



भारत सरकार GOVERNMENT OF INDIA
रेल मंत्रालय MINISTRY OF RAILWAYS

केवल कार्यालयीन उपयोग हेतु
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एल एच बी आरएमपीयू प्रकार के ईओजी एसी कोच
की
त्रुटि निवारण निर्देशिका

**TROUBLE SHOOTING DIRECTORY
FOR
LHB TYPE RMPU EOG AC COACHES
TARGET GROUP - AC COACH ESCORTING MECHANIC**

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**Centre
for
Advanced
Maintenance
TECHnology**



Excellence in Maintenance

महाराजपुर, ग्वालियर - 474 020
Maharajpur, GWALIOR - 474 020

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FOREWORD

The population of LHB type RMPU AC coaches is increasing on Indian Railways day by day. It is essential to maintain AC system functioning properly during run. AC escorting mechanic plays an important role to achieve this.

CAMTECH has prepared this trouble-shooting directory for guidance of AC escorting mechanic. I hope the escorting mechanics will find this directory useful in their day-to-day work.

*CAMTECH, GWALIOR
24th FEBRUARY, 2006*

*R.N.MISRA
EXECUTIVE DIRECTOR*

PREFACE

AC Coach escorting mechanics are deputed on AC Coaches to ensure proper working of air conditioning system during run. This trouble-shooting directory has been prepared with the objective of making escorting mechanics aware of trouble shooting techniques.

It is clarified that this trouble-shooting directory does not supersede any existing provisions laid down by RDSO or Railway Board. This directory is for guidance only and it is not a statutory document.

I am sincerely thankful to Director (PS & EMU) RDSO/LKO for his valuable comments. I am also thankful to all field personnel who helped us in preparing this directory.

Technological upgradation and learning is a continuous process. Hence feel free to write to us for any addition/modification in this directory. We shall highly appreciate your contribution in this direction.

***CAMTECH, GWALIOR
24th FEBRUARY, 2006***

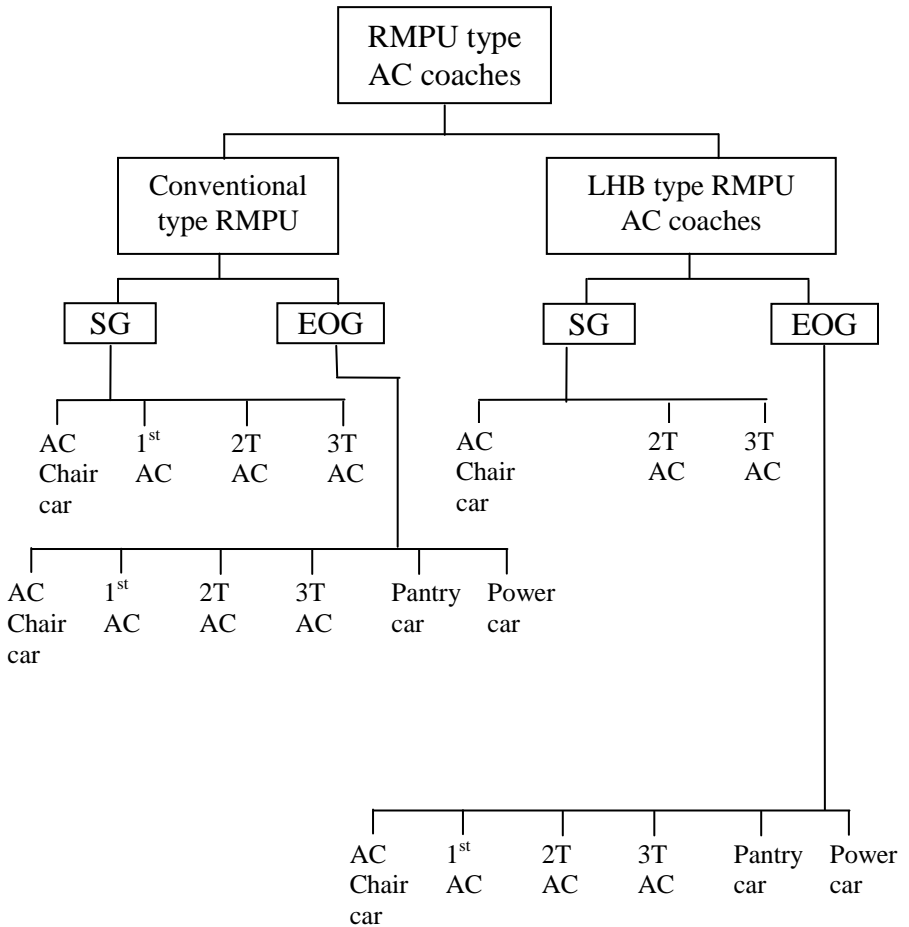
***RANDHAWA SUHAG
DIRECTOR/ ELECT***

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1. INTRODUCTION

Air conditioning equipment in coaches are mounted either under slung (conventional type under slung) or on the roof (RMPU type). RMPU type AC coaches can be classified on the basis of mode of power supply and type of accommodation.



2. SALIENT FEATURES OF LHB TYPE RMPU AC COACHES

- Provision of IGBT based battery charger.
- Microprocessor based AC package with low noise level.
- Integrated modular single switch board with controls of AC & lighting etc.
- Lightweight epoxy moulded transformer.
- On line insulation monitoring.
- Modular and elegant interior light fittings and reading lights.
- Provision of radox type FRLS cables.
- Uniformity of illumination as per UIC.
- Microprocessor based pump line.
- Antiskid protection
- Modular toilets with electro pneumatically controlled toilet fittings. Controlled discharge type toilet with microprocessor control.
- Moulded GRP paneling and antiskid PVC flooring.
- Microprocessor controlled disc break system with wheel slip control device.
- Centre buffer coupler with anti-climbing features.

2.1 Salient Features of NTC Type Temperature Sensor

- Servo motor controlled fresh air dampers.
- Microprocessor based humidity control.
- Capacity control through bypass solenoid valve.
- Thermal switch protection for motors.
- Analog LP/HP display.

2.2 Salient Features of Switch Board Cabinet

- Capable of switching, controlling, adjusting and monitoring of air conditioning system, pantry equipment, lighting, pump, sanitary and antiskid protection.
- Separate housing for battery charger, disconnecting and earthing devices.
- Segregation for different voltage levels.
- Externally ventilated.

3. AIR CONDITIONING SYSTEM

The coach is equipped with two compact air conditioning units installed in the roof area at the coach tails above false ceiling. These units are supplied by three phase mains.

