em. vigilance)	(Feed pipe)	(Brake pipe)
Position	Open	Closed	Closed	closed

10. Connect BP pipe of the dead loco to the BP pipes of load and open BP angle cock of both of loco and load side. The aux. reservoir on dead locomotive will get charged from BP supply. Check the BP pressure gauge in the cab of dead loco. It should show the same pressure as that of the load in case of load (In case of locos are to be attached on a train having twin pipe i.e. both BP and FP then FP of dead locos should also connected and its angle cock should be opened.)

11. Lock the parking brakes in applied condition. This procedure is safe to avoid brake binding and condensation of moisture in the parking brake cylinder. It is as under

- Apply the parking brakes of dead loco by apply push button.
- Lock the parking brakes in applied condition.
- Release the parking brake of the dead loco by manual operation of parking brake release handle on each of the four parking brake units. For manual brake release, first turn the release handle slightly clockwise and then pull till a sound of locking mechanism is heard. The parking brake units are fitted on the following wheels:

Loco Type	Wheel position of P/Brake units			
WAP5	1	4	5	8
WAG9	2	8	7	11

- If some of the parking brake handles are defective and due to this if not possible to release manually, then release the same by manually pressing the "Release" Push Button of the latched solenoid valve no.30 on the pneumatic panel of the dead locomotive.
12. As parking brakes are locked in applied condition PB gauge will show 0 Kg/Cm².
13. Double check the release of parking brakes of dead loco by moving the parking brake unit by hand.

14. Apply auto brakes (A9) in the working locomotive and check that loco brakes on both the locomotives are getting applied. Then release the auto brake in the working loco and check that loco brakes are getting released on both the locomotives. Rear locomotive (WAG-9 / WAP-5 dead) takes about 1 minute to release.
15. As a final check, run the coupled loco for about 500 metres and feel for any abnormal rise in temperature of wheels of dead loco and also check if at subsequent stop during journey.
16. Remember that in the dead locomotive, the loco brakes takes about 1 minute to release after auto brake application from the live loco. Hence after every auto brake application and release wait for adequate time (minimum 1 minute) for release of loco brakes in dead locomotive before resuming traction
17. Escorts accompanied dead locomotive should never put BL key in position 'D' and also strictly avoid energising the dead locomotive.
18. After reaching the destination, before detaching the working loco,
 - a) Unlock the application plunger of parking brake solenoid valve no. 30.
 - b) Press the release button of parking brake solenoid valve no. 30. This will charge parking brake line by 5 kg/cm².
 - c) Apply parking brakes on dead locomotive by application plunger of parking brake solenoid valve no. 30.

B) Hauling dead WAP5/WAG-9 locomotive fitted with E-70 brake pipe control system when attached next to leading working locomotive:

1. Switch off BLDJ and lower the pantograph of the loco to be sent as dead. Isolate the pantograph through panel isolating cock on pneumatic panel.
2. Switch off CEL as follows:
 - a) Operate BL-key from 'D' to 'Off' (wait for 2 sec.)
 - b) Operate BL-key from 'Off' to 'C' and wait until display screen, LSDJ, and UBA goes off.
 - c) It indicates that CE is get' OFF' and now rotate BL from 'C' to 'OFF'. Switch off the 'circuit breaker control circuit locomotive' (112.1) in SB2 panel.
3. Couple the dead loco in rear of the working loco.
4. Put auto brake controller (A9) in "Neutral" position in both cabs of dead loco.
5. Put the direct brake controller (SA9) in "Release" position in both cabs of dead locomotive
6. Drain the Main and Aux. reservoirs of dead locomotive completely. After draining out, close the drain cock of main reservoir and aux. reservoir
7. If loco brake in the dead locomotive have not got released, which can be verified by observing the BC pressure gauge, then release the same in the following steps.
 - i) Manual handle of distributor valve at pneumatic panel should be operated manually to release control pressure. BC pressure

- shall automatically vent through D2 relay valve to release loco brakes.
- ii) In case residual BC pressure remains in brake cylinder line, the BC pressure should be released through bogie isolating cock of both bogies. Make bogie-isolating cocks in 'Normal' position after releasing the BC pressure
 8. In the dead locomotive, ensure isolating cock position in the pneumatic panel as follows. (Towed dead):
 9. Connect BP pipe of the dead loco to the BP pipe of working loco and open BP angle cock of both the locos. The aux. reservoir on dead locomotive will get charged from BP supply of the working locomotive. Check the BP pressure gauge in the cab of dead loco. It should show the same pressure as that of the live locomotive (In case of locos are to be attached on a train having twin pipe i.e. both BP and FP then FP of both the locos should also connected and its angle cock should be opened.)
 10. Lock the parking brakes in applied condition. This procedure is safe to avoid brake binding and condensation of moisture in the parking brake cylinder. It is as under
 - a. Apply the parking brakes of dead loco by apply push button.
 - b. Lock the parking brakes in applied condition.
 - c. Release the parking brake of the dead loco by manual operation of parking brake release handle on each of the four parking brake units. For manual brake release, first turn the release handle slightly clockwise and
 - d. If some of the parking brake handles are defective and due to this if not possible to release manually, then release the same by manually pressing the "Release" Push Button of the latched solenoid valve no.30 on the pneumatic panel of the dead locomotive.
 11. As parking brakes are locked in applied condition PB gauge will show 0 Kg/Cm².
 12. Double check the release of parking brakes of dead loco by moving the parking brake unit by hand.
 13. Apply auto brakes (A9) in the working locomotive and check that loco brakes on both the locomotives are getting applied. Then release the auto brake in the working loco and check that loco brakes are getting released on both the locomotives. Rear locomotive (WAG-9 / WAP-5 dead) takes about 60 seconds to release.
 14. As a final check, run the coupled loco for about 500 metres and feel for any abnormal rise in temperature of wheels of dead loco and also check if at subsequent stop during journey.
 15. Remember that in the deal locomotive, the loco brakes takes about 60 seconds to release after auto brake application from the live loco. Hence after every auto brake application and release wait for

adequate time (minimum 1 minute) for release of loco brakes in dead locomotive before resuming traction

16. Escorts accompanied dead locomotive should never put BL key in position 'D' and also strictly avoid to energise the dead locomotive.
17. After reaching the destination, before detaching the working loco,
 - a) Unlock the application plunger of parking brake solenoid valve no. 30.
 - b) Press the release button of parking brake solenoid valve no. 30. This will charge parking brake line by 5 kg/cm². Apply parking brakes on dead locomotive by application plunger of parking brake solenoid valve no. 30.

