



## ANDHRA PRADESH STATE ROAD TRANSPORT CORPORATION

Office of the VC & MD,  
MSRD, HYDERABAD - 20.

No.OP4/2(1)/2013-MED,

### **CIRCULAR NO: 10/2014-MED, Dt.26-5-2014**

Sub: **SAFETY** - Passenger Safety in AC Buses-Reiteration of instructions - Reg

Ref: 1) Joint OPD & MED Circular No.23/2013, dt.23.11.2013  
2) Circular No.33/2011-MED, dt.30.08.2011

Detailed circular instructions have been issued vide circular 1<sup>st</sup> cited on prevention of fire accidents after the ghastly accident that took place on a private bus near Palem village on 30<sup>th</sup>Oct 2013 in which 45 passengers were charred to death.

Recently, AP21Z 159 an Ashok Leyland INDRA bus of Karimnagar-2 Depot caught fire at 10.20 hrs at KOMURAVELLY KAMAN on 1<sup>st</sup> Apr 2014 while going to Hyderabad from Karimnagar. A high-level committee has visited the accident spot and studied the reasons and submitted a report.

As per the findings of the expert committee, Electrical short circuit is the cause of the fire accident, the fuses which are supposed to safeguard the system in case of passing of excess current in lieu of short circuit were all tampered in this case.

Hitherto the electrical power in the automobile was used to crank the engine and the lighting in the passenger saloon/ head lights, whereas the demand for electrical power is increased manifold with the introduction of new technology such as Air suspension(electrically controlled leveling valves), Air conditioning system, Different kinds of retarder brakes, ABS brakes, fully/Auto manual transmission system etc. for safe and comfortable drive to the passengers and the "Drive-By-wire" Technology has been introduced to reduce the pollution by ensuring the optimum burning of the fuel by replacing the mechanical linkages with sensors and Electronic Control Unit(ECU).

Through the sensors, the information is fed to the ECU (Micro processor), the ECU analyses the data as per the pre coded logic and generate the diagnostic fault code, which helps for carrying out rectification action.

Since, number of electrical circuits have been vastly increased, there is a scope for short circuit and excess heat generation owing to overloads thus endangering the safety of vehicle by catching fire. Therefore there is every need to understand and maintain the wiring harness thoroughly to avoid incidents of electrical related fire accidents. During the course of a joint study conducted by APSRTC and M/s Ashok Leyland on the condition of electrical wiring harness and electrical components on one of the Indra buses revealed the following defects which may lead to fire accident.

1) Serious damage to the Battery Cables:

The length of the battery cable is observed to be more than specified whereby a drop of 6 volts occurred which may result in excess heat generation in the cable strands.

The Battery cables are subjected to rubbing with metal objects due to lack of proper clamping. The electrical conductors are exposed leading to short circuit as the insulation is badly damaged. There is a danger of spark generation and catching fire.



2) Improper arrangement for routing the EDC cables through cabin floor:

Proper rubber grommet is not provided around the cables to avoid fouling with cabin floor. There is scope for damage to the cables once the PVC protective sleeve gets damaged owing to rubbing with sheet metal around it.



3) Missing routing tags for wiring harness:

The routing tags found missing at several places resulting in loose/hanging wires.

Damages due to weld spatter and insulation peeling of due to improper routing/ hanging wires in EDC interface connector



4) Improper body grounding and improper connections to the load:

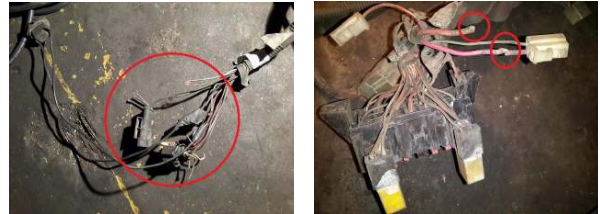
The cables are twisted and simply connected without using any connector (Eyelet) for grounding.

The positive and negative points are connected simply by twisting the wires without using crimped connectors



5) Tampered Main wiring Harness :

Main wiring harness is found cut at many places and the combination switch is bypassed instead of replacing the defective combination switch. The power tapping is done by cutting the insulation of main wiring harness instead of taking it from the spare supply point provided in the panel.



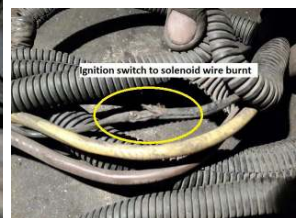
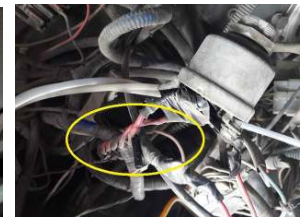
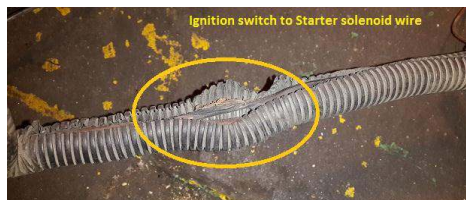
6) Water entry into Relay:

Water ingress observed in the relay which may affect the functioning of relay coil.



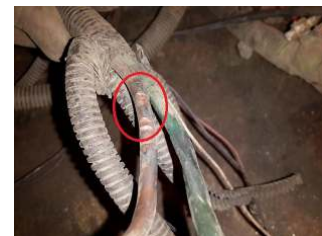
7) Twisted Ignition switch wires and damaged cables:

The Ignition switch wires are found twisted near its barrel due to improper mounting of ignition switch on the base. The ignition switch cables are found burnt and the cable is found opened near starter motor.



8) Cables damaged near Alternator:

The insulation of cables is found damaged at Alternator exposing the copper strands due to rubbing with the alternator mounting/bracket.



9) Missing 4ST Relay for Self Starter

The 4ST relay for Self starter is found missing thus endangering the protection of starter circuit.

In the light of the above defects which may pose threat of fire accidents, the following instructions are issued for strict compliance.

- I. TRAINING: The Electricians and Mechanical Supervisors shall be thoroughly educated to understand the wiring arrangement in Indra buses. The complete chassis wiring harness including EDC has been fixed on a plywood board in Zonal Workshops/UPL to make it easy for Electricians and Supervisors to understand the routing and connections. The Dy.CMEs shall take initiation to train the staff working at Depots under their jurisdiction duly deputing them to ZWS/UPL. The Works Managers of other Zonal Workshops are also advised to prepare similar demo arrangement at their Workshops.

A detailed drawing indicating the entire wiring harness of Indra buses is enclosed herewith. The Depot Managers are advised to take a print out of the drawing in 3'x4' size and display it in the garage at conspicuous place.

- II. CABLES/ WIRING HARNESS PROTECTION:

All cables shall be routed in a secured manner by using proper routing clamps/clips/tags. Cables hanging loose shall not be allowed. Cables shall always be covered with protective sleeves.



Proper care shall be taken while fastening the grounding cables with suitable fasteners. Loose connections in earthing cables may lead to generation of spark. Care shall be taken to avoid chaffing of cables, fouling with metal objects and exposure to heat & oils. The condition of wiring harness, routing tags, clamps, protective sleeves shall be checked and attended during every Sch-III maintenance.