Control and regulation are carried out by a common controller, mounted in switch cabinet S1 and fed from battery net. The operating and display elements of the air condition control are equally contained in the switch cabinet S1.

3.1 Main Electrical Equipment

- Microprocessors controlled package unit.
- Switch board cabinet S1
- 60 kVA transformer
- Battery charger
- Disconnecting and earthing device
- Safety devices
- 110V, 70AH VRLA battery
- Fuse box
- Pump box
- NTC type temp sensor

3.1.1 Microprocessors Controlled Package Unit

The coaches are provided with 2, microprocessor controlled package units. Both package units are controlled by a microcomputer. This is a fully automatic mode. Depending on the ambient temperature, the available modes of heating, ventilating, cooling and dehumidifying are controlled.

3.1.2 Switch Board Cabinet S1

It comprises all necessary equipment for control and protection of the following coach systems

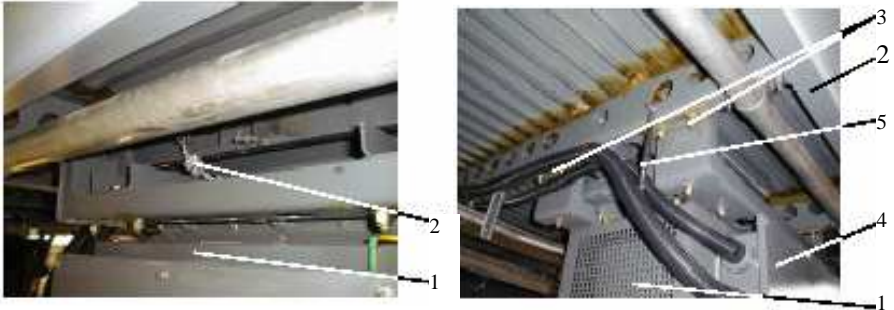
- Heating, ventilation & Air conditioning
- Lighting
- Pantry
- Anti skid protection
- Train destination indicator
- Public address system
- Sanitary system (except w.c. control)
- Throughout the depth of the lower part the cabinet contains the battery charger, dis-connecting and earthing device.



Figure 1.1

3.1.3 60 kVA Transformer

A 3 phase, 60 kVA, 50 Hz transformer to convert 750V to 415V, 3 Φ AC is provided to feed coach load. The 240/415V mains is designed as 5 conductor system (L₁, L₂, L₃, MP, PE).



- | | | |
|---------------------|-------------------|----------------|
| 1. Transformer | 2. Vehicle body | 3. Bolt fixing |
| 4. Cable connection | 5. Earthing cable | |

Figure 1.2

3.1.4 Battery charger

It consists the transformer's secondary voltage amounting to 3 x 415V into a direct voltage of 110V for charging the battery and feeding of the direct voltage loads. It is powered with 5 kW and is mounted in the switch cabinet S1.

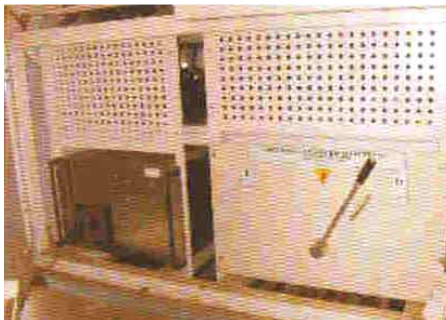


Figure 1.3

3.1.5 110V, 70AH, VRLA battery

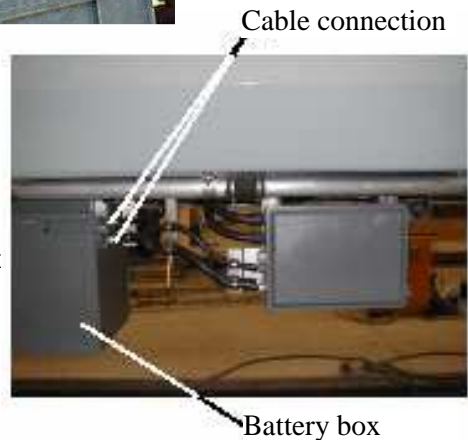
The battery is maintenance free with a nominal voltage of 108V and a capacity of 60 Ah. The oxygen evolved is recombined. It consists of 9 battery blocks of 12V each and is mounted in a box in the underframe.

The box also contains a temperature sensor for detecting the ambient temperature in the battery box.



Figure 1.4a Battery

Figure 1.4b Battery box



3.1.6 Disconnecting and earthing device

The disconnecting and earthing device makes it possible to isolate the high voltage system of a coach completely from the train bars. This permits repair and maintenance work on a unit coach.

3.1.7 Safety Devices

3.1.7.1 Equipment Earthing

All current carrying equipments such a motors, heaters etc is earthed with respect to the coach body.

3.1.7.2 Thermal Protection

All motors are provided with thermal protection devices embedded inside, which switched off the motor via the controller, if a motor heats up beyond permissible limit.

The electric heaters are protected in two ways against over temperature. If the supply air temperature reaches an impermissible level, a device switches off the heaters via the control system. If this safety device fails, the heater is finally switched off by a relief device i.e. fusible link.

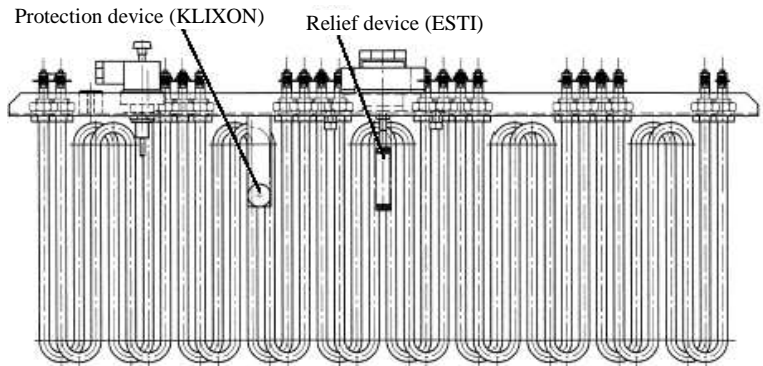


Figure 1.5

3.1.8 Fuse Box

Fuse box is provided in the under frame supported on brackets by fixing bolts. This box is properly earthed by earth cable. It is totally covered and locked by hinged bolts.