C) Hauling dead locomotive fitted with IRAB-1/28LAV-1 brake system by WAP-5/WAG-9 locomotive

1. Set up the IRAB-1/28LAV-1 locomotives for hauling dead in normal condition.
2. Connect BP pipe of the dead loco to the BP pipes of working loco and open BP angle cock of both of loco and load side. The aux. reservoir on dead locomotive will get charged from BP supply. Check the BP pressure gauge in the cab of dead loco. It should show the same pressure as that of the live locomotive (In case of locos are to be attached on a train having twin pipe i.e. both BP and FP then FP of both the locos should also connected and its angle cock should be opened.)
3. Check the release of parking brakes/hand brakes of dead loco by moving the parking brake/ hand brakes unit by hand and observing the clearance between the brake blocks/pads and the wheels wheel disc.
4. Apply auto brake (A9) in the working locomotive and check that loco brakes on both the locomotives are getting applied. Then release the auto brake in the working loco and check that loco brakes are getting released on both the locomotives.
5. As a final check, run the coupled loco for about 500 metres and feel for any abnormal rise in temperature of wheels of dead loco and also check if at subsequent stop during journey.
6. After reaching destination, before detaching the working loco, apply parking brake/hand brake on dead locomotive.

Modification and Special Equipment

III.10.3.4

The Start/Running Interlock means that traction is set to “O” with a ramp of approx. 100 kN/s. However, the regenerative brake is still available.

Reason Start/Running Interlock are -	Parking brake applied (not applicable for WAP-7).
-	Direct loco brake applied.
-	Automatic brake applied.
-	The pressure in the main reservoir has fallen below 5.6 kg/cm ² .
293.2	The isolating cock brake pipe control system is closed.
-	Fire alarm.
-	Emergency exhaust isolating cock open.

Note:

The interlock is released as soon as the reason is eliminated and the train crew moves the TE/BE throttle through the “O” position. The Start/Running Interlock is never released automatically but always requires manual intervention

3.6.4 Third Party Control Electronics

The following third party systems are operated by their own control electronics and independent from the above mentioned bus concept:
Brake control (Pneumatic brake systems), Automatic Vigilance ,Fire detection and Speedometer

Procedure of TM isolation status checking in 3 phase IGBT locos

Traction Motor isolation status can be detected from the following observations in IGBT locos.

GENERAL PROCEDURE:

Under Running Condition:-

1. Observe reading of TE/BE meter of Bogie-1 & Bogie-2. Any difference in reading is clear indication of TM isolation.
2. Observe TM Temperature Status in DDS (Process Information -> Motor Temperature). Any major difference in temperature is clear indication of TM isolation.

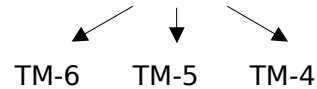
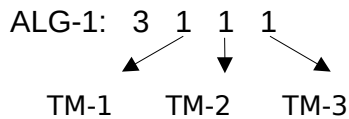
Under Stationary Condition:-

1. Check loco status in DDS, if it showing 02 then check whether TM isolation or not in browse mode.

Traction Motor Isolation Status in various converters:-

1. CGL make traction convertor:

Observe the Status on DDS of ALG 1 and ALG 2



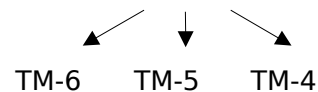
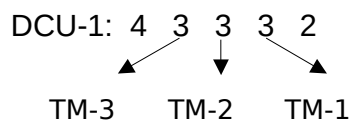
The last three digit '111' of ALG-1 stands for status of TM-1, TM-2 & TM-3 and last three digit '111' of ALG-2 stands for status of TM-6, TM-5 & TM-4 respectively as indicated above.

If any TM is in isolated condition then the digit '1' will turn to 'F'.

For example if the status of ALG-1 is "3 F11" it means (TM-1) isolated.

2. BT make traction convertor:

Observe the Status on DDS of DCU 1 and DCU 2



The Middle three digit '333' of DCU-1 stands for status of TM-3, TM-2 & TM-1 and Middle three digit '333' of DCU-2 stands for status of TM-6, TM-5 & TM-4 respectively as indicated above.

If any TM is in isolated condition then the digit '3' will turn to '0'.

For example if the status showing „DCU-2: 43032" it means (TM-5) isolated

3. MEDHA make traction convertor:

TM Status always available on DDS Screen as indicated in Fig 1.



Gray color —————> TM in Service
 Red Color —————> TM Isolated

4. BHEL (TCN) make traction convertor:

- (i) On DDS touch screen press the button “Process Info” (Fig - 2)
- (ii) On right side of the screen a drop down menu will display. (Fig-3) .
- (iii) Press the bottom button “Motor converter” as indicated in Fig 3



Fig-2

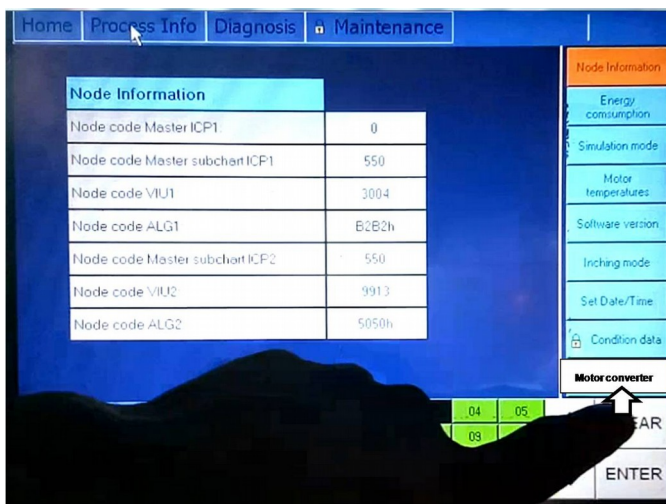


Fig-3

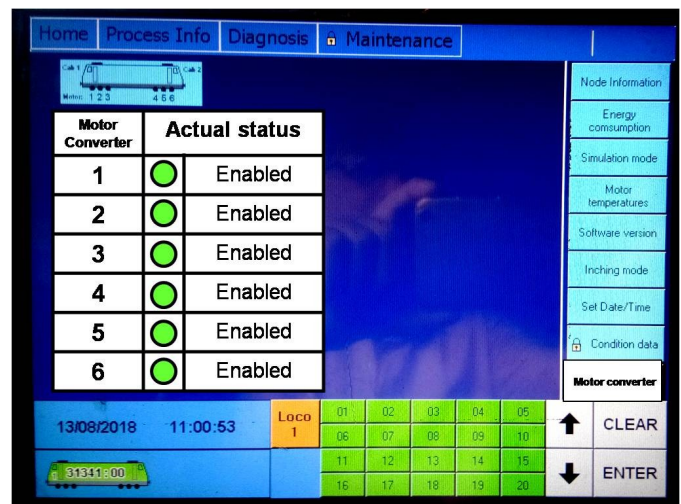


Fig-4

- (iv) TM status will display on DDS Screen as shown in (Fig-4).

