

LOS ANGELES COUNTY

METROPOLITAN TRANSPORTATION AUTHORITY

LIGHT RAIL VEHICLE

P2550

**RUNNING
MAINTENANCE
AND
SERVICE MANUAL**

**SECTION 10
LOW VOLTAGE
DISTRIBUTION SYSTEM**



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RUNNING MAINTENANCE
AND
SERVICE MANUAL

VOLUME M-01
PART I
THEORY OF OPERATION
SECTION 10 - LVDS

SECTION 10

LOW VOLTAGE DISTRIBUTION SYSTEM

PART I

THEORY OF OPERATION

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TABLE OF CONTENTS

Section/ Para	Title	Page
10-I-01	INTRODUCTION	1
10-I-01.a	List of Abbreviations, Acronyms and Symbols	2
10-I-01.b	List of Definitions	4
10-I-01.c	List of Measurement Units and Symbols	5
10-I-02	THEORY OF OPERATION	7
10-I-02.01	General Description of the System.....	7
10-I-02.02	The APS/LVPS System Components	24
10-I-02.02.01	Power Circuit Architecture	24
10-I-02.02.02	Line Filter.....	26
10-I-02.02.03	APS/LVPS Fan.....	30
10-I-02.02.04	APS System	31
10-I-02.02.05	LVPS System	37
10-I-02.02.06	Active Clamp and Component Assembly	46
10-I-02.02.07	Auxiliary Inverter Control Unit.....	51
10-I-02.02.08	Treatment of Signals	68
10-I-02.02.09	Protection Logic.....	82
10-I-02.03	Vehicle Electric/Electronic Equipment.....	88
10-I-02.03.01	Electronic Lockers	89
10-I-02.03.02	Electric Lockers	90
10-I-02.03.03	Operator's Cab Electrical Equipment	96
10-I-02.03.04	Operator Console	100
10-I-02.03.05	Indicator and Switch Panels	113
10-I-02.04	Functional Schematics and Topographics	123
10-I-02.04.01	APS/LVPS Functional Schematics	123
10-I-03	APPENDIX	126
10-I-03.01	Inverter and IGBT Theory and PWM Modulation.....	126
10-I-03.02	How to Use the Functional Schematics: Example	128
10-I-03.03	How to Read Topographics: Example	131
10-I-03.04	Vehicle Circuit Breakers	137
10-I-03.05	Circuit Breakers - How They Work	141
10-I-03.06	Relays - How They Work.....	142
10-I-03.07	Ingress Protection Ratings (IP Codes).....	144
10-I-03.08	Insulation Class	145

LIST OF ILLUSTRATIONS

Figure	Title	Page
Figure 10-I-02.1	APS/LVPS System and APS/LVPS Line Reactor Overview	7
Figure 10-I-02.2	APS/LVPS Functional Diagram	8
Figure 10-I-02.3	APS/LVPS (#12) and APS/LVPS Line Reactor (#11) Location	9
Figure 10-I-02.4	System-Vehicle Relationship	10
Figure 10-I-02.5	APS / LVPS Configuration Block Diagram	11
Figure 10-I-02.6	APS/LVPS Overall Dimensions	12
Figure 10-I-02.7	APS/LVPS Front View	15
Figure 10-I-02.8	208Vrms (60Hz) 3-phase Loads	16
Figure 10-I-02.9	120Vrms (60Hz) Mono-phase Loads	17
Figure 10-I-02.10	APS/LVPS Rear View	19
Figure 10-I-02.11	Voltage - Battery Current	20
Figure 10-I-02.12	Voltage - Total Current	20
Figure 10-I-02.13	37,5 Vdc Loads	22
Figure 10-I-02.14	APS/LVPS Functional Description	24
Figure 10-I-02.15	APS/LVPS Components Layout	25
Figure 10-I-02.16	Line Filter	26
Figure 10-I-02.17	Line Reactor	27
Figure 10-I-02.18	Line Reactor Overall Dimensions	28
Figure 10-I-02.19	Input Filter Connected Elements	29
Figure 10-I-02.20	APS/LVPS Fan and Cooling Duct	30
Figure 10-I-02.21	APS Electrical Schematic	31
Figure 10-I-02.22	APS Inverter Module	32
Figure 10-I-02.23	APS Electric Schematic (1)	34
Figure 10-I-02.24	APS Electric Schematic (2)	35
Figure 10-I-02.25	Location of APS Transformer and CF Capacitors	36
Figure 10-I-02.26	LVPS Diagram	38
Figure 10-I-02.27	LVPS Inverter Module	39
Figure 10-I-02.28	LVPS Electrical Schematic (1)	41
Figure 10-I-02.29	LVPS Electrical Schematic (2)	42
Figure 10-I-02.30	LVPS Transformer	43
Figure 10-I-02.31	SUC (Start-Up Circuit)	45
Figure 10-I-02.32	Active Clamp Module	46
Figure 10-I-02.33	Active Clamping Circuit	47
Figure 10-I-02.34	DN Block Diode Function	48
Figure 10-I-02.35	Active Clamp Electric Schematic	49
Figure 10-I-02.36	Component Assembly	50
Figure 10-I-02.37	Auxiliary Inverter Control Unit Front View	52
Figure 10-I-02.38	PSU	53
Figure 10-I-02.39	CIA - 04 board location	56
Figure 10-I-02.40	CIA - 04 Board	57

LIST OF ILLUSTRATIONS

Table	Title	Page
	Figure 10-I-02.41 PSC - 04 board location	61
	Figure 10-I-02.42 PSC - 04 Board	62
	Figure 10-I-02.43 ACU2 Mother Board	67
	Figure 10-I-02.44 Transducers' Connections	71
	Figure 10-I-02.45 Amperometric Transformer	72
	Figure 10-I-02.46 APS IGBTs	75
	Figure 10-I-02.47 LVPS IGBTs	76
	Figure 10-I-02.48 LONWorks Bus and CAN Bus Connectors	80
	Figure 10-I-02.49 Input - Output Signal Block Diagram	81
	Figure 10-I-02.50 Electronic and Electric Lockers location	88
	Figure 10-I-02.51 Data Download Panels	90
	Figure 10-I-02.52 Electronic Lockers	91
	Figure 10-I-02.53 "A" Cab Electric Locker Layout	92
	Figure 10-I-02.54 "B" Cab Electric Locker Layout	93
	Figure 10-I-02.55 Cab Circuit Breaker Location	96
	Figure 10-I-02.56 By-Pass Panel	96
	Figure 10-I-02.57 "A" Cab - By-pass panel	98
	Figure 10-I-02.58 "A" Cab - By-pass panel	99
	Figure 10-I-02.59 Operator's Console Overview	100
	Figure 10-I-02.60 Indicator and Switch Panels	113
	Figure 10-I-02.61 APS/LVPS in LV Functional Schematic	123
	Figure 10-I-02.62 APS/LVPS Functional Schematic Hierarchy	124
	Figure 10-I-02.63 APS/LVPS Functional Schematic Connectors	125
	Figure 10-I-03.1 DC/AC Diagram	126
	Figure 10-I-03.2 COMRH and COMRL generation (PWM Modulation)	127
	Figure 10-I-03.3 Phase R (Before Transformer) Diagram	128
	Figure 10-I-03.4 #11 LV Functional Schematic	132
	Figure 10-I-03.5 MV Compressor Connector (AA042BH Abstract)	133
	Figure 10-I-03.6 C17 Electric Locker Connector (AA042BH Abstract)	133
	Figure 10-I-03.7 A17 Table and 2F05 CB (AA05H25, #17 Abstract)	134
	Figure 10-I-03.8 MT Connector (AA042BH Abstract)	135
	Figure 10-I-03.9 VMT1 Connector (AA042BH Abstract)	135
	Figure 10-I-03.10 MV Connector Bundle (AA04EPD Abstract)	136
	Figure 10-I-03.11 VMT1 Connector (AA042BJ Abstract)	136
	Figure 10-I-03.12 MT Connector (AA042BJ Abstract)	136
	Figure 10-I-03.13 MV APS Output Connector (AA042BJ Abstract)	137
	Figure 10-I-03.14 Circuit Breaker	141
	Figure 10-I-03.15 Circuit Breaker Characteristic Curve	142
	Figure 10-I-03.16 Relay Scheme	143

LIST OF ILLUSTRATIONS

Figure	Title	Page
Figure 10-I-03.17	2 minutes Relay Timing Unit	143
Figure 10-I-03.18	Insulation Class	145

LIST OF TABLES

Table	Title	Page
Table 10-I-02.1	208 VAC Circuit Breakers and Loads - "A" Car Section	18
Table 10-I-02.2	208 VAC Circuit Breakers and loads - "B" Car Section	18
Table 10-I-02.3	PSU Outputs	55
Table 10-I-02.4	CIA - 04 Board Analog Input Signals	58
Table 10-I-02.5	CIA - 04 Board Digital Input Signals	59
Table 10-I-02.6	PSC - 04 Board Analog Input Signals	64
Table 10-I-02.7	PSC - 04 Board digital Input Signals	65
Table 10-I-02.8	Transducer Signals	68
Table 10-I-02.9	Board Connectors for Transducer Signals	69
Table 10-I-02.10	Amperometric Transformer Signals	72
Table 10-I-02.11	PT100 Thermal Sensor Signals	72
Table 10-I-02.12	Digital Input Signals coming from outside the APS/LVPS	73
Table 10-I-02.13	Digital Input Signals coming from inside the APS/LVPS	74
Table 10-I-02.14	Signals from CIA - 04 to APS Inverter Module	75
Table 10-I-02.15	Signal from PSC - 04 to LVPS Inverter Module	76
Table 10-I-02.16	Connectors for APS/LVPS Digital Output Signals	77
Table 10-I-02.17	J1 Pin-out (CIA and PSC Boards)	78
Table 10-I-02.18	APS/LVPS RS-232 connectors	79
Table 10-I-02.19	CLON1 and CLON2 Connectors (CIA and PSC Boards)	79
Table 10-I-02.20	CCAN2 Connector	79
Table 10-I-02.21	CCAN1 Connector	79
Table 10-I-02.22	APS Permanent Protection	83
Table 10-I-02.23	APS Memorized Protection	83
Table 10-I-02.24	APS temporary protection	84
Table 10-I-02.25	LVPS Permanent Protection	85
Table 10-I-02.26	LVPS memorized protection	85
Table 10-I-02.27	LVPS temporary protection	86
Table 10-I-02.28	Resident Diagnostic Signals	87
Table 10-I-02.29	Electric Locker - Circuit Breakers	93
Table 10-I-02.30	Cab - LV and MV Circuit Breakers	97
Table 10-I-02.31	Cab "A" - By-pass panel	98
Table 10-I-02.32	"B" Cab - By-pass panel	99
Table 10-I-03.1	LV Bill of Materials	129
Table 10-I-03.2	Vehicle CB Location	137
Table 10-I-03.3	Ingress Protection Ratings (IP Codes)	144
Table 10-I-03.4	Insulation Class	145

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SECTION 10

LOW VOLTAGE DISTRIBUTION SYSTEM

10-I-01 INTRODUCTION

This Section of the Running Maintenance and Service Manual is divided into three Parts:

- Part I: Theory of Operation
- Part II: Troubleshooting
- Part III: Maintenance

Each Paragraph is numbered accordingly, to avoid that paragraphs of the same Section, pertaining to a different Part, have the same number.

Part I - Theory of Operation

Part I gives a thorough overlook of the System structure and operation, by means of descriptions, figures, photos, schematics, block diagrams and flow charts, together with references to other documents or Sections when needed.

Part II - Troubleshooting

It gives the Maintenance Technicians a path to troubleshoot the System in every condition by means of the available tools:

- The PTU, equipped with the specific SW program
- The IDU
- The Fault Isolation Table

The Part III - Maintenance consists of:

- Preventive Maintenance
- Corrective Maintenance
- Consumable Materials
- Test Equipment , Tools & Special Tools

10-I-01.a LIST OF ABBREVIATIONS, ACRONYMS AND SYMBOLS

The Abbreviations, Acronyms and Symbols commonly used throughout this manual are given below with their related meaning.

Abbreviation	Meaning
Δ/Y.....	Triangle - Star Transformer
AB.....	AnsaldoBreda
AC/DC	Alternate Current - Direct Current Converter
ADA	Americans with Disabilities Act
APS	Auxiliary Power Supply
ATP.....	Automatic Train Protection
BCU.....	Brake Control Unit
C/L.....	Centerline
CB.....	Circuit Breaker
CCH.....	Communication Control Head
CM.....	Coast Motoring
DC/AC	Direct Current - Alternate Current Converter
DC/DC	Direct Current - Direct Current Converter
EB.....	Emergency Brake
ECU.....	Electronic Control Unit (Brakes)
EDU.....	EMI Detector Unit
FSB.....	Full Service Brake
GTW.....	Gateway
HRSB.....	High Rate Service Brake
HSCB.....	High Speed Circuit Breaker
HV.....	High Voltage
HVAC.....	Heat Ventilation & Air Conditioning
HVDS.....	High Voltage Distribution System
HW.....	Hardware
IDU	Integrated Diagnostic Unit
IGBT.....	Insulated Gate Bipolar Transistor
IP	Ingress Protection Rating
KO	Out of Service
LED.....	Light Emitting Diode
LH.....	Left Hand Side
LON	Local Operative Network
LRV.....	Light Rail Vehicle
LV	Low Voltage
LVDS	Low Voltage Distribution System

Abbreviation	Meaning
LVPD	Low Voltage Power Distribution
LVPS	Low Voltage Power Supply
M	Motoring
MBL	Metro Blue Line
MV	Medium Voltage
MVB	Multifunction Vehicle Bus
MVPD	Medium Voltage Power Distribution
OK	Working
PGL	Pasadena Gold Line
PTU	Portable Test Unit
PWM	Pulse Width Modulation
RH	Right Hand Side
SB	Service Brake
SCEB	Slide Controlled Emergency Brake
SVM	Space Vector Modulation
SW	Software
TBS	To Be Supplied
TCMS	Train Communication System
TCN	Train Communication Network
TCU	Traction control Unit
THD	Total Harmonic Distortion
TWC	Train-to-Wayside Communication
WTB	Wired Train Bus

10-I-01.b LIST OF DEFINITIONS

The Definitions commonly used throughout this manual are given below with their related meaning.

Definition	Meaning
//	Parallel
'A' body section	The section of an articulated vehicle containing the pantograph
'B' body section	The section of an articulated vehicle not containing the pantograph
AW0.....	Empty car operating weight
AW1.....	Full seated load plus AW0
AW2.....	Standees at 4 persons per square meter plus AW1
AW3.....	Standees at 6 persons per square meter plus AW1
AW4.....	Standees at 8 persons per square meter plus AW1
Front door.....	The door close to the Operator's Cab
LC filter.....	Filter made up of Inductance and capacity
Rear door	The door close to the Articulation Section
RLC filter	Filter made up of Resistance, Inductance and Capacity
Sine-wave.....	Sinusoidal wave

10-I-01.c LIST OF MEASUREMENT UNITS AND SYMBOLS

The Measurement Units commonly used throughout this manual are given below with their related meaning.

Definition	Meaning
Ω	Ohm
µF	Micro Farad
°C	Celsius degree
°F	Fahrenheit degree
A	Ampere
ac	Alternate Current
dB	Decibel
dc	Direct Current
F	Farad
ft	Foot
gal	Gallon
H	Henry
Hz	Hertz
in	Inch
kΩ	Kilo Ohm
kg	Kilogram - approx 2.205 pounds
kHz	Kilo Hertz
km	Kilometer - approx 0.621 miles
kN	Kilo-Newton - approx 224.809 pounds force
kVA	Kilo Volt Ampere
kW	Kilo Watt
lb	Pound
lb-ft	Pound force
lps	Liters per Second
m	Meter - approx 3.28 feet
mΩ	Milli Ohm
mH	Milli Henry
mm	Millimeter - approx 0.0394 inches
ms	Milli second
Pa	Pascal
rms	Root Mean Square Voltage
rpm	Revolution per Minute
V	Voltage
Vin	Input Voltage

Definition	Meaning
Vpp	Peak to Peak Voltage
W	Watt

10-I-02 THEORY OF OPERATION

10-I-02.01 General Description of the System

The auxiliary Static Converter (APS/LVPS System) is located in the B Body Section Underframe.

Since the auxiliary converter is mounted on the vehicle underframe, the casing has been designed to support the shocks that can be typically expected on devices installed on the underframe of rolling stocks.

The APS/LVPS System transforms the HV electric power (750 Vdc), collected from the catenary line through the pantograph, into 37.5 Vdc for LV Loads and for charging the battery, and into 208 Vrms (three phase), 120Vrms (one-phase) @60Hz for MV Loads.

In brief:

Input	750Vdc nominal
Outputs	208Vrms - 60Hz 3-phase (and 120Vrms) - 60Hz mono-phase for MV Loads 37,5Vdc for LV Loads

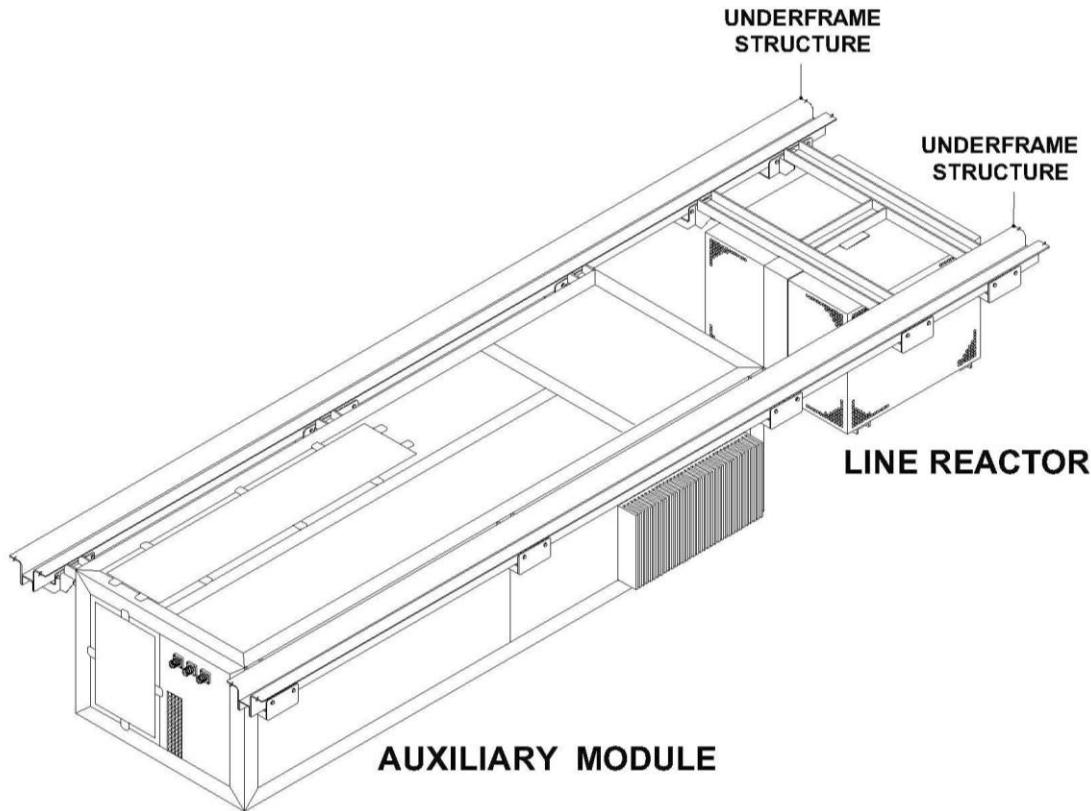
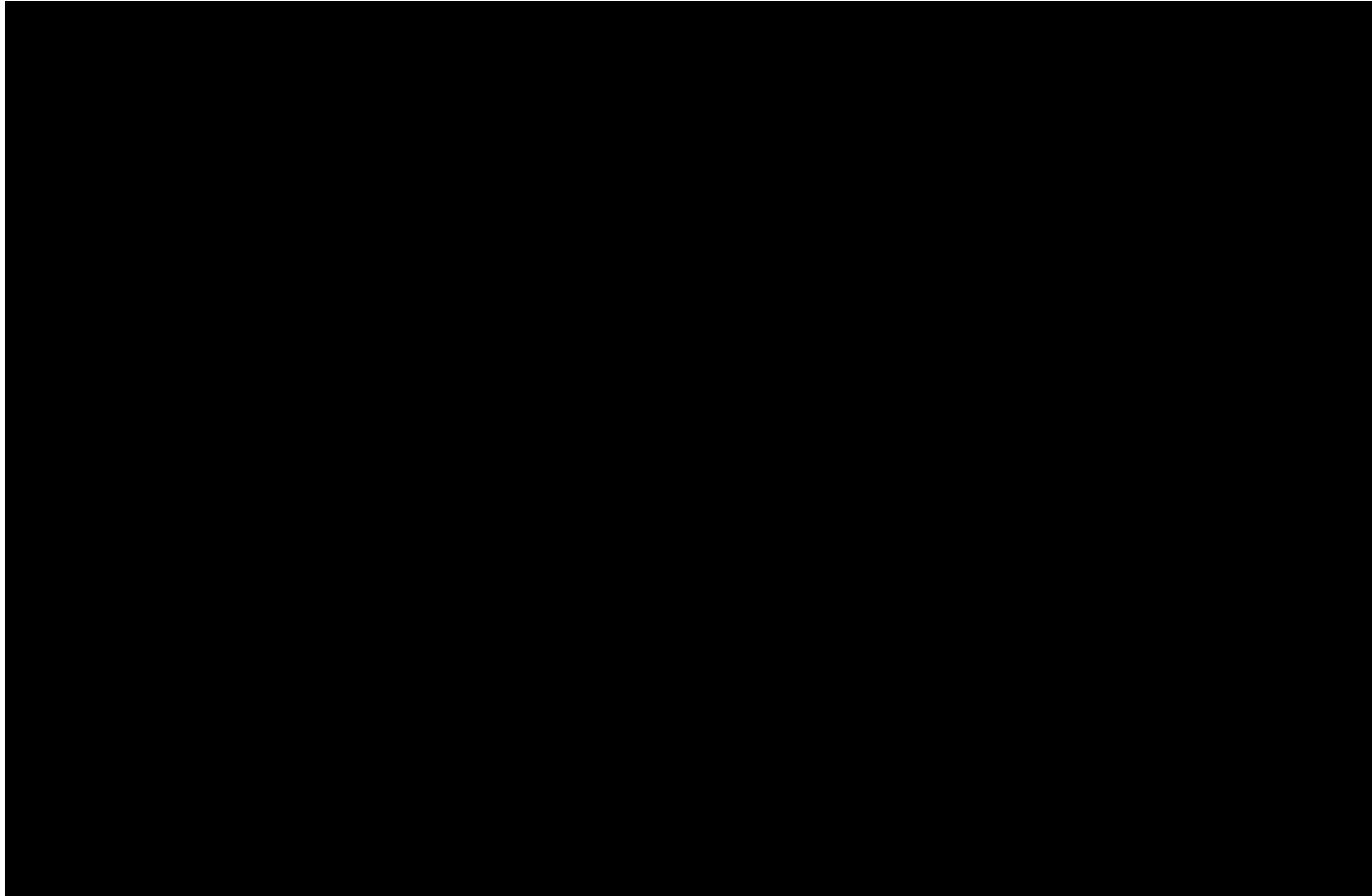


Figure 10-I-02.1 APS/LVPS System and APS/LVPS Line Reactor Overview

The two outputs (MV and LV) are obtained by means of two independent static converters (refer to Figure 10-I-02.2):

- The APS converter (Auxiliary Power Supply) to generate 208 Vrms - 60 Hz 3-phase and 120 Vac - 60 Hz mono-phase (The 120 Vrms is obtained using a single phase output)
- The LVPS converter (Low Voltage Power Supply), to generate 37.5 Vdc



The control and regulation circuits (Auxiliary Inverter Control Unit) of both static converters are enclosed in a block located near them and supplied by the batteries.

The LVDS supplies the Medium Voltage (MV) and Low Voltage (LV) and Loads.

The MV loads are supplied by the APS (Auxiliary Power Supply) system while the LV loads are supplied by the LVPS (Low Voltage Power Supply) system.

The LVDS status can be checked through the IDU screen (refer to Section 18).

The auxiliary static converter is capable of starting up even with exhausted or disconnected batteries, thanks to a start-up device (SUC - Start-up Circuit) supplied directly from the HV.

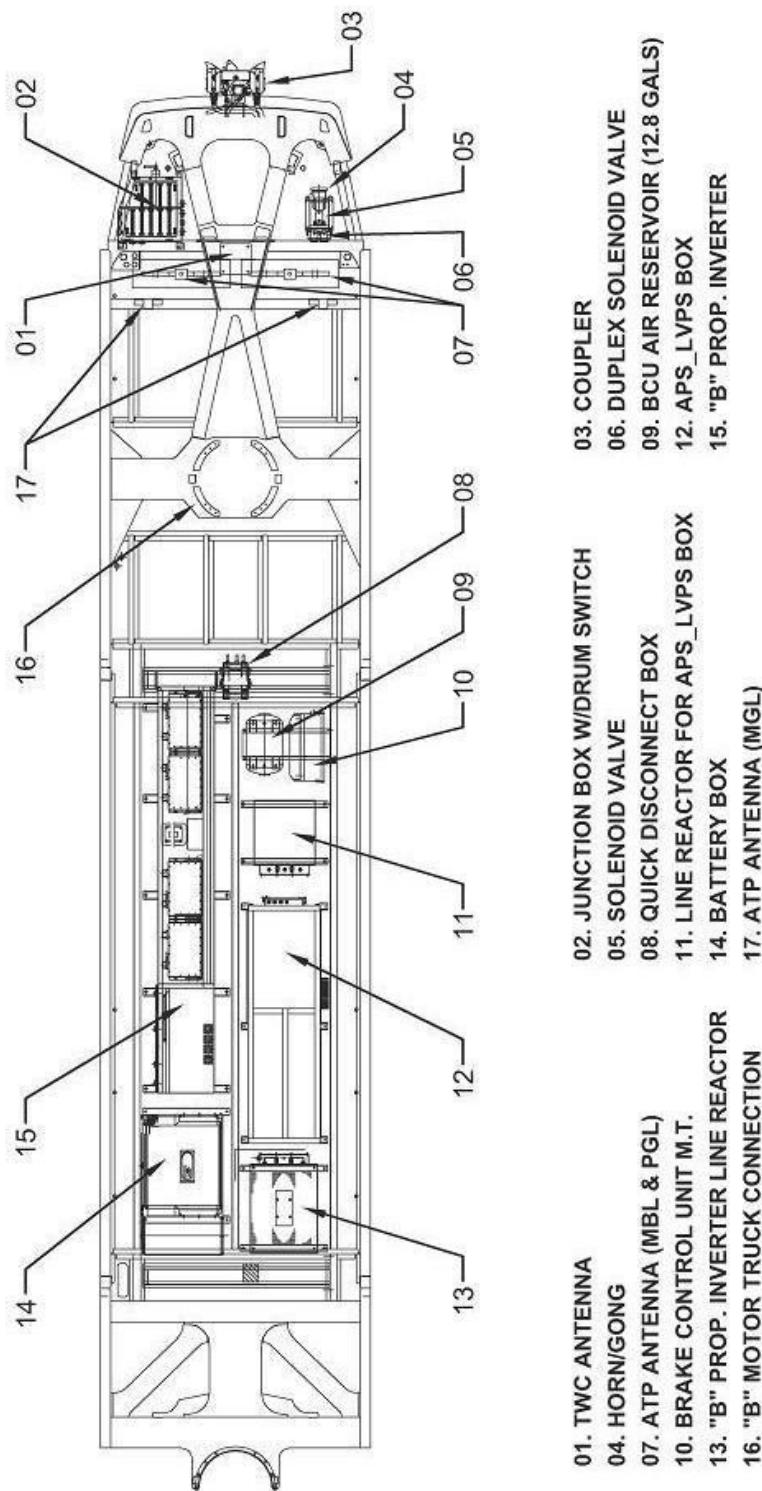


Figure 10-I-02.3 APS/LVPS (#12) and APS/LVPS Line Reactor (#11) Location

i. System-Vehicle Relationship

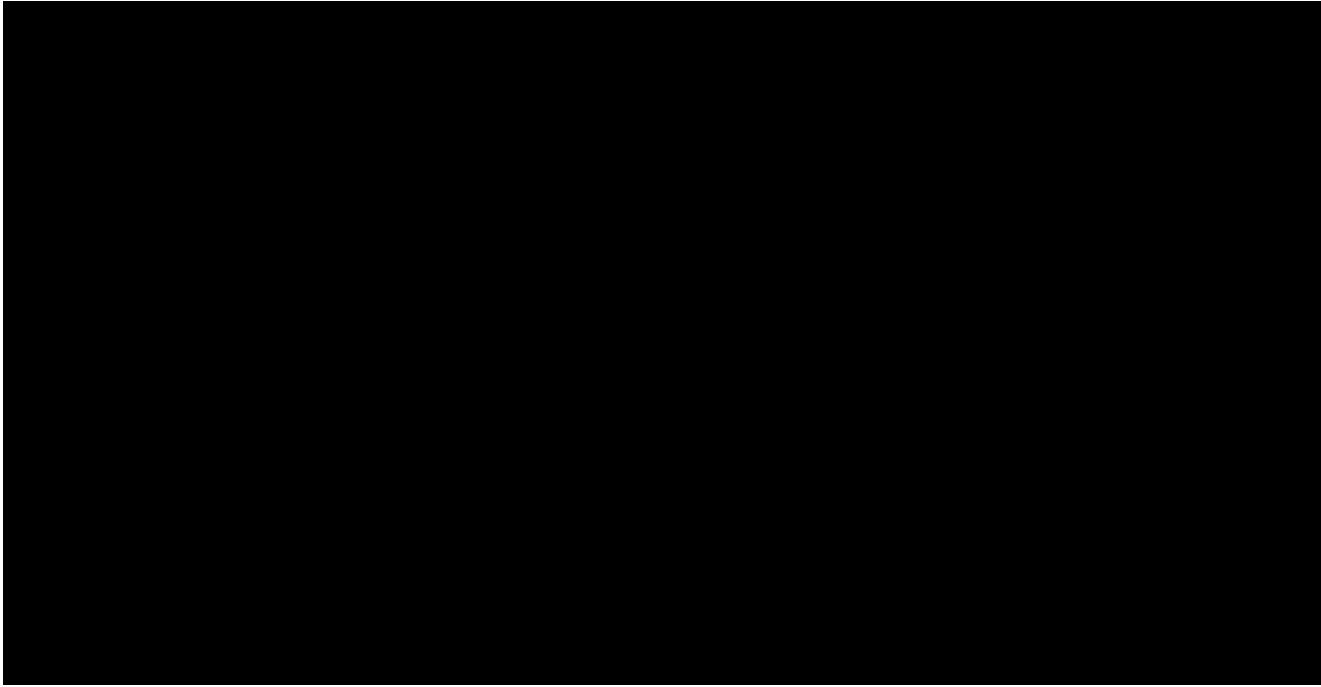


Figure 10-I-02.4 System-Vehicle Relationship

One of two branches of the HVDS goes to the Auxiliary System Line Reactor and to the Low Voltage Distribution System.