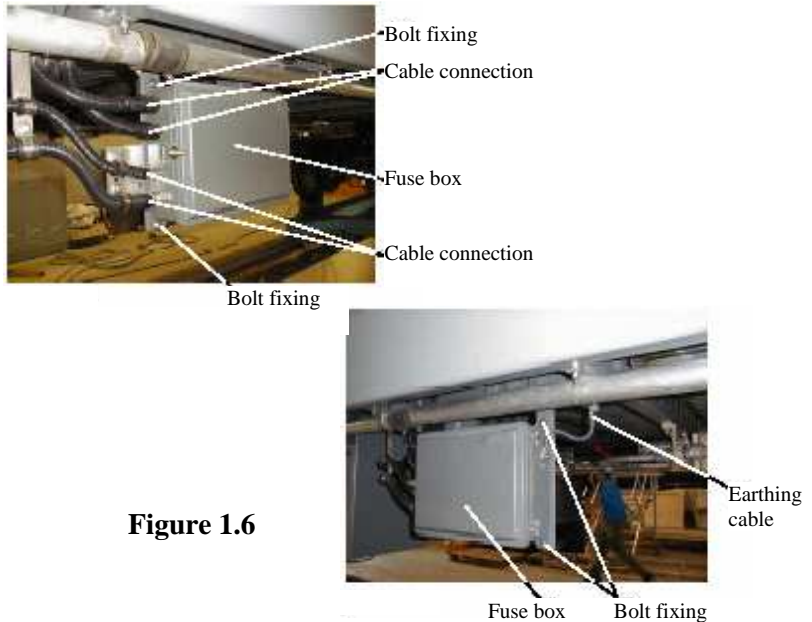


Figure 1.6

4. CONSTRUCTION

Following assemblies constitutes an AC system of the coach.

1. Compact air conditioning unit along with protection device.
2. Supply air duct system
3. Fresh air screen
4. Open/closed loop control device.
5. Sensors

4.1 Compact Air Conditioning Unit

Compact air conditioning unit consists of following components

- Two refrigerant compressors
- Two condensers
- Two axial fans for cooling condensers
- Two evaporators and heating assembly
- Two twin sucking radial fans for the supply air
- Two air inlets for circulating air
- Two air inlets for fresh air
- Two mixed air filters & fresh air filter
- Control and safety devices
- Servo drive

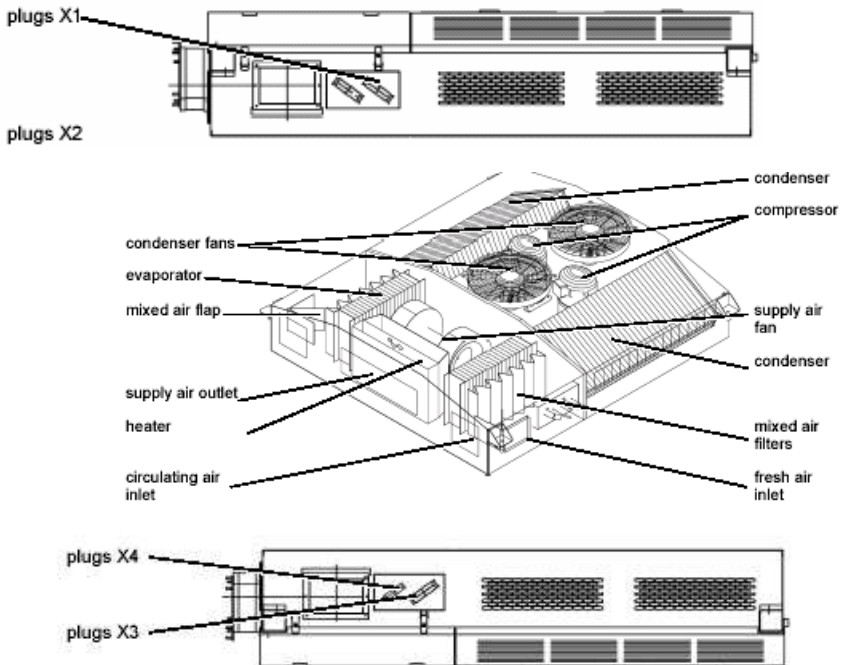


Figure 1.7

The fresh air is sucked in via air screens and their air filters. It is mixed in the unit and re-circulated from the coach. Fresh air/ re-circulated air ratio can be set by means of servo drive driven air dampers which is controlled by microprocessor controller of the air conditioning system.

4.2 Air Duct System

The air duct system can be sub divided into following:

4.2.1. Supply air duct system

The cold or warm supply air is carried from two carriage ends via a diagonally split supply duct through perforated ceilings into the coach and supplied over the entire duct length with a uniform flow and inlet rate. The ducting is connected to the air conditioner via a silencer and a vibration damped duct-connecting piece.

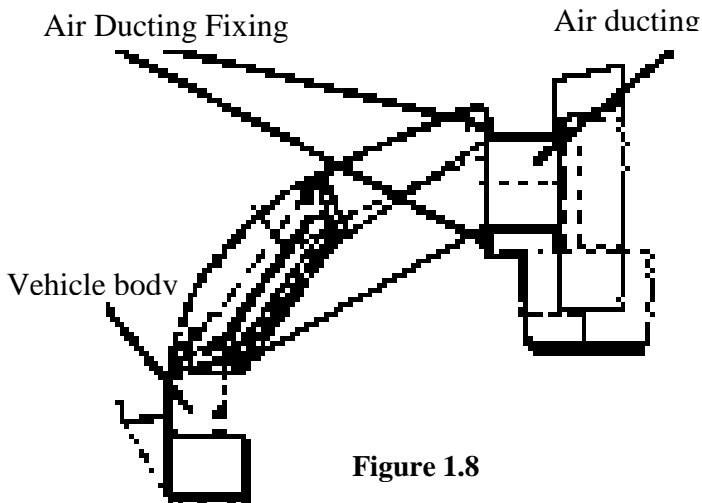
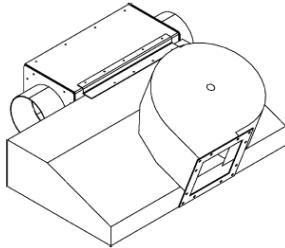


Figure 1.8

4.2.2 Exhaust air system

The exhaust air unit is installed in the roof at the kitchen end of the coach. It has three exhaust connections, one radial fan and one exhaust air box.