Green Indication TM Enabled/In service

Orange Indication TM Isolated/Disabled

5. ABB make traction convertor:

There is no direct procedure to check Traction Motor isolation status in ABB make converters and TM isolation can only be identified from “Browse Mode” history.

9. Pressure switches provided near auxiliary reservoir –

- a. 269.4 - Low MR pressure
- b. 172.3 - RGCP 1
- c. 172.2 - RGCP 2
- d. 269.6/2 - Pressure switch for brake cylinder
- e. 269.6/1 - Pressure switch for brake cylinder



6.3 AIR CONDITIONED CAB

FEATURES:

1. COOLING CAPACITY: 1.5 T AT 50° C AMBIENTS.
2. HEATING CAPACITY: 2.2 KW
3. TEMPARATURE: SUMMER: 23° C TO 25° C & WINTER : 19° C TO 21° C
4. NO. PER LOCO: 2 NOS (1 NO. EACH CAB)
5. DIMENSION: 1120 X 1000 X 430

6. SUPPLY: 415 V 3 PHASE

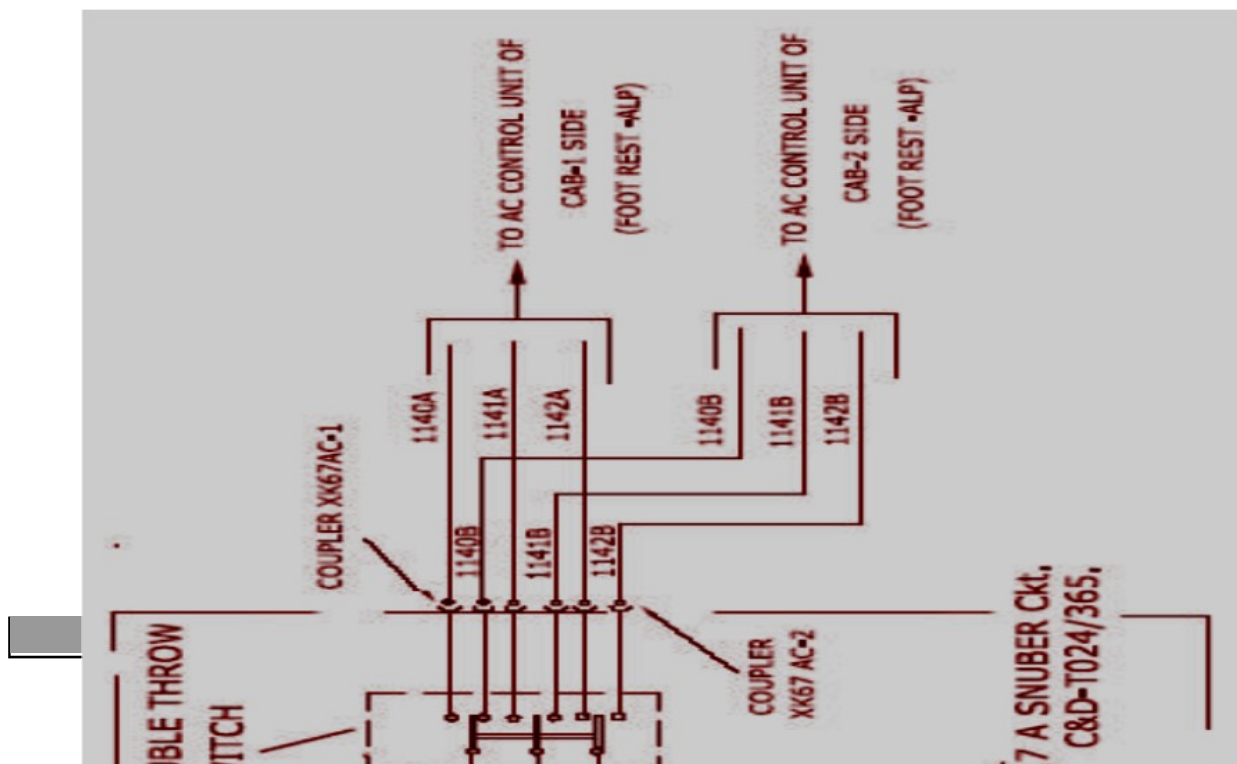
ELECTRICAL CONNECTION

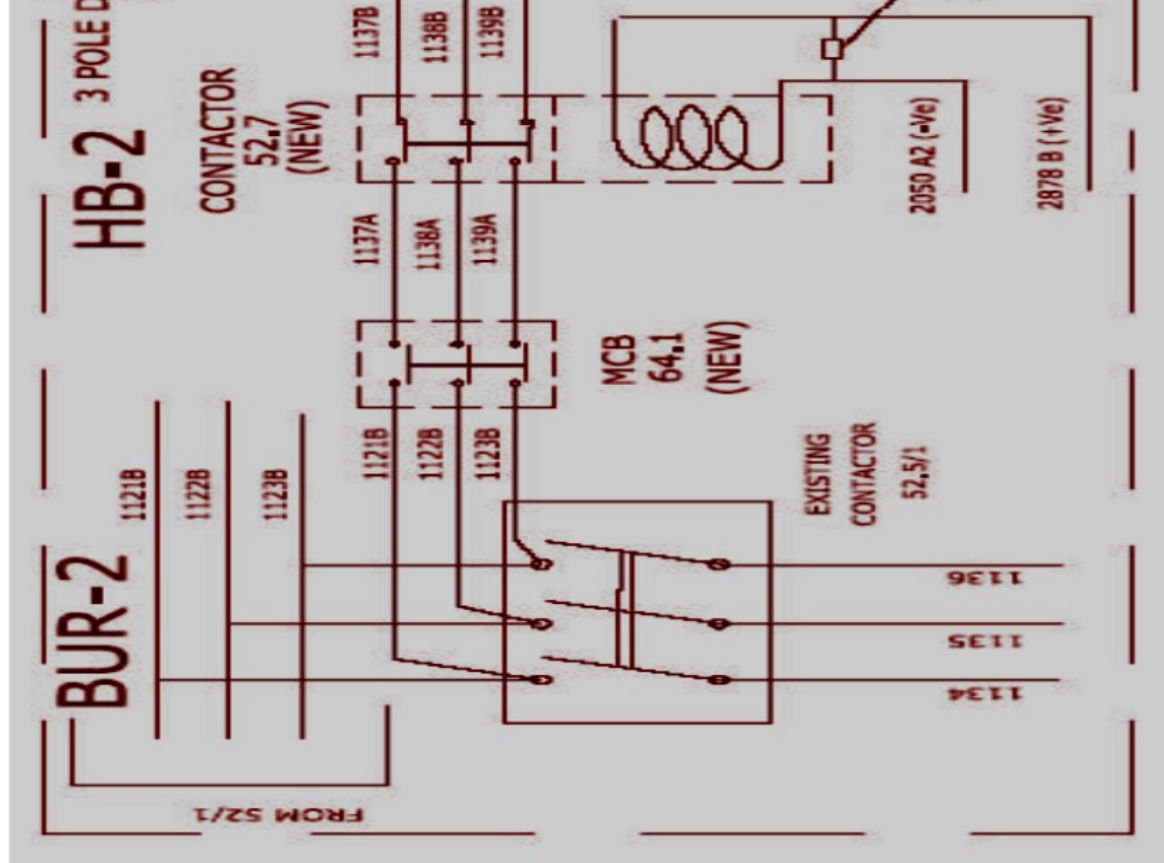
The supply taken from BUR-2 interlocking to-

I) Only one Cab AC will run at a time.