All Medium Voltage and Low Voltage Loads of the vehicle are supplied by the APS/LVPS converters, either directly, or indirectly through the Battery which is supplied and charged by the LVPS.

The LVDS status can be checked on the IDU screen and on the PTU. In particular the IDU screen can show the APS and LVPS Status, the Circuit Breaker status and the faults related to the System. Also the TCUs acquire the APS/LVPS Status.

ii. System-Equipment Relationship

The most important equipment of the LVDS is the APS/LVPS System made up of the APS (Auxiliary Power Supply) and the LVPS: (Low Voltage Power Supply) system.

Figure 10-I-02.5 shows the APS/LVPS components and the relationship between the System and its equipment.

iii. System Characteristics and Performance

— System Performances:

APS:

Nominal line-to-line voltage	208Vrms ± 5%
Basic voltage frequency	60Hz ± 1%
Wave form	sine-wave
Number of phases	3 + neutral connected to housing
Phase shift between basic output voltage components	120° ± 1%
Power supplied.....	70KVA ($\cos\phi = 0.8 - 1$)
Transient overload for 15 seconds	100KW ($\cos\phi = 0.5 - 1$)
Harmonic distortion factor.....	≤ 10%

LVPS:

Nominal voltage	37.5Vdc
Static range	25 - 42Vdc
Power drained under normal operation	≤ 100W
Power drained with no HV supply or with converter not working	≤ 3 W

— Mechanical Characteristics:

External Casing Material: Fe 430B

Total Weight 1,654 lbs (750kg)

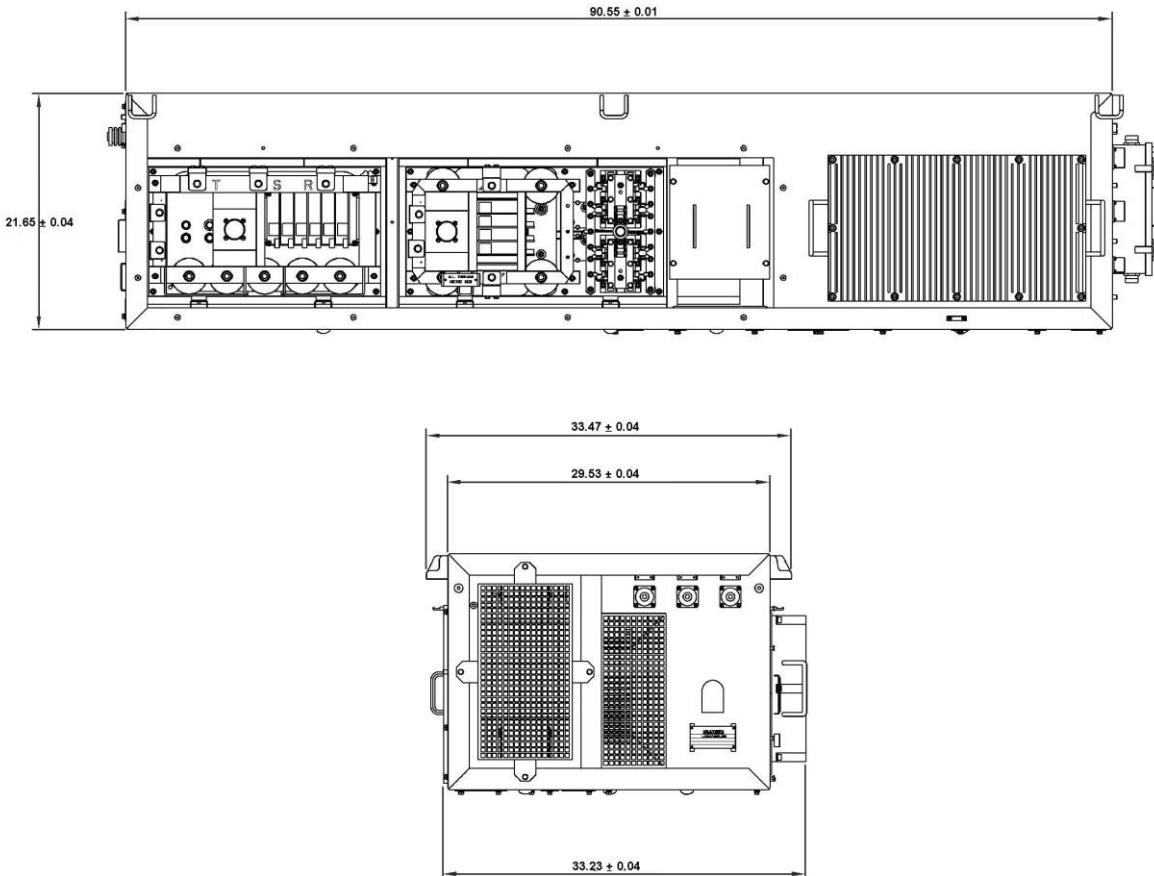
Overall dimensions:

Figure 10-I-02.6 APS/LVPS Overall Dimensions

— Electrical Characteristics

Degree of protection:

Magnetic Components (transformers):	IP20
Electronic compartment:	IP56

HV INPUT:

Nominal voltage	750Vdc
Static range	500 ÷ 900Vdc
Transient input voltage	in accordance with EN50163 ¹

The auxiliary static converter stops its operation automatically if the input voltage goes beyond the 450-1,050 Vdc range.

It automatically starts operating again as soon as the input voltage is back within the range (temporary protection).

The auxiliary static converter also stops its operations if the input voltage exceeds 950 Vdc for more than 100s.

OUTPUTS:

The APS/LVPS is designed for not stopping its operations if a short input voltage interruption takes place.

The max time interval from input voltage interruption and its return, due to continuous operation of the APS/LVPS, depends on:

- Input Voltage before the interruption: V_0
- Requested Output Power: P_{out}

This max time interval (Δt) can be calculated according to the following formula:

$$\Delta t = \frac{10^{-3} * (V_0 - 450)^2}{P_{out}} [sec]$$

¹ Temporary overvoltages are allowed: 5 min maximum for 1,000 Vdc, 20 ms maximum for up to 1,270 Vdc.

APS OUTPUTS:

Nominal line-to-line voltage	208Vrms ± 5%
Basic voltage frequency	60Hz ± 1%
Wave form	sine-wave
Number of phases	3 + neutral connected to housing
Phase shift between basic output voltage components	120° ± 1%
Power supplied	70KVA ($\cos\phi = 0.8 - 1$)
Transient overload for 15 seconds	100KW ($\cos\phi = 0.5 - 1$)
Harmonic distortion factor.....	≤ 10%
Maximum unbalance between phase voltages	≤ 1% Vnominal
Maximum unbalance of the three-phase load	10%
Maximum transient line-to-line output voltage variation after transition on the MV load or HV input voltage	(-20%, +10%) Vnominal
Maximum timeout for return to static tolerance range of the output voltage after load or HV input voltage variations	200 ms

The loads supplied by the 208 Vrms are (refer to Figure 10-I-02.8):

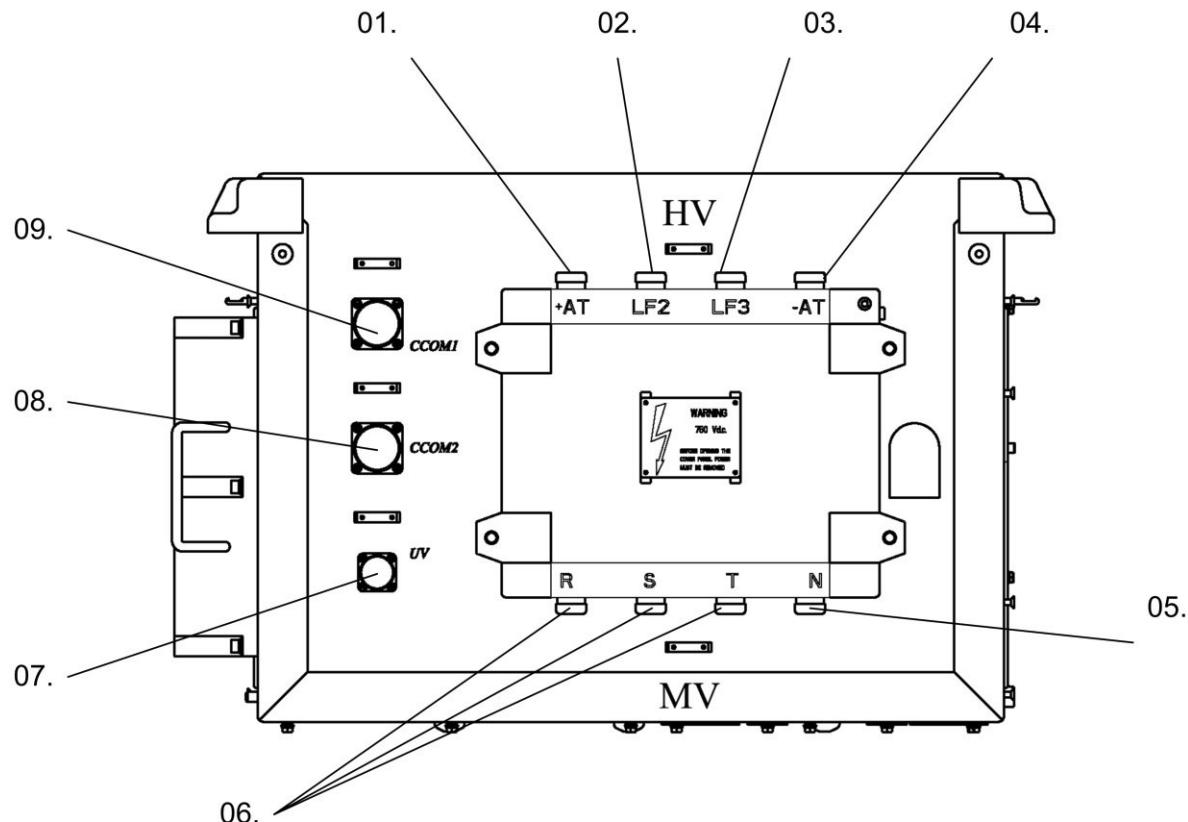
- Two propulsion motor fans
- Air Compressor
- HVAC 208 Vrms loads
- Evaporator and condenser fans
- Heaters
- APS/LVPS motor fan

The loads supplied by a single phase (120Vac) are (refer to Figure 10-I-02.9):

- The Windshield Defroster/Demisters (also used as Cab Heaters) in the two operator cabs
- 8 convenience outlets (two in each cab and two in each Electric locker)

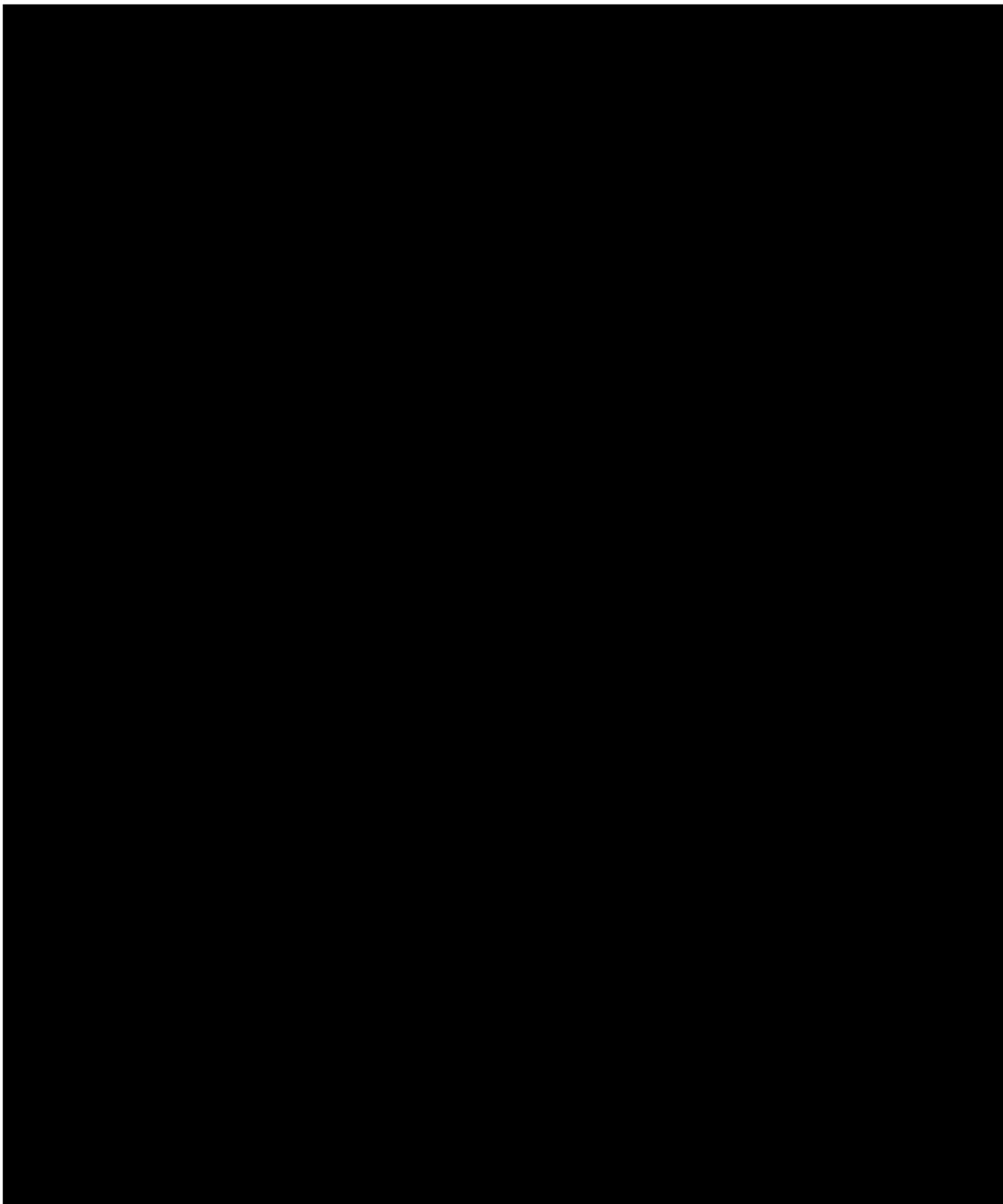
The APS maintains a line to line output voltage of 208Vrms ±5% independently from load variations.

This is possible through a feedback on the output voltage with regard to the load current.



- | | |
|------------------------------------|---|
| 01. Positive Line Connector (+AT) | 06. Three-phase ATP Output Connectors (R, S, T) |
| 02. Line Reactor Connector (LF2) | 07. APS/LVPS Fan Connector (UV) |
| 03. Line Reactor Connector (LF3) | 08. LV Connector (COM2) |
| 04. Negative Line Connector (-AT) | 09. LV Connector (COM1) |
| 05. Ground Reference Connector (N) | |

Figure 10-I-02.7 APS/LVPS Front View



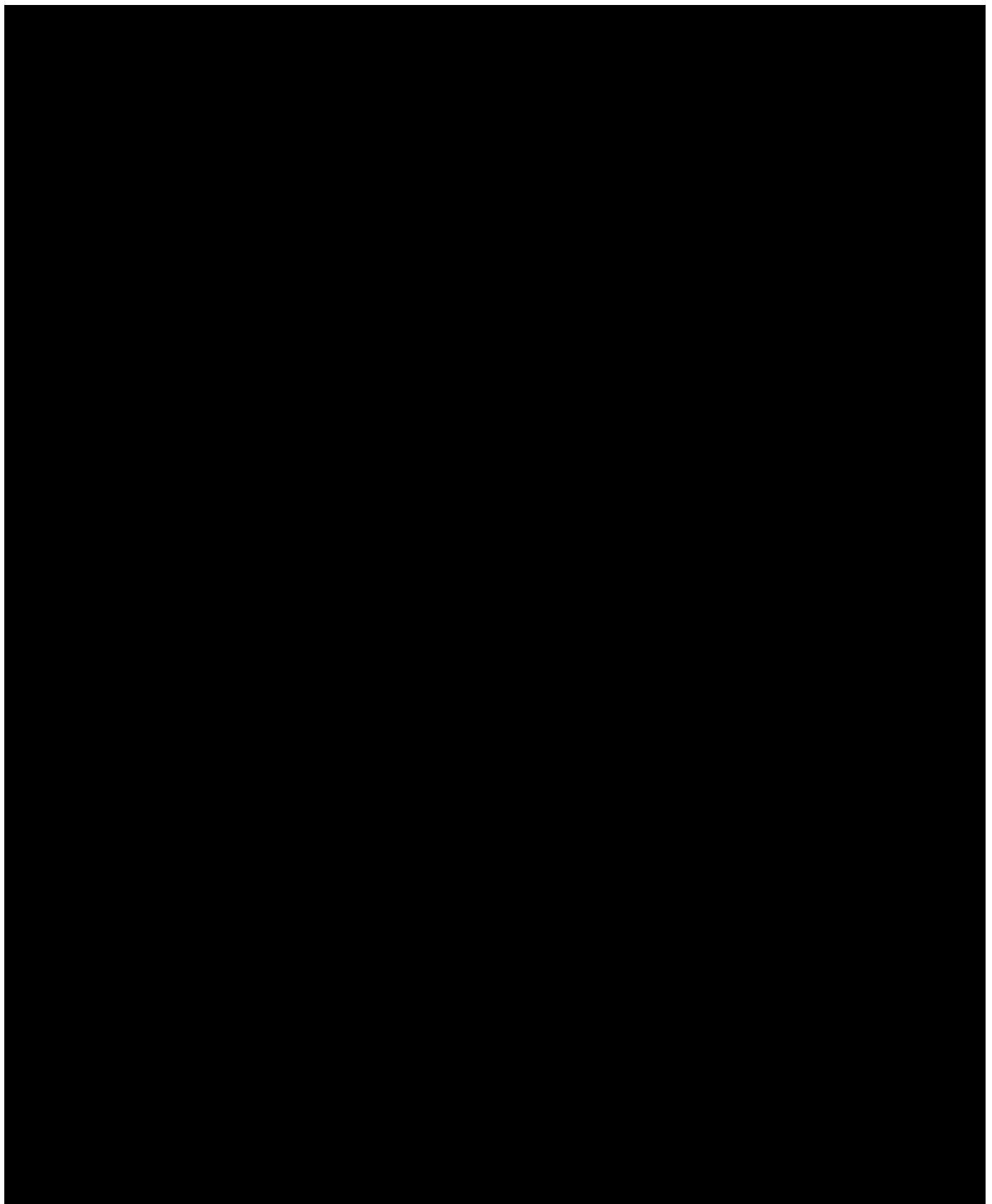


Table 10-I-02.1 and Table 10-I-02.2 list the 208 and 120 Vrms circuit breakers and related loads, respectively in the “A” and “B” sections.

Table 10-I-02.1 208 VAC Circuit Breakers and Loads - “A” Car Section

Circuit Breaker	Load
2F04	HVAC CB (Car A)
2F05	Air Compressor CB
2F06	Propulsion Motor Fan CB (Car A)
2F07	Convenience Outlet CB (Cab A)
2F08	Convenience Outlet CB (Cab A)
2F09	Convenience Outlet CB (Electric Locker A)
2F11	Windshield Defroster/Demister CB (Cab A)

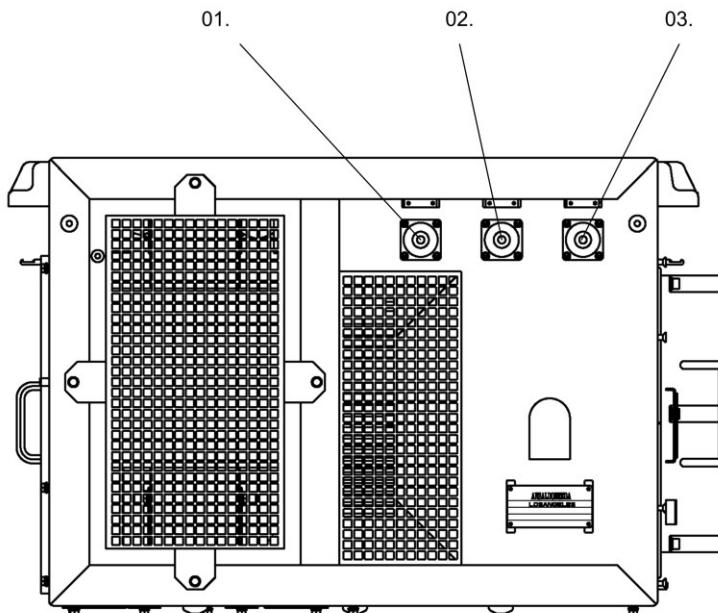
Table 10-I-02.2 208 VAC Circuit Breakers and loads - “B” Car Section

Circuit Breaker	Load
2F04	HVAC CB (Car B)
2F06	Propulsion Motor Fan CB (Car B)
2F07	Convenience Outlet CB (Cab B)
2F08	Convenience Outlet CB (Cab B)
2F09	Convenience Outlet CB (Electric Locker B)
2F11	Windshield Defroster/Demister CB (Cab B)
2F12	APS/LVPS Motor Fan CB

LVPS OUTPUT:

LVPS output involves three terminals identified as follows:

- (+B) Positive Battery Output Connector
- (+L) Positive LV Load Output Connector
- (-) Negative Center Terminal



01. Positive Battery Output Connector (+B)

03. Negative Center Terminal (-)

02. Positive LV Load Output Connector (+L)

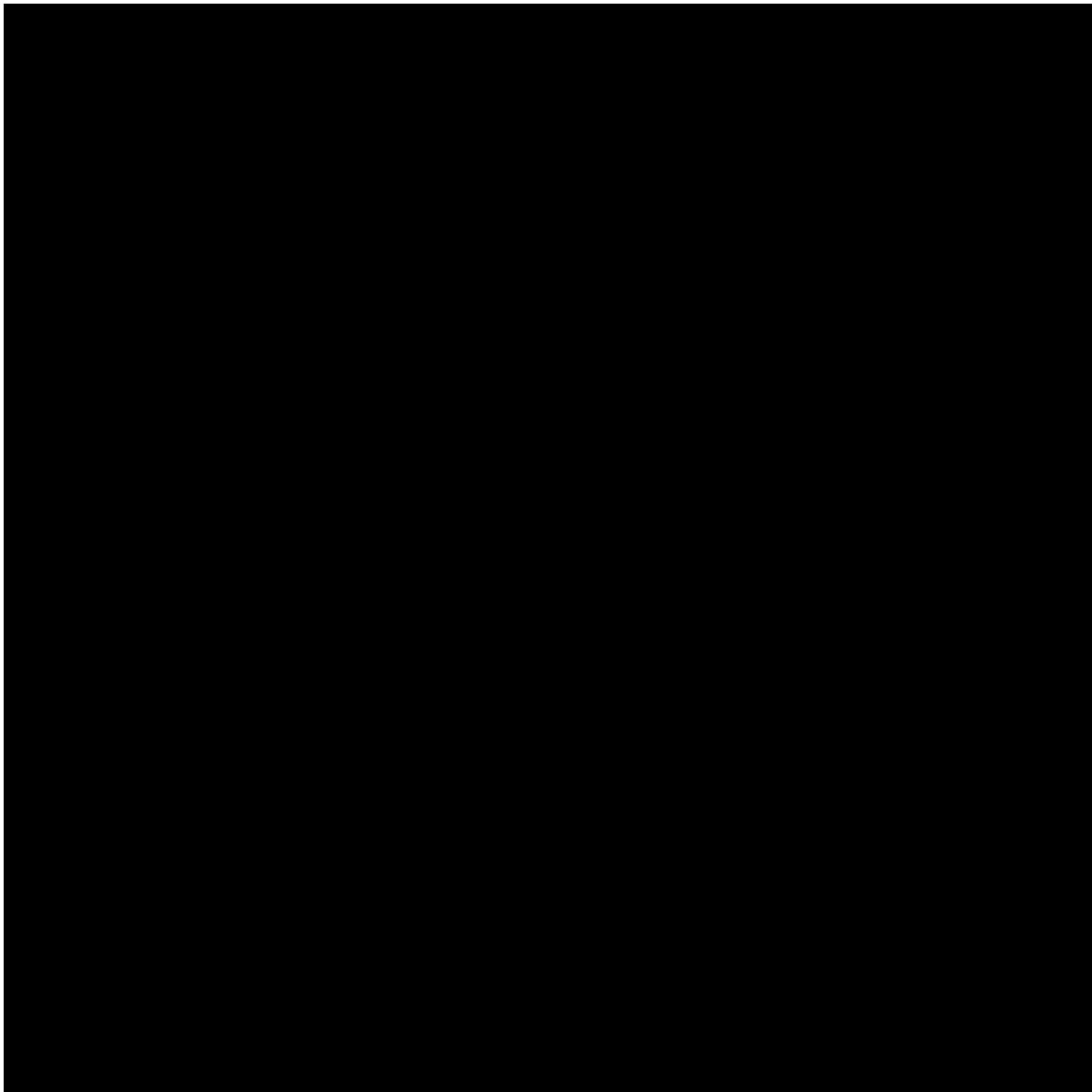
Figure 10-I-02.10 APS/LVPS Rear View

The primary LV load of the converter is made up of the vehicle battery, charged at constant voltage and with current limited to the characteristic curve.

The voltage applied to the loads (terminals "+L" and "-") may therefore vary according to the battery recharge characteristics.

Regardless of battery status, a load variation between terminals "+L" and "-" does not influence the voltage-current (VI) battery recharge characteristics.

The output terminals (+B) and (+L) are uncoupled by a blocking diode (within the converter) in order to avoid uncontrolled battery recharge by the HV output of a remote battery charger.



Given the directionality of the diode, the battery can supply the loads connected to terminal +L when LVPS is not working.

BATTERIES: 25 NiCd 300Ah battery cells

Cell Nominal Voltage	1.2Vdc
Battery Nominal Voltage	$1.2 \times 25 = 30$ Vdc
Battery Charge Voltage	37.5Vdc
Cell End of Charge Voltage	$37.5 / 25 = 1.5$ Vdc

The nominal output power (maximum direct) is 16kW, corresponding to an output voltage of 37.5Vdc and total output current of 427Adc.

Nominal Output Power	16kW
Nominal Output Voltage	30Vdc
Fully-charged Output Voltage with Battery Temperature of 68°F (20°C)	37,5Vdc ± 1,5%

Fully-charged voltage compensation based on the battery electrolyte temperature, with fully-charged voltage (holding voltage) are equal to:

37.5[V] - 0.04[V°C]*(T - 20°C) ± 1.5%	where T ∈ 68°F - 122°F (-20°C - + 50°C)
39.1[V] ± 1.5%	where T < - 68°F (-20°C)
36.3[V] ± 1.5%	where T > 122°F (50°C)

At Power-OFF/Power-ON of the LV Loads, the transient is limited and the static range of the output voltage (measured between (+L) and (-)) stays within 42Vdc and 25Vdc.

LV SUPPLY:

Nominal voltage	37.5Vdc
Static range	25 - 42Vdc
Power drained under normal operation	≤ 100W
Power drained with no HV supply or with converter not working	≤ 3 W

OTHER CHARACTERISTICS:

Efficiency:	>0.89 (Nominal operating conditions) >0.86 (other operating conditions)
Acoustic noise:	<65dB (1 m distance from all directions)
Maximum start-up time of the converter from the time of the 750 Vdc nominal input	<5s

Operating and storage conditions:

Ambient Temperature	-13°F - 122°F (-25°C-50°C)
Relative Humidity	100% at 77°F - 104°F (25-40°C)
Storage Temperature	77°F - 158°F (25°C-70°C)
Operating Temperature inside the Converter	77°F - 158°F (25°C-70°C)

The LVPS maintains an output voltage between 37Vdc and 38Vdc (refer to Figure 10-I-02.11 and Figure 10-I-02.12) independently from load variations.