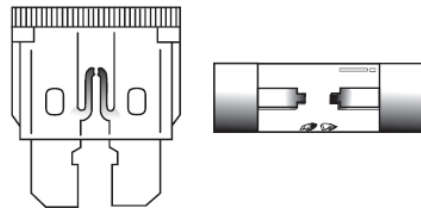


Utmost care shall be taken to avoid cables fouling with hot components like turbocharger, exhaust manifold, silencer pipes etc.

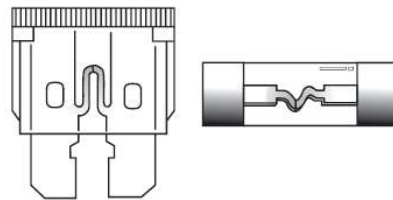
- III. BATTERY CABLES: Battery cables of prescribed length shall only be used to avoid voltage drop and overheating of cables. The battery cables shall be checked at every 1 lakh kms and the ruptured/ damaged battery cables shall be replaced immediately with new cables. If a voltage drop of more than 1 volt is observed near Self Starter, the location of the battery may be changed to reduce the cable length.
- IV. IGNITION SWITCH: The Ignition switch barrel should be checked for any rotation. The barrel shall be properly locked to avoid twisting. Minimum quantity of switches shall be kept in Depot stock for timely replacement.

- V. 4ST RELAY FOR SELF STARTER: 4ST Relay provided for Starter Motor shall always be kept under proper working condition. It shall not be bypassed under any circumstance. At least one 4ST Relay shall be kept under depot stock always to ensure timely replacement of defective Relay.
- VI. RELAYS FOR HEAD LIGHTS & HORN: The Relays provided for Head Lights and Horn shall not be disconnected under any circumstance. The defective Relays shall be replaced duly stocking the minimum quantity at Depots.
- VII. ENGINE CRANKING: The drivers shall be desisted from long cranking of engine. The defects like weak battery, air lock, clogged filters etc shall always be corrected in time to avoid late starting of engine.
- VIII. FUSES: There shall not be any direct connection or tampering of fuses under any circumstances. If there is any fuse failure, it shall be thoroughly checked to find out the actual cause of fuse failure. Excessive current caused by short circuit or overloading of the component (Ex: Sticky wiper arm or fouling fan blades etc). There is also chance for failure of fuse due to fatigue caused by fluctuations in current. The following diagrams indicate the typical fuse failures.

FUSE FAILURE DUE TO EXCESS CURRENT

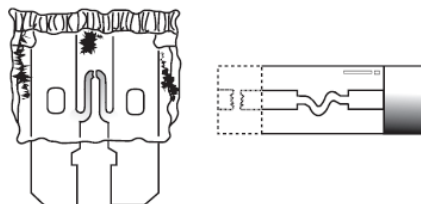


FAILURE DUE TO FATIGUE



There is one more reason for generation of excess heat because of defective fuse. Poor contact between the fuse and fuse holder leads to more resistance and thereby causes excess heat. Melting of plastic on bladed fuses and melting of contacts at the cap is an indication of excess heat generated by loose contact (shown in the following figure).

FUSE DEFORMATION DUE TO POOR CONTACT



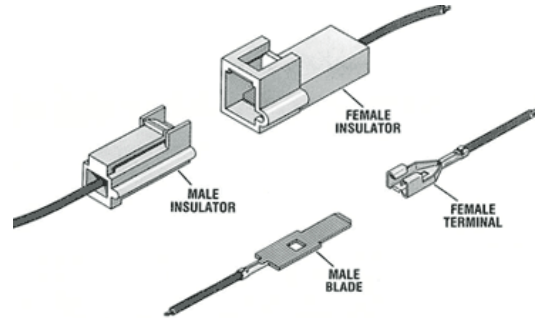
Overrated fuses shall not be used under any circumstance. Only the rated fuses of approved sources shall only be used as recommended by the vehicle manufacturer.

The lid on Fuse Box shall always be kept closed to prevent entry of dirt & water. The rating of different fuses is displayed on Fuse Box and also

furnished at the annexure. Fuses of only genuine makes like “*Littelfuse*” shall be used

- IX. ELECTRICAL CABLES & CONNECTORS: The electrical wires of prescribed gauge (as per wiring diagram) shall only be used. Cheap/ non-genuine cables shall not be used under any circumstance for both chassis and body wiring.

The wire-to-wire electrical connections shall be properly made using suitable connectors/ eyelets with the help of a crimping tool. Under no circumstances, crude method of joining electrical cables by twisting and applying insulation tape shall be followed.



- X. TAPPING OF POWER: Wrong tapping of power from the electrical system may lead to heat generation and fire hazards (Ex: Additional Head lights, Audio players etc.). The electrical power for accessories shall be drawn only from the provision made by the vehicle manufacturer. Power shall not be tapped under any circumstance by cutting the insulation of a wire and joining it with the wire. The Drivers shall be desisted from tapping the power supply unauthorizedly for extra head lights which may lead to overloading and overheating of cables.

All the above instructions shall be implemented with true spirit and any laxity in implementation will be viewed very seriously. A compliance report as having implemented the above instructions shall be sent by RMs to reach this office by 31<sup>st</sup> May 2014.

A handwritten signature in black ink, consisting of a series of loops and a long horizontal stroke at the end.