II) In case of isolation of any of Aux converter the AC unit will not run.

1	64.1=> MCB rating 16 Amps--- 01 No (Type-17)		
2	52.7=. Contactor 3-Phase 80 Amps---01 No (type-LPID 80)		
3	Socket 4P/24 PIN 'N'- 3HW470071P0001 (ABB part no) Coupler XK32 ---- 2 Nos.		
4	PLUG—4P BU 'N' IRCA/Connector—3HW47004R0001 (ABB part no) Coupler XK67 ---- 2 Nos.		
5	PIN---8GH—2.5---8 Nos.	13	SCREW---M6X16---03 Nos.
6	SOCKET---8GH—2.5---8 Nos.	14	NUT—M6---03Nos.
7	FASTOON LUG—6.3X 0.8—4 Nos.	15	SPRING WASHER—M6—03 Nos.
8	SOCKET—2.5/8 mm (m 8)---4 Nos.	16	PLANE WASHER—M6---03 Nos.
9	N-SLEEVE—2.5 – 12 mm---12 Nos.	17	END STOPPER---02 Nos.
10	PRINTABLE SLEEVES –3/16-60 Nos.	18	52.7A=> Snuber Ckt., C&D – T024/365
11	JOINTING SLEEVES-6.3 X 0.8-1No.	19	CABLE 2.5 Sq. mm –26 mts---03 Nos.
12	BLACK SLEEVES—6.4 X 0.288K—1meter	20	CABLE 2.5 Sq. mm –11 mts---03 Nos.





DISTRIBUTED POWER WIRELESS CONTROL SYSTEM OPERATING PROCEDURE

1. INAUGURATION PROCEDURE

1.1 STEP-1 : CONFIGURE THE SLAVE LOCO FIRST

- 1.1.1 Proceed to Slave Loco. Ensure pneumatic setup as Master loco
(COC-74,70,136 to be kept Open and COC-47 to be kept close)
- 1.1.2 Switch on the MCBs of DPWCS Equipment in SB2 panel.
- 1.1.3 Keep the Loco Brake Handle (SA 9) in the Release Position and A-9 handle to

be removed.

- 1.1.4 Put the BL Key in driving Mode in the intermediate cab.
- 1.1.5 Wait for Loco Node Number jumps to 504.
- 1.1.6 Press DPWCS Mode in DIU.
- 1.1.7 Enter Password **“as given by company”**
- 1.1.8 Enter Driver ID and train ID in DIU (Drivers Interface Unit).
- 1.1.8 Select Zone if any or select default.
- 1.1.9 Press Slave and then Press Enter/OK.
- 1.1.10 Press Slave position from given four slaves and press OK, note down Radio Channel No to enter in the Master loco DIU during configuration
- 1.1.11 Remove the BL Key in the OFF Position.
- 1.1.12 Proceed towards Master Loco.

1.2 STEP-2 : CONFIGURE THE MASTER LOCO

- 1.2.1 Proceed to Master Loco. Ensure pneumatic setup as COC-74, 70,136 to be kept Open and COC-47 to be kept close.
- 1.2.2 Switch on the MCBs of DPWCS equipment From SB2 panel.
- 1.2.3 Put the BL Key in driving mode in D/Cab
- 1.2.4 Press DPWCS Mode in DIU.
- 1.2.5 Enter Password **“as given by company”**
- 1.2.6 Enter Driver ID and train ID in DIU.
- 1.2.7 Select Zone if any or select default.
- 1.2.8 Select Master and on Pressing OK, enter Radio Channel no of Slave loco and Press **“CONFIRM”**.
- 1.2.9 Wait for the Slave Loco Number appears on Master Loco Display.
- 1.2.10 If the slave loco number appeared on the display is correct, Press on Slave Loco no and press **“OK”** Types of wagon page will appear.

1.3 STEP-3 : SELECT WAGON TYPE & NUMBER OF WAGONS (IN MASTER)

- 1.3.1 Select any one type of wagon (BOXN,BOB-N,TBT etc) and enter the no of Wagons, and press **“↵”**
- 1.3.2 After entering all the data of wagons between master and first slave Press **“Enter”**.
- 1.3.3 If train is having more than one slave follow the above procedure.
- 1.3.4 After entering the wagons verify the train length and press enter for next process.
- 1.3.5 Raise the Panto and close the VCB.
- 1.3.6 Wait till BP to increase 4.8 Kg in master and slave.
- 1.3.7 Once BP reached 4.8 Kg, automatic drop carried by slave which reflects in

Master and Home screen will appear.

2. NEUTRAL SECTION NEGOTIATION:

At neutral sections, special operating procedure is needed for opening and closing the VCBs of slave locomotives.

2.1 PROCEDURE FOR NEUTRAL SECTIONS.

2.1.1 100 meters before the open DJ board, Press Neutral Section button in DIU and then BLDJ open.

2.1.2 You will see message in display “neutral section in progress”.

2.1.3 After neutral section, Close the VCB one mast after close DJ Board.

2.1.4 You will see message in display “Slave VCB will be OFF near neutral section”

2.1.5 If given command is proper, then Slave loco will get tripped near neutral section.

2.1.6 If you don't find the message, it means that Neutral OFF switch activation has not been acknowledged by the system. Under this circumstances, the master and slave loco VCBs may trip/close together under synchronous mode.

2.1.7 If such a situation is encountered then press EMG hard key in DIU and quickly change to <IND> mode and operate the slave loco VCB independently at neutral section. After passing neutral section, the mode can be changed to synchronous. The slave loco VCB can be operated under IND mode.

2.1.8 Make sure while using independent mode that slave loco VCB must be opened before the neutral section.

2.1.9 If Slave Loco VCB does not get closed, one mast after close DJ board, then Press EMG in DIU hard key and open the VCB of master loco and then close the VCB of master loco.

3. PANTO LOWERING NEGOTIATION:

At Panto lowering sections, special operating procedure is needed for lowering and raising the panto of slave locomotives.