This is possible through a feedback on the output voltage with regard to the load current.

— Wire Characteristics

The size of external cables has been calculated by taking into consideration the worst operating condition possible: the one with the highest current for the longest period of time, as shown below.

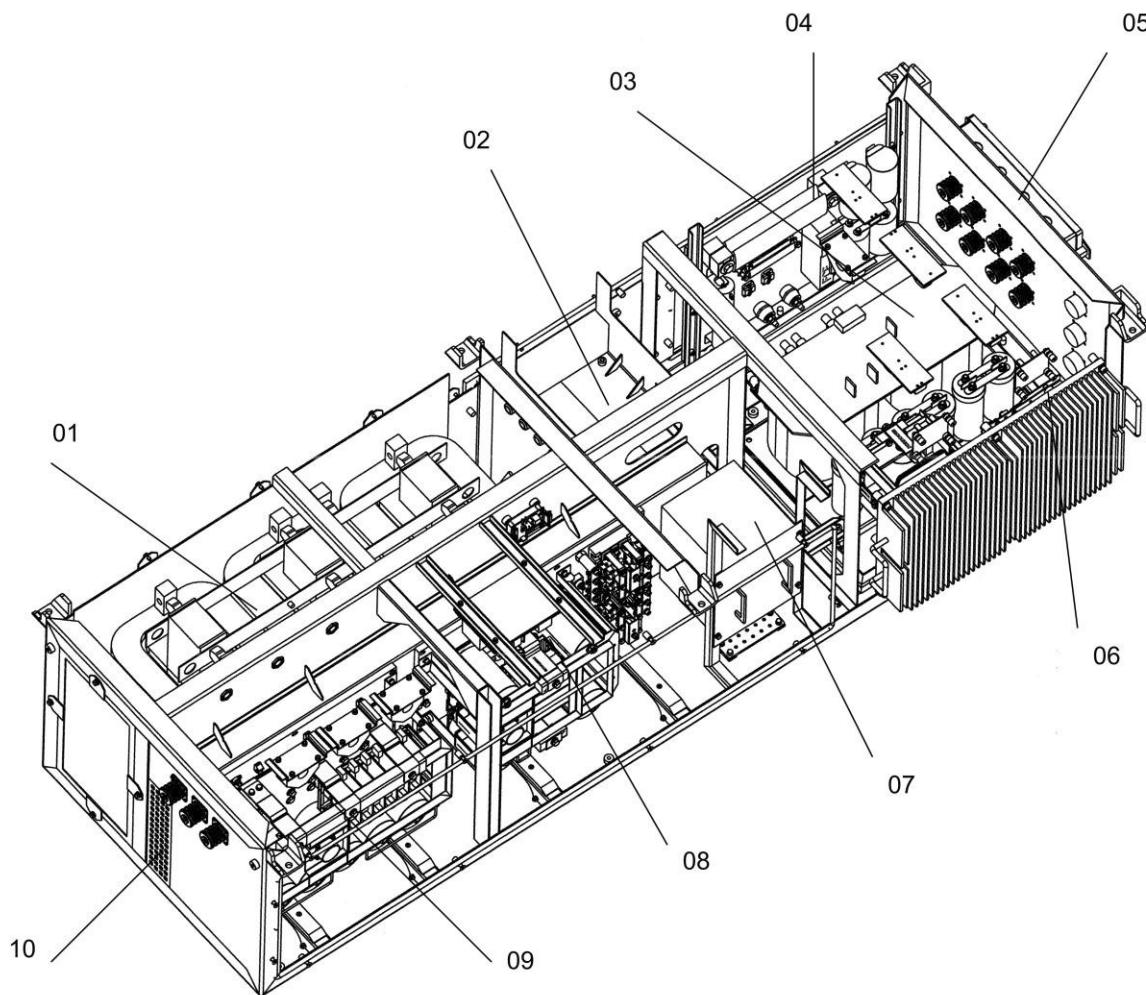
Maximum continuous operating voltage	1000Vdc
dielectric strength test voltage	4500Vrms,50Hz,1min
maximum direct current drained from terminal LF1	12Adc
maximum direct current drained from terminal LF2	160Adc
maximum direct current drained from terminal LF3	40Adc
maximum direct current drained from terminal -HV	200Adc

The values of the direct current drained by the HV input terminal are related to the maximum performance of the converter, i.e. nominal MV output power (70KW), nominal LV output power (16KW) and minimum HV input (500Vdc).

To single a specific cable section out refer to the Topographic Drawings (refer to Section 00).

10-I-02.02 The APS/LVPS System Components

10-I-02.02.01 Power Circuit Architecture



01. APS Transformer

06. Active Clamp Circuit

02. APS/LVPS Fan

07. Control Rack

03. LVPS Transformer

08. LVPS Inverter Module

04. Component Assembly

09. APS Inverter Module

05. Connection Box

10. Air Inlet

Figure 10-I-02.15 APS/LVPS Components Layout

10-I-02.02.02 Line Filter

The Line Filter is a low-pass filter made up of:

- Inductance: $L = 20\text{mH}$ (-0%, +10%)
- Capacitance: $C = 1980 \mu\text{F}$ (-0%, +5%)

The purposes of the Line Filter are:

- To adjust the input resonance frequency
- To adjust a low input impedance to 50 Hz frequency
- To limit the noise coming from the line that could enter the vehicle and go back from the vehicle to the line

The needed Inductance is realized by means of the Line Reactor, which is located upstream of the Auxiliary Inverter.

The Capacity is obtained by means of the APS Inverter Module capacitors (refer to paragraph 10-I-02.02.04.01) and the LVPS Inverter Module capacitors (refer to paragraph 10-I-02.02.05.01)

The +AT line of the Auxiliary Inverter Line Filter (which is also the input of the entire Auxiliary Inverter), is connected directly to the Pantograph through a fuse (Auxiliary Fuse - 01F02) in order to make it possible, in case the Low Voltage power is unavailable, to restart the battery charger by means of the Start-Up Circuit (SUC).

Four Hall-effect active transducers monitor the input filter status:

- TAI_V current transducer for the auxiliary inverter input valve TACB current transducer for the auxiliary battery charger
 - TAN current transducer for overall return (output)
 - TVF voltage transducer for the input filter

Signals from the aforementioned transducers are managed by the Auxiliary Inverter Control Unit to implement the control, protection and diagnostic functions.

In particular, via the three current transducers, ground fault protection is implemented, which performs the algebraic addition of the three current signals.

In the event of ground fault, the control unit sends the relevant signal on the LONWorks Bus to the TCMS (refer to Section 18 of this Manual).

10-I-02.02.02.01 Inductors (Line Reactor)

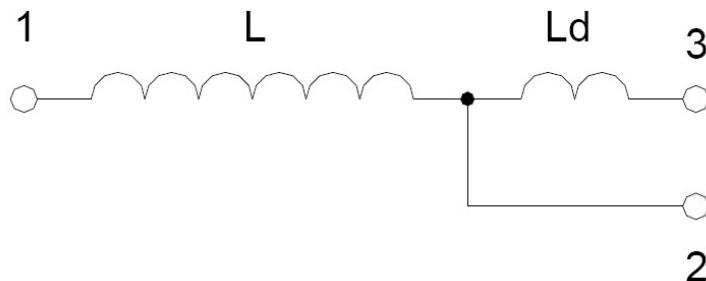


Figure 10-I-02.17 Line Reactor

Inductance L, directly connected to line, is common for APS and LVPS, while Ld is on the branch that feeds the LVPS and has the purpose of uncoupling the two static converters at high frequency.

Electric Characteristics:

L	20 mH -0%, +10%
Ld	0.1 mH -0%, +10%
Nominal working Voltage	750Vdc
Working Voltage	500 - 1250 Vdc
Continuous Current allowed	200 A
Maximum Current	400 A (for a few seconds, a maximum of 20 times a day)
Max Resistance (320°F)	110 mΩ
Dissipated Power (320°F) (efficiency = 0.89)	4200W (500Vdc); 1925W (750Vdc); 1368W (900Vdc)

Mechanical Characteristics:

The Inductor is contained in an IP21 protection degree grid , while electric terminals (LF1, LF2, LF3) are contained inside an IP56 protection degree box (refer to Appendix 10-I-03.04).

Weight	≤ 270 kg
Magnetic Material	M6 T35
Conducting Material	Aluminum
Insulating Material	Polyester-glass, myca-glass, impregnation resins

Line Reactor Overall Dimensions:

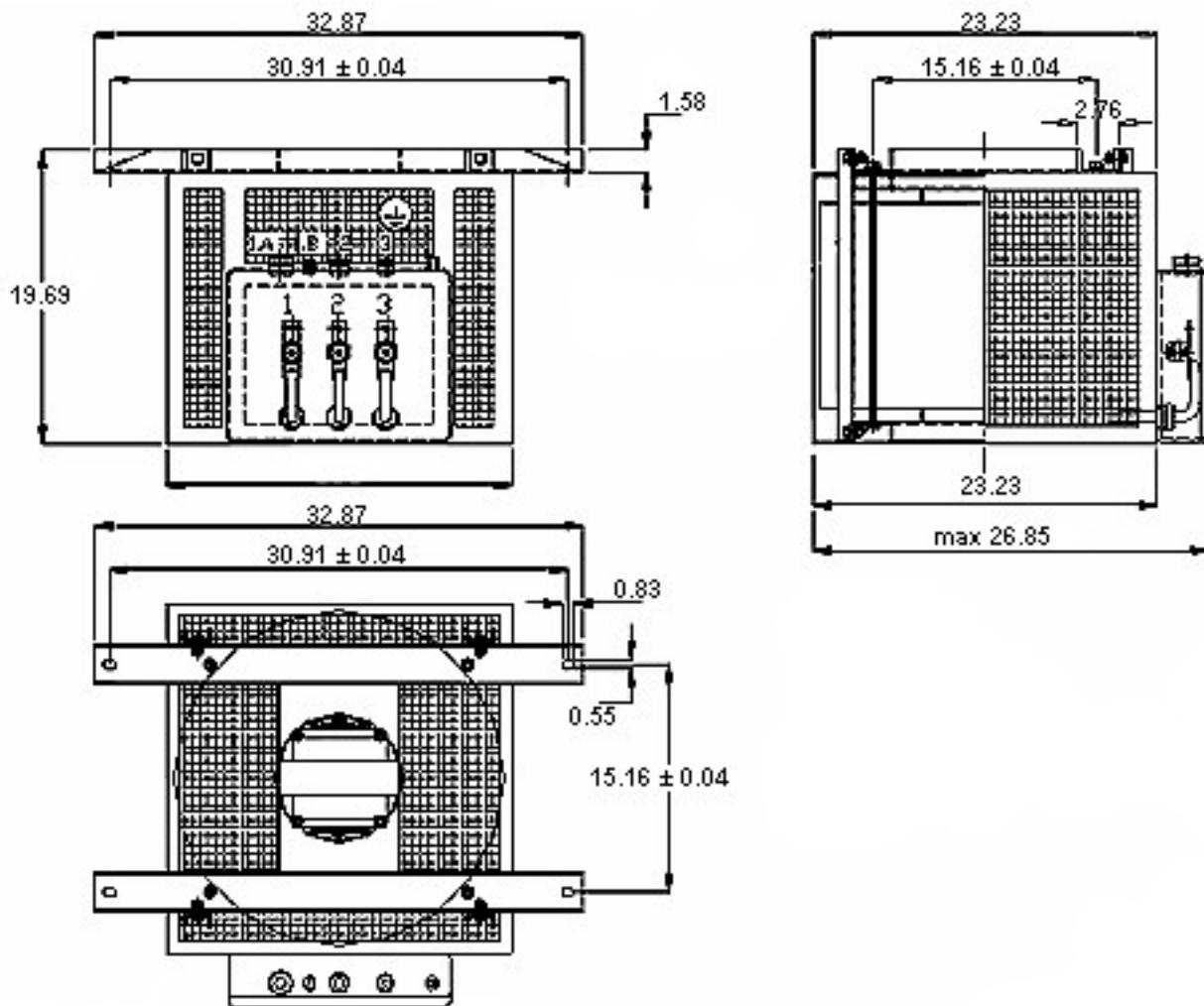
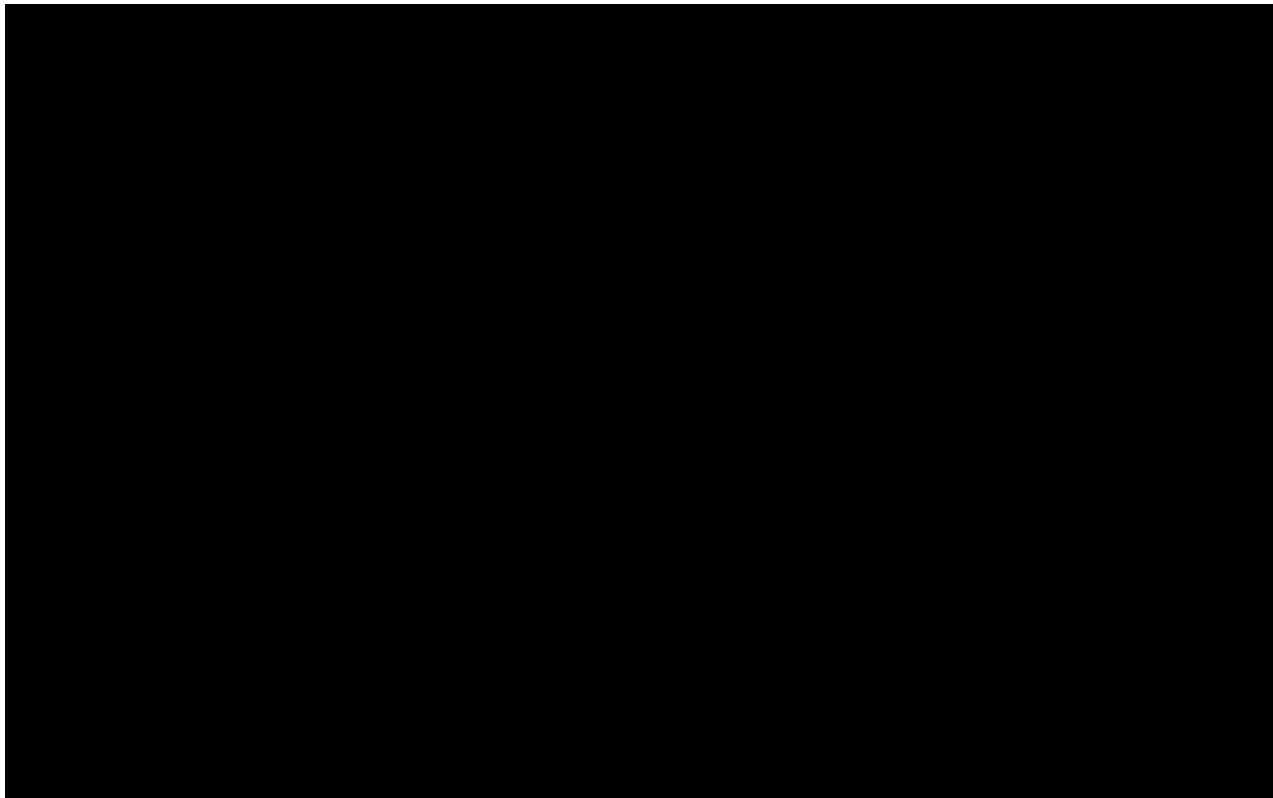


Figure 10-I-02.18 Line Reactor Overall Dimensions

10-I-02.02.02.02 Capacitors

Capacity C=1980 μF (-0%, +5%) is obtained directly from paralleling the input capacitors of the APS/LVPS inverters. Specific capacitors are not used for the input filtering.



A Clamp Circuit (refer to Figure 10-I-02.19) is connected antiparallel with respect to the Line Reactor.

The functions of this circuit are:

- To allow the pre-charging of the input filter without the use of electro-mechanical devices
- To reduce the over voltages on the filter capacitors in case of sharp variations of the line voltage

RP is part of the “Component Assembly” (refer to paragraph 10-I-02.02.06.02), while DT is located in the “Auxiliary Inverter Module” (refer to paragraph 10-I-02.02.04.01). The input peak current is limited to the inductance of the Line Reactor.

The DT diode does not allow to the Line Current to by-pass the Line Reactor, the RP Resistance shades the Capacitor Voltage that initially can grow also 100% more than the Line Voltage.

The FCB fuse is an input fuse to the LVPS (63Adc/1000V) that disconnects the battery in case of short circuit.

10-I-02.02.03 APS/LVPS Fan

A highly integrated solution was adopted for the APS/LVPS system in order to guarantee full access to the main subassemblies of the power and loop circuits, while the converter is in use.

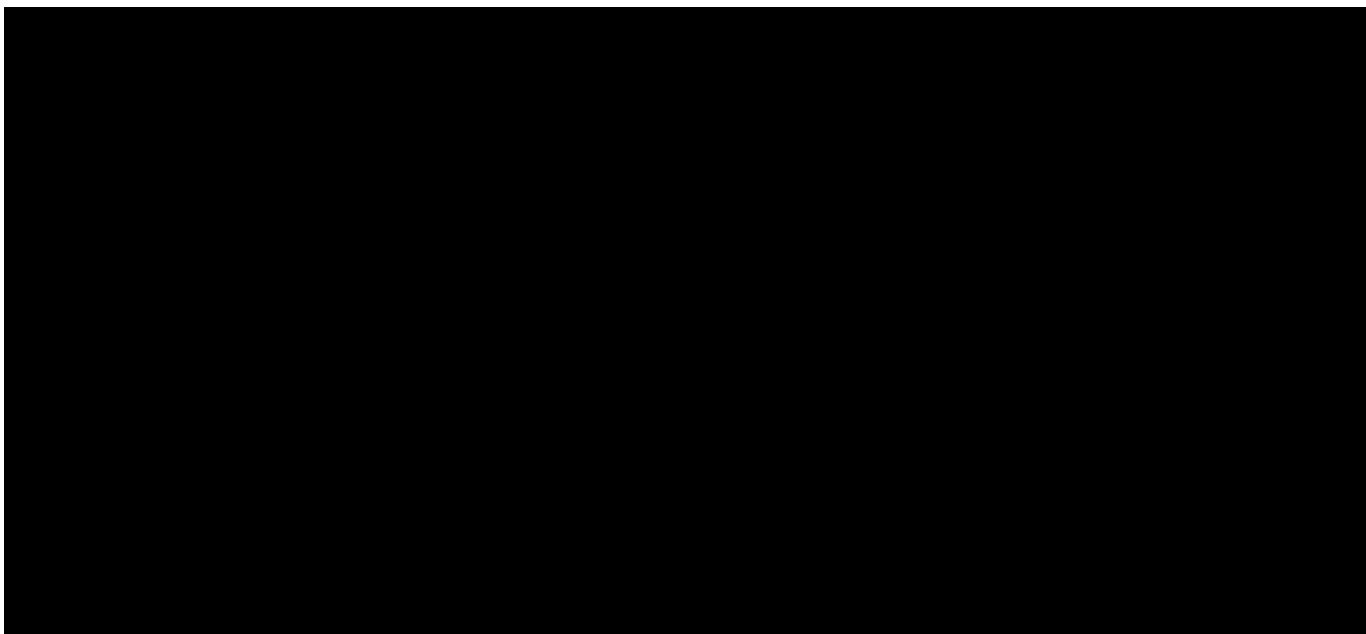
The power circuits of both the auxiliary inverter and the battery charger are made up of two compact modules weighing less than 77 lbs (35Kg).

Besides its great advantages, high integration implies a more difficult heat exchange such that an air cooling system is necessary to assure, under all operating conditions, a maximum temperature of the junctions of the power semiconductors lower than 194°F (90°C).

The fan, mounted at the center of the APS/LVPS box, intakes air from exterior through a grid on the short side of the cooling duct.

From here the air courses along the cooling duct and cools down both the APS and LVPS Inverter dissipators.

For this reason the fins of the dissipators are located inside the cooling duct while all other parts of the converter are located inside the watertight area of the casing, with an IP56 degree of protection (refer to Appendix 10-I-03.04).

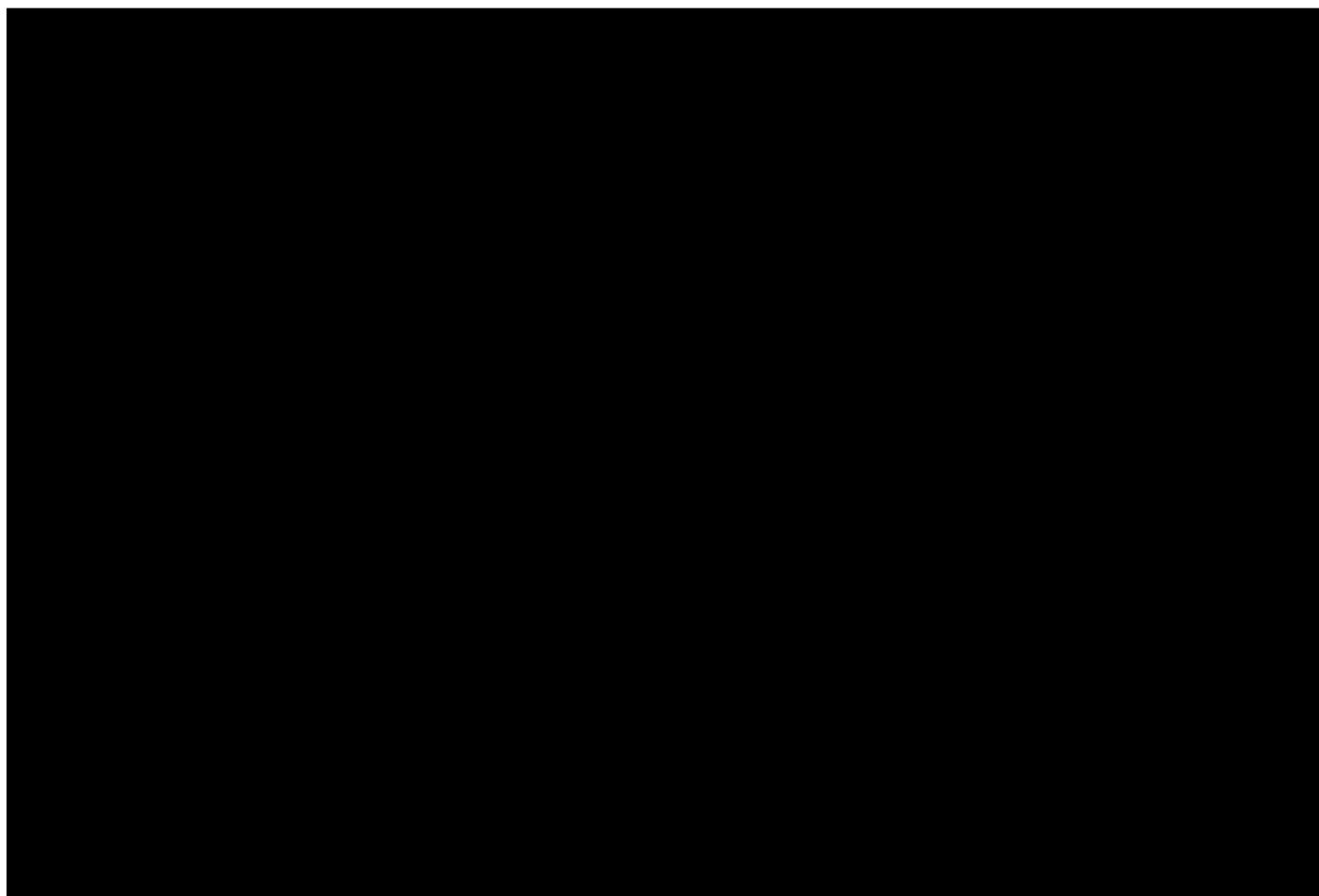


Main characteristics of the motor fan:

power supply	three-phase 208Vrms/60Hz
power drained	< 400W
service mode	continuative
nominal capacity	200 lps
nominal static prevalence	360Pa
fan wheel diameter	133 mm
speed	3424 rpm
weight	≤ 18kg
casing and rotor material	AISI 304 stainless steel
motor degree of protection	IP56
winding insulation class	H

10-I-02.02.04 APS System

The APS circuit transforms the 750 Vdc nominal input, into a 208 Vrpm 3-phase voltage output.



Input Voltages are filtered by the Input Filter and, through the Inverter Module, they are transformed into three 60 Hz frequency alternate voltages, phase-shifted by 120° one from the other. The output current from terminals R, S, T, monitored by the relevant current probes (TAR, TAS and TAT) enters the 3-phase transformer (Δ/Y) that realizes the important function of isolating input from output and regulates the 311 Vrms voltage of the first harmonic to the desired 208 Vrms output.

Before being sent to the loads, the current passes through a low pass filter made up of two parallel capacitors for each phase.

The N terminal (neutral) of the 3-phase output is connected, directly inside the converter, to the metallic carpentry.

10-I-02.02.04.01 APS Inverter Module

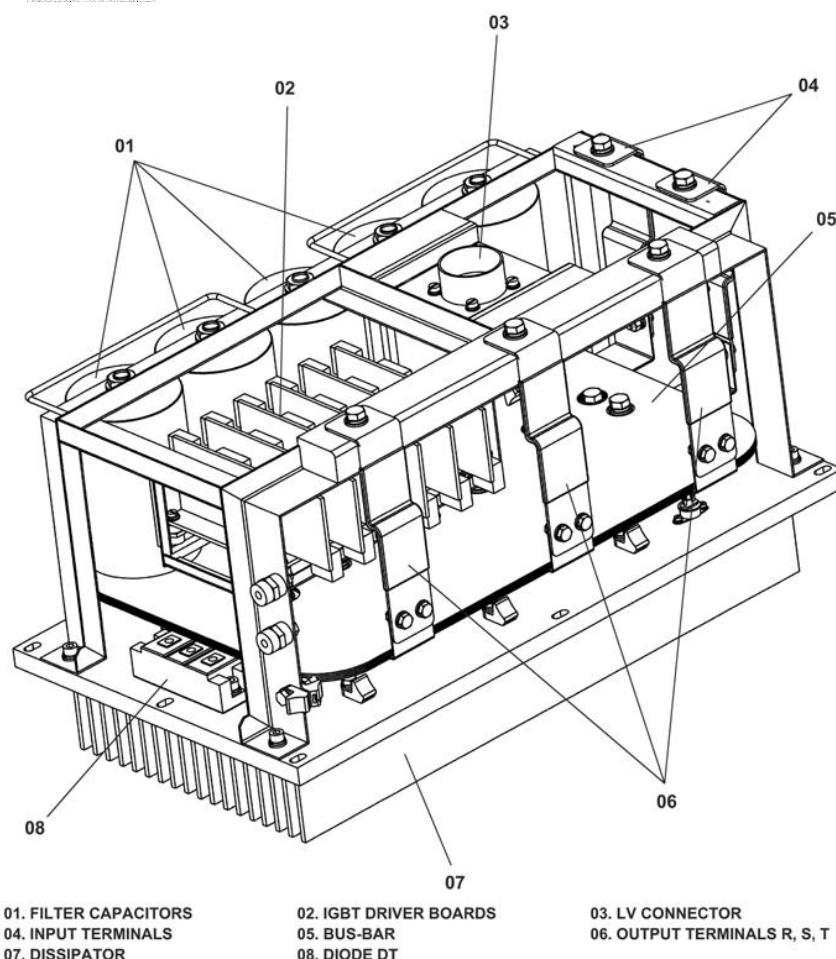


Figure 10-I-02.22 APS Inverter Module

a) APS Input filter

The R//C input filter ($R = 9 \text{ k}\Omega$, $C = 1100 \mu\text{F}$) is made up of two $18 \text{ k}\Omega$ resistances in parallel and by five $220 \mu\text{F}$ capacitors (refer to Figure 10-I-02.23)

The purpose of the filter is not only to block quick variations that have gotten inside the Module, but also to reduce overvoltages that could be created when switching off the IGBTs, thanks to the low impedance BUS-BAR type connection between input filter and IGBT.

The filter capacity is also used in parallel with the LVPS inverter capacity and the Line Reactor Inductance for the Line Filter (LC).

b) Driver Assembly for the 6 IGBTs (PSA Assembly)

The Driver Assembly contains the six inverter driver boards (GEDI type) mounted on a support board (PSG1).

Driver Boards are supplied by means of square wave alternate voltage (30 Vpp - 50 Hz) directly coming from the CIA board (control board for this module) that receives it from the supply of the control rack power supply.

Each board contains a local insulating transformer that assures the galvanic isolation obtained by means of opto-insulators.

Each driver board is provided with a self-diagnostic system, capable of detecting the following malfunctions:

- Supply Driver KO
- IGBT KO

Three LEDs on each board give information on their operating status, as follows:

- Green LED = Supply OK
- Yellow LED = Starter command OK
- Red LED = board and/or IGBT KO

The 237EE40261C AnsaldoBreda document contains the PSG1 Motherboard Functional Schematic (refer to AB Database).