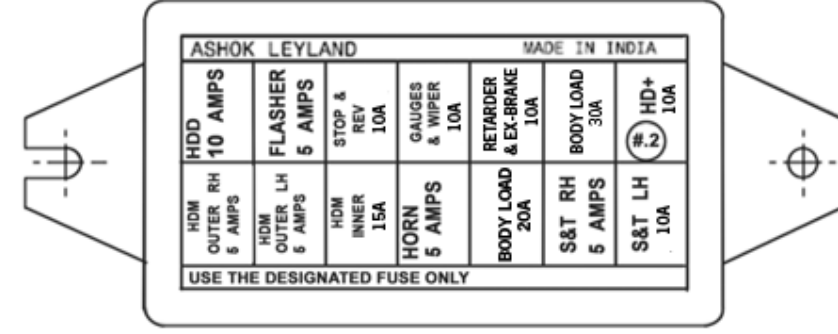
**VICE CHAIRMAN & MANAGING DIRECTOR**

Encl: As above

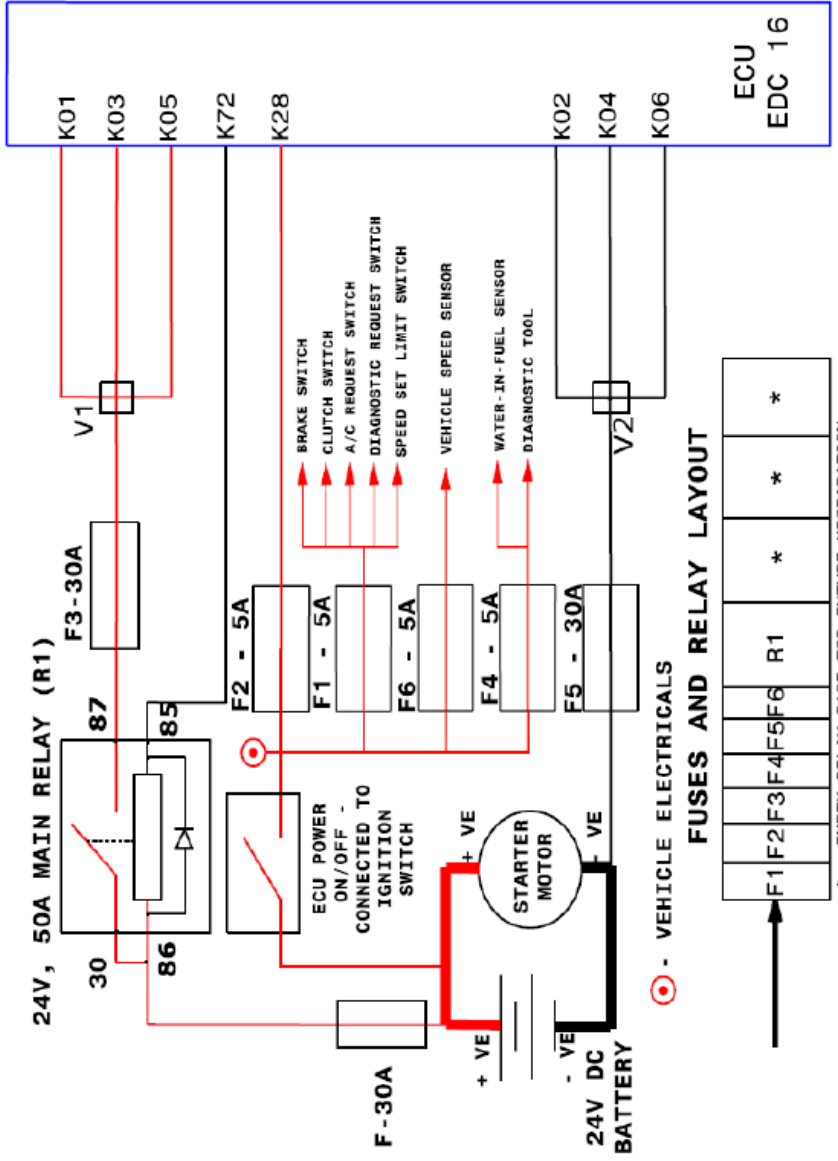
To  
All Regional Managers.

Copy to: All EDs (Zones) for necessary action  
Copy to: Dir(V&S), ED(O), ED(E&IT), ED(HRD&Medi), ED(A&P) for infm. & n.action  
Copy to: CME(O), CME(C&B), CM(HRD), CM(EE) for information & n.action  
Copy to: All DVMs, Dy.CTM, Dy.CMEs, WMs & COS' for necessary action  
Copy to: All DMs, Maintenance incharges & Traffic incharges for necessary action.