3.1 PROCEDURE FOR PANTO LOWERING.

3.1.1 One mast before the Lowering section, Press Panto DOWN in DIU and then BLDJ OFF and lower the panto.

3.1.2 You will see message in display “Panto Lowering in progress”.

3.1.3 After Panto lowering section, Raise the panto and close the VCB after close DJ Board.

- 3.1.4 You will see message in display “Panto of Slave will be lower near Lowering section”.
- 3.1.5 If given command is proper, then Slave loco will get tripped near Lowering section.
- 3.1.6 If you don't find the message, it means that Panto lowering switch activation has not been acknowledged by the system. Under this circumstance, the master and slave loco Panto may trip/close together under synchronous mode.
- 3.1.7 If such a situation is encountered, quickly change to <IND> mode and operate the slave loco independently at Lowering section. After passing Lowering section, the mode can be changed to synchronous.
- 3.1.8 Make sure while using independent mode that slave loco Panto must be opened before the Lowering section.
- 3.1.9 If Slave Loco Panto does not get Raised, one mast after the lowering section, then lower the Panto in master loco and then Raise the panto in master loco.

4 PROCEDURE FOR RESTARTING SLAVE LOCO

If there is a need to restart the slave loco, then Bring slave node to 504 and Press “REBOOT” then press LOCO and then press respected slave and enter in master DIU then Slave loco will get restarted.

5 PROCEDURE FOR SELECTING MODES

5.1 INDEPENDENT MODE ACTIVATION

- 5.1.1 Press “MODES “ button in Master DIU Home screen.
- 5.1.2 Select “IND” button and Press respected slave and press ENTER.
- 5.1.3 Independent Selected slave will have highlighted with red box.
- 5.1.4 Independently control the Panto, VCB and throttle of the slave locomotives by given switches in the DIU.

5.2.1 ISOLATION MODE ACTIVATION

- 5.2.1 Press “MODES “ button in Master DIU Home screen.
- 5.2.2 Select “ISO” button and Press respected slave and press ENTER.

5.3 IDLE MODE ACTIVATION

- 5.3.1 Press “MODES “ button in Master DIU Home screen.
- 5.3.2 Select “IDLE” button and Press respected slave and press ENTER.

5.4 BRAKE MODE ACTIVATION

5.4.1 Press “MODES “ button in Master DIU Home screen.

5.4.2 Select “BRAKE” button and Press respected slave and press ENTER.

5.5 BRAKE_OUT MODE ACTIVATION

5.5.1 Press “MODES “ button in Master DIU Home screen.

5.5.2 Select “BRAKE_OUT” button and Press respected slave and press ENTER.

6.0 Fault Troubleshooting

6.1 In case of any wrong command during neutral section or Panto lowering section press EMG hard key in DIU and operate the section independently.

6.2 If slave loco VCB gets tripped due to any loco related fault then acknowledge the fault by pressing BPFA in master and try to open and close the Master VCB.

6.3 If Slave and Master Locomotives are required to restart due to some loco fault, then restart the slave loco by pressing loco REBOOT in master DIU and once the slave loco restarted then restart the master loco manually.

6.4 If both master and slave locomotive restarted at once then Inauguration procedure must be carried out.

6.5 Due to loco fault, if slave loco must restart then restart the slave from master by operating reboot in master DIU.

VCU resetting in SU :

When MCE is required to Switch OFF on run ,train is required to stop as per existing procedure. Because during “MCE OFF” BP pressure drops due to Contactor no-126 gets open along with Contactor no-218 and more time taken to build up pressure and get ready to start the train, causing time loss in section.

In this modification one VCU switch cum relay is provided in SB-1 panel. After pressing VCU push button switch only contactor no-218 gets open and BP pressure will not drop because contactor no-126 remains in close position.

VCU resetting procedure:-

- 1) Don't stop the train, keep in motion.
- 2) Open VCB by opening BLDJ, contactor no-136.4 will be dropped.
- 3) Lower pantograph by ZPT, contactor no-130.1 will be dropped.
- 4) Keep BL key will in position 'D'.
- 5) Press VCU reset button provided in SB-1 panel. MCE will be “Switched OFF” but BP will not drop. (In this period acknowledge vigilance by pressing pedal switch)
- 6) After releasing VCU reset button, wait for both FLG will show 504 in DDU. Raise panto, close VCB and work the train.

Note:- In case failure in brake system for “Switching OFF” MCE, existing procedure to be followed after stopping the train.

- i) 2-nos of push button switches provided in panel “D” in both cabs and designated as “Self/Master” and “Trail/Slave”. On pressing “Self/Master” switch resetting of VCU of the self loco and in MU on pressing “Trail/Slave” switch resetting of VCU of the slave/trailing loco will be done.
- ii) One rotary program switch (ZCAB) is provided in SB-1 for selection of driving cab during formation of MU i.e if Cab-1 is driving cab, ZCAB switch to be kept on ‘1’ and if Cab-2 is driving cab, ZCAB switch to be put on ‘2’.
- iii) **(a) Condition for resetting of VCU in MU operation:-**

Self/Master loco:-

- ❖ VCB should be opened.
- ❖ Pantograph should be lowered.
- ❖ BL key should be in Driving (D) position.

Trailing/slave loco:-

- ❖ VCB should be opened.
- ❖ Pantograph should be lowered.

(b) Condition for resetting of VCU in SU operation:-

- ❖ ZCAB to be selected as per driving cab number, i.e in case of Cab-1 is driving cab, ZCAB switch to be kept on ‘1’ and if Cab-2 is driving cab, ZCAB to be put on ‘2’.

iv) Procedure for resetting of VCU

Trailing/slave loco

- ❖ Press the “Trail/Slave” reset push button in leading loco (driving cab).
- ❖ During booting of VCU message ‘Communication disturbance will display on DDU in leading loco. Acknowledge the message until SS19 is isolated.
- ❖ After 60 seconds press “Self/Master” reset push button switch. After completion of booting of master loco SS19 will restore and node 504 will appear in both locomotives.

- ❖ In case of disturbance in any sub-system in trailing loco, fault message related to the sub-system will display in the DDU and BPFA will glow. Acknowledge the message, node 504 will appear.

Self/Master loco:-

- ❖ Press “Self/Master” reset push button in leading loco (driving cab). Booting of the master loco will initiate and after 60 seconds node 504 will appear.
- ❖ In case of disturbance in any sub-system, fault message related to the sub-system will display in the DDU and BPFA will glow. Acknowledge the message, node 504 will appear.