Exhaust Air Unit

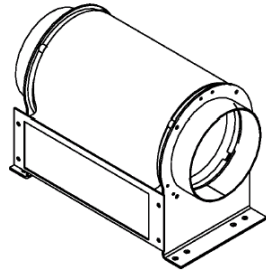


Figure 1.9

Exhaust Air Fan

4.3 Fresh Air Screens

The fresh air screens are installed parallel to the air conditioning unit. These screens are fitted with exchangeable air filters.

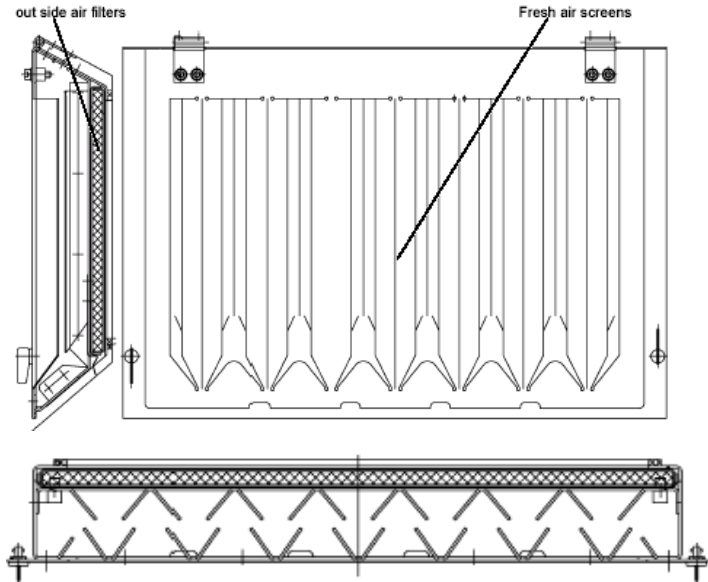


Figure 1.10

5 OPERATION OF AC SYSTEM

5.1 Operating Mode

(a) Preheating and Cooling Operation

In this mode the outside air dampers are closed to facilitate rapid heating up or cooling down of the coach.

(b) Normal Operation

In this mode, the dampers are set to ensure the envisaged fresh air volume of 21 m³/h per person.

(c) Emergency Operation

When AC system fails due to failure of power supply, the adjusting dampers of the circulating air duct close so that the system is operated exclusively with outside air.

5.2 Switch Panel Operation

To make system ready for controlled operation, ensure 24V supply on the switch panel and “400V ok” signal on input BA011 = 1L. Switch ON the HVAC system by means of switch S1U4S1 (61-S2), (BA 001=1L) provided on the switch panel. The system may be turned OFF by putting this switch on position ‘O’.

Switch S1U4S1 (61-S2) when set to position ‘0’ turns the system off.

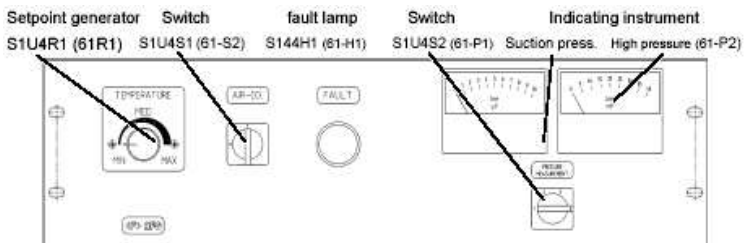


Figure 1.11

5.3 Fan operation

When the air conditioning system is turned ON with switch S1U1S1 (BA001=1L) and the 400V level is available (BA011=1L), output BY 003=1L activates contactor K26 (61-K3). This turns ON the supply air fan in CACU1. Similarly, the same input conditions enable output BY 013=1L activating contactor K 28 (61-K5). The supply air fan in CACU2 starts running. The three exhaust fans work together with the supply air fans. This is achieved by activating contactor K-29 (61-K6) via output BY 014=1L.

Two conditions should be met for ventilation mode:

1. The indoor temperature exceeds the setpoint temperature by at least 1°C in heating mode or falls sort of the setpoint temperature by at least 1°C in cooling mode.
2. With HVAC system turned ON, the computers fail due to a defect, the signal on output BY 001 = 0L causes control contactor K27 (61-K4) to drop out. This is signal for the emergency ventilation mode to be turned ON.

5.4 Heating Coil Operation

The heating output is controlled by the two heating contactors K 35 (61 – K16) and K 40 (61-K21), which can be actuated separately by one output each. The heater is cycled with a period of 60 seconds. The ON period of the heater is controlled by a control signal of the computer.

The heater does not start running if the following conditions exist:

- When operating switch S1U4S1 (61-62) is turned OFF.
- At a duct temperature over 65°C.
- When duct sensor (AA005 and AA007) is not working.
- An error message of the appropriate supply air fan (BA 004 and BA 014, respectively) exists.
- An error message of the heating coil thermostat exists.
- There is no 400V feed (BA 003)

5.5 Cooling Circuit Operation

Ensure following safety checks before turn ON the compressor.

- The supply air fans are running (BA 004 and BA 014)
- Thermal contacts M3F1 (61-S3) and M7F1 (61-S4) are to sample the function of the condenser fans.
- The low-pressure message is ok in the form of logic 1.
- The high-pressure message is ok in the form of logic 0.

Now start the appropriate compressor via output BY008, BY009, BY018 or BY019. In cooling mode, the fresh air/ re-circulating air flap must be activated for as long as it takes to supply 21m³/h fresh air for every person.

The compressor is blocked/ switched OFF in the following conditions.

- When operating switch S1U1S1 is turned OFF.
- When an error message exists in the safety chain high pressure (BA009, BA010, BA019, BA020 = 1L)
- When a suction error message exists (BA006, BA007, BA016, BA017 = 1L) and this message is not reset within 120 sec. while the compressor is switched ON.
- When the switching frequency limit is exceeded.
- When the duct temperature sensor (AA005, AA007) is not working properly.
- At duct temperature below 5°C (cold-blast-protection)
- At out door temperature below 10°C (AA003, AA006)
- If suction pressure error occurs three times in 30 minutes in cooling mode.

5.6 Dehumidification

The dehumidification function is available at cooling mode step 2. It is used if the relative humidity of the room air rises to over 60%. This condition is monitored by the moisture sensor on input AA010. If the relative humidity is less than 60%, a simulated temperature of below 60°C is measured (appr. 10kΩ). When the sensor switches, this resistance is reduced via a measuring bridge so as to enable measurement over 60°C (appr. 1k Ω).