**FUSE BOX LAYOUT & FUSES RATING**



**CIRCUIT DIAGRAM - RELAYS AND FUSES  
CRS EDC 16 SYSTEM - EDC16UC40-4.20**

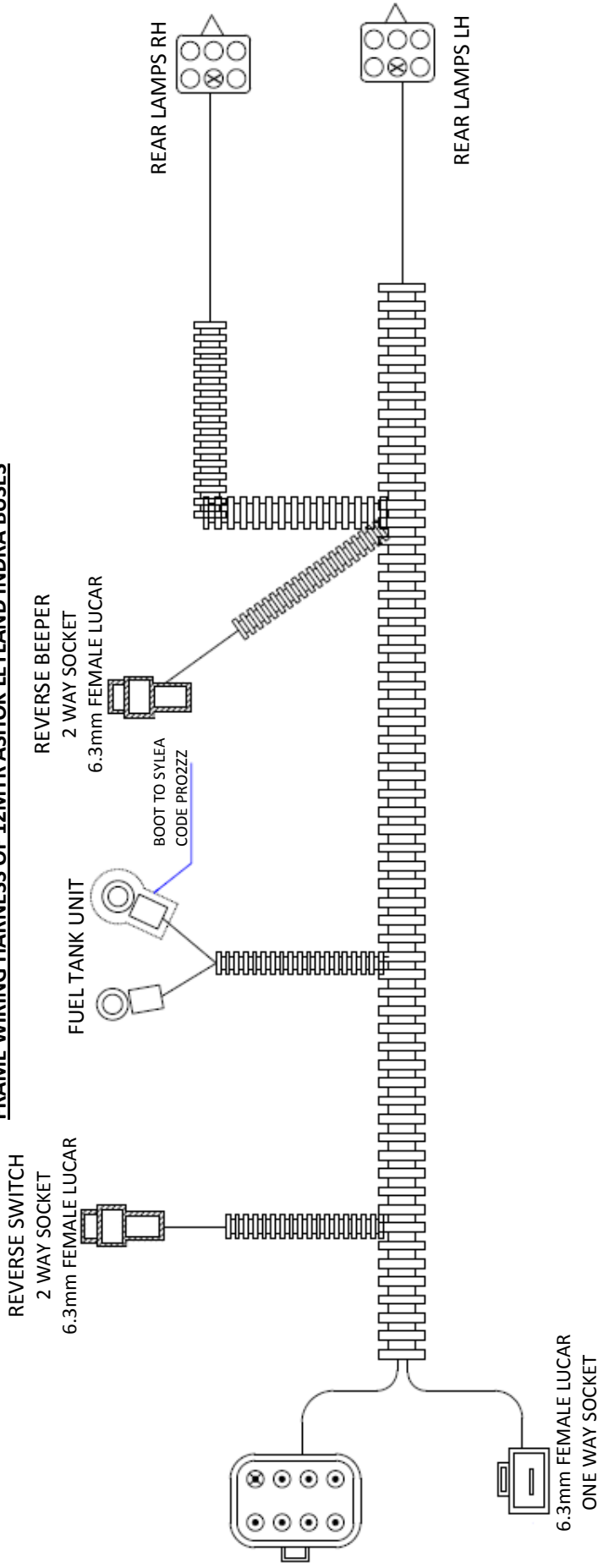


**FUSES AND RELAY LAYOUT**



ANNEXURE-B

**FRAME WIRING HARNESS OF 12MTR ASHOK LEYLAND INDRA BUSES**



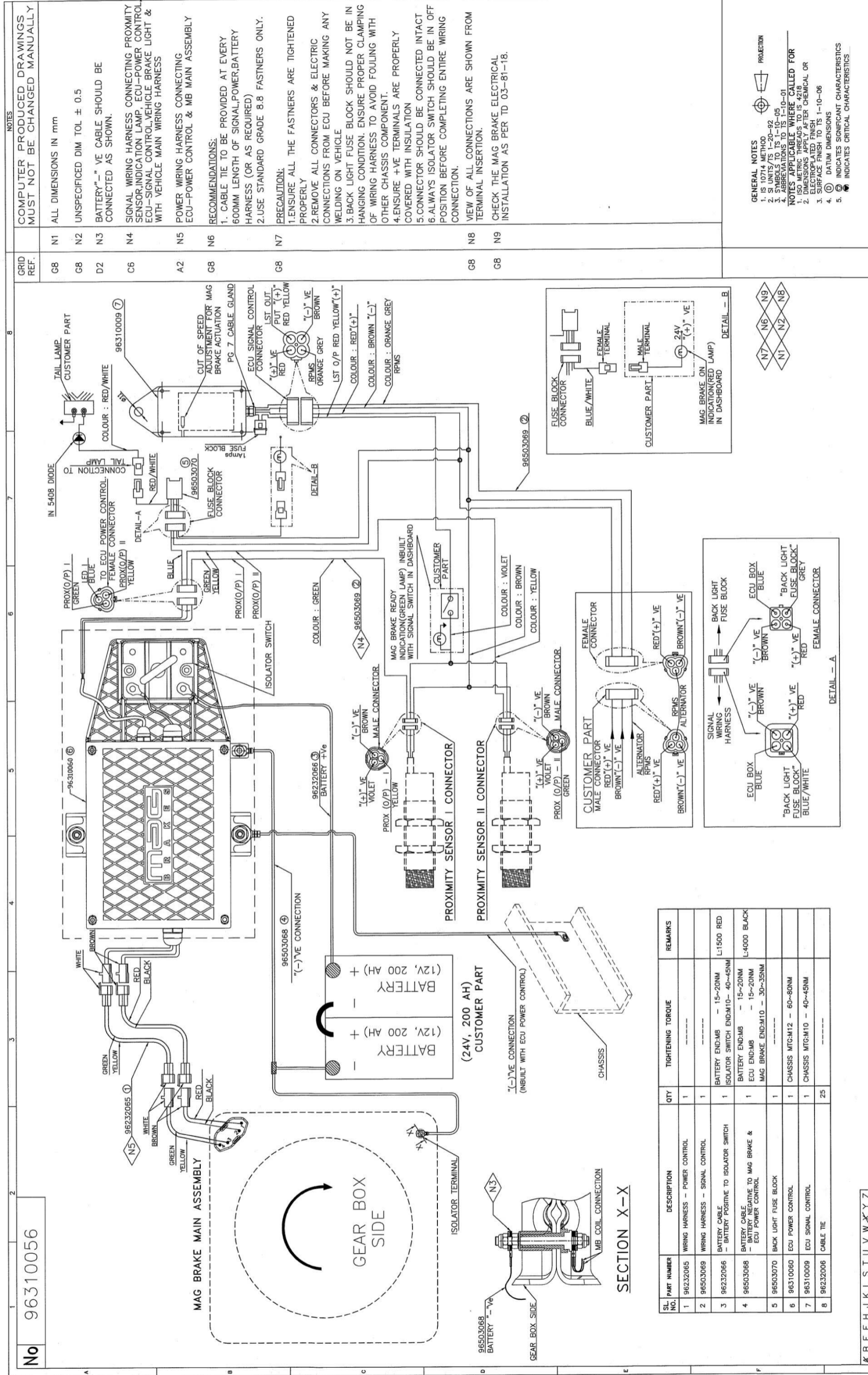
S.No	DESCRIPTION OF ITEM	PART NO	QTY
1	FRAME WIRING HARNESS	FM800534	E:1
2	BATTERY CABLE KIT (COMPRISES OF ITEMS MARKED #)	BOK04301	E:1
3	BATTERY +VE CABLE (FROM ISO. SWITCH TO STR.)	FM700130 #	E:1
4	BATTERY NEGATIVE CABLE (BATTERY -VE TO STARTER -VE)	FM700230 #	E:1
5	BATTERY INTER CONNECTOR	FM700330 #	E:1
6	BATTERY +VE CABLE (FROM BATT. +VE TO STR. +VE)	FM700430 #	E:1
7	CONNECTOR FOR PROXIMITY SENSOR	B8857401	E:1
8	EARTH STRAP	F8167600	E:1
9	STRAP-SPL OLAS	F0845214	E:20
10	CLIP ASSY-PIPE PNL	F7874130	E:10
11	SCHEDULE OF CLIPS	F0830540	E:5

S.No	DESCRIPTION OF ITEM	PART NO	QTY
12	BATTERY TERMINAL-LEAD ANTIMONY ALLOY	F8166500	E:1
13	EDC POWER CABLE	F8178700	E:1
14	551 9.0 MM CABLE TIE - BLACK	F6M00900	E:10
15	453 8.00 MM CABLE TIE - BLACK	F6M01000	E:15
16	CLAMP WITH RUBBERIZED/PVC SLEEVE -20MM	F6M01200	E:10
17	CLAMP WITH RUBBERIZED/PVC SLEEVE - 25MM	F6M01300	E:5
18	CLAMP WITH RUBBERIZED / PVC SLEEVE - 35MM	F6M01400	E:5
19	CLAMP WITH RUBBERIZED / PVC SLEEVE - 40MM	F6M01500	E:5
20	CLAMP WITH RUBBERIZED / PVC SLEEVE - 60MM	F6M01600	E:5
21	153 3 6 MM CABLE TIE - BLACK	F6M00700	E:10
22	312 7.6 MM - CABLE TIE - BLACK	F6M00800	E:10