NOTE:

The 237EE40260C AnsaldoBreda document contains the GEDI board Functional Schematic (refer to AB Database).
The GEDI board Components location is described in the 232EE40260B AnsaldoBreda document.

Refer to Section 01 for "AB Database" use.

The drivers drive the IGBTs by means of a PWM (Pulse Width Modulation).

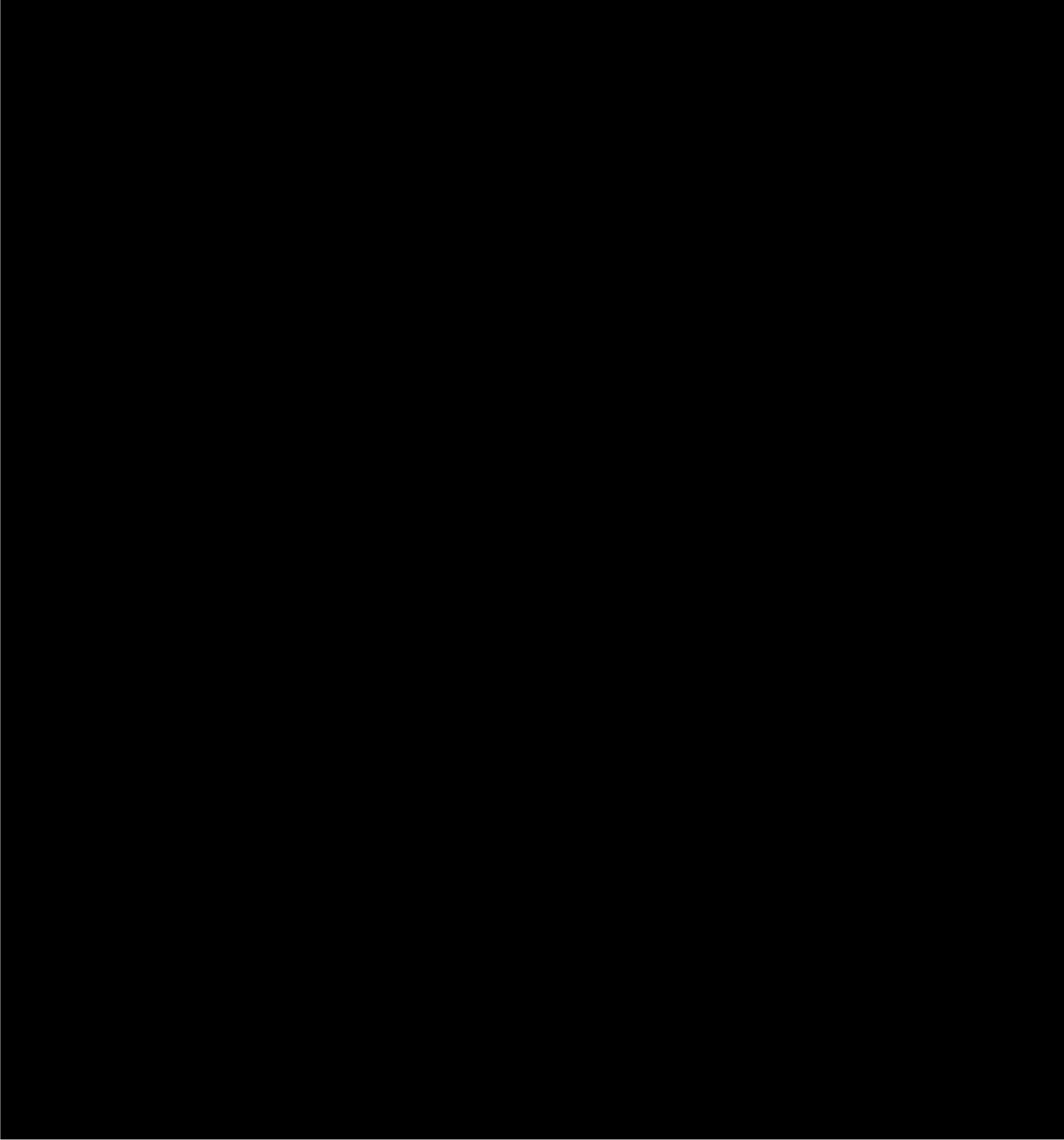
A PWM alternate square wave, with a frequency of 2,160 Hz with the first harmonic at 311 Vrms and 60 Hz, is obtained as IGBT output.

c) DT Diode

The DT Diode is physically located in the APS Module.

Its function has been described in the Clamp Circuit (refer to paragraph 10-I-02.02.02.03) together with the LC input filter (refer to paragraph 10-I-02.02.02).

d) APS Inverter Module Electric Diagram



10-I-02.02.04.02 APS Transformer

The APS Transformer is a 70 kVA 311 Vrms/208 Vrms insulating Transformer DY11 (triangle/star with neutral).

Its function is to galvanically isolate the HV Input from the MV output and to generate the requested output voltage value (208 Vrms line-to-line).

This transformer assures the nominal output value, in any operating condition (even at a minimum voltage of 500 Vdc and with the maximum inverter modulation index). The nominal output voltage value may vary by $\pm 5\%$ between no load and full load conditions.

The APS Transformer, with the help of the LC Low-Pass filter at the output of the secondary winding, generates a sinusoidal wave form with 10% of maximum harmonic distortion.

L is simply the connection between the phases, while C is obtained by adding a bank of six capacitors (CF1, CF2, ..., CF6) star connected to two 100 μF capacitors per phase.

The cut-frequency of the filter is 863 Hz.

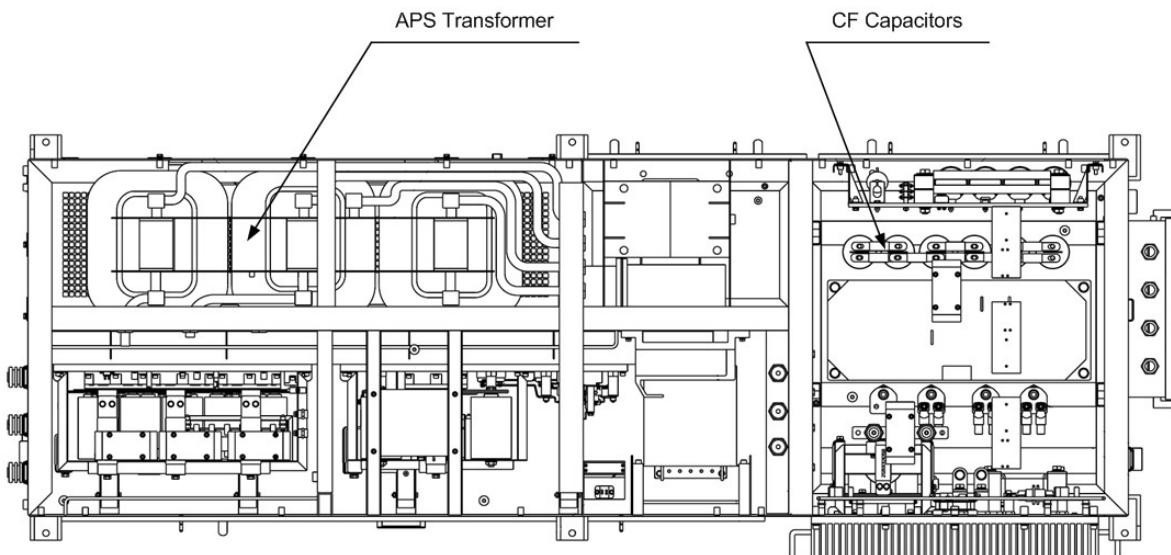


Figure 10-I-02.25 Location of APS Transformer and CF Capacitors

APS Transformer Electric Characteristics

Input Voltage (linked to the primary winding):

Wave form	Modulation square wave PWM ²
First Harmonic Effective Value	311 Vrms ±5%
First Harmonic Nominal Frequency	60 Hz ±5%

Output Voltage (linked to the secondary winding, after the bank of capacitors):

Wave form	sinusoidal (THD ≤10%).
Effective Value	208 Vrms ±5% (depending on the load).
Frequency	60 Hz ±5%.

Secondary Winding Nominal Power 70 kVA

Power factor ($\cos \varphi$) 0.75-1

A transient of a few seconds is allowed with 200 kVA and $\cos \varphi = 0.5-0.75$.

Secondary Winding Effective Current ($V = 198 \text{ nVrms}$, $\cos \varphi = 1$) 205 Arms

10-I-02.02.05 LVPS System

The LVPS circuit purpose is to transform the 750 Vdc nominal input into a continuous 37.5 Vdc output voltage, capable of supplying the LV loads and charge the batteries.

The Noise is eliminated from the input voltage by means of a Line Filter (refer to paragraph 10-I-02.02.02).

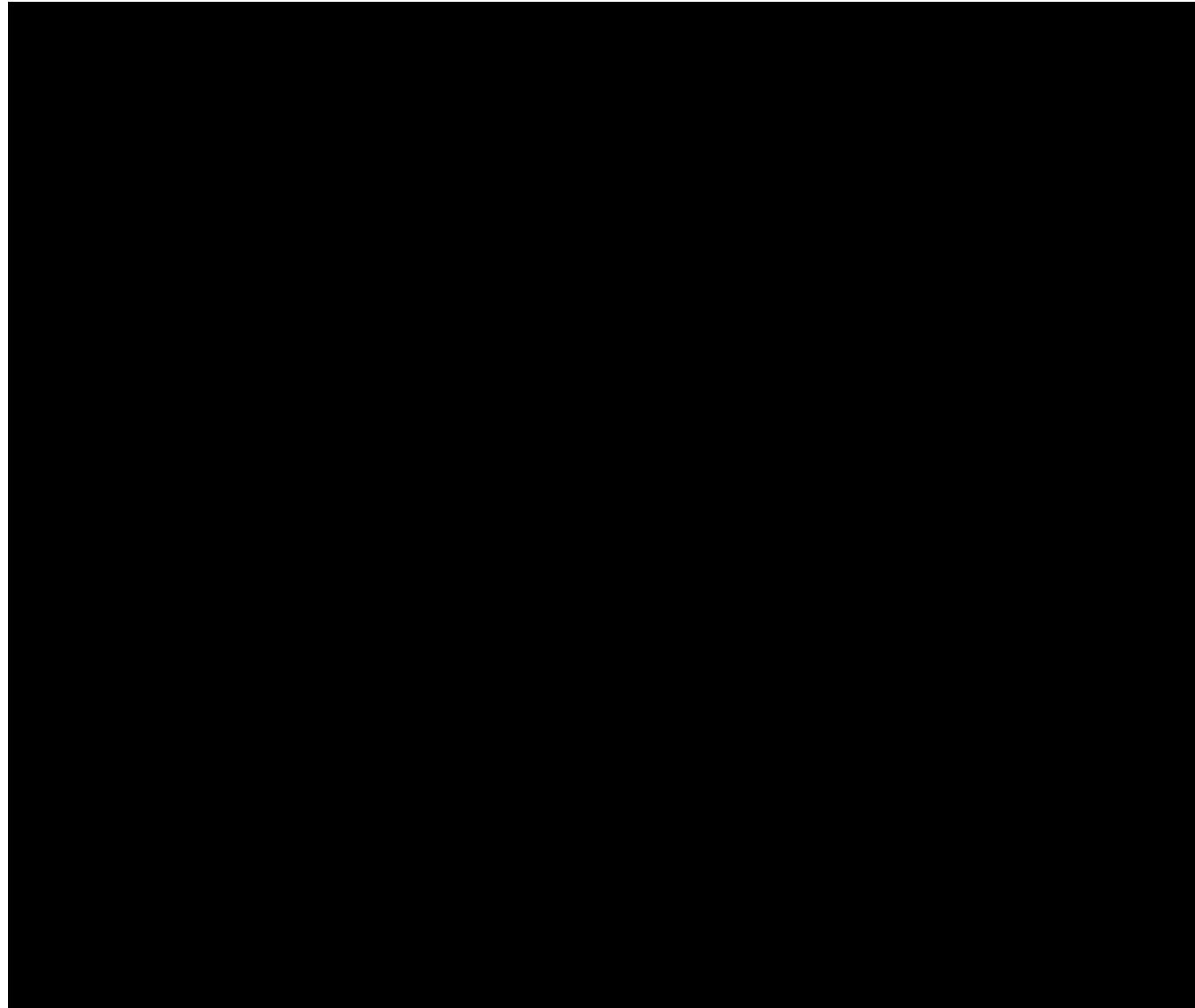
Through the LVPS inverter (with four H-bridge IGBTs) the current is transformed into alternate current and sent to the mono-phase transformer that realizes the galvanic isolation between inputs and outputs and brings the voltage to the required value (37.5 Vdc nominal).

Then the voltage is rectified by means of system of diodes (Rectifier Bridge) and an RLC filter made up of three 110Ω resistances and four 15mF capacitors. R and C are located inside the "Component Assembly" (refer to 10-I-02.02.04.01) connected in series with a $40\mu\text{H}$ inductor directly inside the LVPS transformer block.

The output towards the battery positive (+B) and the LV loads (+L) is made independent by means of a DN diode.

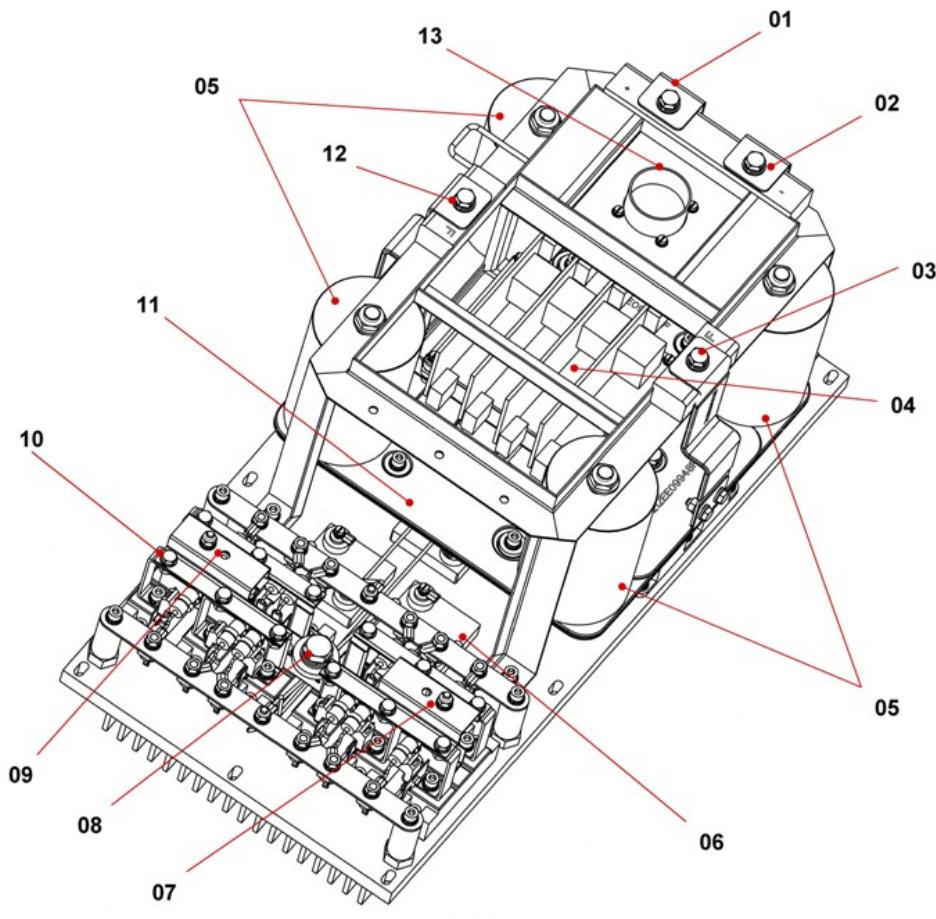
The negative reference connector (-) is not directly connected to the ground: two 680 nF capacitors and one 10Ω resistance are connected in parallel. They are located in the Active Clamp Module (refer to 10-I-02.02.06.01).

² PWM: Pulse Within Modulation. Refer to Appendix: 10-I-03.



10-I-02.02.05.01 LVPS Inverter Module

The LVPS Inverter Module contains the input low-pass filter, the LVPS inverter and the rectifier bridge.



- | | |
|---|---|
| 01. HV INPUT – PCB TERMINAL | 08. NEG - OUTPUT TERMINAL (FROM LVPS TRANSFORMER) |
| 02. HV INPUT – NCB TERMINAL | 09. E – OUTPUT TERMINAL (FROM LVPS TRANSFORMER) |
| 03. B - OUTPUT TERMINAL (FROM LVPS TRANSFORMER) | 10. RECTIFIER BRIDGE DIODES |
| 04. IGBT DRIVER ASSEMBLY | 11. BUS-BAR CONNECTION |
| 05. FILTER CAPACITORS | 12. A – OUTPUT TERMINAL (FROM LVPS TRANSFORMER) |
| 06. DISCHARGE FILTER RESISTANCES | |
| 07. F - OUTPUT TERMINAL (FROM LVPS TRANSFORMER) | 13. LV CONNECTOR |

Figure 10-I-02.27 LVPS Inverter Module

The input R//C filter ($R = 9 \text{ k}\Omega$, $C = 880 \mu\text{F}$) is made up of two $18 \text{ k}\Omega$ resistances and four $220 \mu\text{F}$ capacitors in parallel.

The filter capacitor is also used in parallel with the APS inverter capacitor for the input LC filter.

a) Drive Assembly for the four IGBTs (PCB Assembly)

The Driver Assembly contains the four inverter driver boards (GEDI type) mounted on a support board (PSG2).

The Driver Boards are supplied by means of a square wave alternate voltage (30 Vpp - 50 Hz) coming directly from the PSC board (control board for this module) that receives it from the supply of the power supply control rack.

Each board contains a local insulating transformer that assures the galvanic isolation obtained by means of opto-insulators.

Each driver board is provided with a self-diagnostic system, capable of detecting the following malfunctions:

- Supply driver KO
- IGBT KO

Three LEDs on each board give information on their operating status, as follows:

- Green LED: supply OK
- Yellow LED: starter command OK
- Red LED: board and/or IGBT KO

The drivers drive the IGBTs in H-bridge configuration; such that the current varies alternately the direction inside the primary of the LVPS Transformer (refer to paragraph 10-I-02.02.05.02).

The 237EE40260C AnsaldoBreda document contains the GEDI board Functional Schematic.

NOTE: The GEDI board Components location is described in the 232EE40260B AnsaldoBreda document.
Refer to Section 01 for “AB Database” use.

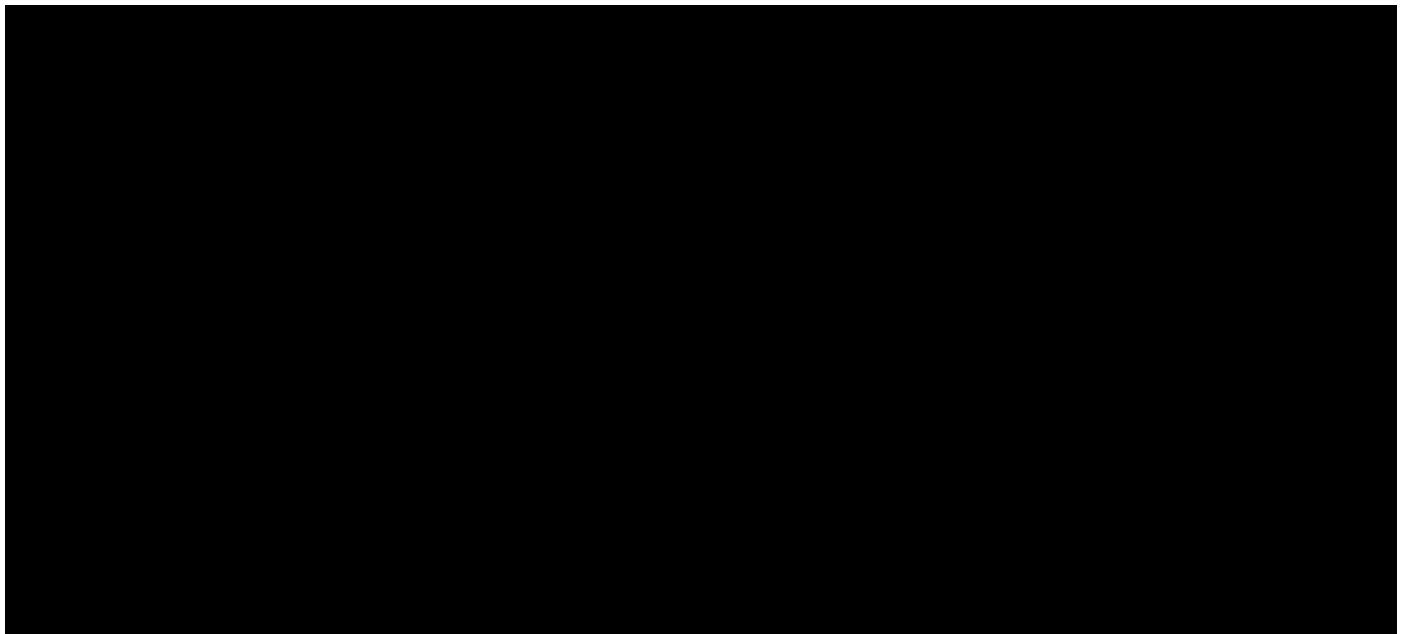
10-I-02.02.05.02 LVPS Transformer

The mono-phase LVPS Transformer has the function of:

- Galvanically isolating high voltage from low voltage
- Providing a 37.5 Vdc output voltage

The transformer also contains, in the same module, an output filter inductance

$L = 40\mu H$ and the amperometric transformer for measuring the current drained from the primary side of the transformer.



The transformer assures the nominal output voltage in any working condition (even with 500 Vdc minimum input voltage and inverter maximum duty cycle (45%).

LVPS Transformer Electric Characteristics:

Nominal Continuous Power	16 kW
Primary Winding Input Voltage	90 V
Frequency	7.5 kHz
Primary Input Current:	
Peak	48 A
Effective	43 A
Mean	0 A.
Peak Voltage on Secondary Winding:	
Nominal Value	75 V
Range	46-90 V

10-I-02.02.05.03 SUC (Start-Up Circuit)

When no LV supply from the batteries (disconnected or completely exhausted) is available, the SUC (Start-Up Circuit) permits the auxiliary static converter to start-up by connecting the LVPS to the HV (750 Vdc) directly and providing an auxiliary LV source to the command and control devices of the converter.

Once started, the converter stays on and self-supplies.

Supply nominal Voltage	750Vdc
Transitory over-voltage is permitted with a maximum duration of less than 1 s, with no degradation of the equipment or its protections.	1500Vdc
Output Nominal Voltage (on connectors P2 e P3)	26Vdc (nominal) 24-28 Vdc depending on ambient temperature
Total Nominal Power (P2 e P3) continuous output	≥50 W
Total Nominal Power (P2 e P3) output ≤10s	≥80 W

Positive Contact: Connector P2 pin 1, Connector P3 pin 1

Negative Contact: Connector P2 pin 2, Connector P3 pin 2

Maximum Input Power with minimum input voltage and nominal load.	120W
Maximum Input Power with minimum input voltage and converter OFF	0.7W

Efficiency, with nominal input conditions and maximum allowed ambient temperature:	70 %
--	------

Natural (air) cooling

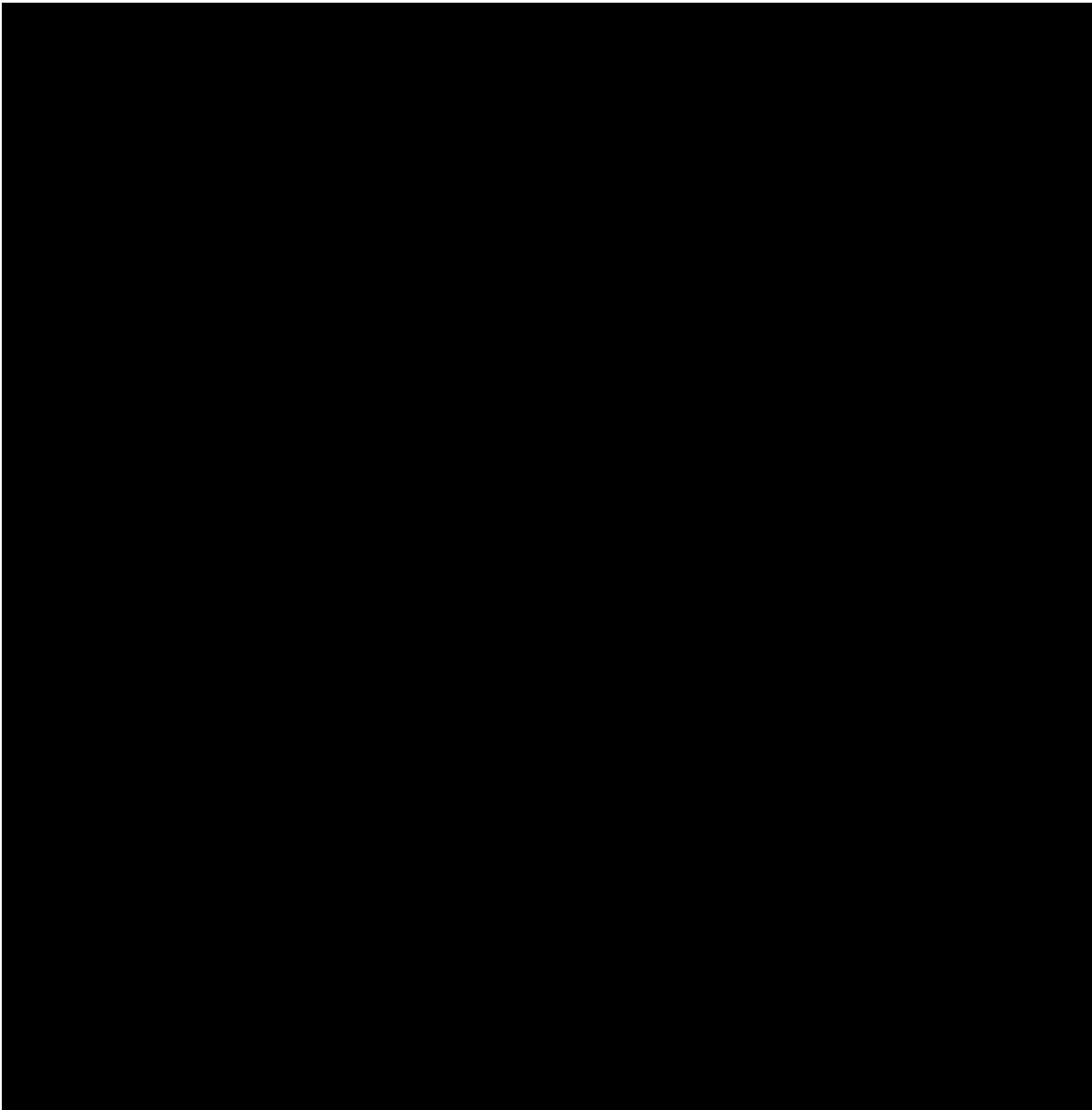
a) Start-Up in case of sectioned or exhausted batteries:

To start up the converter with no LV supply, the following conditions must be met:

- HV input (500-900 Vdc) available
- APS/LVPS supply Circuit Breakers closed
- RESCB (Reset Battery Charger) inactive (refer to Table 10-I-02.7)

In these conditions, if no battery voltage supply is available, the SUC provides the LV supply only for the control and internal regulation devices that allow the LVPS to startup and then the converter to self-supply through its own LV output.