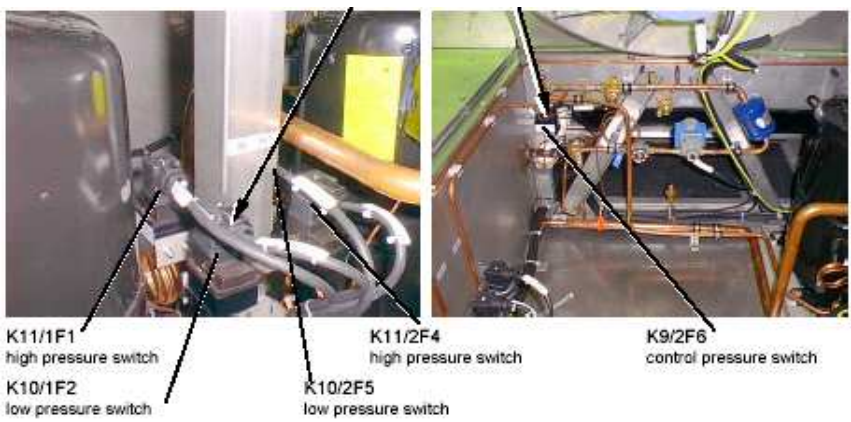
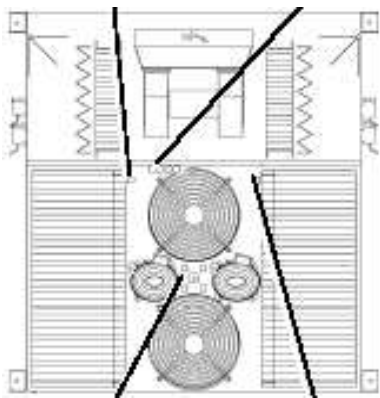
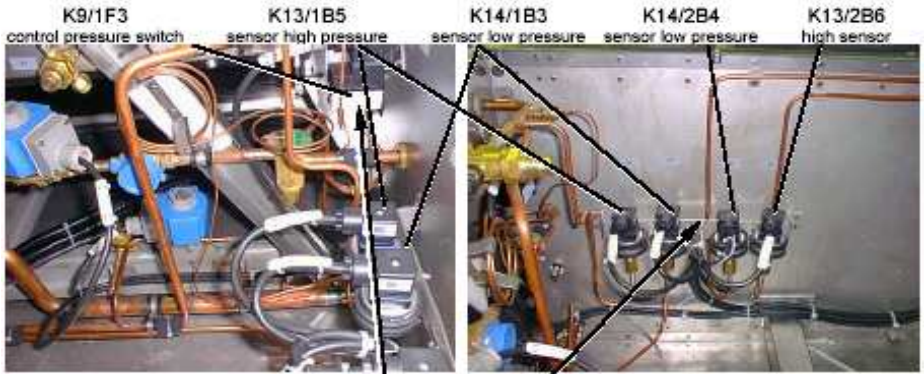


Figure 1.12

6. CONTROL OF AC SYSTEM

All controlling and regulating functions are performed by digital controller FPC 20/2 software/operating modes.

The control of the air conditioning system is divided into the following operating modes.

- Test mode
- Emergency mode
- Control mode

6.1 Test Mode

This mode only support test run. The PC is connected to the a/c computer via serial port.

6.2 Emergency Mode

If a measuring sensor fails, the system continues in emergency mode. This mode consists of the two steps.

Outdoor temperature sensor defective	Step 1: Evaluation is taken over by the sensor of the other system. Step 2: Fixed value of 20°C.
Duct air temperature sensor defective	Control together with room temperature.
Room air temperature sensor defective	Step 1: Evaluation is taken over by the sensor of other system. Step 2: Control according to duct temperature and outdoor temperature.
Set point generator defective	Control to fixed value of "Mid"
Room and duct sensors defective	Turns OFF heating and cooling, ventilation remains possible.

6.3 Control Mode

In this mode the air conditioning units are controlled & regulated by a microprocessor controller. This is a fully automatic operating mode. Depending on the ambient temperature, the available modes of heating, ventilating, cooling and dehumidifying are controlled.

6.4 Control Unit Lamp Display

Meaning of lamp displays on control unit is described below:

6.4.1 M/s LLYOD Electric Make

Lamp	Meaning of Displays (output)
O1	Lights controller o.k.
O2	Lights if the fresh air/re-circulating air flap set to re-circulating air.
O3	If the supply air fan in a/c unit 1 is switched ON
O4	Not active in this system.
O5	Lights in cooling operation, if by pass cooling 1 in a/c unit 1 is released.
O6	Lights in cooling operation, if the condenser fan in 1 a/c unit 1 is released. However, the fans only run if a control pressure switch is reacted.
O7	Lights in cooling operation, if the condenser fan in 2 a/c unit 1 is released. However, the fans only run if a control pressure switch is reacted.
O8	Lights in cooling operation, if compressor 1 in a/c unit 1 is switched on.

Lamp	Meaning of Displays (output)
O9	Lights in cooling operation, if compressor 2 in a/c unit 1 is switched on.
O10	Lights if the heater in a/c unit 1 is switched on.
O11	Lights if an error in the a/c system preventing its proper function has been realized.
O12	Lights if the fresh air/re-circulating air flap set to fresh air.
O13	Lights if the supply air fan in a/c unit 2 is switched ON.
O14	Lights if the exhaust air fans are switched ON.
O15	Lights in cooling operation, if by pass cooling 1 in an a/c unit 2 is released.
O16	Lights in cooling operation, if the condenser fan 1 in an a/c unit 2 is released. However, the fans only run if a control pressure switch has reacted.
O17	Lights in cooling operation, if the condenser fan 2 in a/c unit 2 is released. However, the fans only run if a control pressure switch has reacted.
O18	Lights in cooling operation, if compressor 1 in a/c unit 2 is switched ON
O19	Lights in cooling operation, if compressor 2 in a/c unit 2 is switched ON
O20	Lights if the heater in a/c unit 2 is switched ON (possibly timed)

Lamp	Meaning of Displays (input)
I 1	Lights if the a/c system is switched ON with the switch S1U4S1 (=61-S2)
I 2	Lights if the winding temperature of the condenser fan motor 1 in a/c unit 1 is in the admissible range. Is dark if the max. temperature exceed, the fan is not released anymore, a/c unit 1 is only partly ready for service in cooling operation.
	Error message
I 3	Lights if the winding temperature of the condenser fan motor 2 in a/c unit 1 is in the admissible range. Is dark if the max. temperature exceeds, the fan is not released anymore, a/c unit 1 is only partly ready for service in cooling operation.
	Error message
I 4	Lights if the winding temperature of the supply fan motor in a/c unit 1 is in the admissible range. Is dark if the max. temperature is exceeded, the fan is not switched ON anymore, a/c unit 1 is out of service
	Error message !