# MAG RETARDER BRAKE ELECTRICAL SYSTEM

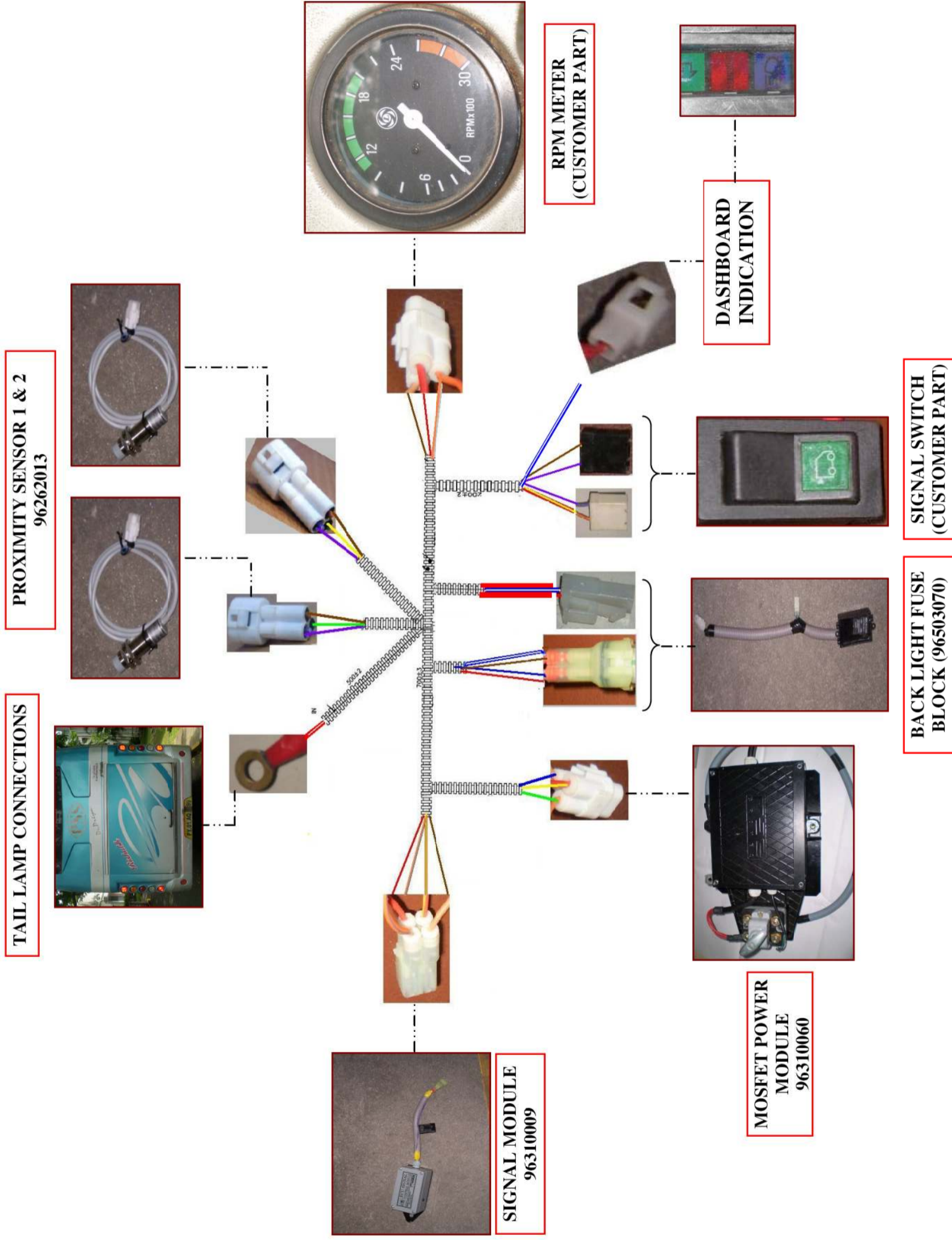


No 96310056

SL. NO.	PART NUMBER	DESCRIPTION	QTY	TIGHTENING TORQUE	REMARKS
1	96232065	WIRING HARNESS - POWER CONTROL	1	---	
2	96503069	WIRING HARNESS - SIGNAL CONTROL	1	---	
3	96232066	BATTERY CABLE - BATTERY POSITIVE TO ISOLATOR SWITCH	1	BATTERY END-MB - 15-20NM ISOLATOR SWITCH END-M10 - 40-45NM	L1500 RED
4	96503068	BATTERY CABLE - BATTERY NEGATIVE TO MAG BRAKE & ECU POWER CONTROL	1	BATTERY END-MB - 15-20NM ECU END-MB - 15-20NM MAG BRAKE END-M10 - 30-35NM	L4000 BLACK
5	96503070	BACK LIGHT FUSE BLOCK	1	---	
6	96310060	ECU POWER CONTROL	1	CHASSIS MTC-M12 - 60-80NM	
7	96310009	ECU SIGNAL CONTROL	1	CHASSIS MTC-M10 - 40-45NM	
8	96232006	CABLE TIE	25	---	

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

### SIGNAL WIRING HARNESS AND INTERCONNECTIONS OF MAG ELECTROMAGNETIC RETARDER

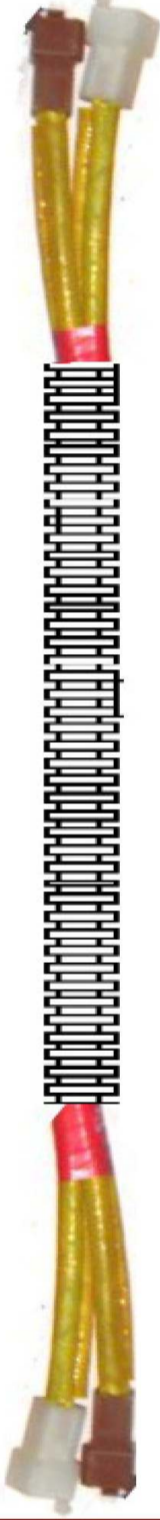
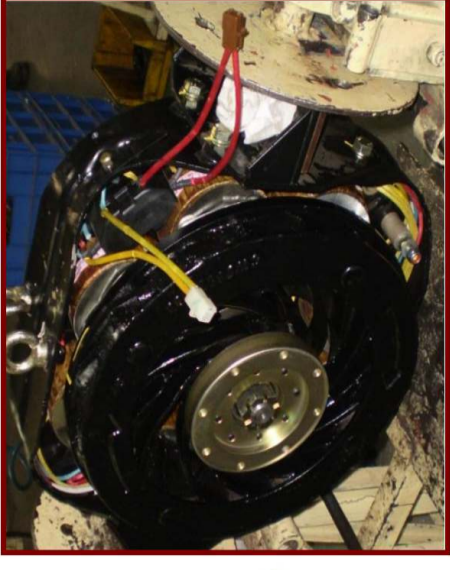