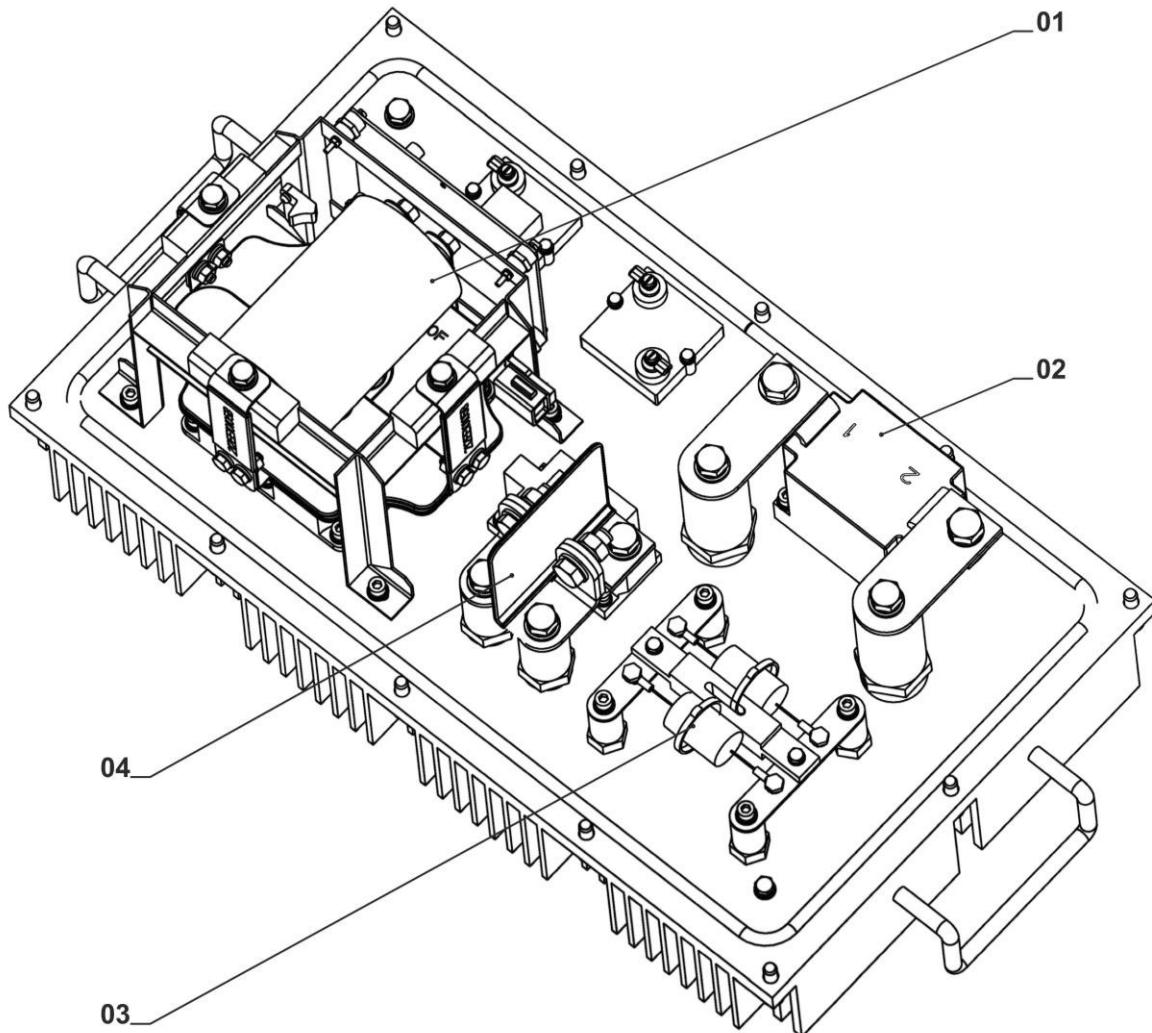
The SUC is always turned on and provides an output voltage of 26Vdc, but when the LVPS is working the voltage output is 37.5Vdc so the SUC output current is zero.



The output voltage (26 Vdc nominal) comes out of converter COM1-N through the P3-2 connector and re-enters through the COM-T connector after a magneto-thermic device (Circuit Breaker 3F04) that is used to block eventual overcurrents (the Circuit Breaker 3F04 is not shown in Figure 10-I-02.31).

The battery voltage (or the SUC voltage, when the battery voltage is missing), passing through a diode, reaches the MSA connector and then the CA connector of the Mother board to feed the logic circuits.

The SUC has internal devices to avoid overcharging and permanent short circuit output. Tranzorb devices also limit output overvoltage caused, for example, by internal failure.

10-I-02.02.06 Active Clamp and Component Assembly**10-I-02.02.06.01 Active Clamp Module**

01. ACTIVE CLAMP CIRCUIT

04. DIODE DN

02. DIODE DS

03. R/C CIRCUIT

Figure 10-I-02.32 Active Clamp Module

The Active Clamp Module contains the IGBTs and their driver boards to carry out an "Active Clamp."

a) Active Clamp Circuit

The purpose of the main circuit of this block is to protect the APS from possible overvoltages entering from the line into the Auxiliary Static Converter.



If $V_{in} \geq 1100$ Vdc, the IGBT driver board commands the opening of the first IGBT and the closing of the second one in order to put an RB1//RB2 resistance in parallel to the APS Inverter Module.

The resistance drains part of the line power, protecting the APS. With normal line voltage, the second IGBT is open. In this way no current flows through the resistances or goes directly to the -AT connector.

A 220 μ F (CF) filter capacitor and an 18 k Ω (RF) resistance are in parallel with the two IGBTs (refer to Figure 10-I-02.35).

The CIS board, mounted on the Active Clamp Module, drives the IGBTs.

The 237EE40325C AnsaldoBreda document contains the CIS board Functional Schematic.

NOTE: The CIS board Components location is described in the 232EE40325C AnsaldoBreda document.

Refer to Section 01 for “AB Database” use.

— DS Block Diode

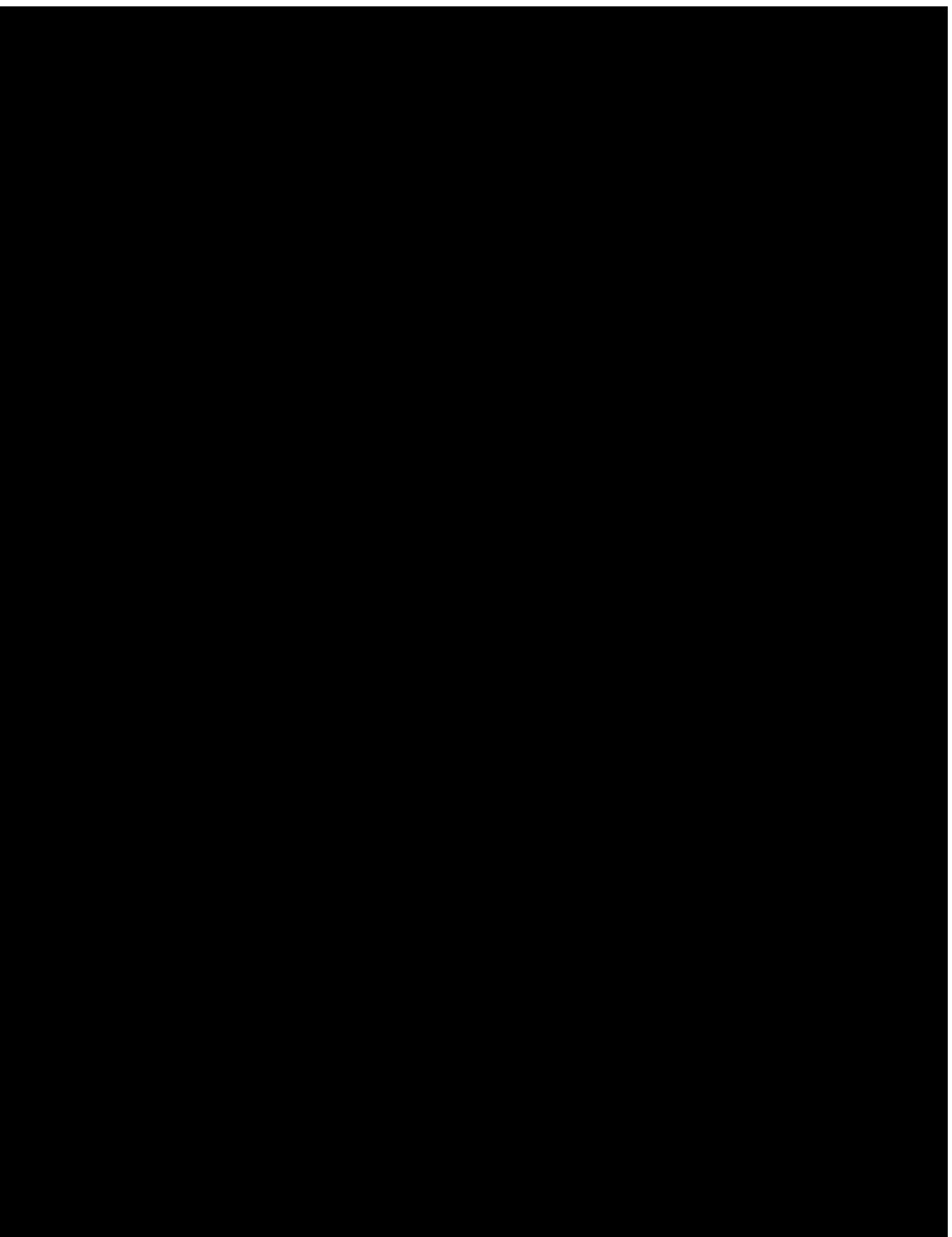
The DS High Voltage Block Diode does not allow the current flowing from the (-AT) connector to the APS/LVPS System.

— R//C Circuit

The R//C Circuit (number 3 in Figure 10-I-02.32) is an uncoupling circuit. It is made up of two 680 nF capacitors and one 10Ω resistance in parallel, placed between GND and the nominal 37.5 Vdc reference (-) output. Through this circuit, the LV reference is uncoupled from GND. So the Electronic systems and the electric devices are protected against any current pulse from the HV Grounding System.

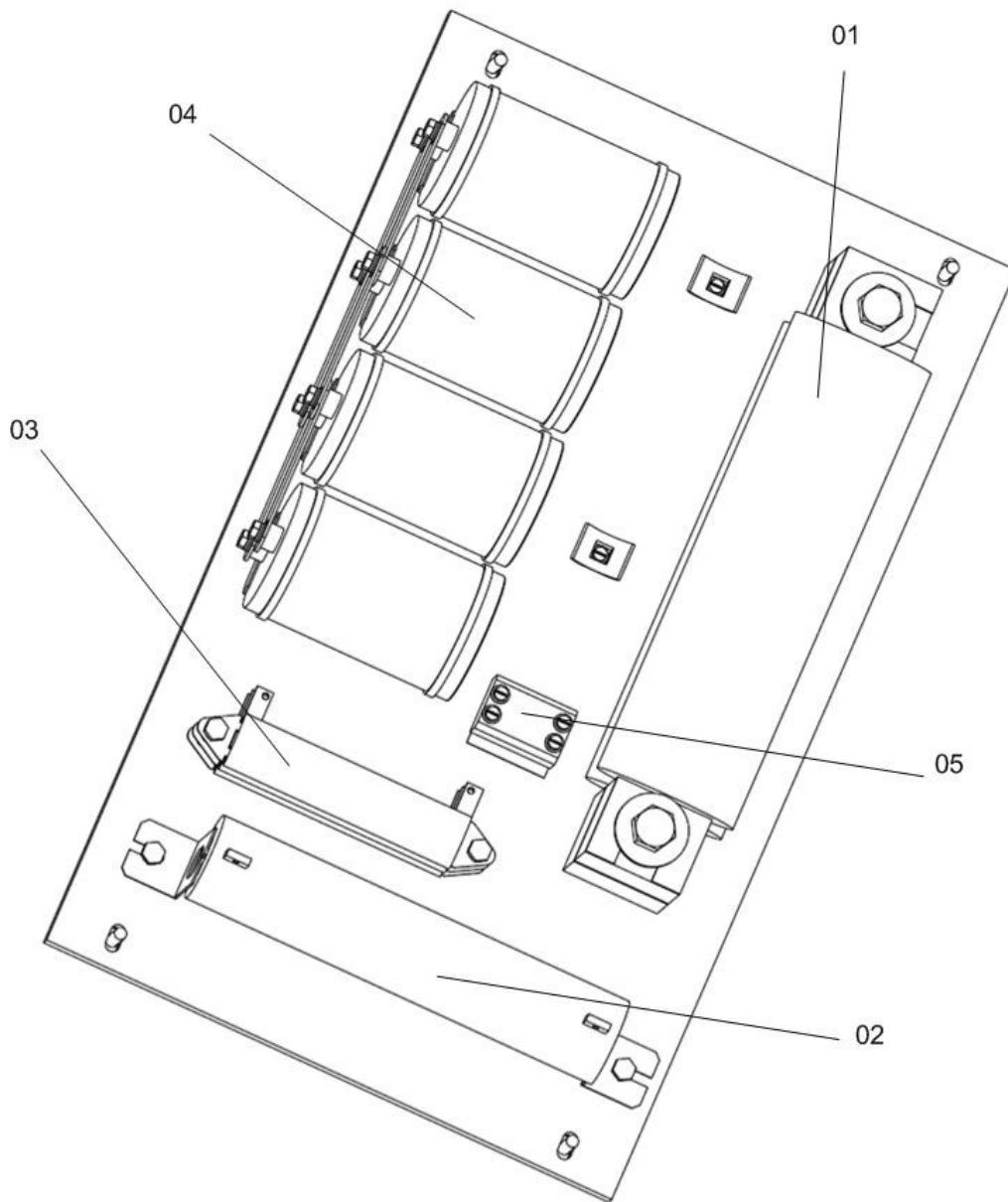
— DN Block Diode

The DN Low Voltage Block Diode is used to uncouple the Battery output (+B) from the Loads output (+L). Through this Diode the Battery can supply the LV Load (37.5Vdc nominal), but no current coming from the LV Loads can reach the Battery.



10-I-02.02.06.02 Component Assembly

This block contains components used by both the APS and the LVPS.



- | | |
|---|---|
| 01. RB1 and RB2 (Active Clamp Circuit) | 04. CU1, CU2 and CU3 (LVPS Output Filter) |
| 02. RP (Clamp Circuit) | 05. DBAT Diodes |
| 03. RU1, RU2 and RU3 (LVPS Output Filter) | |

Figure 10-I-02.36 Component Assembly

10-I-02.02.07 Auxiliary Inverter Control Unit

The Auxiliary Inverter Control Unit manages and monitors the auxiliary static converter operations.

Its main functions are:

- Driving the IGBTs
- Monitoring the APS and LVPS operations
- Monitoring the main electric values
- Autonomous Intervention in case of incorrect operation
- Interfacing external devices

For the correct implementation of regulations and controls, besides the acquisition of signals coming from transducers inside the Auxiliary Static Converter, the Auxiliary Inverter Control Unit can acquire information from the exterior and send information to the outside regarding the working status of the converter.

All connections between the converter and the vehicle are realized by means of two 37 pins connectors, named COM1 and COM2, located on the side of the static converter near the HV inputs (refer to Figure 10-I-02.7: #09 and #10).

The control and regulation logic of the Auxiliary Static Converter is concentrated in two boards (CIA and PSC) connected to a mother board (MBACU2) located in a rack (RACK Europa 2) together with a supply unit. The Rack Europa 2 contains:

- Power Supply Unit
- CIA-04 board
- PSC-04 board
- MBACU2 motherboard

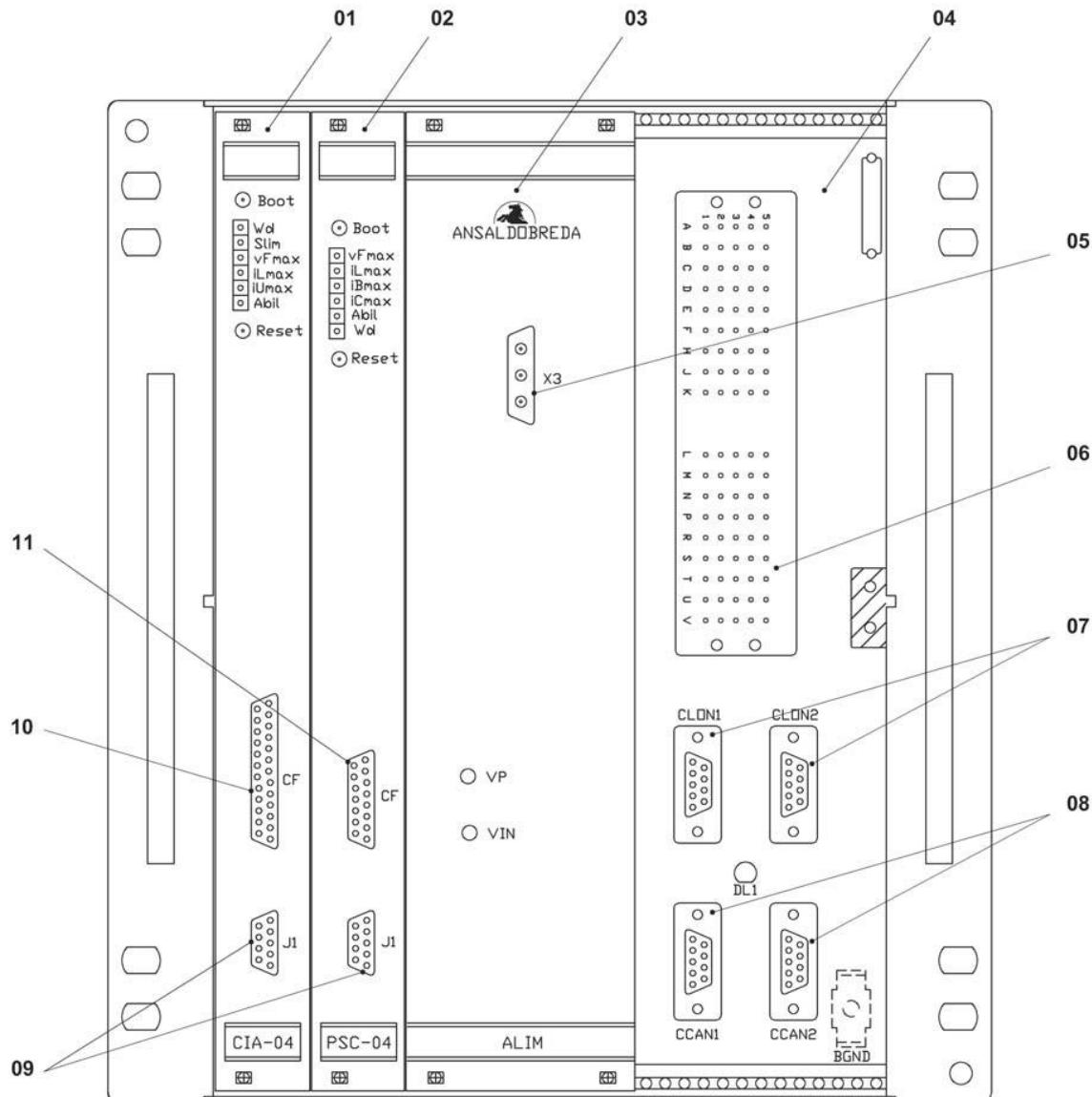
The CIA board has the function of regulating and monitoring the operations of the APS.

The PSC board has the function of regulating and monitoring the operations of the LVPS.

The motherboard allows connections between boards and towards the exterior.

The supply unit receives voltage from the battery (or from the SUC, in case the battery is exhausted or disconnected).

It also supplies the boards which in turn supply both the transducers and the IGBT driver boards.



01. CIA-04 BOARD (APS CONTROL)
 03. POWER SUPPLY UNIT
 05. POWER SUPPLY FROM BATTERY
 07. LON-BUS INTERFACE
 09. RS232 DIAGNOSTIC INTERFACE
 11. LVPS IGBT DRIVER COMMANDS

02. PSC-04 BOARD (LVPS CONTROL)
 04. MOTHER BOARD ACU2
 06. TRANSDUCERS & DIGITAL I/O
 08. CAN-BUS INTERFACE
 10. APS IGBT DRIVER COMMANDS

Figure 10-I-02.37 Auxiliary Inverter Control Unit Front View

10-I-02.02.07.01 PSU (Power Supply Unit)

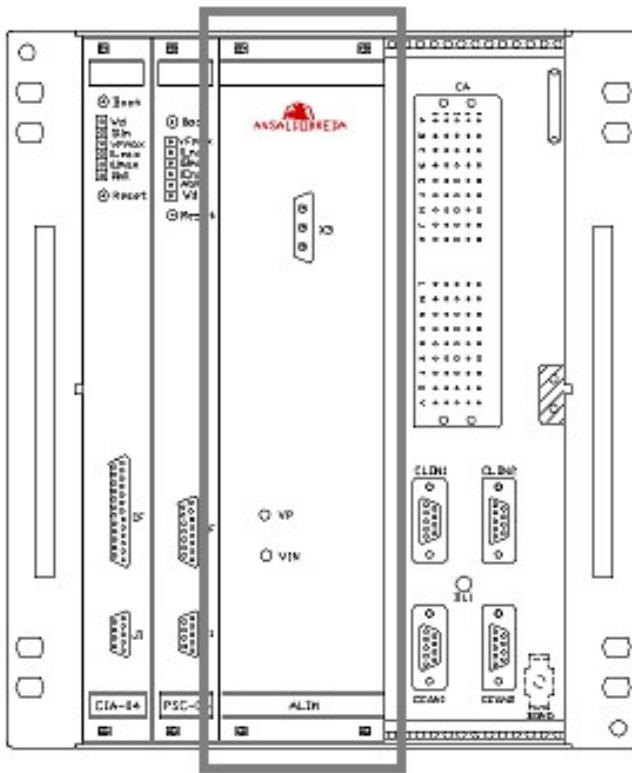


Figure 10-I-02.38 PSU

a) Function

Supply the boards.

Supply the transducers.

Supply the IGBT driver boards.

b) Characteristics

The Power Supply Unit is capable of maintaining the output nominal voltages for at least 10 ms after the loss of supply (if previously supplied with a voltage of at least 24 Vdc for at least 2 min).

Efficiency ≥85% at nominal power, 30 Vdc input voltage, 185°F ambient temperature.

Working Ambient Temperature	-40°F/ +185°F
-----------------------------	---------------

The actual working conditions are between -13,00°F/+158°F due to the other components of the Auxiliary Static Converter.

Electric Characteristics:

1. Input

The supply comes from the LVPS or the SUC by means of pins N, P, R, S, T of COM1 connector.

Nominal Supply Voltage	24Vdc - 37.5Vdc
Voltage Supply Static Variable Range	16.8 - 43 Vdc
Allowed overvoltage for $t \leq 100ms$	45Vdc
Allowed undervoltage for $t \leq 100ms$	14.4Vdc

2. Output

Overall Maximum Output Power	150W
Nominal power supplied to CIA board	5W
Nominal power supplied to PSC board	5W
Driver board power	30W
Power towards transducers	15W

Four different output voltages are supplied:

V1	+5Vdc	supply for board digital circuits
V2	$\pm 15Vdc$ ($V2P = +15Vdc$, $V2N = -15Vdc$)	supply for transducers
V3	+15Vdc	supply for board analog circuits

The Power Supply Unit also supplies an external thermal sensor, located inside the Battery Box, above the Battery Cells.

The maximum nominal currents at output connectors, for thermal dimensioning of the PSU and for overload conditions, are:

	NOMINAL	Overload	Thermal threshold
V1	$I_n = 10\text{ Adc}$	$I_{maxs} = 15\text{Adc}$	$I_{maxt} = 20\text{Adc}$
V2	$I_n = 2\text{Adc}$	$I_{maxs} = 4\text{Adc}$	$I_{maxt} = 6\text{Adc}$
V3	$I_n = 0.4\text{Adc}$	$I_{maxs} = 0.6\text{Adc}$	$I_{maxt} = 0.6\text{Adc}$
V4	2.3Arms	$I_{maxs} = 6.44\text{Arms}$	$I_{maxt} = 7\text{Adc}$

Maximum currents must be compatible with the maximum output current, that is 150W.

The PSU has an X3 connector, D-SUB type.

Table 10-I-02.3 PSU Outputs

Output Voltage	Nominal/overload Power	Feeder Pins	Description
V1 = +5Vdc ±2%	35W / 52W	12J1, 16J1, 18J1 Ref: 14J1, 20J1, 22J1	Supply for PSC, CIA logic circuitry
V2P = +15Vdc ±3%	60W / 120W	18J2 Ref: 20J2, 22J2	Supply for PSC, CIA analog circuitry
V2N = -15Vdc ±3%		24J2 Ref: 20J2, 22J2	Supply for Transducers
V3 = +15Vdc ±3%	4.5W / 9W	14J2 Ref: 16J2	Supply for PSC, CIA interface commands
V4 = +30Vpp ±3% 50KHz	35W / 96W	8J2, 10J2	Supply for IGBT Inverter driver boards
Total max Power	150W		

c) Input and Output Control Circuits

The PSU has monitoring devices of the inputs and outputs that, in case of out-of-range readings, automatically trip the required protections.

With values below the minimum input voltage threshold the PSU switches off. It switches on again automatically as soon as the input voltage goes back to the required range.

The input voltage control is managed by the PG2 circuit that detects if $V_{in} < 16.8 \pm 0.5\% \text{ Vdc}$.

10-I-02.02.07.02 CIA - 04 Board

The CIA-4 board manages controls and diagnostics related to the DC/AC conversion from 750 Vdc to 208 Vrms, 60 Hz (APS).

The most important component of the CIA board is the SIMENS SAK167CS microprocessor that takes care of the following tasks:

- Generating the firing frequencies of the IGBT modules for the three phases
- Managing the diagnostics
- Managing the inverter protections

The inverters are driven with the SVM (Space Vector Modulation) modulation technique.

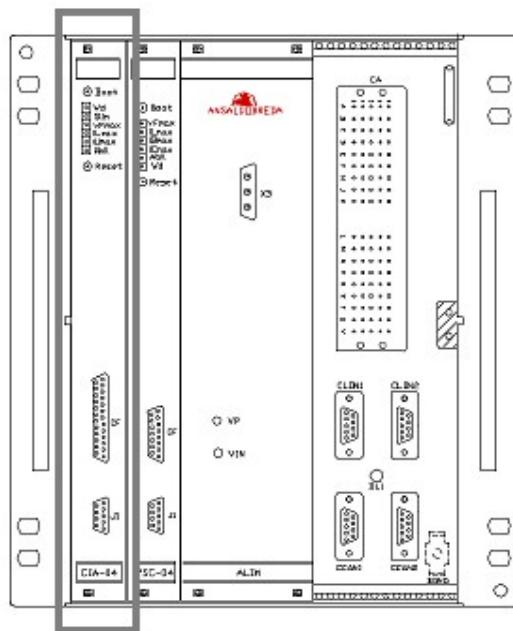


Figure 10-I-02.39 CIA - 04 board location

The 237EE60408C AnsaldoBreda document contains the CIA-04 board Functional Schematic (refer to the AB Database).

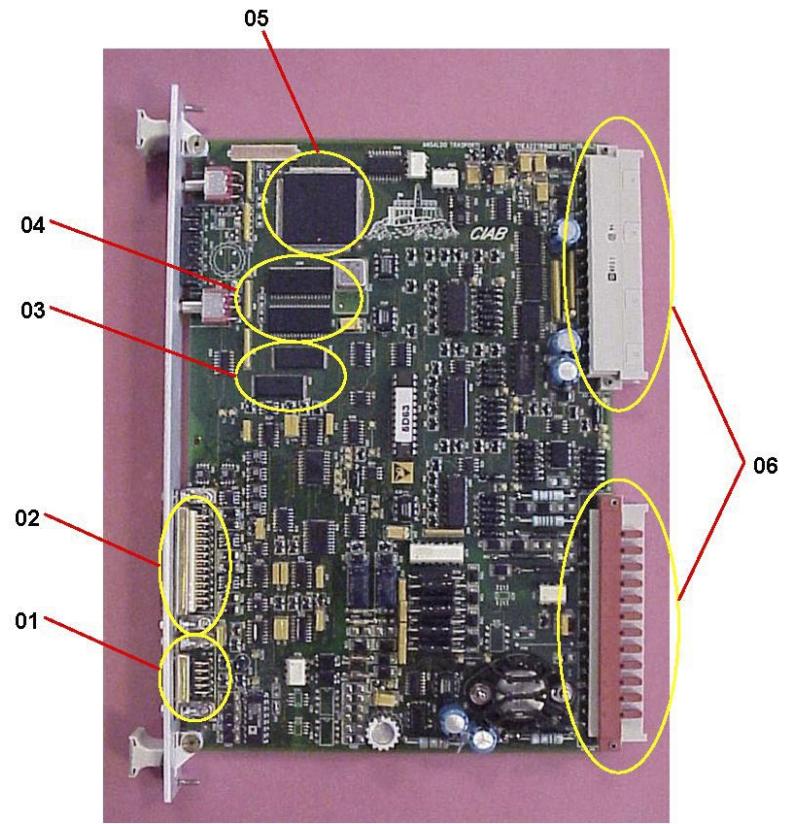
NOTE: The CIA-04 board Components location is described in the 232EE60445C AnsaldoBreda document (refer to the AB Database). Refer to Section 01 for “AB Database” use.

a) CIA-04 Board - Front Side

- The CIA-04 board front side shows (refer to Figure 10-I-02.37):
 - Six LEDs - for fault indication
 - A CF connector (25 pins) - for the IGBT driving commands of the APS inverter
 - A J1 connector (9 pins), RS 232 interface - for local diagnostics

The six LEDs indicate the following faults:

- Wd Microprocessor Fault
- SlimActive Output Current Limitation
- vFMax Maximum Input Voltage
- iLMax Maximum Input Current
- iUMax Maximum Output Current
- Abil Board Enabling



- | | |
|---|--|
| 01. RS232 DIAGNOSTIC INTERFACE
03. N°2 512KBYTES (FLASH)
05. 16 BIT MICROCONTROLLER | 02. APS IGBT DRIVER COMMANDS
04. N°2 512KBYTES (SRAM)
06. INTERFACE WITH MOTHER BOARD ACU2 |
|---|--|

Figure 10-I-02.40 CIA - 04 Board

By means of a PTU (with the ATRTerm interface SOFTWARE program installed) connected to the CIA-04 board through the J1 connector, using an RS 232 serial peripheral (refer to Figure 10-I-02.37 - 01), the following operations are made possible:

- Loading the software application
- Real-time displaying of all analog and digital signals captured on the board
- Converter status monitoring
- Data downloading

Through the CF Connector this board is directly connected with the APS Inverter Module in order to drive the APS IGBTs and acquire the APS Inverter Status.

b) Input Signals

In order to manage the APS device, the CIA-04 board must acquire all signals, both analog and digital, necessary for controlling diagnostics and for managing protections.