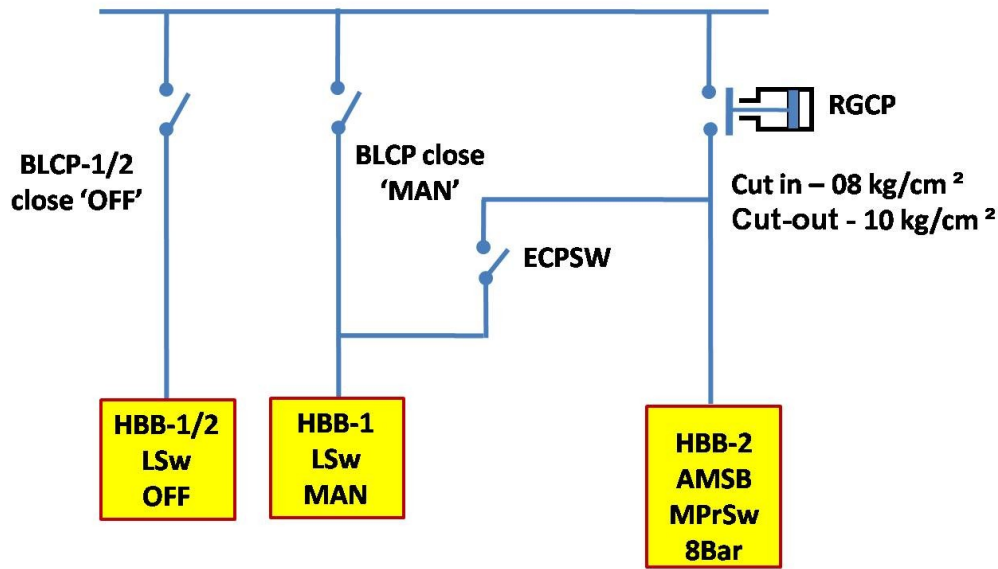
ECPSW modification: (Emergency compressor switch)

When HBB-2 Processor fails, then both MCP will not work Hence during this failure to run the compressor one switch ECPSW is provided in SB-1 panel.

Effects on loco if HBB-2 fails:-

- 1) Cab-2 will isolate & both compressor will not work.
- 2) During working from Cab-1 the both compressor will not work in Auto Mode but will work in Manual Mode only.
- 3) Pantograph-1 will not raise, hence raise pantograph-2.
- 4) Isolate Vigilance by putting switch 237.1 on '0'.
- 5) Release Parking brake manually from Pneumatic Panel.
- 6) The following pressure switch are no longer monitored:-
 - a. Pantograph 1 and 2
 - b. Direct brake (SA-9)
 - c. Train parting
 - d. Low pressure main reservoir
 - e. 6 Kg/cm² feed pipe.
 - f. Brake cylinder, bogie 1 and 2.

ECPSW Circuit



ECPSW have two positions:

"1 or OFF" – ECPSW will not work (Normal position)

"0 or ON" – ECPSW will work (When HBB-2 failed)

- 1) When ECPSW switch kept on '0' or 'ON' HBB-1 comes in service, hence no need to change the cab of loco provided with redundancy feature. From that cab the MCP will work in Auto mode but will not work in MAN mode.
- 2) During working from Cab-1 MCP will work in both AUTO & MAN mode.

Note:- After putting ECPSW switch on '0' or 'ON' during checking of oil level of compressor open VCB, as HBB-1 will get feed even though BLCP 'OFF' and CP will start when RGCP contact close.

IGBT Loco's Special Instructions:-

- 1) Ensure 3 way COC of water coolant pump in proper position provided for SR.
- 2) It will take more time for complete switching ON of CE compared with GTO loco. (Approx. 90 seconds)
- 3) Due to space constraint the message for isolation of TM will be displayed in SS04 & SS05 subsystems fault messages.
- 4) Pneumatic COCs for SR-1 & SR-2 are closed in pneumatic panel.
- 5) If water level decreases below sensor level, concern SR will isolate with Fault messages as F0206P1/F0306P1.

- 6) In some IGBT locos water coolant SR pump is provided inside of SR.
- 7) In case of short circuit in TM, single phasing in TM etc, TM can isolate individually by the system, instead of TR Bogie isolation.
- 8) For Traction converters(SRs) electromagnetic contactors are provided in place of electro pneumatic contactors of GTO locos.
- 9) SRs are cooled by water coolant instead of oil. Water level sensors are provided in some locos.

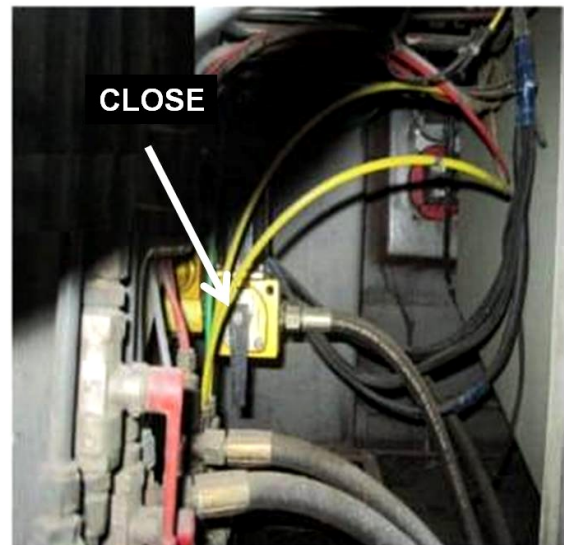
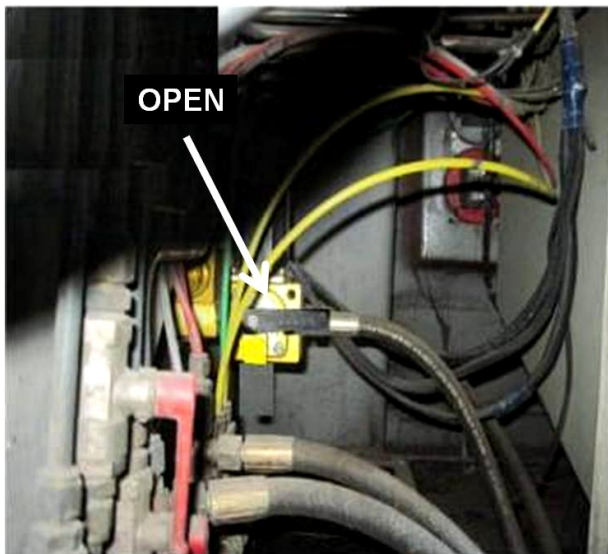
TPWS (Train Protection Warning System):

Isolation procedure:

In TPWS provided loco, while working in non TPWS area,

- ❖ Ensure Battery control switch should be in OFF position,
- ❖ TPWS isolation switch should be in ON position on TPWS unit,
- ❖ Pneumatic isolation COCs in closed condition in both Cabs, provided under the brake controller A-9 on the FTIL interface unit,(one window is provided for opening and closing of this COC)