Lamp	Meaning of Displays (input)
I 5	<p>Lights if the temperature at the heater in a/c unit 1 is in the admissible range.</p> <p>Is dark if the max. temperature is exceeded, the heater is not switched ON anymore.</p>
	<p>Error message ! This fault will only occurs in case of lack of air in the a/c unit or defective heater contactor.</p>
I 6	<p>Lights if the pressure at the low pressure switch in refrigeration circuit 1 of a/c unit 1 has not fallen below the switching threshold</p> <p>Is dark if the pressure switch has reacted.</p> <p>This message is ignored for ca. 30 sec when the respective compressor starts, in case of further operation of the compressor it results in switching OFF the refrigeration circuit 1.</p>
	<p>Error message !</p>
I 7	<p>Lights if the pressure at the low pressure switch in refrigeration circuit 2 of a/c unit 1 has not fallen below the switching threshold.</p> <p>Is dark if the pressure switch has reacted.</p> <p>This message is ignored for ca. 30 sec when the respective compressor starts, in case of further operation of the compressor it results in switching OFF the refrigeration circuit 2.</p>
	<p>Error message !</p>
I 8	Lights, control pressure 1

Lamp	Meaning of Displays (input)
I 9	<p>High pressure switch of refrigeration circuit 1 reacts when compressor 1 in a/c unit 1 is switched ON.</p> <p>The compressor is switched OFF and only released again after the safety time, a/c unit 1 is only partly ready for service in cooling operation.</p>
	Error message !
I 10	<p>Lights if the high pressure switch of refrigeration circuit 2 reacts when compressor 2 in a/c unit 1 is switched ON.</p> <p>The compressor is switched OFF and only released again after the safety time a/c unit 1 is only partly ready for service in cooling operation.</p>
	Error message !
I 11	Lights, 400V OK
I 12	<p>Lights if the winding temperature of the condenser fan motor 1 in a/c unit 2 is in the admissible range.</p> <p>is dark if the max. temperature is exceeded, the fan is not released anymore, a/c unit 2 is only partly ready for service in cooling operation.</p>
	Error message !
I 13	<p>Lights if the winding temperature of the condenser fan motor in a/c unit 2 is in the admissible range.</p> <p>Is dark if the max. temperature is exceeded, the fan is not released anymore, a/c unit 2 is only partly ready for service in cooling operation.</p>
	Error message !

Lamp	Meaning of Displays (input)
I 14	<p>Lights if the winding temperature of the supply fan motor in a/c unit 2 is in the admissible range. Is dark if the max. temperature is exceeded, the fan is not switched ON anymore, a/c unit 2 is out of service.</p>
	Error message !
I 15	<p>Lights if the temperature at the heater in a/c unit 2 is in the admissible range. Is dark if the max. temperature is exceeded, the heater is not switched ON anymore. Error message ! This fault will only occur in case of lack of air in the a/c unit or defective heater contactor.</p>
I 16	<p>Lights if the pressure at the low pressure switch in refrigeration circuit 1 of a/c unit 2 has not fallen below the switching threshold. Is dark if the pressure switch has reacted. This message is ignored for ca. 30 sec when the respective compressor starts, in case of further operation of the compressor it results in switching OFF the refrigeration circuit 1.</p>
	Error message !
I 17	<p>Lights if the pressure at the low pressure switch in refrigeration circuit 2 of a/c unit 2 has not fallen below the switching threshold. Is dark if the pressure switch has reacted. This message is ignored for ca. 30 sec when the respective compressor starts, in case of further operation of the compressor it results in switching OFF the refrigeration circuit 2.</p>
	Error message !

Lamp	Meaning of Displays (input)
I 18	Lights, control pressure 2
I 19	Lights if the high-pressure switch of refrigeration circuit 1 reacts when compressor 1 in a/c unit 2 is switched ON. The compressor is switched OFF and only released again after the safety time, a/c unit 2 is only partly ready for service in cooling operation.
	Error message !
I 20	Lights if the high-pressure switch of refrigeration circuit 2 reacts when compressor 2 in a/c unit 2 is switched ON. The compressor is switched OFF and only released again after the safety time, a/c unit 2 is only partly ready for service in cooling operation.
	Error message !

6.4.2 M/S Sidwal Make

LAMP	Meaning of Displays (output)
K 101	Lights in cooling operation, if compressor 1 in a/c unit 1 is switched ON.
K 102	Lights in cooling operation, if compressor 2 in a/c unit 1 is switched ON.
K 103	Lights in cooling operation, if the compressor 1 in a/c unit 2 is switched ON.
K 104	Lights in cooling operation, if the compressor 2 in a/c unit 2 is switched ON.
K 105	Lights if the heater in a/c unit 1 is switched ON.
K 106	Lights if the heater in a/c unit 2 is switched ON (possibly timed).

LAMP	Meaning of Displays (output)
K 107	Cooling 1 in a/c unit 1 is released.
K 108	Lights in cooling operation, if bypass cooling 1 in a/c unit 2 is released.
K 109	Lights in cooling operation, if the condenser fan 1 in a/c unit 1 is released. However, the fans only run if a control pressure switch has reacted.
K 110	Lights in cooling operation, if the condenser fan 2 in a/c unit 1 is released. However, the fans only run if a control pressure switch has reacted.
K 111	Lights in cooling operation, if the condenser fan 1 in a/c unit 2 is released. However, the fans only run if a control pressure switch has reacted.
K 112	Lights in cooling operation, if the condenser fan 2 in a/c unit 2 is released. However, the fans only run if a control pressure switch has reacted.
K 113	If the supply air fan in a/c unit 1 is switched ON.
K 114	Lights if the supply air fan in a/c unit 2 is switched ON.
K 115	Lights in the exhaust air fans are switched ON.
K 116	Lights if the fresh air/ recirculating air flap set to recirculating air.
K 117	Lights if the fresh air/ recirculating air flap set to fresh air.
K 118	Lights controller ok.
K 119	Lights if an error in the a/c system preventing its proper function has been released.
K 1	Is dark if the max. temperature is exceeded, the fan is not released anymore, a/c unit 1 is only partly ready for service in cooling operation.
	Error message