1. Analog Signals

Table 10-I-02.4 CIA - 04 Board Analog Input Signals

Code	Signal	Source transducer	Remote diagnostics	HARDWARE action	SW action
VFIVMis	Inverter module input voltage	TVF	Available in analog format (0-5V range) on the connector CA and on RS232/CAN/LON	Max value protection	ADC capture Max and min value protection Regulation
ILIVMis	Inverter module input current	TAIV	Available in analog format (0-5V range) on the connector CA and on RS232/CAN/LON	Max value protection	ADC capture Max and min value protection Regulation
IRMis	R-phase output current	TAR	Available in analog format (0-5V range) on the connector CA and on RS232/CAN/LON	Max value protection Regulation	ADC capture Max and min value protection Regulation
ISMis	S-phase output current	TAS	Available in analog format (0-5V range) on the connector CA and on RS232/CAN/LON	Max value protection Regulation	ADC capture Max and min value protection Regulation
ITMis	T-phase output current	TAT	Available in analog format (0-5V range) on the connector CA and on RS232/CAN/LON	Max value protection Control	ADC capture Max and min value protection Regulation

2. Digital Signals

Table 10-I-02.5 CIA - 04 Board Digital Input Signals

Code	Signal	Source	Remote diagnostics	HARDWARE action	SOFTWARE action
WD	Watch Dog (Internal input)	Microcontroller		Permanent block	
PWG	Power Good (Input)	Rack supply	RS232/CAN/LON	Permanent block	Permanent block
TSWIV	Inverter module thermo-switch	Inverter module thermo-switch	RS232/CAN/LON	Galvanic isolation	Temporary block
ID6/ STFCB	Battery charger HV fuse status (input)	Battery charger fuse	RS232/CAN/LON	Galvanic isolation	
ID7/ ONSA	Inverter start-up (Input)	VCOM1/H Connector	RS232/CAN/LON	Galvanic isolation	
ID8	Shut-down (Input)	VCOM1/f Connector	RS232/CAN/LON	Galvanic isolation	
OD7	Spare (Output)	VCOM1/a Connector	RS232/CAN/LON	Galvanic isolation	
OD8	Spare (Output)	VCOM1b Connector	RS232/CAN/LON	Galvanic isolation	
OD9/ APSOK	Inverter diagnostics (Output)	VCOM1/K Connector	RS232/CAN/LON	Galvanic isolation	Active if inverter is active and in operation ³
OD10	Spare (Output)	VCOM1/d Connector	RS232/CAN/LON	Galvanic isolation	

For a more detailed description of signals, refer to paragraph 10-I-02.02.08.

³ Digital Signal OD9/APSOK: the inverter is “active” if the APS LV circuit is supplied and is “in operation” when the APS is providing MV.

c) Output Signals

The CIA-04 board commands the IGBTs of the APS inverter module through command signals coming from the CF connector towards the CCINV connector of the piloting drivers. (Refer to paragraph 10-I-03 on IGBTs' Theory).

Each IGBT receives:

- Positive Supply
- Negative Supply
- Command

The CIA Output Signals are listed in Table 10-I-02.14.

d) Internal Diagnostics

Evaluating the voltage values of the APS transducers, the CIA-04 board detects the faults present and answers both via Hardware and Software, by inhibiting the command pulses of the IGBTs and actually blocking the auxiliary static converter operation.

The CIA-04 board, by means of a self-test at start-up, is also capable of verifying the correct operation of the analog inputs, the correct intervention of the HARDWARE protections and of restoring normal operation.

Finally, all internal diagnostic circuits, related to the voltage supply monitoring, are checked.

The AC loads (motors, for example) can have start-up current peaks. The CIA-04 board regulates the load peaks with two different thresholds:

- Software threshold (lowest): accomplished by adequately varying the effective value and the output voltage frequency. This permits the V/f ratio to remain constant
- Hardware threshold (highest): the peak value of the phase current is kept constant by reducing the output voltage effective value. The operating threshold of this protection can be set via SOFTWARE by acting independently on the three phases. This methodology can also be used to manage load unbalances

To optimize the inverter performance, the two modes can be applied together.

10-I-02.02.07.03 PSC..04 Board

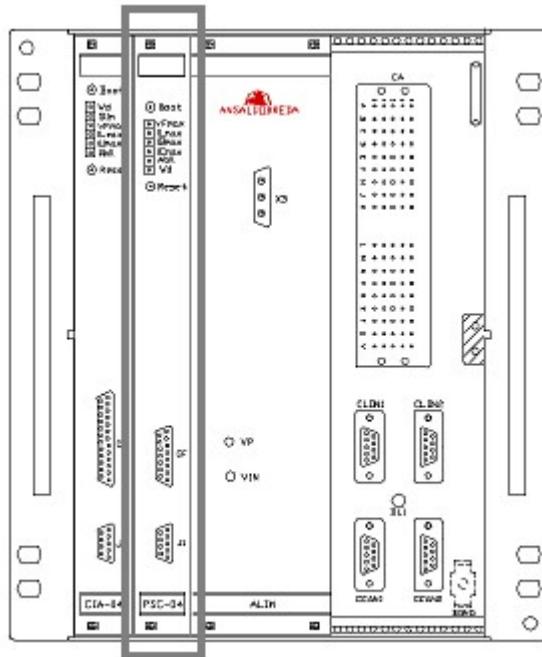


Figure 10-I-02.41 PSC - 04 board location

The 237EE60410C AnsaldoBreda document contains the PSC-04 board Functional Schematic.

NOTE:

The PSC-04 board Components location is described in the 232EE60430C AnsaldoBreda document.

Refer to Section 01 for “AB Database” use.

The PSC-04 board takes care of the control and diagnostics related to the DC/DC conversion from 750 Vdc to 37.5 Vdc (LVPS).

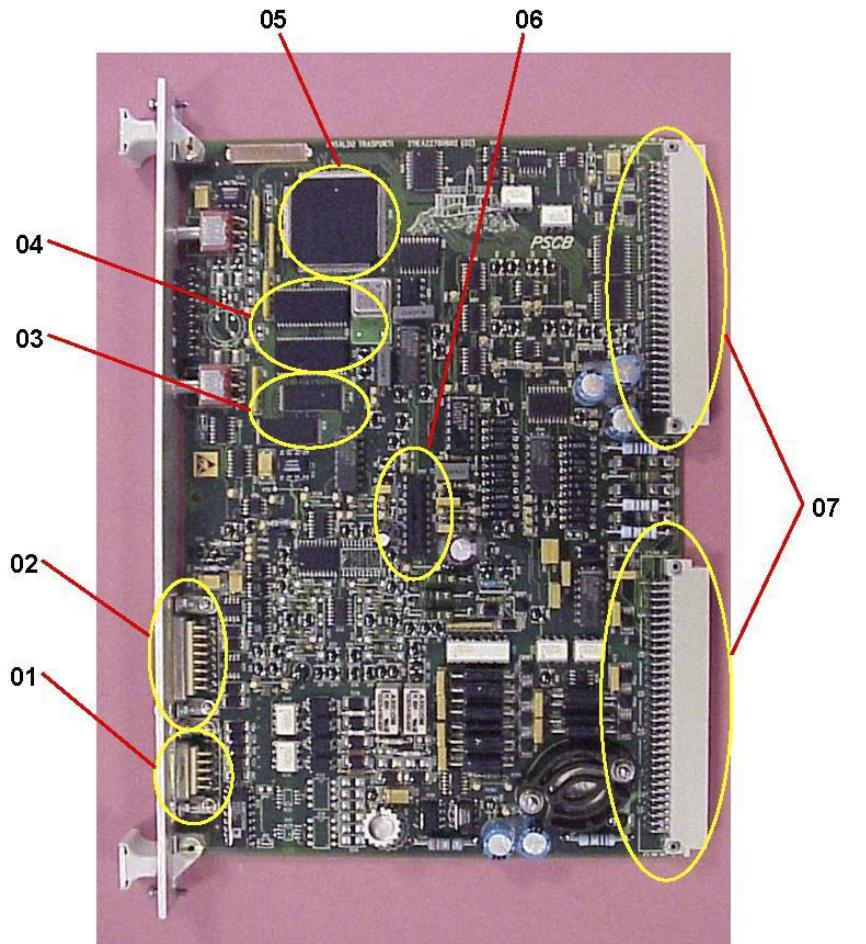
The most important element of the board is the SIMENS SAK167CS microprocessor that has the following tasks:

- Managing the LV output references
- Managing the LVPS operation logic
- Managing the intervention logic and the HARDWARE (quick) and SOFTWARE (slow) protections
- Managing the connections with the exterior (via BUS-CAN e via LONWorks Bus) and with the CIA-04 board (via BUS_CAN)

The PSC board to evaluate the correct operation of the LVPS system checks the following signals:

- The LV output voltage
- The total current delivered on the LV output
- The current delivered on the battery side

To improve the dynamic performances of the system, an internal current loop ("current mode" control) is also used. It takes the primary current of the insulating transformer of the DC/DC converter as reference signal.



01. RS232 DIAGNOSTIC INTERFACE

02. APS IGBT DRIVER COMMANDS

03. N°2 512KBYTES (FLASH)

04. N°2 512KBYTES (SRAM)

05. 16 BIT MICROCONTROLLER

06. "PHASE-SHIFT" SWITCHING REGULATOR

07. INTERFACE WITH MOTHER BOARD ACU2

Figure 10-I-02.42 PSC - 04 Board

a) Front Side

The PSC-04 front side shows:

- Six LEDs for fault indication
- CF connector (15 pins)
- J1 connector (9 pins)

The six LEDs indicate the following faults:

- vFMax: maximum module input voltage
- iLMax: maximum module input current
- iCMax: maximum total output current
- iBMax: maximum battery output current
- Abil: general enable status
- Wd: microprocessor fault

Red LED	DL1	ON
Red LED	DL2	ON
Red LED	DL3	ON
Red LED	DL4	ON
Green LED	DL5	ON
Green LED	DL6	OFF

Through the J1 connector, it is possible to get connected to the PSC-04 board by means of a laptop computer by means of a serial RS-232 peripheral and with the interface Software ATRterm.

The possible operations are the following:

- Software application loading
- Real-time displaying of all analog and digital signals received from the board
- Converter status monitoring
- Data downloading

Through the CF Connector, this board is directly connected with the LVPS Inverter Module, to drive the LVPS IGBTs and acquire the LVPS Inverter Status.

b) Input Signals

For managing the LVPS, the PSC-04 board uses both analog and digital signals which are necessary for controlling diagnostics and managing protections.

1. Analog Signals

Table 10-I-02.6 PSC - 04 Board Analog Input Signals

Code	Signal	Source transducer	Remote diagnostics	HARDWARE action	SOFTWARE action
VFCBMis	Battery charger module input voltage	TVF	Available in analog format (0-5V range) on the connector CA and on RS232/CAN/LON	Max value protection	ADC capture Max and min value protection Regulation
ILCBMis	Battery charger input module current	TACB	Available in analog format (0-5V range) on the connector CA and on RS232/CAN/LON	Max value protection	ADC capture Max and min value protection Regulation
VBMis	Battery charger output voltage	TVB	Available in analog format (0-5V range) on the connector CA and on RS232/CAN/LON	Max value protection Regulation	ADC capture Max and min value protection Regulation
iCarMis	Battery charger supplied current	TAC	Available in analog format (0-5V range) on the connector CA and on RS232/CAN/LON	Max value protection Regulation	ADC capture Max and min value protection Regulation
iBatMis	Battery charger current supplied to the battery	TAB	Available in analog format (0-5V range) on the connector CA and on RS232/CAN/LON	Max value protection Regulation	ADC capture Max and min value protection Regulation
IP1Mis	Current to battery charger primary track	TAP	Available in analog format (0-5V range) on the connector CA and on RS232/CAN/LON	Max value protection Control	ADC capture Max and min value protection Regulation
TMis	Battery electrolyte thermo-switch	4-wire PT100 probe	Available in analog format (0-5V range) on the connector CA and on RS232/CAN/LON	Max value protection	ADC capture Max and min value protection Regulation

2. Digital Signals

Table 10-I-02.7 PSC - 04 Board digital Input Signals

Code	Signal	Source	Remote diagnostics	HARDWARE action	SOFTWARE action
WD	Watch Dog (Internal input)	Microcontroller		Permanent block	
AVCLK	Switching regulator KO (Internal input)	Switching regulator on board	RS232/CAN/LON	Permanent block	Permanent block
PWG	Power Good (Input)	Rack supply	RS232/CAN/LON	Permanent block	Permanent block
TSWCB	Thermo-switch (Input)	Battery charger module thermo-switch	RS232/CAN/LON	Galvanic isolation	Temporary block
ID1/STTR	Trolley status (Input)	VCOM1/D Connector	RS232/CAN/LON	Galvanic isolation	
ID2/STKB	Batter contact status (Input)	VCOM1/E Connector	RS232/CAN/LON	Galvanic isolation	
ID3/VENTOK	GS ventilator interrupt status (Input)	VCOM1/M Connector	RS232/CAN/LON	Galvanic isolation	
ID4/DISP	Ground Fault identifier status (Input)	GOB	RS232/CAN/LON	Galvanic isolation	
ID5/RESCB	Reset BC (Input)	VCOM1/J Connector	RS232/CAN/LON	Galvanic isolation and reset BC	Converter protection status reset
OD1	Spare (Output)	VCOM1/U Connector	RS232/CAN/LON	Galvanic isolation	
OD2	Spare (Output)	VCOM1/V Connector	RS232/CAN/LON	Galvanic isolation	
OD3/LVPSOK	BC diagnostics (Output)	VCOM1/L Connector	RS232/CAN/LON	Galvanic isolation	Active if BC in operation
OD4	Spare (Output)	VCOM1/W Connector	RS232/CAN/LON	Galvanic isolation	
OD5	Spare (Output)	VCOM1/X Connector	RS232/CAN/LON	Galvanic isolation	
OD6	Spare (Output)	VCOM1/Z Connector	RS232/CAN/LON	Galvanic isolation	

More details on digital signals are given in paragraph 10-I-02.02.08

c) Output Signals

The PSC board commands the IGBTs of the LVPS inverter module through the command signals coming from the CF connector towards the CCB connector of the piloting drivers. (Refer to 10-I-03 for the IGBTs Theory).

Each IGBT receives three signals:

- Positive Supply
- Command
- Negative Supply

The PSC Output Signals are listed in Table 10-I-02.15

d) Internal Diagnostic

The PSC-04 board receives the voltage values of the LVPS transducers, detects the faults and intervenes both via HW and SW, inhibiting the IGBT command pulses and actually blocking the auxiliary static converter operation (Refer to paragraph: 10-I-02.02.09).

The PSC-04 board is also capable of verifying, through a self-test at start-up, the correct operation of analog inputs and the correct tripping of the HARDWARE protections. In addition, all internal diagnostic circuits related to the monitoring circuits supply voltages are checked by the PSC-04 board.

10-I-02.02.07.04 Communication between Boards

The CIA-04 and the PSC-04 boards exchange information and interact with the exterior via BUS-CAN (controller area network) through the motherboard. The PSC-04 board can also communicate with the exterior through the LONWorks Bus.

10-I-02.02.07.05 ACU2 Motherboard

The ACU2 motherboard carries-out all connections between the two control boards and the supply unit.

The ACU2 motherboard also assures the connections with the exterior by means of the interface connectors.

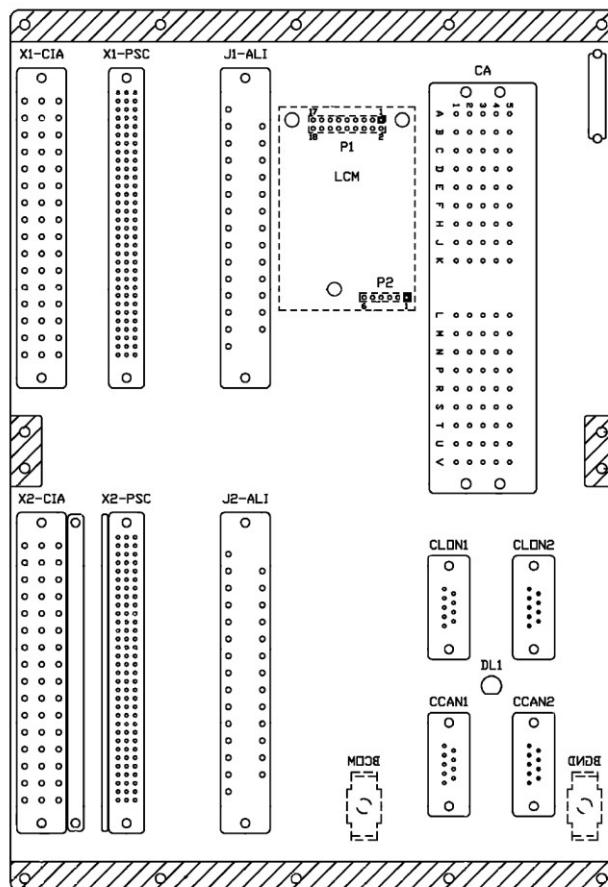


Figure 10-I-02.43 ACU2 Mother Board

Connectors:

- CA (90 pins) supply, input transducers, digital I/O
- CCAN1 and CCAN2 (9 pins) BUS-CAN interface
- CLON1 and CLON2 (9 pins) LONWorks Bus interface

A LON control Module is present in the ACU2 motherboard. Through this module the PSC-04 board can interface with the LONWorks Bus.

NOTE: The 237EE40319C AnsaldoBreda document contains the ACU2 Motherboard Functional Schematic.
Refer to Section 01 for “AB Database” use.

10-I-02.02.08 Treatment of Signals

10-I-02.02.08.01 Analog Input Signals

a) Transducers

The APS/LVPS transducers (refer to Table 10-I-02.8) are located inside the auxiliary converter to control its correct operation.

Through the CA connector of the motherboard, these transducers are connected to the relevant board:

- CIA board for monitoring the APS transducers
- PSC board for monitoring the LVPS transducers

Table 10-I-02.8 Transducer Signals

Code	Description	Transducer Voltage (depending on the value being checked)
P15M TVF N15M	Supply +15V Input voltage Supply -15V	$V = 3.638 \times 10^{-3} V_{in}$
P15E TAR N15E	Supply +15V auxiliary inverter module R phase output current Supply -15V	$V = 5.934 \times 10^{-3} I_{fase}$
P15G TAS N15G	Supply +15V auxiliary inverter module S phase output current Supply -15V	$V = 5.934 \times 10^{-3} I_{fase}$
P15L TAT N15L	Supply +15V auxiliary inverter module T phase output current Supply -15V	$V = 5.934 \times 10^{-3} I_{fase}$
P15C TAIV N15C	Supply +15V auxiliary inverter module input current Supply -15V	$V = 11.620 \times 10^{-3} I_{in}$
P15A TACB N15A	Supply +15V Input current to the battery charger Supply -15V	$V = 23.240 \times 10^{-3} I_{in}$
P15M TAB N15M	Supply +15V battery charger output current Supply -15V	$V = 37,087 \times 10^{-3} I_{bat}$
P15F	Supply +15V	
TACT N15F	Battery Charger Total Output Current Supply -15V	$V = 7,417 \times 10^{-3} I_{tot}$
P15M TVB N15M	Supply +15V Battery charger output voltage Supply -15V	$V = 37,25 \times 10^{-3} V_{bat}$
P15B TAN N15B	Supply +15V Return current to the line Supply -15V	does not go to the boards PSC e CIA to the GOB only

Table 10-I-02.9 Board Connectors for Transducer Signals

name	MB	GOB card		Boards				
		CA	CIN	COUT	CIA - X2	PSC - X2	CIA - X1	PSC - X1
P15M	L1				(-) 4z	(-) 2A		
TVF	L2				(+) 4d	(+) 6c	26d	26c
N15M	L3							
P15E	P1				(-) 10z			
TAR	P2				(+) 10d		24b	
N15E	P3							
P15G	R1				(-) 8z			
TAS	R2				(+) 8d		24z	
N15G	R3							
P15L	S1				(-) 6z			
TAT	S2				(+) 6d		26z	
N15L	S3							
P15C	M1	1	1		(-) 2d			
TAIV	M2	3	3		(+) 2z			
N15C	M3	2	2					
P15A	N1	9	9			(-) 4c		
TACB	N2	10	10			(+) 6b		23c
N15A	N3	11	11					
P15M	U1					(-) 8c		
TAB	U2					(+) 8b		22c
N15M	U3							
P15F	V1					(-) 2b		
TACT	V2					(+) 8a		27c
N15F	V3							
P15M	T1							
TVB	T2					10a		25c
N15M	T3							
P15B	H1	13	13					
TAN		5						
N15B	K1	14	14					

The three cables (red “+”, yellow “-”, amber “M”) pass from transducers TACB, TAN and TAB through connectors MTACB, MTAN and MTAB respectively.

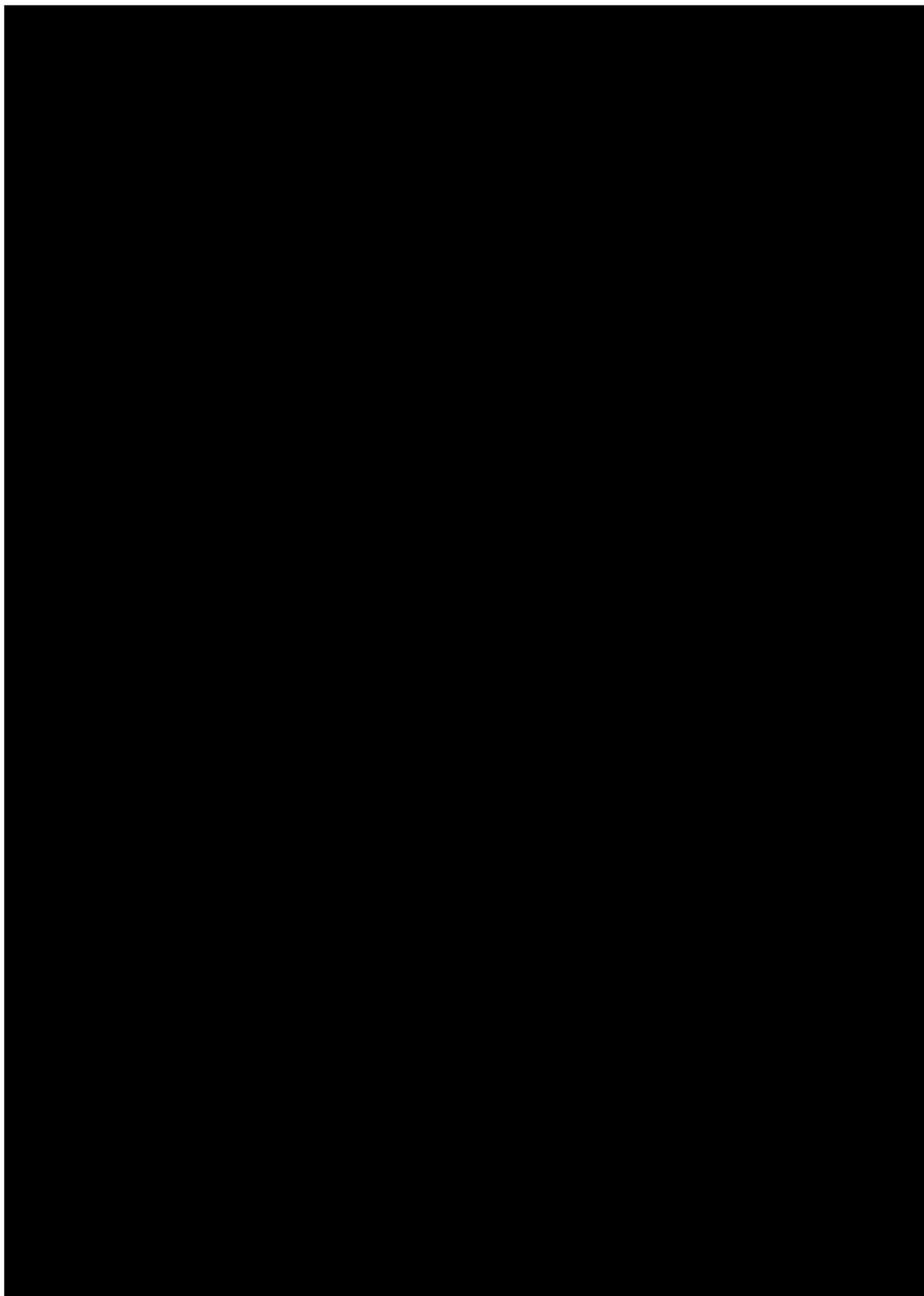
The GOB board verifies if the sum of the input currents detected by TACB and TAIV transducers is equal to the output current detected by transducer TAN.

For $|TAIV| + |TACB| - |TAN| > 5A$ the GOB card detects a Ground Fault and activates the digital COM signal that is sent from the GOB card to the CA connector of the Mother Board.

The 237EE40331C AnsaldoBreda document contains the GOB card Functional Schematic.

NOTE: The GOB card Components location is described in the 232EE40331B AnsaldoBreda document.
Refer to Section 01 for “AB Database” use.

Figure 10-I-02.44 shows the APS/LVPS Transducers and their connections with the CA Connector.



b) Amperometric Transformer

A transducer for detecting current on primary winding is inside the LVPS transformer. Information coming from this device, passing through the motherboard CA connector, goes to the PSC board which controls the entire LVPS.

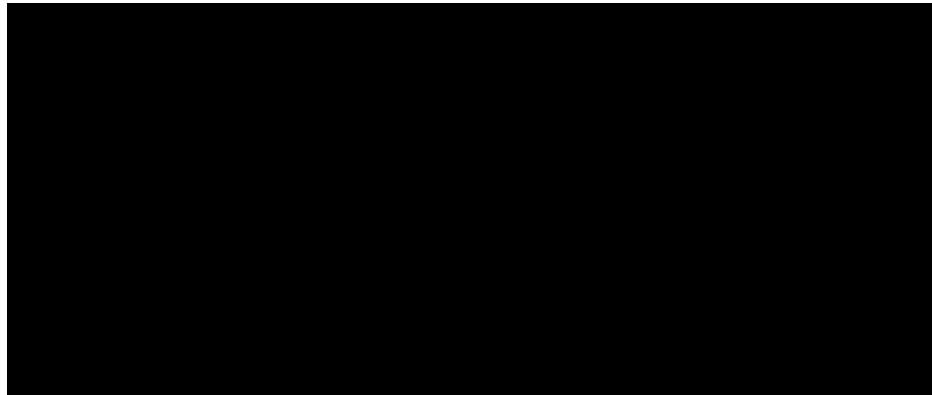


Figure 10-I-02.45 Amperometric Transformer

S: shield

C: positive connector

D: negative connector

Table 10-I-02.10 Amperometric Transformer Signals

Name	Description	CA	PSC - X2	PSC - X1
IP1P	Transformer primary winding current	L4	10b	27B
IP1N	Transformer primary winding current	L5	10c	

c) PT100 Thermal Sensor

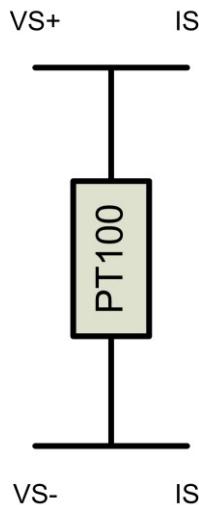
The Auxiliary Inverter Control Unit monitors the temperature of the Battery Cells located in the Battery Box (B Body Section - underframe), by means of the PT100 thermal sensor.

The supply to the probe is provided by means of the rack supply unit.

Table 10-I-02.11 PT100 Thermal Sensor Signals

Name	Description	COM1	CA	PSC - X2	PSC - X1
VS+	Voltmeter acquisition	A	M4	6a	
VS-	Voltmeter acquisition	G	N4	4b	
IS+	Amperometric acquisition	C	M5	4a	24c
IS-	Amperometric acquisition	F	N5	8c	

PT100 thermal sensor operating principle:



A constant 1mA current is sent to thermal sensor. The difference of potential between the negative and the positive connectors of thermal sensor is measured ($V_{tpt}=VS+ - VS-$).

Thermal sensor resistance is proportional to the operating temperature. According to this, the difference of potential between the negative and the positive connectors of thermal sensor depends on the Battery temperature.

This value is proportional to the temperature, according to the formula $V_{tpt} = ((Temp[^\circ C] + 50) / 2584.8) + 0.086$. In this way the Battery temperature can be continuously monitored.

10-I-02.02.08.02 Digital Input Signals

Digital inputs of the regulating unit are dimensioned for input signals referred to the battery voltage (16 Vdc - 46 Vdc).

The electric characteristics of the digital signals of the regulating unit are:

- Input Impedance $2400\Omega \pm 2\%$
- Maximum High Input Voltage 46 Vdc
- Minimum High Input Voltage 15 Vdc

The limit of the Maximum High Input is 46 Vdc, but at 43 Vdc the Tranzorb device limits it before it reaches the maximum value.

Table 10-I-02.12 Digital Input Signals coming from outside the APS/LVPS

name	description	COM1	CA	PSC - X2	CIA - X2
STTR	Pantograph status	D	A3	12b	
STKB	Battery contactor status (On or OFF)	E	A4	14b	
VENTOK	Status of the fan magneto-thermic switch	M	B3	16b	14b
RSCB	HARDWARE reset signal of the battery charger	J	C3	20c	
ONSA	Start-up command status of the auxiliary inverter	H	D3		

Converter start-up (SUC):

With the HV input available, the APS starts-up if the digital input ONSA is high (1), while the battery charger (LVPS) starts-up if the digital input RSCB is low.