**EMR POWER WIRING HARNESS – ECU Power module to Retarder Brake Main assembly**

**ECU Power Module**



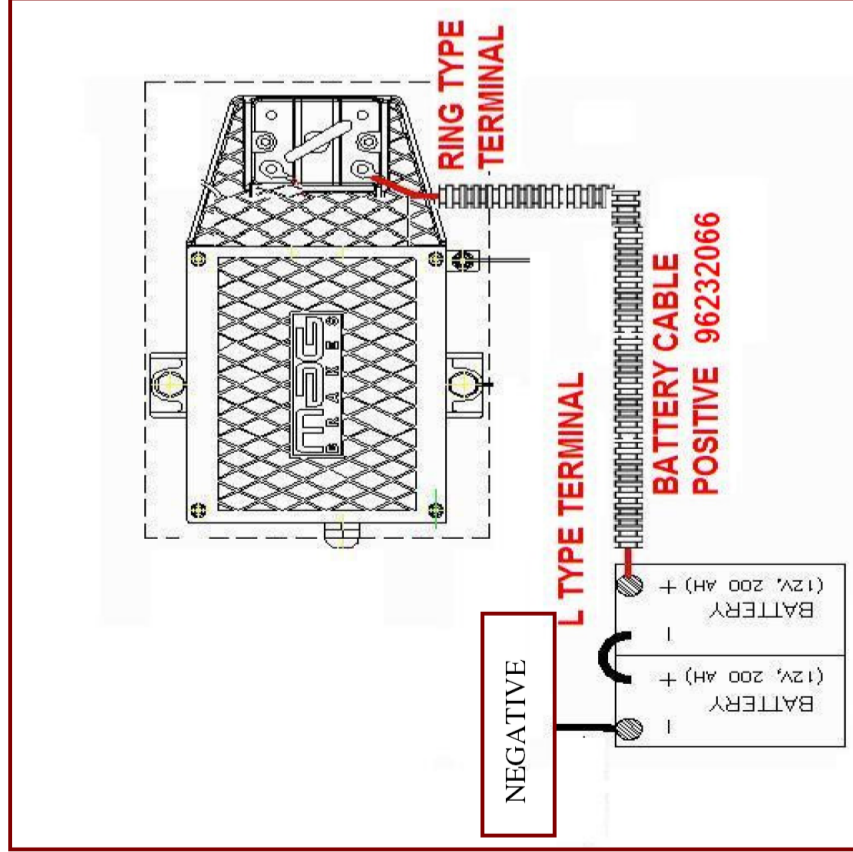
**MagBrake**



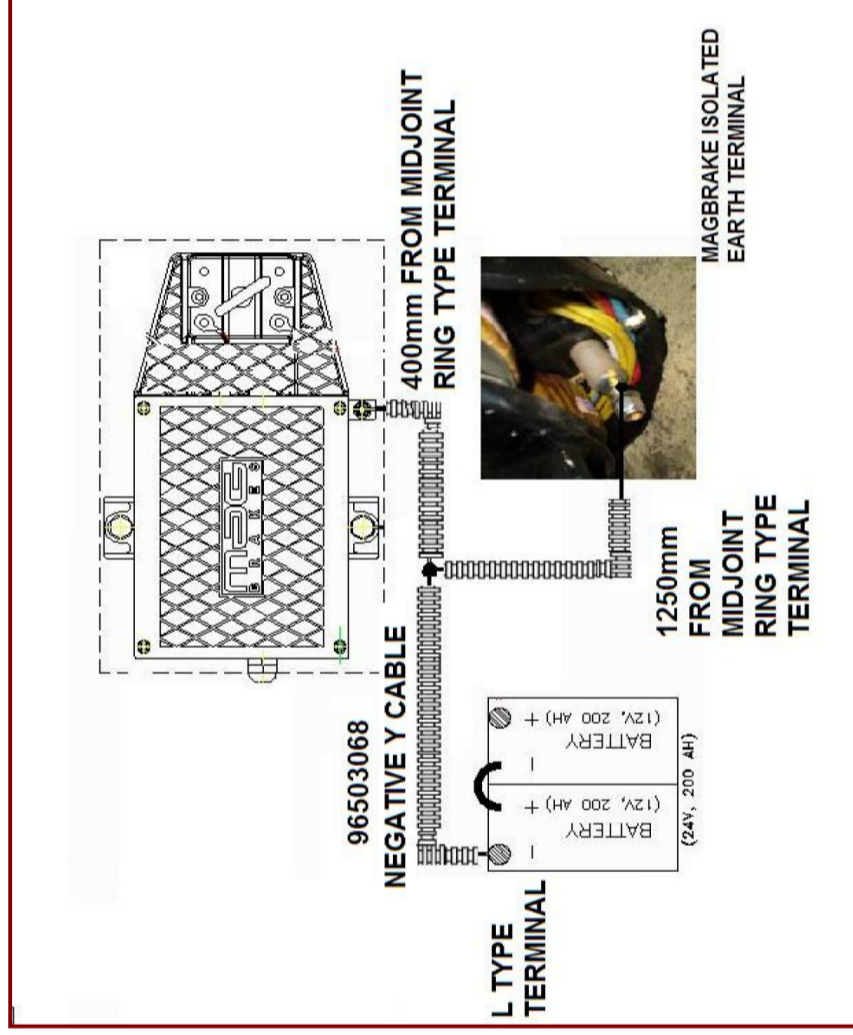
**Power Wiring Harness**

**BATTERY CABLE CONNECTIONS**

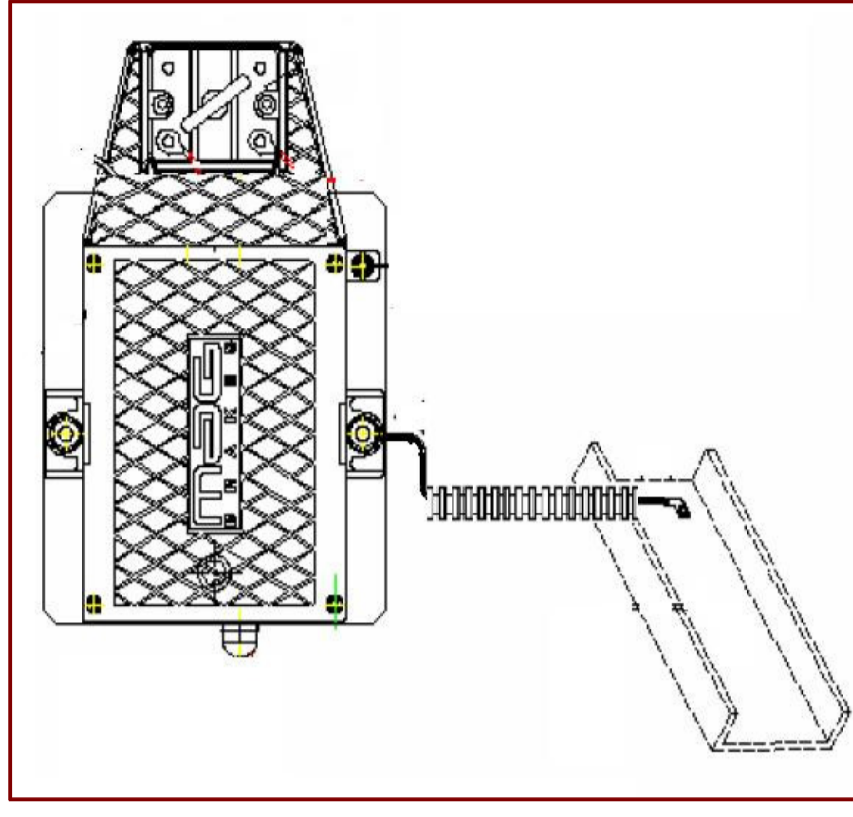
**POSITIVE CABLE CONNECTION**



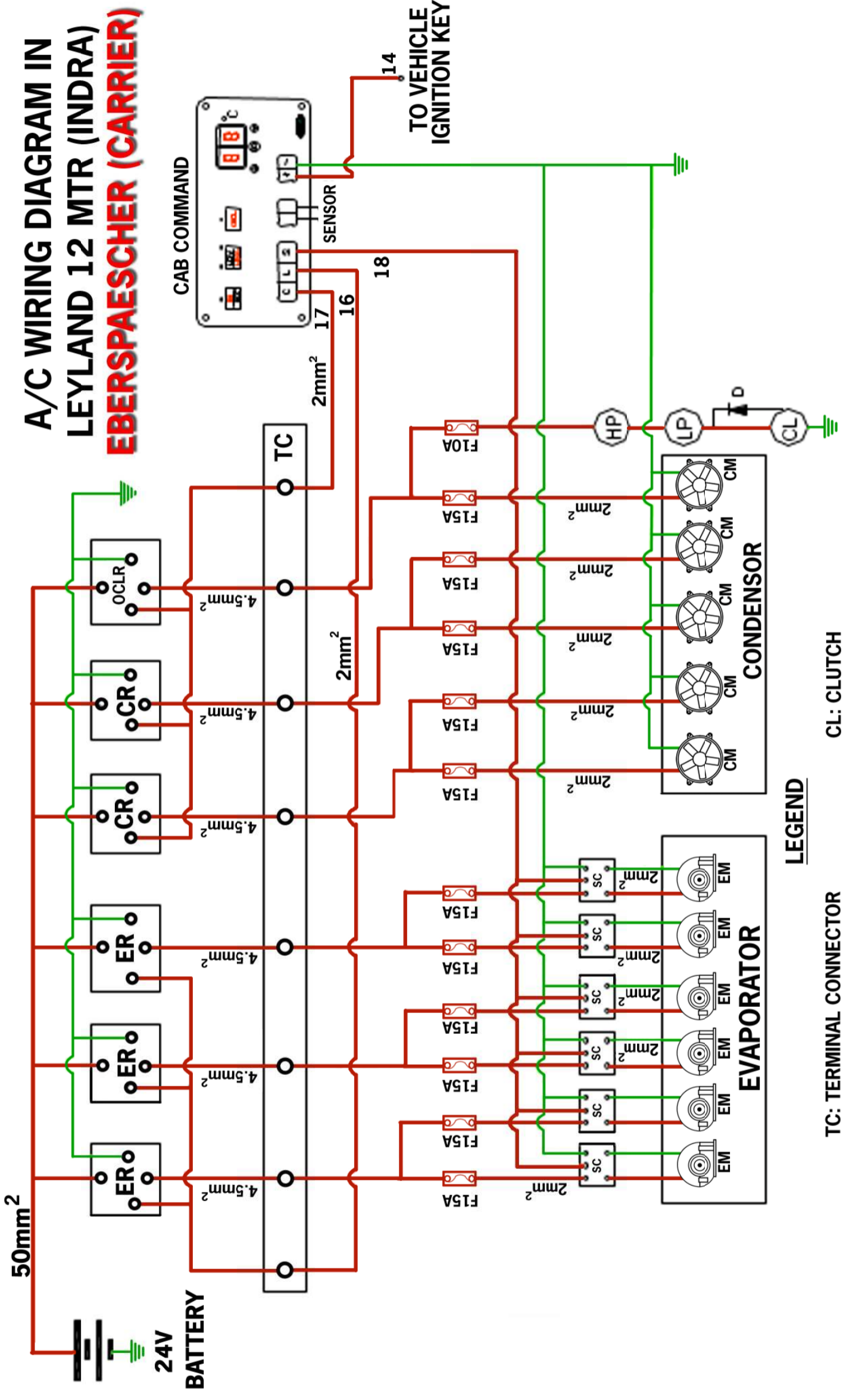
**NEGATIVE Y CABLE CONNECTION**



**MosFET ECU EARTHING CONNECTION**

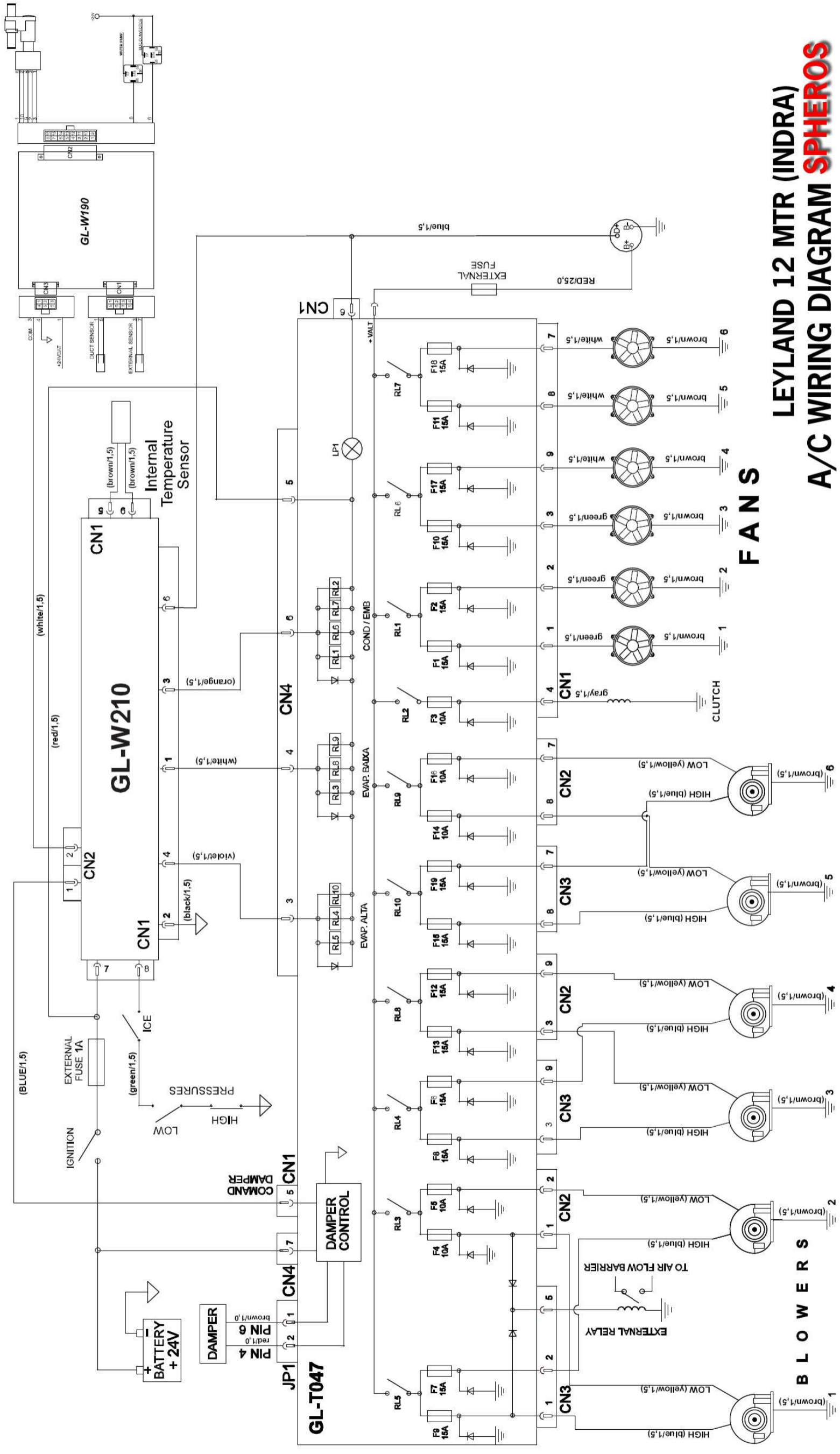


**A/C WIRING DIAGRAM IN  
LEYLAND 12 MTR (INDRA)  
EBERSPAESCHER (CARRIER)**



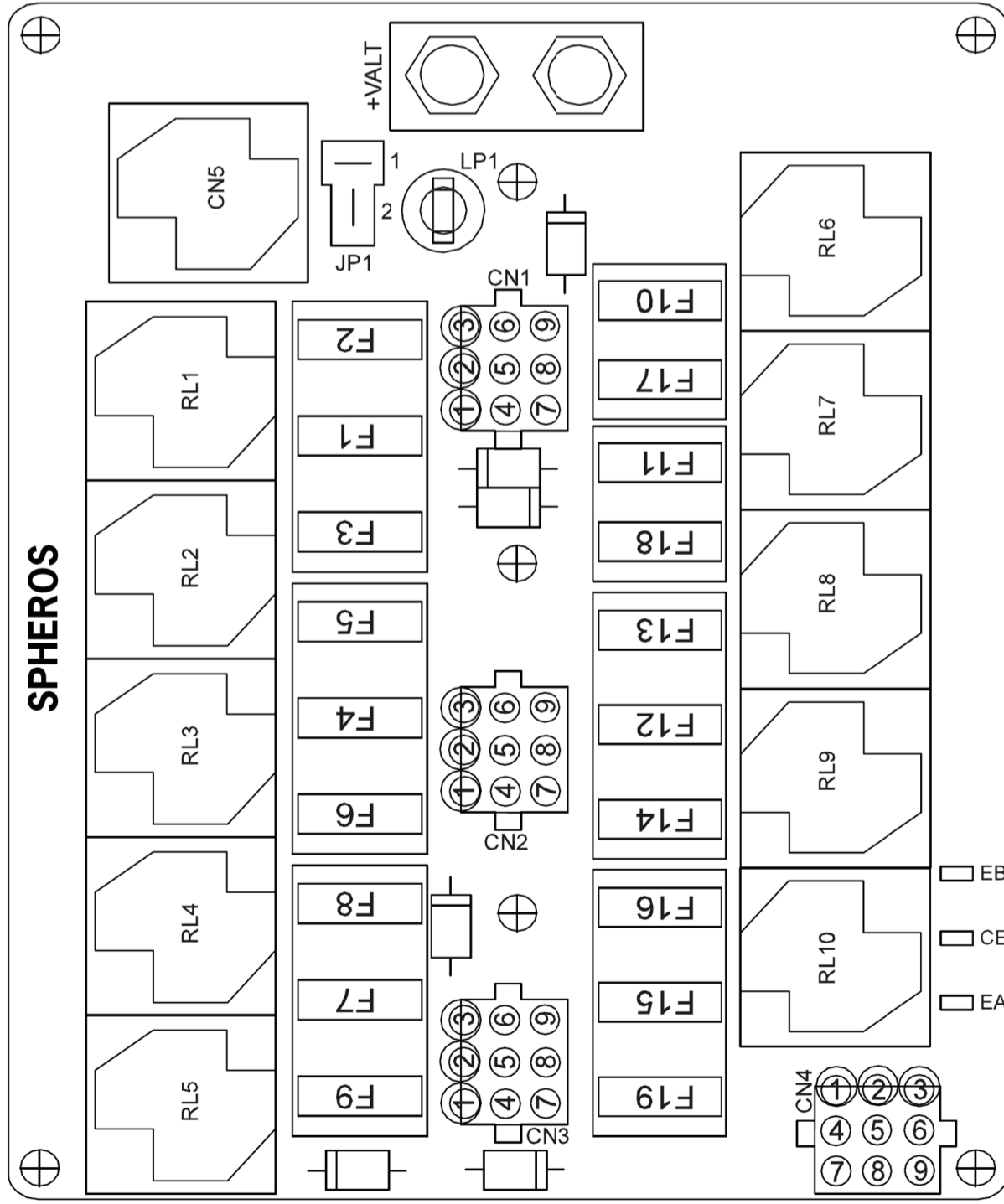