Lamp	Meaning of Displays (output)
K 2	Is dark if the max. temperature is exceeded, the fan is not released anymore, a/c unit 1 is only partly ready for service in cooling operation.
	Error message
K 3	Is dark if the max. temperature is exceeded, the fan is not released anymore, a/c unit 2 is only partly ready for service in cooling operation.
	Error message
K 4	Is dark if the max. temperature is exceeded, the fan is not released anymore, a/c unit 2 is only partly ready for service in cooling operation.
	Error message
K 5	Lights if compressor 1 in a/c unit 1 is switched ON. The compressor is switched OFF and only released again after the safety time, a/c unit 1 is only partly ready for service in cooling operation.
	Error message
K 6	Lights if the pressure at the low pressure switch in refrigeration circuit 1 of a/c unit 1 has not fallen below the switching threshold.
	Is dark if the pressure switch has reacted.
	This message is ignored for ca. 30 sec when the respective compressor starts, in case of further operation of the compressor it results in switching OFF the refrigeration circuit 1.
	Error message
K 7	The compressor is switched OFF and only released again after the safety time, a/c unit 1 is only partly ready for service in cooling operation.
	Error message

Lamp	Meaning of Displays (output)
K 8	Lights if the pressure at the low pressure switch in refrigerating circuit 2 of a/c unit 1 has not fallen below the switching threshold.
	Is dark if the pressure switch has reacted.
	This message is ignored for ca. 30 sec when the respective compressor starts, in case of further operation of the compressor it results in switching OFF the refrigeration circuit 2.
	Error message
K 9	Lights when compressor 1 in a/c unit 2 is switched ON. Dark if the compressor is switched OFF and only released again after the safety time, a/c unit 2 is only partly ready for service in cooling operation.
	Error message
K 10	Lights if the pressure at the low pressure switch in refrigeration circuit 1 of a/c unit 2 has not fallen below the switching threshold. Is dark if the pressure switch has reacted. Compressor starts, in case of further operation of the compressor it results in switching OFF the refrigeration circuit 1
	Error message
K 11	The compressor is switched of and only released again after the safety time, a/c unit 2 is only partly ready for service in cooling operation.
	Error message

Lamp	Meaning of Displays (output)
K 12	Lights if the pressure at the low pressure switch in refrigeration circuit 2 of a/c unit 2 has not fallen below the switching threshold
	Is dark if the pressure switch has reacted.
	This message is ignored for ca. 30 sec when the respective compressor starts, in case of further operation of the compressor it results in switching OFF the refrigeration circuit 2
	Error message
K 13	Is dark if the max. temperature is exceeded, the fan is not switched ON anymore, a/c unit 1 is out of service.
	Error message
K 14	Is dark if the max. temperature is exceeded, the fan is not switched ON anymore, a/c unit 1 is out of service.
	Error message
K 15	Lights if the a/c system is switched ON with the switch S1U1S1
K 16	Lights, 400V OK
K 17	Is dark if the max. temperature is exceeded, the heater is not switched ON anymore.
	Error message. This fault will only occur in case of lack of air in the a/c unit or defective heater contractor.
K 18	Is dark if the max. temperature is exceeded, the heater is not switched ON anymore.
	Error message. This fault will only occur in case of lack of air in the a/c unit or defective heater contractor.
K 19	Lights, control pressure 1
K 20	Lights, control pressure 2
K 21	Not active in the system

7. SAFETY CHECKS AFTER MAKING RACK READY FOR SERVICE

Following super checks to be carried out after making rack ready for service:

7.1 When Power Supply is OFF

- Visually check the switchboard cabinet and other electrical accessories, visible from inside the coach, for any abnormality like damage to the fittings, loose cable connections etc.
- Ensure that disconnecting and earthing device is not in earthed position.
- Ensure that no safety device or MCB is in tripped or isolated condition in the switchboard cabinet.
- Visually inspect all electrical equipment fitted in the under frame of all coaches and ensure that their module and safety fittings are intact properly. Particularly check that equipment on which any repairing/ replacement work has been carried out.
- Visually check switchboard cabinet of all coaches for any loose connection, operation/locking of their doors. Any other material should not be placed inside the cabinet.
- Check rotary switch mounted on switch panel.
- Ensure that switchboard cabinet is not accessible to the passengers or any other unauthorized person.
- Ensure all indicating LEDs of all power panels are functioning properly.
- Ensure healthiness of batteries of all coaches.
- Check and ensure items of escorting tool and equipment.

7.2 When Power is ON

- Check the feeder voltage.
- Select appropriate NET and ensure proper working of battery.
- Check for availability of the control supplies for all control systems and equipments.
- Switch ON the supplies for all the electrical appliances, equipments and electrical fittings in the coach and check for their working.
- Start AC plants of individual coaches and ensure they are functioning properly.
- Switch OFF feeder and ensure working of emergency lights.
- Pre-cool the coach by using selector switch well before departure.
- Select the desired temperature for coach by using temperature selector switch after pre-cooling and unit will be put on cooling mode.
- Record any abnormality like failure of the electrical fittings, equipments and control system etc in log book.
- Ensure working of pump guard.
- In case of loss of supply of 750V 3 ph, in any of the phases, replace the fuse link. As the fuse link is provided in side the 750V cabinet in an inaccessible location the staff should be trained to replace the same.
- Ensure availability of water in under frame mounted water tanks to prevent dry running of water pumps.

8. TROUBLE SHOOTING

The common troubles are listed below along with their probable causes and remedial action to be taken:

1. Plant is switched on but does not start	
Probable Cause	Remedial action
No voltage	Check voltage at input device and fuses.
2. Condenser fan does not start	
No voltage applied to motor.	Check fuses thermal relays.
Condenser motor defective	By pass defective unit.
3. Compressor does not start even though indoor temperature is high	
No voltage applied to compressor.	Reset HP, if already tripped.
	Check fuses thermal relays.
Compressor motor defective.	By pass defective unit.
4. Compressor starts and stops but preset temperature is not reached	
Suction pressure low	Check rotation of fan.
	Air filter clogged. Clean as much as possible.
	Refrigerant shortage. Record in logbook.
High pressure goes high	Check fuses, thermal relays
	Condenser contaminated, clean it.
	Condenser defective/ extra refrigerant.
Control pressure switch doesn't come on	Check rotation of fan.
	Replace high-pressure cut out.