By operating on the relevant input command, it is possible to control the start-up of the APS or of the LVPS only.

Table 10-I-02.13 Digital Input Signals coming from inside the APS/LVPS

Name	Description	Internal block connector	CA	PSC - X2	CIA - X2
DISP	GOB status	OUTD of GOB	B4	18c	
COM	Currents In and currents OUT comparison	15 - COUT of GOB	F1		
TSWIN	Status of thermo-switch of the auxiliary inverter module	W - CCINV	E4		14z
PBIW	Supply of the INV thermo switch	X - CCINV	F5		
TSWCB	Status of thermo switch of the LV generator module	X - CCB	F4	14c	
PBCB	Supply of the LVPS thermo switch	W - CCB	E5		

Signals coming from the two thermo-switches are “high” when the contact inside thermo-switch is closed and consequently the temperature is below the maximum allowed threshold.

These signals are “low” if the contact is open, which means that the temperature exceeded the maximum allowed.

10-I-02.08.03 Digital Output Signals

a) Digital Output Signal to the APS Inverter Module

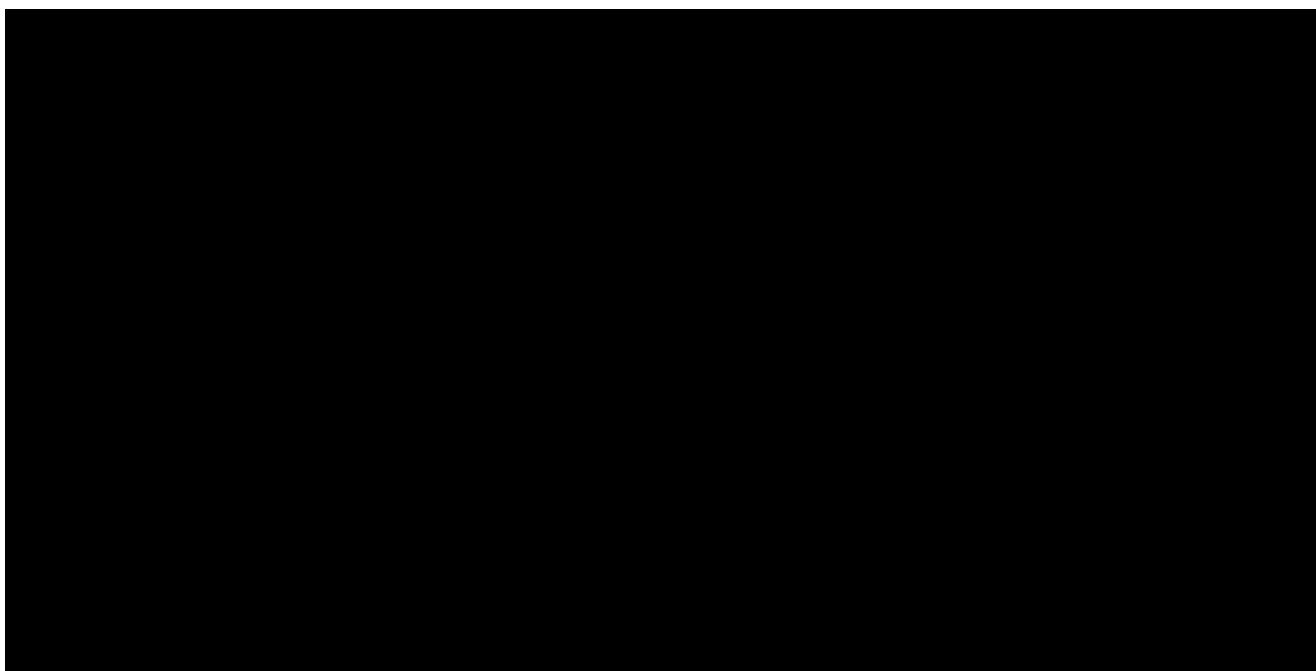
The CIA-04 board commands the IGBTs of the APS inverter module through command signals coming from the CF connector towards the CCINV connector of the piloting drivers. (Refer to 10-I-03 for the IGBTs Theory).

Each IGBT receives three wires:

- One for Positive Supply
- One for Negative Supply
- One for Command

Table 10-I-02.14 Signals from CIA - 04 to APS Inverter Module

CF - CIA	signal	description	CCIV
8	P15RH	Supply of R phase command	A
7	COMRH	R phase command high	B
18	RIFRH	R phase command reference	C
20	P15RL	Supply of R phase command	E
6	COMRL	R phase command low	F
19	RIFRL	R phase command reference	G
3	P15SH	Supply of S phase command	K
2	COMSH	S phase command high	L
14	RIFSH	S phase command reference	M
16	P15SL	Supply of S phase command	S
1	COMSL	S phase command low	T
15	RIFSL	S phase command reference	U
13	P15TH	Supply of T phase command	a
12	COMTH	T phase command high	b
23	RIFTH	T phase command reference	c
25	P15TL	Supply of T phase command	g
11	COMTL	T phase command low	h
24	RIFTL	T phase command reference	j



b) Digital Output Signal to the LVPS Inverter Module

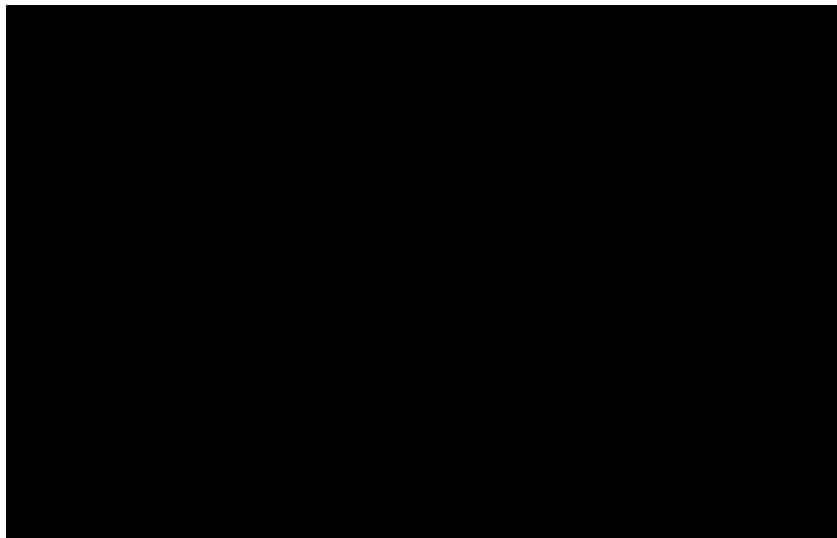
The PSC board commands the IGBTs of the LVPS inverter module through the command signals coming from the CF connector towards the CCB connector of the piloting drivers. (Refer to 10-I-03 for the IGBTs Theory).

Each IGBT receives three signals:

- Positive Supply
- Command
- Negative Supply

Table 10-I-02.15 Signal from PSC - 04 to LVPS Inverter Module

CF - CIA	signal	description	CCIV
10	P15AH	Supply of A phase command	A
9	COMAH	A phase command	B
11	RIFAH	A phase command reference	C
2	P15AL	Supply of B phase command	E
1	COMAL	B phase command	F
3	RIFAL	B phase command reference	G
15	P15BH	Supply of C phase command	K
14	COMBH	C phase command	L
13	RIFBH	C phase command reference	M
8	P15BL	D Supply of D phase command	S
7	COMBL	D phase command	T
6	RIFBL	D phase command reference	U



c) APS/LVPS Digital Output Signals COM1 connector

Field side digital outputs of the regulating unit are dimensioned for output signals referred to the battery voltage (16Vdc - 46Vdc) (nominal value: 24Vdc - 37,5Vdc).

Both low-side and high-side output signals are present, but only two active high-side output signals are used.

The low-side output signal is indicated with the letter "L" at the end of the code name, while the high-side output signal is indicated with a letter "H" at the end of the code name.

Table 10-I-02.16 Connectors for APS/LVPS Digital Output Signals

Name	Description	PSC - X2	CIA - X2	CA	COM1
SPODL1	not used	18a		A2	U
SPODL2	not used	20b		B2	V
SPODH4	not used	24b		D2	W
SPODL5	not used	14a		E2	X
SPODL6	not used	16a		F2	Z
SPODL7	not used		20d	H2	a
SPODL8	not used		24d	J2	b
SPODH10	not used		22d	K3	d
LVPSOK	Battery charger status	22c		C2	L
APSOK	Auxiliary Inverter status		22z	K2	K

The LVPSOK signal energizes the 3K04 relay. When this relay is de-energized the LVPS does not work.

The APSOK signal energizes the 3K18 relay. When this relay is de-energized the APS does not work.

The 3K04 and the 3K18 relays are located inside the Electric Locker of the B Body Section (refer to Figure 10-I-02.50).

d) Battery Charger Start-up (LVPS) and LVPSOK

Once the input filter pre-charging phase has been successfully completed, the LV generator starts and the output voltage goes from 0Vdc to 37,5Vdc (start-up ramp).

In particular, during the start-up ramp, the LV output varies linearly from a minimum of 1Vdc \pm 10 % to the nominal value of 37,5Vdc \pm 1,5 % in 2 sec \pm 20 %.

If the output is connected to the battery, the voltage value is determined by the charge status of the battery.

In particular, if the current taken by the battery is lower than 60 Adc, the output voltage value is equivalent to the battery voltage at the end of the charging process (37.5 Vdc).

On the contrary, if the current drained from the battery is higher than 60 Adc, the regulation circuits of the LVPS reduce the value of the output voltage, in order to regulate the above mentioned value at 60 Adc (the battery is charged by means of a constant current, not a constant voltage).

When the output voltage exceeds the minimum value of 25 Vdc, the diagnostic digital output LVPSOK is activated and the LVPSOK signal energizes the 3K04 LVPS Fault Relay.

e) APS Start-up and APSOK Signal Generation

After the filter pre-charging phase, also the APS starts operating, and the output voltage and frequency go from 0 to the relative nominal value.

Within the start-up ramp, Vrms and f_{out} (output frequency) of the MV output 3-phase voltage, vary linearly, keeping constant the Vrms/f_{out} = 3,47V*sec ratio.

The start-up ramp of the Inverter lasts about 3 sec.

At the end of the start-up ramp, the diagnostic digital output APSOK is activated and the APSOK signal energizes the 3K18 APS Fault Relay.

f) APS/LVPS Digital Output Signals CON2 connector

The APS and LVPS diagnostics are sent to the exterior by means of an RS-232 interface, the LONWorks BUS and the CAN-BUS. (refer to).

The RS-232 interface is realized by means of J1 connectors on the CIA and PSC boards. The J1 connectors are female nine pin D-BUS type. The J1 pin-out is perfectly the same for both CIA and PSC Boards.

Table 10-I-02.17 J1 Pin-out (CIA and PSC Boards)

J1	Signal	Description	COM2
2	TX	Data Transmission	B
3	RX	Data Reception	C
5	COM	Ground Reference	G

These RS-232 connectors are connected to two connectors on the Data Download Panel in the B Body Section:

Table 10-I-02.18 APS/LVPS RS-232 connectors

APS/LVPS RS-232 Connector	Data Download Panel (B body Section) Connector
J1-CIA (APS)	3X31
J1-PSC (LVPS)	3X30

The interface with the LONWorks Bus is realized with the LON control module mounted on the motherboard by means of the CLON1 and CLON2 connectors (male and female respectively).

Table 10-I-02.19 CLON1 and CLON2 Connectors (CIA and PSC Boards)

CLON1 e CLON2		Signal	Description	COM2	
1	1	NET_A	Line A		
2	2	NET_A	Line A	N	L
6	6	NET_B	Line B		
7	7	NET_B	Line B	P	M

Only an A and a B line are connected to the COM2 connector.

The CCAN2 and CCAN1 connectors (D-SUB types, 9 pins) have the same pin-out and carry out the interface with CAN-BUS (to communicate with PSC and CIA boards).

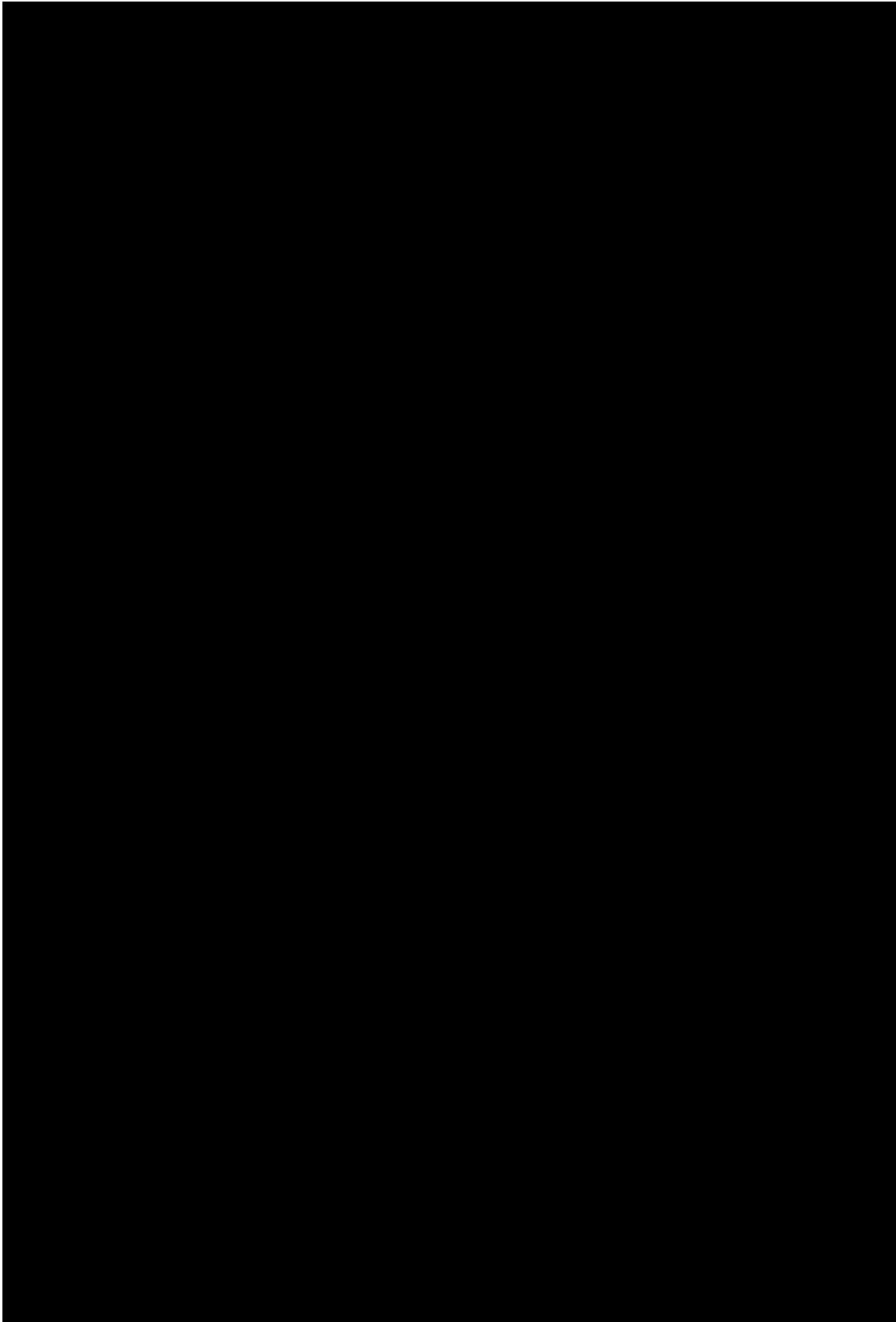
Table 10-I-02.20 CCAN2 Connector

CIA - X1	PSC - X1	CCAN2	Signal	Description	COM2
		6	GNDCAN	Ground Reference	J
10B	7A	2	CANH	Line CAN H	D
10D	8C	7	CANL	Line CAN L	H

Table 10-I-02.21 CCAN1 Connector

CIA - X1	PSC - X1	CCAN1	Signal	Description
10B	7A	2	CANH	Line CAN H
10D	8C	7	CANL	Line CAN L

The two CCAN1 pins (2 and 7) are connected by means of the characteristic resistance RCAN (120Ω).



10-I-02.02.08.04 Input - Output Signal Summary

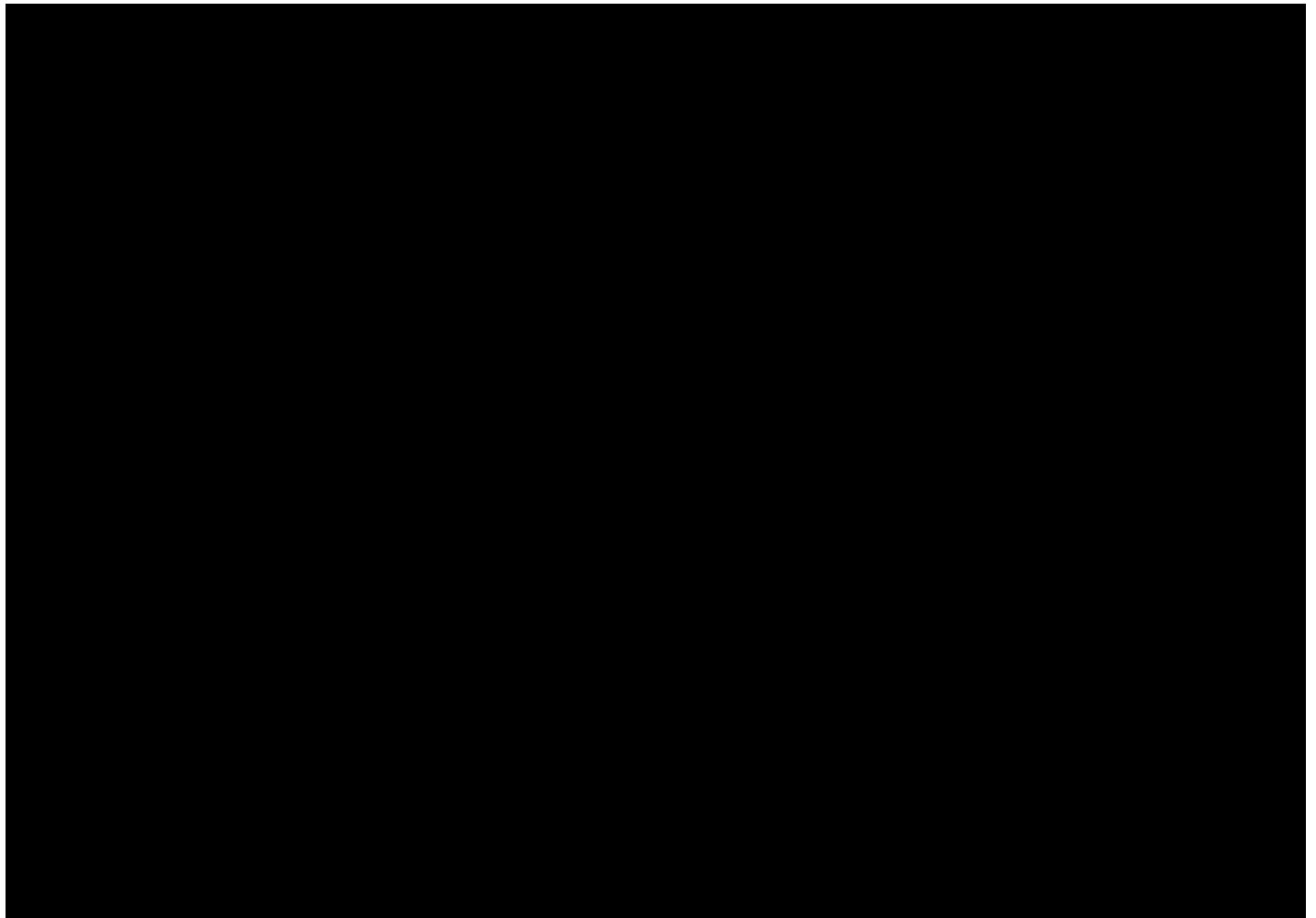


Figure 10-I-02.49 Input - Output Signal Block Diagram

10-I-02.02.09 Protection Logic

10-I-02.02.09.01 Types of Protection

The protections implemented by the regulating units can be divided into two main categories:

HARDWARE protections. In this case the quantity to be monitored is managed by a dedicated HARDWARE circuit. The intervention of this type of protection stops the driving pulses. All HARDWARE protections are redundant and are also managed via SW, to assure the intervention of the protection and to acquire the hardware protection intervention for diagnostic purposes.

SOFTWARE protections. The quantity to be monitored is managed exclusively via SW, which means by the microcontroller of the reference board.

Both types of protection can be “Permanent”, “Memorized” or “Temporary”:

Permanent: when its restoration depends not only on the elimination of the cause, but also on an external reset operation (carried out by the personnel).

Memorized: when its restoration depends not only on the elimination of the cause, but also on a reset operation that can be external (carried out by the personnel or by the vehicle logic) or internal (auto-reset carried out by the APS/LVPS internal logic).

Temporary: the restoration only depends on the elimination of the cause.

Restoration strategy in case of Permanent or memorized protections:

For a determined category of causes that produce the locking of the Auxiliary Static Converter, the Converter internal Logic “automatically “tries” to restore (self-reset) for NI (NI: number of self-resets allowed) consecutive times maximum (NI=0 for permanent protection).

Once the maximum number of self-resets has been reached, it is possible to try restoring by means of an external reset operation for NE (NE: number of external (operator) resets allowed) times maximum.

Once also the maximum number of external resets has been reached, if the converter does not unlock, it switches to a “self-cutout” status where it stays until the regulation unit is not supplied any more.

The reset counters are set back at zero after a few seconds of normal operation of the converter.

If the cause of the locking is considered “important” (in the sense that reiterated attempts could produce the failure of the converter power circuit), no reset attempt is carried out (NI=0) while the possibility to carry out an external reset (for a maximum of NE consecutive times) is always available

10-I-02.02.09.02 APS Protection

a) Permanent Protection

The main characteristics of the protections which generate permanent blocks on the APS Inverter are summarized in Table 10-I-02.22.

Table 10-I-02.22 APS Permanent Protection

Code	TYPE	Description	Intervention threshold	NI	NE
iLIVMax	HW	Inverter module input over-current	408 Adc ⁴	0	3
ILIVMAX	SW	Inverter module input over-current	325 Adc where t>500ms	0	3
CTO_FF	SW	Phase-phase short circuit		0	3
SQFASE	SW	Phase-earth short circuit or imbalance	load imbalance > 35%	0	3
NoPwrIV	SW	No three-phase power supply	< 10Arms ⁶	0	3

b) Memorized Protection

The main characteristics of the protections which generate memorized blocks on the APS Inverter are summarized in Table 10-I-02.23.

Table 10-I-02.23 APS Memorized Protection

Code	TYPE	Description	Intervention threshold	NI	NE
vFIVMax	HW	Inverter module input over-voltage	1135V	3	3
iOutMax	HW.	Inverter module phase output over-current	805 A _{peak}	3	3
VFIVMAX	SW.	Inverter module input over-voltage	1100V	3	3
IOUTMAX	SW.	Inverter module phase output over-current	350 A _{peak}	3	3
ST_PMAX	SW.	Continuous overload	120KW for 30secs	3	3
SLIMPRO_L	SW.	Prolonged intervention of second limit protection	SLIM active for t > 10secs.	3	3

c) Temporary Protection

The main characteristics of the protections which generate temporary blocks on the APS Inverter are summarized in Table 10-I-02.24.

Table 10-I-02.24 APS temporary protection

Code	TYPE	Description	Intervention threshold
vFCBKO	SW.	Input voltage exceeds limit	< 400Vdc for t >500ms > 950Vdc for t >500ms
TSWCB	SW.	Inverter module thermo-switch intervention	212.00°F
IVGSKO	SW.	Ventilator switch opened	
PWG	HW.	Supply unit (ALIM) regulation diagnostics	
PSCKO	HW	PSC-04 board internal fault	
AvCk	HW	Switching regulator fault	
TestKO	SW	PSC-04 board self-test KO	
TVFKO	SW	TVF transducer fault	High offset
TACBKO	SW	TACB transducer fault	High offset / no reading
TVBO	SW	TVB transducer fault	High offset / no reading
TACKO	SW	TAC transducer fault	High offset / no reading
TAPKO	SW	TAP transducer fault	High offset / no reading
TABKO	SW	TAB transducer fault	High offset / no reading
INTFCB	SW	FCB fuse intervention	Fuse open (nominal current 68Adc)
ERRFCB	SW	Voltage / FCB fuse status conflict	Auxiliary contact fuse open in the presence of input HV

10-I-02.02.09.03 LVPS Protection

a) Permanent Protection

The main characteristics of the protections which generate permanent blocks on the APS Inverter are summarized in Table 10-I-02.25.

Table 10-I-02.25 LVPS Permanent Protection

Code	TYPE	Description	Intervention threshold	NI	NE
iLCBMax	HW	Battery charger input module overcurrent	202 A	0	3
ST_ILCBMAX	SW	Battery charger input module overcurrent	33 Acc where t>500ms	0	3
CT_BT	SW	LV output short circuit		0	3
intMCA	SW	Active clamp module intervention/diagnostics		0	3
NoPwrCB	SW	No power supply	Around 90W	0	3

b) Memorized Protection

The main characteristics of the protections that produce “memorized” blocks on the LVPS Inverter are summarized in Table 10-I-02.26.

Table 10-I-02.26 LVPS memorized protection

Code	TYPE	Description	Intervention threshold	NI	NE
“vFCBMax”	HW	Battery charger input module over-voltage	1203V	3	3
“iPMax”	HW	Transformer primary overcurrent	225Apeak	3	3
“iOutMax”	HW	Battery charger output overcurrent	670Acc	3	3
“vOutMax”	HW	Battery charger output over-voltage	43 V	3	3
“VFCBMAX”	SW	Battery charger input module over-voltage	1100V	3	3
“IOUTMAX”	SW	Battery charger output overcurrent	427Acc	3	3
“VOUTMAX”	SW	Maximum output voltage	42 V	3	3
“PMAX”	SW	Continuous overload	17KW for 30secs	3	3

c) Temporary Protection

The main characteristics of the protections which generate temporary blocks on the LVPS Inverter are summarized in Table 10-I-02.27.

Table 10-I-02.27 LVPS temporary protection

Code	TYPE	Description	Intervention threshold
“vFCBKO”	SW	Input voltage exceeds limit	< 400Vdc for t >500ms > 950Vdc for t >500ms
“TSWCB”	SW	Inverter module thermo-switch intervention	212°F
“IVGSKO”	SW	Ventilator switch opened	
“PWG”	HW	Supply unit (ALIM) adjustment diagnostics	
“PSCKO”	HW	PSC-04 board internal fault	
“AvCk”	HW	Switching regulator fault	
“TestKO”	SW	PSC-04 board self-test KO	
“TVFKO”	SW	TVF transducer fault	High offset
“TACBKO”	SW	TACB transducer fault	High offset / no reading
“TVBO”	SW	TVB transducer fault	High offset / no reading
“TACKO”	SW	TAC transducer fault	High offset / no reading
“TAPKO”	SW	TAP transducer fault	High offset / no reading
“TABKO”	SW	TAB transducer fault	High offset / no reading
“INTFCB”	SW	FCB fuse intervention	Fuse open (nominal current 68Adc)
“ERRFCB”	SW	Voltage / FCB fuse status conflict	Auxiliary contact fuse open in the presence of input HV

10-I-02.02.09.04 Residential Diagnostic

All diagnostic information, as well as the analog and digital quantities of the system, can be made available in real time through the RS232 interface.

They can also be memorized on non volatile memory for off-line diagnostic investigations.

It is possible to allocate 512 Kbite of non-volatile memory, both on the PSC-04 and the CIA-04 boards (for a total of 1 MB) for recording diagnostic information.

These signals are memorized in a time frame around the fault occurrence, with a number of previous information and a number of later information.

The events that can trip the recording of the diagnostic information on the non volatile memory are defined in the development phase.

All analog and digital information that are acquired by the boards can be memorized.

The boards memorize by default the signals listed in Table 10-I-02.28:

Table 10-I-02.28 Resident Diagnostic Signals

Symbol	Description	Length in bits
DiagCVS	CVS diagnostics code sent on LONWorks BUS containing main diagnostics data and all alarms managed (see 234EE10052B)	64
vFil	Input filter voltage [Vdcx10]	16
iLIVMis	Line current drawn by the inverter [Accx10]	16
iLCBMis	Line current drawn by the battery charger [Accx10]	16
v2RMS	Line-to-line MV output voltage [Vrmsx10]	16
iRrms	R-phase inverter output current [Armsx10]	16
iSrms	S-phase inverter output current [Armsx10]	16
iTrms	T-phase inverter output current [Armsx10]	16
vBatMis	LV output voltage [Vdcx10]	16
iCarMis	Current supplied by the LV output [Accx10]	16
iTCBMis	Current supplied by the battery charger module [Apx10]	16
tAmb	CVS internal temperature [°Cx10]	16
stdoIV	CIA-04 board digital output status	16
stdiIV	CIA-04 board digital input status	16
stIV	Inverter status	16
stdoCB	PSC-04 board digital output status	16
stdiCB	PSC-04 board digital input status	16
stCB	Battery charger status	16
Total		21 words = 42 bytes

The length of the word used by the system is 16-bit. With the exception of the first signal, all the others are one-word signals.