TPWS Cock Below A-9



Description of Equipments with its number

'REF' Equipment No.	DESCRIPTION	QTY
1	AIR HORN	2
2	AIR HORN	2
3	PANTOGRAPH	2
4	MAIN CIRCUIT BREAKER	1
5	ISOLATING COCK 3/8" VENTED	1
6	SOLENOID VALVE (PANTOGRAPH)	2
7	-	-
8	ISOLATING COCK 3/8" VENTED	2
9	PRESSURE SWITCH PANTOGRAPH	2
10	SAFETY VALVE 3/4"	2
11	COMPRESSOR CHECK VALVE 1-1/4"	2
12	UNLOADER EXHAUSE VALVE 1"	2
13	LATCHED ISOLATING COCK 1-1/4" VENTED	1
14	ISOLATING COCK 1-1/4"	2
15	FINAL FILTER	1
16	-	-
17	AUXILIARY COMPRESSOR DELIVERY HOSE	1
18	COMPRESSOR DELIVERY HOSE	1
19	COMPRESSOR DELIVERY HOSE	1
20	MAIN COMPRESSOR WITH MOTOR	2
21	-	-
22	PANTOGRAPH RESERVOIR 5 LITRE	1

23	SAFETY VALVE ¼"	1
24	COMPRESSOR CHECK VALVE ½"	1
25	CHEK VALVE ½"	1
26	AUXILIARY COMPRESSOR PRESSURE SWITCH	1
27	½" TEST POINT (VENTED PLUG)	1
28	-	-
29	E70 EQUIPMENT MANIFOLD ASSEMBLY	1
30	LATCHED SOLENOID VALVE (PARKING BRAKE)	1
31	CHOKE	1
32	PARKING BRAKE PRESSURE SWITCH	1
33	EP VALVE UNLOADING	1
34	BRAKE FEED PIPE PRESSURE SWITCH	1
35	COMPRESSOR PRESSURE SWITCH	1
36	COMPRESSOR PRESSURE SWITCH	1
37	LOW MAIN RESERVOIR PRESSURE SWITCH	1
38	KABA-KEY COCK	1
39	SAFETY VALVE ¾"	1
40	½" TEST POINT	1
41	-	-
42	VENTURE VALVE	1
43	FLOW METER GAUGE RELAY VALVE	1
44	VENTURI VALVE PRESSURE SWITCH	1
5	ELECTRONICS ENCLOSURE	1
46	BREAKAWAY PROTECTION VALVE	1
47	TOWING COCK 3/8"	1
48	CHECK VALVE WITH STRAINER ½"	1

49	DISTRIBUTOR DMD3	1
50	-	-
51	BRAKE SUPPLY RESERVOIR 240 LITRES RIGHT HAND	1
52	BRAKE CUT OUT VALVE	1
53	CAPACITY RESERVOIR 5 LITRES	1
54	DOUBLE CHECK VALVE ½"	1
55	EBC/5BLENDING UNIT	1
56	½" TEST POINT (VENTED PLUG)	1
57	D2 RELAY VLVE (AUTOMATIC BRAKE)	1
58	D2 RLAY VLVE (DIRECT BRAKE)	1
59	DIRECT BRAKE PRESSURE SWITCH	1
60	VIGILANCE PRESSURE SWITCH	1
61	½" TEST POINT (VENTED PLUG)	1
62	CHOKE 3/16" BORE	2
63	ISOLATING COCK 3/4" VENTED	2
64	BRAKE CYLINDER PRESSURE SWITCH	2
65	ANTI SPIN VALVE	2
66	DOUBLE CHECK VALVE ¾"	4
67	CHOKE 3/16" BORE	2
68	ISOLATING COCK 3/8" (TRACTION CONVERTER 2)	1
69	BRAKE PIPE PRESSURE SWITCH B.P.G	1
70	E70 BRAKE PIPE ISOLATING COCK WITH SWITCH 1-1/4"	1
71	EMERGENCY EXHAUST VALVE	1
72	EMERGENCY EP VALVE	1
73	SANDING VALVE	4

74	EMERGENCY /VIGILANCE ISOLATING COCK WITH SWITCH 1-1/4"	1
75	1/2" TEST POINT (VENTED PLUG)	1
76	1/2" TEST POINT (VENTED PLUG)	1
77	TWIN TOWER AIR DRYER WITH PRE-COALESCER	1
78	AUXILIARY COMPRESSOR	1
79	PRESSURE REGULATOR 1/2"	1
80	THROTTLE VALVE	2
81	FLANGE LUBRICATION CONTROL	4
82	GREASE PUMP WITH RESERVOIR	2
83	FLEXIBLE HOSE 3/8"	2
84	CENTRIFUGAL STRAINER WITH DRAIN COCK 1/2"	1
85	PANTOGRAPH SELECTION SWITCH	1
86	ISOLATING COCK 3/8" (WHEEL FLANGE LUB)	1
87	OIL SEPARATOR / DRIP CUP WITH AUTO DRAIN VALVE	1
88	ISOLATING COCK 3/8" (FILTER CUBICLE)	1
89	MAIN RESERVOIR 240 LITRES LEFT HAND	2
90	DRAIN COCK 3/8"	4
91	CHECK VALVE 1-1/4"	1
92	DUPLEX CHECK VALVE 1-1/4"	1
93	PRESSURE CONTROL VALVE	1
94	LATCHED ISOLATING COCK 1-1/4"	1
95	HOSE AND COUPLING 1" (M.R.E.P)	2
96	END COCK 1" RH	2
97	HOSE AND COUPLING 1-1/4" R.H BRAKE PIPE	2
98	END COCK 1-1/4"	2

99	HOSE AND COUPLING 1-1/4" L.H	2
100	END COCK 1"	2
101	HOSE AND COUPLING 1-1/4" L.H FEED PIPE	2
102	END COCK 1-1/4"	2
103	SANDER NOZZLE	8
104	HOSE	2
105	HOSE	2
REF	DESCRIPTION	QT Y.
106	CHECK VALVE 1"	1
107	½" TEST POINT (VENTED PLUG)	1
108	COMBINED BRAKE CYLINDER/PARKBRAKE UNIT WITH SLACK ADJUSTER	4
109	BRAKE CYLINDER WITH SLACK ADJUSTER	4
110	MAIN RESERVOIR 240 L RIGHT HAND	1
111	DRIVERS BRAKE CONTROLLER	2
112	DRIVERS DIRECT BRAKE VALVE FDI	2
113	ISOLATING COCK 1-1/4" (EMERGENCY)	2
114	PRESSURE REGULATOR ½"	1
115	DIRECT BRAKE EXHAUST VALVE	2
116	EMERGENCY EXHAUST VALVE 1-1/4"	2
117	-	1
118	½" TEST POINT	2
119	½" TEST POINT	2
120	ISOLATING COCK 3/8" VENTED	2
121	DUPLEX PRESSURE GAUGE (F.P-M.R)	2
122	PRESSURE GAUGE BRAKE PIPE	2