**LEGEND**

- TC: TERMINAL CONNECTOR
- EM: EVAPORATOR MOTOR
- CM: CONDENSER MOTOR
- ER: EVAPORATOR RELAY
- CR: CONDENSER RELAY
- OCLR: CLUTCH RELAY
- CL: CLUTCH
- F: FUSE
- D: DIODE 6A4
- SC: SPEED CONTROLLER



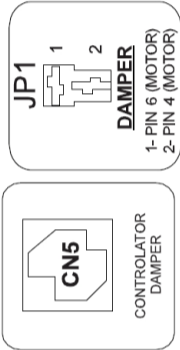
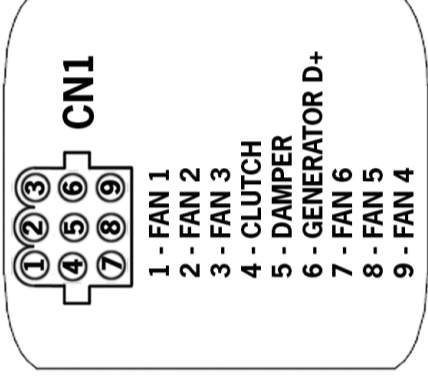
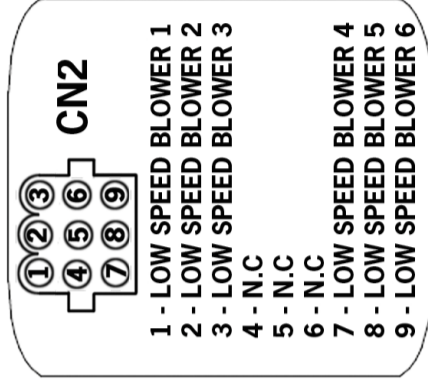
**LEYLAND 12 MTR (INDRA)  
A/C WIRING DIAGRAM SPHEROS**

**A/C ELECTRICAL SCHEMATIC DIAGRAM - LEYLAND 12 MTR (INDRA)**



**FUSES:**

- F1 - FAN 1 - 15A
- F2 - FAN 2 - 15A
- F3 - CLUTCH - 10A
- F4 - LOW BLOWER 1 - 10A
- F5 - LOW BLOWER 2 - 10A
- F6 - HIGH BLOWER 4 - 15A
- F7 - HIGH BLOWER 2 - 15A
- F8 - HIGH BLOWER 3 - 15A
- F9 - HIGH BLOWER 1 - 15A
- F10-FAN 3 - 15A
- F11-FAN 5 - 15A
- F12-LOW BLOWER 4 - 10A
- F13-LOW BLOWER 3 - 10A
- F14-LOW BLOWER 5 - 10A
- F15-HIGH BLOWER 5 - 15A
- F16-LOW BLOWER 6 - 10A
- F17-FAN 4 - 15A
- F18-FAN 6 - 15A
- F19-HIGH BLOWER - 15A



**RELAYS:**

- RL1 - FAN 1 & 2
- RL2 - CLUTCH
- RL3 - LOW SPEED BLOWER 1 & 2
- RL4 - HIGH SPEED BLOWER 3 & 4
- RL5 - HIGH SPEED BLOWER 1 & 2
- RL6 - FAN 3 & 4
- RL7 - FAN 5 & 6
- RL8 - LOW SPEED BLOWER 3 & 4
- RL9 - LOW SPEED BLOWER 5 & 6
- RL10-HIGH SPEED BLOWER 5 & 6