5. Supply air-handling unit not running	
No voltage	Check incoming voltage, fuse and power connection.
Motor defective	By pass defective unit & record.
6. 415V/110V insulation failure	
Weak insulation	Replace/ re-strengthen wire insulation.
7. MMR Defective	
Wrong phase sequence	Correct the phase sequence.
8. Contactor K 13, 14, 15, 16, 43, 44, 48 not operating	
Jam/ defective	Check and ensure proper operation.
9. Blower motor defective/ noisy	
Reverse phase sequence	Correct phase sequence
Contactor non contact	Ensure proper operation of contactors.
Shaft broken	By pass motor and record.
Fan defective	By pass motor and record.
10. Compressor defective	
Earthed	Check connection and rectify
Abnormal sound	Check and rectify
Terminal connection defective	Clean and connect terminals properly.
11. Heater not working	
Contactor non contact	Switch ON operating switch S1U1S1. ensure operation of contactors K35 & K40.
Sensor non contact	Ensure operation of appropriate duct sensors (AA005 and 007)

12. Excessive/ poor cooling	
Temperature setting disturb	LP/HP meter/switch defective Adjust setting.
Flapper motor adjustment disturb	Reverse the connection and record. Ensure correct adjustment
Gas less/ leakage	Transducer defective By pass compressor and record.
AC sensors not functioning	Ensure proper function of sensor.
Grills/filter choked up	Clean grills/ filters.
13. 60 kVA Transformer defective	
No output	Ensure 3 AC 750 V feed on primary.
Lead wire burnt and secondary giving output of 415V but coach equipment not getting power.	Replace lead wires having adequate rating.
14. AC system not working	
Microprocessor control card defective	Rectify internal defect.
15. Defect on Pump	
Water not coming	Check and clean filters. Ensure function of NR valve.
Pump efficiency less	Ensure proper phase sequence and leakage.
Air lock	Tighten loose joints.
Pump not working	Check function of pump controller. Check function of sensor.
	Ensure free running of motor/ pump by hand. Ensure incoming supply from DC to DC converter. Ensure earthing/ burning of pump motor. Take necessary action.

16. Battery not getting properly charged	
Output voltage of the charger is too low.	Check for charger setting and adjust the output voltage if necessary.
	Check for charging current limit of the charger.
17. Bulging of battery	
Over charging of the batteries	Check for charging current limit of the charger and inform the battery supplier.
18. OK condition not glowing and fault indication not glowing	
Battery is not connected to the battery charger.	Connect the battery to battery charger.
19. OK indication not glowing and fault indication glowing	
Fault in the battery charger.	Check and rectify the defect.
20. OK indication glowing and fault indication glowing	
Battery charger is ok but battery temperature is high.	Check battery temperature; if OK, sensor is defective replace it.
21. LED 2 (RED) glowing over voltage fault	
The output voltage reaches beyond 135V DC.	Check wiring of DC feedback circuitry and if wiring is ok, replace the control card.
22. LED 3 (RED) glowing under voltage fault	
The mains voltage is below 353VAC or input fuses have blown.	Increase beyond 353VAC, replace fuses if blown and if still problem is not solved, replace the control card.

23. LED 4, LED5, LED 6, LED 7 (GREEN) not glowing	
Battery charger defective.	Check and rectify defect.
Control supply voltage not available.	Check control fuse (F6 & F7) and input fuses (F1, F2, F3).
Heat sink over heated.	Check transformer supply on terminals J7, J9, J11, J14, J15.
	Check heat sink temperature and thermostat & its wiring.
24. LED 8, LED 9, LED 10, LED 11 (GREEN) not glowing	
Control supply voltage not available.	Check control fuse (F6 & F7) and input fuses (F1, F2, F3).
	Check transformer supply on terminals (J7, J9, J11, J14, J15)
25. Battery charger output not available and fault indication glowing and LED 1, LED 2 or LED 3 on control card not glowing	
Heat sink temperature goes above 90 deg. C.	Check & ensure working of cooling fans inside the battery charger.
Defective thermostat or thermostat wires are open.	Check terminals J3-1 & 3 wires (coming from thermostat) if opened, connect them.

Output fuse blown due to overload.	Check and replace fuses. Adjust load, interchange battery connections.
26. Battery charger goes in current limit	
When current at the output of battery charger crosses 50 amps, output DC voltage will decrease with increase in output current above 50 amps.	<p>Check the load current and if higher than 50A, reduce the load.</p> <p>Replace the control board and/or current sensor in the battery charger.</p>

9. TOOL KIT FOR ESCORTING STAFF

SN	DESCRIPTION OF MATERIAL	QTY.
1	Toolbox of size 325x440x120 mm (Approx.) with fixing arrangement for tools and locking arrangement with 2 no. of keys	1 Set
2	Screw driver set with 8nos of blades similar to Jhalani P. No.830 or equivalent.	1 Set
3	Combination plier insulated with thick CA sleeve with joint cutter length 205 mm.	1
4	Digital multimeter.	1
5	T spanner of sizes 10,13,15,17.	1 set
6	Panel key, square type ¼ inch size suitable for opening of control panel of AC coaches.	1
7	Key for opening fitting of AC coaches.	1
8	Test lamp holder (brass) fitted with 2 m of 2-core flexible copper wire.	1
9	Torch, cells (+ 2 cell spare).	1
10	DE spanner set 8pcs of sizes 6/7, 8/9, 10/11, 12/13, 14/15, 16/17, 18/19, 20/22.	1 Set
11	Allen key size 4mm, 3/16, 7/32.	1 set
12	Heavy duty cable cutting knife adjustable in aluminum casing overall size 140 mm.	1
13	Adjustable spanner length 255 mm.	1
14	Digital thermometer	1

SN	DESCRIPTION OF MATERIAL	QTY.
15	Nose plier 6".	1
16	Tounge tester AC (0 – 100 A).	1
17	Hammer ½ kg.	1
18	Hacksaw frame with blade (+ 1 spare blade).	1
19	Insulating tape.	1
20	Wire fuse.	1

OUR OBJECTIVE

To upgrade maintenance technologies and methodologies and achieve improvement in productivity, performance of all Railway assets and manpower which inter-alia would cover reliability, availability, utilisation and efficiency.

If you have any suggestions and specific comments please write to us.

Contact person	Director Electrical
Postal address	Indian Railways Centre for Advanced Maintenance Technology, Maharajpur, Gwalior, Pin Code - 474 020
Phone	0751 – 2470740 0751 – 2470803
Fax	0751 - 2470841