123	2-WAY HORN VALVE	4
124	AUTO DRAIN VALVE	2
125	ISOLATING COCK 3/8" (TRACTION CONVERTER 1)	1
126	-	-
127	-	-
128	-	-
129	AIR LINE SIEVE 3/8"	2
130	ISOLATING COCK 3/8" VENTED	2
131	DUPLEX PRESSURE GAUGE (B.C1-B.C2)	2
132	FLOW METER GAUGE	2
133	-	-
134	ISOLATING COCK 3/8" VENTED	2
135	EP VALVE	2
136	ISOLATING COCK 1-1/4"	1
137	PRESSURE REDUCING VALVE	1
138	AIR LINE SIEVE 1" (IN LINE)	3
139	-	-
140	BRAKE FRAME INTERFACE MANIFOLD	1
141	BRAKE CONTROL EQUIPMENT RACK	1
142	-	-
143	-	-
144	-	-
145	-	-
146	-	-
147	WHEEL TREAD CONDITIONERS	8
148	BRAKE DISC	8

149	BRAKE CALIPERS STANDARD (RH)	4
150	BRAKE CALIPERS SPB (LH)	4
151	-	-
152	-	-
153	-	-
154	-	-
155	-	-
156	-	-
157	-	-
158	-	-
159	-	-
160	-	-
161	-	-
162	-	-
163	-	-
164	-	-
165	-	-
166	-	-
167	-	-
168	-	-
169	-	-
170	CAPACITY RESERVOIR 5 LITRE	1
171	CHOKE	1
172	37 WAY FREE SOCKET (CUSTOMER)	1
173	19 WAY FREE SOCKET (CUSTOMER)	1

174	19 WAY FREE SOCKET (CUSTOMER)	2
175		
176	VIGILANCE CONTROL EQUIPMENT	1
177	-	-
178	19 WAY FREE SOCKET (CUSTOMER) VIGILANCE	1
179	ISOLATING COCK VENTED ¾"	2
180	ISOLATING COCK VENTED 1-1/4"	2
181	ISOLATING COCK VENTED ¾"	2
182	ISOLATING COCK VENTED 1-1/4"	2
183	HOSE 3/8"	2
184	HOSE ½"	8
185	DUMMY COUPLING	8

STANDARD INSTRUCTIONS FOR THREE PHASE LOCOMOTIVES

- In case of Harmonic filter isolation and speed reduction to 40 kmph , isolate SR-1 using switch 154 and work with 1 bogie . If the problem persists, clear block section at 40kmph. Bogie isolation can be done by switch 154 but restoration needs electronics on/off
- DDS to be seen in case of speed not increasing more than 1 kmph and bogie-1/bogie-2 to be isolated accordingly.
- Configuration switch 160 restricts loco speed to 15 kmph & can be corrected without switching electronics OFF/ON. However the loco has to be dead stopped before operating switch 160.
- In case of message ' VCB not close' , Try to troubleshoot by isolating bogie one by one
- In case Angle transmitter going defective, immediately switch over to manual mode using switch 152 in running condition. There is no need to stop.
- BPCS switch should not be pressed for more than 5sec. It shall give switch stuck up message and become non-functional
- In case of converter temp alarm/ equipment temperature high, Close VCB and coast for sometime before taking traction

- Slow creation of pressure can be due to leakage from Air drier. In such a scenario, the air drier to be isolated immediately.
 - Pressure drop/notch regression may also occur due to VCD getting activated. Isolate the VCD and look for reasons for malfunctioning at the next stop station to avoid further detention in the block section. VCD isolation can be done using switch 237.1.
 - MCB 127.7 in SB2 needs to be checked first during Brake Electronics failure.
 - In case of main power getting OFF due to BURs isolation, LP should switch OFF/ON the electronics. If get success then continue otherwise try to isolate OCB1/2, SR1/2 with bogie isolation. However the loco can continue to work with 1 BUR isolated.
 - 3-Phase tripped MCB in HB-1/HB-2 can be put in ON once to restore an equipment. Restoring the MCB does not require switching OFF/ON of the electronics system.
 - In case of BL key giving trouble in three phase locos, try by pulling key up slightly
 - Any fault message in DDS should not be acknowledged without reading and follow up as suggested. Once acknowledged, the message gets lost.
 - P1 messages have to be immediately acted upon & course of action is also available in DDS. P2 messages need not be acted immediately except for Battery voltage low/MCB 100 tripped. P1 messages come with a red flashing of LSFI in addition to BPFA.
1. If any fault appears in DDS, first read it carefully and note it then only acknowledge the same, as because some faults appears but not stored.
 2. During any fault of priority-1 or priority-2 inspect the machine room and trouble shoot as per TSD.
 3. Before resetting any MCB, must check the concerning auxiliary/equipment. If auxiliary/equipment is found OK, then only reset the MCB.
 4. Reset/trip the MCB provided in HB-1/HB-2 only after opening the VCB.
 5. Reset/trip the MCB provided in SB-1/SB-2 after switching OFF the MCE but Reset/trip speedometer MCB 127.92 (SB-2), Head light MCB 310.1/1 (SB-1), Head light MCB 310.1/2(SB-2) and Marker light MCB 310.7/1(SB-2) after opening the VCB.
 6. Whenever it is required to switch OFF MCE, first try to clear block section on coasting and then put A-9 to emergency to avoid the discharging of MR pressure.
 7. If Bogie isolation is required during following faults, then bogie to be isolated only by the MCB

127.1/1or MCB 127.1/2.

F0104P1- "CATENARY VOLTAGE OUT OF LIMIT"

F0107P1- "PRECHARGE OR MAIN CONTACTOR STUCK ON"

F0107P2- "DEMANDED SPEED CAN NOT BE ACHIEVE"

Except above fault if other fault message display to isolate the Bogie then Bogie to be isolated by the switch 154.

8. Switching OFF of MCE is required before putting the isolated Bogie in service.
9. Whenever it is required to renew the PT fuse, open VCB and lower the Panto
10. During resetting of MCB of oil cooling blower (OCB1/2) or traction motor blower (TMB1/2) advise ALP to stand near concerning auxiliary and then close the VCB. If any defect is noticed (Abnormal sound, Bad smell etc.) isolate the same.
11. If it is required to switch OFF MCE during fault no. F0201P1 and F0301P1 then switch ON MCE after 5 minutes from switching OFF.
12. If VCB trips and DDS becomes blank and panto lowered with glowing of LSFI & BPFA then take action as per F0103P1.
13. After putting BL Key from OFF to D in IGBT (ABB Make) loco, train configuration takes place after 90 Sec.
14. During RB, if RB fails/No tension/VCB opens immediately press PVEF and apply A-9. As because during above fault by the blending valve MR pressure goes to loco brake cylinder and loco brake applied and may cause wheel skidding for above reason.
15. If VCB opens during cooling mode operation, then without fail check OCR-78 in machine room and Transformer oil (TF oil) and if everything found normal then only reclose VCB.
16. If any auxiliary MCB drops again after resetting once then troubleshoot as per F0804P1 then by SS06,SS07,SS08 as per TSD