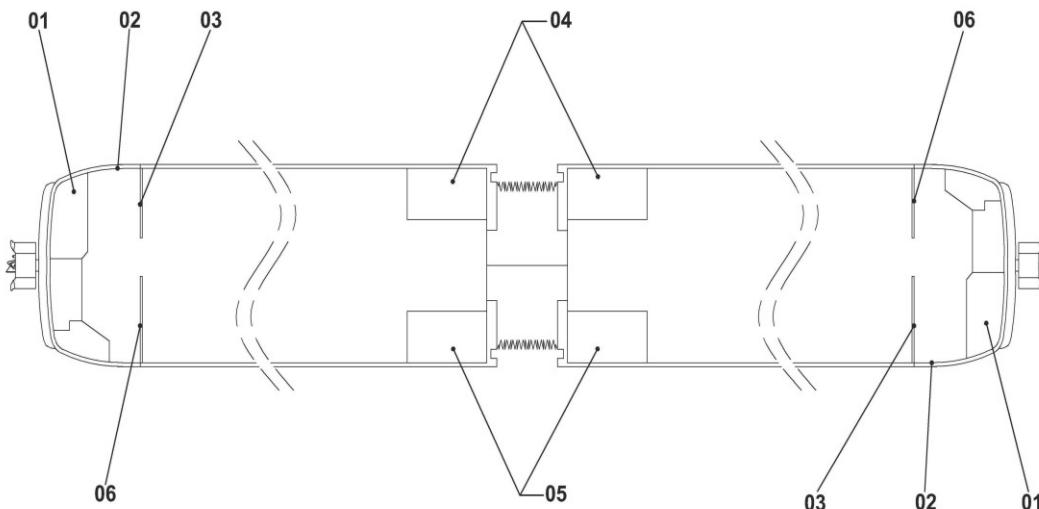
10-I-02.03 Vehicle Electric/Electronic Equipment

The Electronic and Electric Lockers that contain most of the vehicle electrical/electronic equipment are located at the center of the vehicle, on both sides of the aisle.

The two Electronic Lockers, one per vehicle section, are located on the right side of the vehicle, facing cab A, while the two Electric Lockers are located on the left side of the vehicle, as represented in Figure 10-I-02.50. (Refer to 10-I-02.03.01 and 10-I-02.03.02).

Each cab contains:

- LV and MV circuit breaker panels
- A By-pass panel
- An Operator console
- Indicator & Switch Panels



01. CONSOLE

02. BY-PASS PANEL

03. LV CIRCUIT BREAKER PANEL

04. ELECTRONIC LOCKERS

05. ELECTRIC LOCKERS

06. MV CIRCUIT BREAKER PANEL

Figure 10-I-02.50 Electronic and Electric Lockers location

10-I-02.03.01 Electronic Lockers

Two Electronic Lockers contain the electronic equipment meant to supervise and control the vehicle systems and operations.

The Electronic Equipment mounted in the Electronic racks of Car Section "A" are the following (Refer to Figure 10-I-02.52):

- Gateway (GTW) ("A" Car Section only)
- Data Download Panel
- EDU - EMI Detector Unit ("A" Car Section only - refer to Section 09)
- ECUs and ECUs - Brake Electronic Control Unit, for the braking control of the "A" (Motor) and "C" (Center) Trucks (refer to Section 13)
- ATP (Automatic Train Protection System) ("A" Car Section only - refer to Section 15)
- Communications Rack (Railway Devices - refer to Section 14)

The Electronic Equipment mounted in the Electronic racks of Car Section "B" are the following (Refer to Figure 10-I-02.52):

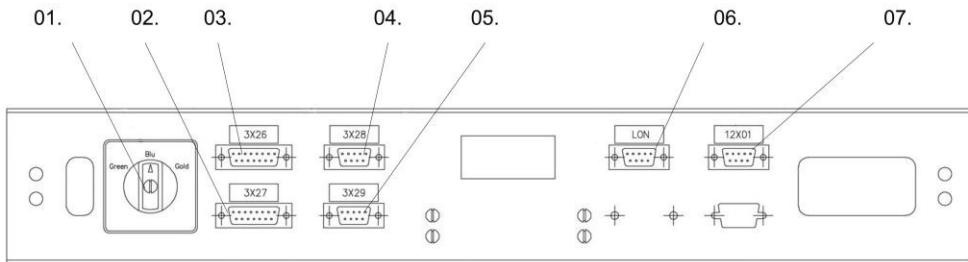
- Data Download Panel
- ECUs - Brake Electronic Control Unit, for the braking control of the "B" (Motor) Truck (refer to Section 13)
- Communications Rack

The GTW is part of the Train Control and Monitoring System - TCMS, together with the Integrated Diagnostic Unit - IDU, located in the Operator's cabs) (refer to Section 18). It manages the flow of data in the WTB, MVB and LONWorks Buses.

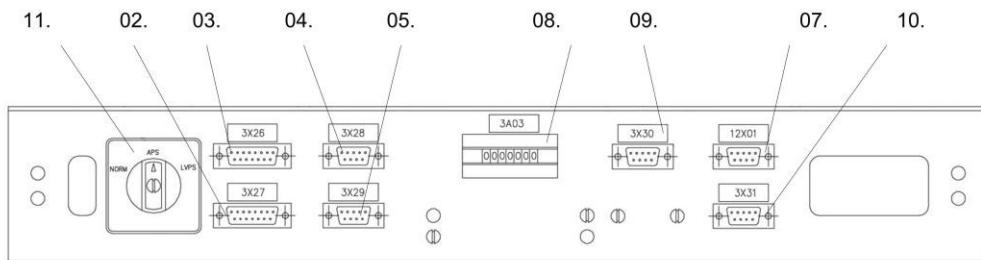
The Data Download panel is housed inside the Rack of the "A" and the "B" Sections. The main purpose of the Data Download Panel (DDP) is to download data from the AnsaldoBreda systems to a laptop computer (PTU) for data analysis.

Figure 10-I-02.51 shows the Data Download panel front components (both for A and B Body Section)

The APS/LVPS Selector defines the APS/LVPS working mode: only the APS functioning, only the LVPS functioning or both.



A BODY SECTION



B BODY SECTION

- | | |
|--|--|
| 01. LINE SELECTOR | 07. (12X01) HVAC CONNECTOR |
| 02. (3X27) PCADAC CONNECTOR (PROPULSION) | 08. ODOMETER DISPLAY |
| 03. ((3X26) FBKDI A CONNECTOR (PROPULSION) | 09. (3X30) JP1P (PSC) CONNECTOR (APS/LVPS) |
| 04. (3X28) PCA232 CONNECTOR (PROPULSION) | 10. (3X31) JP1C (CIA) CONNECTOR (APS/LVPS) |
| 05. (3X29) STB232 CONNECTOR (PROPULSION) | 11. APS/LVPS SELECTOR |
| 06. LONWORKS BUS CONNECTOR | |

Figure 10-I-02.51 Data Download Panels

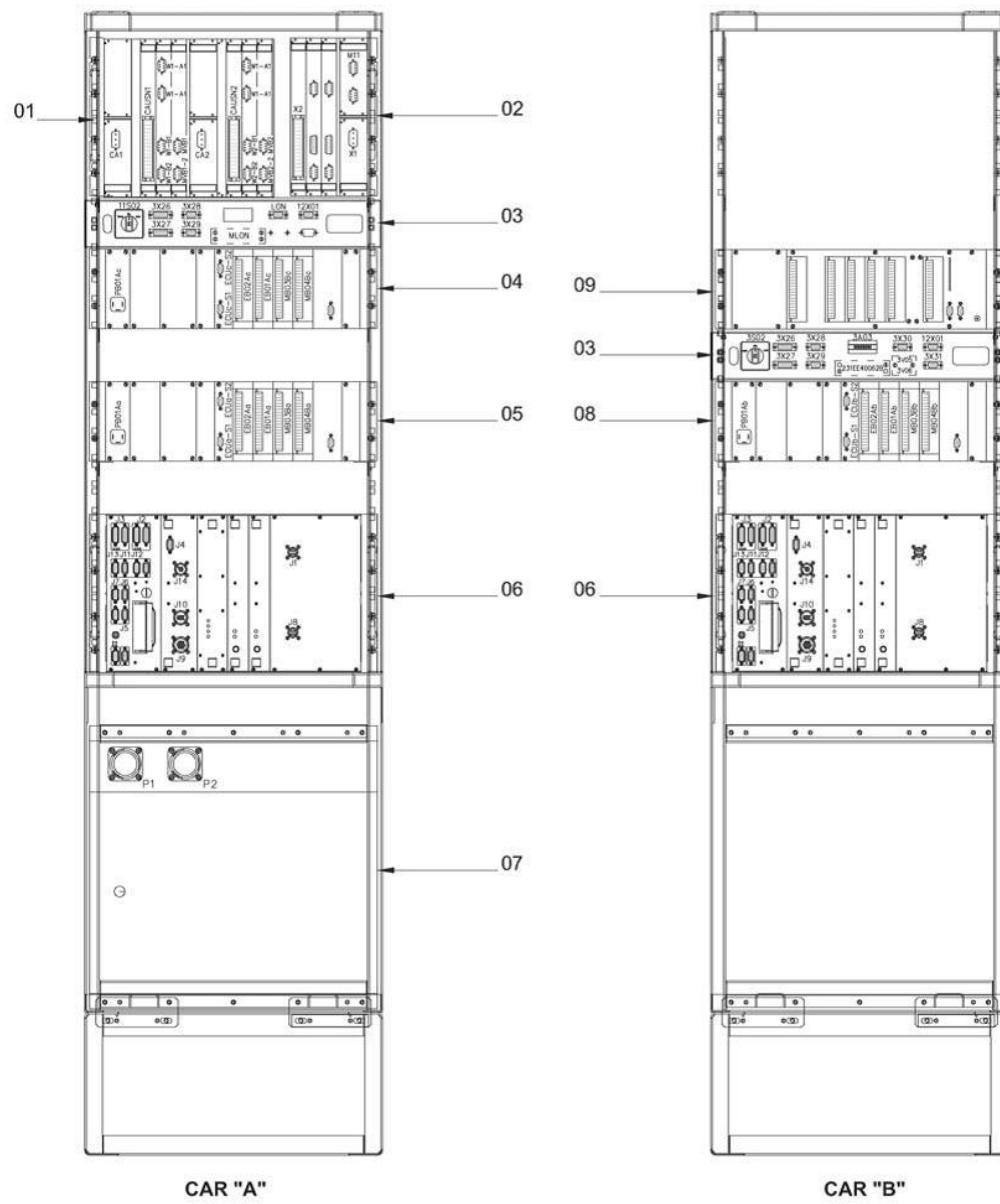
10-I-02.03.02 Electric Lockers

The outputs of the APS and the LVPS are routed from the APS/LVPS System to the two Electric Lockers located in the "A" and "B" Sections, close to the aisle.

The LV goes from the Electric lockers to the vehicle LV Loads.

The Electric Racks (refer to Figure 10-I-02.53 and Figure 10-I-02.54) contain Circuit Breakers, Relays, Terminal Boards, Connectors, Contactors, Diodes and other electronic/electromechanical devices needed to control the loads supplied by the APS/LVPS and all of the operational functions of the vehicle.

The Lockers are made up of a metallic structure, subdivided into shelves and drawers, wherein the devices are housed.



01. GATEWAY
 04. ECU A
 07. ATP RACK

02. EDU
 05. ECU C
 08. ECU B

03. DATA DOWNLOAD PANEL
 06. COMMUNICATIONS RACK
 09. EVENT RECORDER

Figure 10-I-02.52 Electronic Lockers

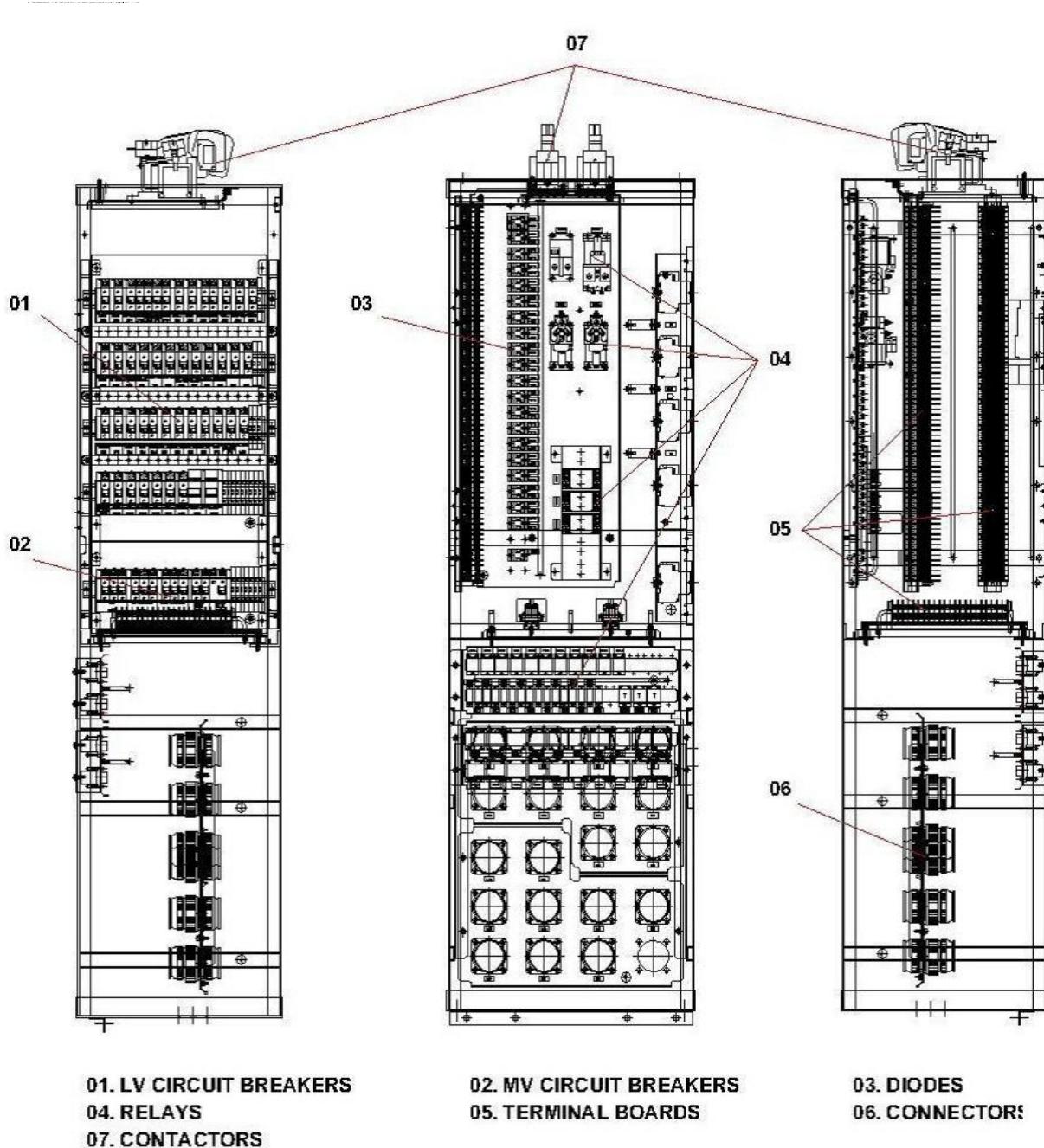


Figure 10-I-02.53 “A” Cab Electric Locker Layout

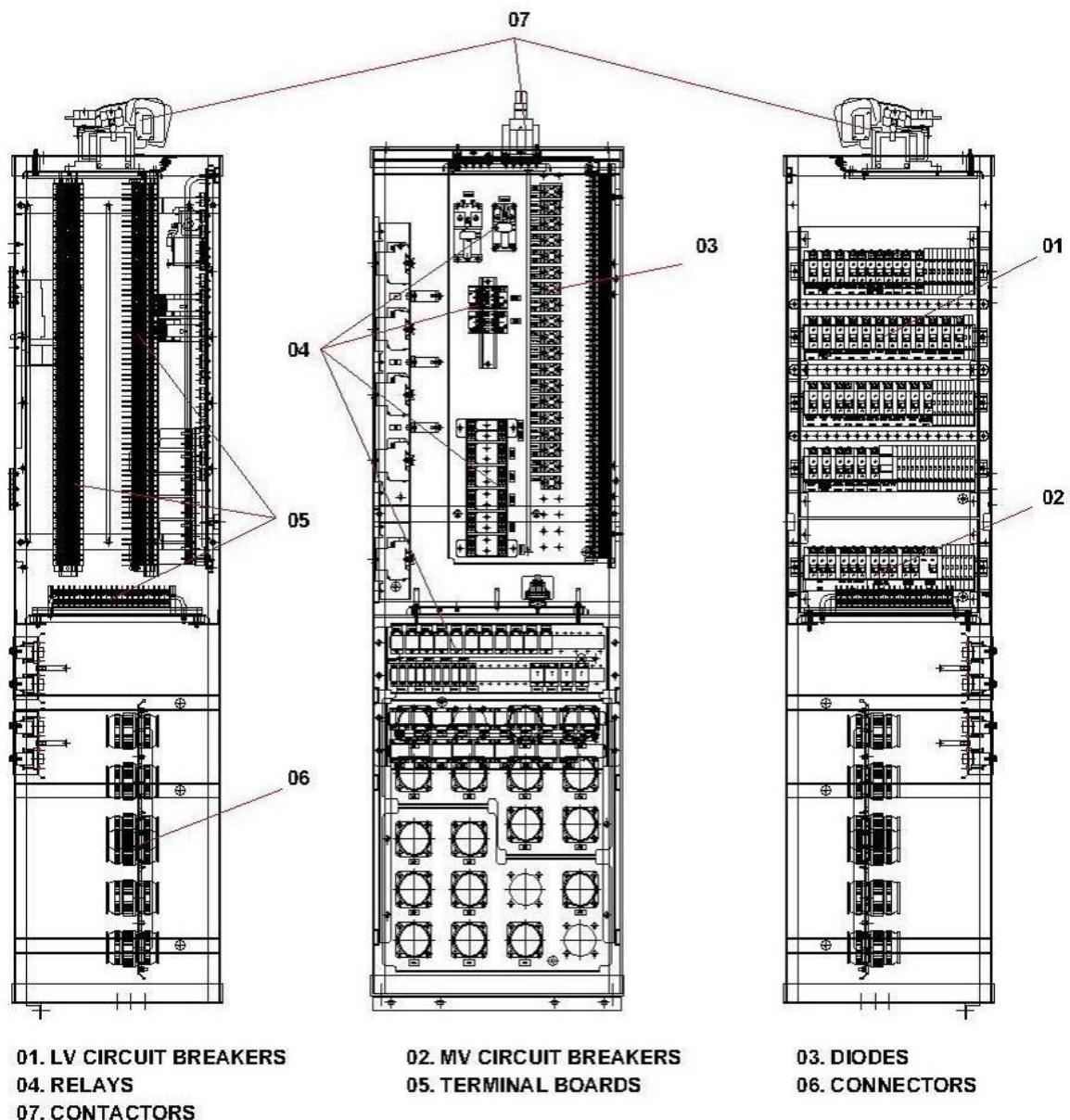


Figure 10-I-02.54 “B” Cab Electric Locker Layout
Table 10-I-02.29 Electric Locker - Circuit Breakers

Label	Description	Locker
02F04	HVAC	A and B
02F05	Air Compressor	A

Table 10-I-02.29 Electric Locker - Circuit Breakers

Label	Description	Locker
02F06	Motor Fan Inverter	A and B
02F09	Exterior Outlets	A and B
02F12	Motor Fan Auxiliary M.V.	B
02F15	Exterior Outlets	A and B
03F03	APS+LVPS Power Supply	B
03F04	APS+LVPS Dead Battery Startup	B
03F07	Cab Enable	A and B
03F09	IDU power Supply	A and B
03F10	Air Compressor Circuit Breaker	A
03F11	Propulsion LV Power Supply	A and B
03F13	Fault Indicators	A and B
03F14	Door & Brake Status Indicator	A and B
03F18	Rate Ref. Encoder Power Supply	A and B
03F19	Status Acquisition	A
03F21	GTW Power Supply	A
03F22	GTW Power Supply	A
03F23	35mph Speed Limit Trainline	A
03F24	Auxiliary No Motion	A and B
03F25	CEMIPS Power Supply Switch	A
03F26	Auxiliary No Motion	A
04F01	HSCB Control	A and B
04F02	1Q02 Hold Coil Switch (HSCB)	A
05F01	Pantograph UP/DOWN	A
05F03	Pantograph UP/DOWN Contactor	A
06F01	Dead Man Control	A
07F01	Supply ECUs	A and B
07F02	Supply ECUs	A
07F04	Supply Track Brake Bogie 1-3	A and B
07F05	Supply Track Brake Bogie 2	A
07F06	Supply Contactor Track Brake Bogie 1-3	A and B
07F07	Supply Contactor Track Brake Bogie 2	A
07F08	Supply Sanders	A and B
07F12	Supply Command Track Brake	A and B

Table 10-I-02.29 Electric Locker - Circuit Breakers

Label	Description	Locker
07F13	Supply Command Sanders	B
08F01	Cab Lighting	A and B
08F03	A Compartment Lighting	B
08F04	B Compartment Lighting	B
08F06	Hazard Lights	A and B
08F07	Direction Indicators	A and B
08F08	Direction Indicators	B
08F09	Direction Indicators	B
08F10	Marker Lights	A
08F13	Silent Alarm Switch	B
08F14	Stop Indicator Lights	A
08F15	Supply Tail Switch	B
08F16	Active By-Pass Lights	B
08F17	8A01 Power Supply	B
08F18	Cabinet Lights	A and B
09F04	First Left Doors Control Unit	A and B
09F05	First Right Door Control Unit	A and B
09F06	Second Left Door Control Unit	A and B
09F07	Second Right Door Control Unit	A and B
09F10	End Train Relay	A and B
09F11	Door Open Loop Circuit	A and B
10F01	Horn & Gong	A and B
10F02	Mirrors and Windshield Wiper and Washer	A and B
10F03	Mirror Adjuster	A and B
11F01	ATP Protection	A
11F02	ATP Display Protection	A and B
11F03	TWC Protection	A
12F01	HVAC Protection	A and B
14F01	Coupler Protection	A and B
14F08	Coupler Protection	A and B

10-I-02.03.03 Operator's Cab Electrical Equipment

Each Cab is equipped with Cab LV and MV Circuit Breaker Panels, a By-Pass Panel, an Operator Console and Indicator and Switch Panels.

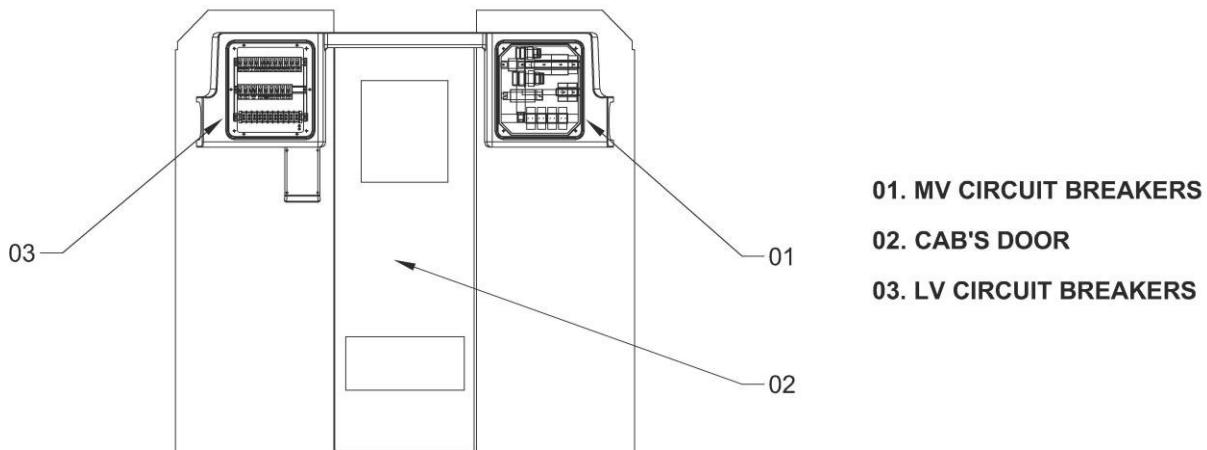


Figure 10-I-02.55 Cab Circuit Breaker Location

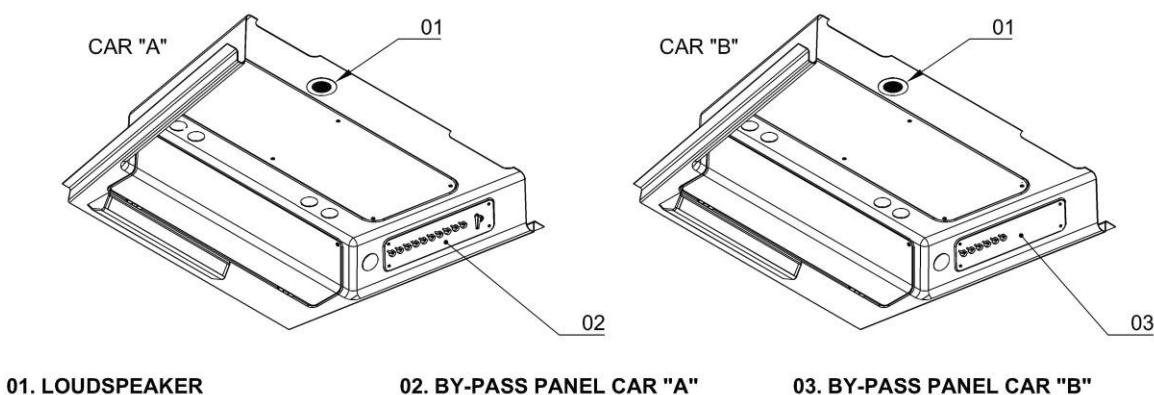


Figure 10-I-02.56 By-Pass Panel

10-I-02.03.03.01 Cab - LV and MV Circuit Breakers

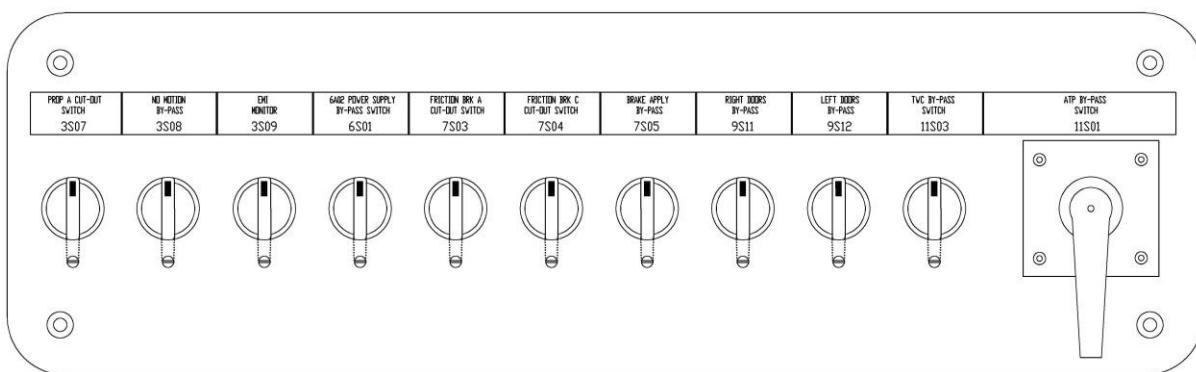
Both the LV and the MV Circuit Breaker Panels are installed behind the Operator's seat, on the Cab dividing wall. The Cab LV and the MV Circuit Breaker Panels are not identical, since the circuits protected are not the same.

Table 10-I-02.30 Cab - LV and MV Circuit Breakers

Label	Description	Cab Panel
02F07	Exterior Outlets	A and B
02F08	Exterior Outlets	A and B
02F11	Windshield Defroster/Demister	A and B
02F13	Exterior Outlets	A and B
02F14	Exterior Outlets	A and B
03F05	Desk Enabling Contactor	A and B
03F06	Cab Enable Contactor	A and B
03F08	Cab Relay	A and B
03F12	Dynamic Brake Cut-Out	A and B
03F20	Master Controller	A and B
05F02	Pantograph Control Motor	A
06F02	6A02 Power Supply	A
06F03	Security Brake Relay	A
07F09	Supply By-Pass Brake System	A and B
07F14	Supply Valve BCU	A and B
07F15	Supply Valve BCU	A
08F02	Compartment Lighting	B
08F05	Emergency Lighting	B
08F11	Headlights	A and B
08F12	Roof Headlight	A and B
09F02	Supply Command Doors	A and B
09F08	Emergency CB for Doors	A
09F09	Door Closed Loop Circuit	A and B
10F04	Defroster	A and B
10F05	Defroster / Demister Motor Protection	A and B
12F02	HVAC Protection	A and B
13F01	Communication System Protection	A and B
13F02	13K01 Protection	A and B
13F03	Signs Protection	A and B

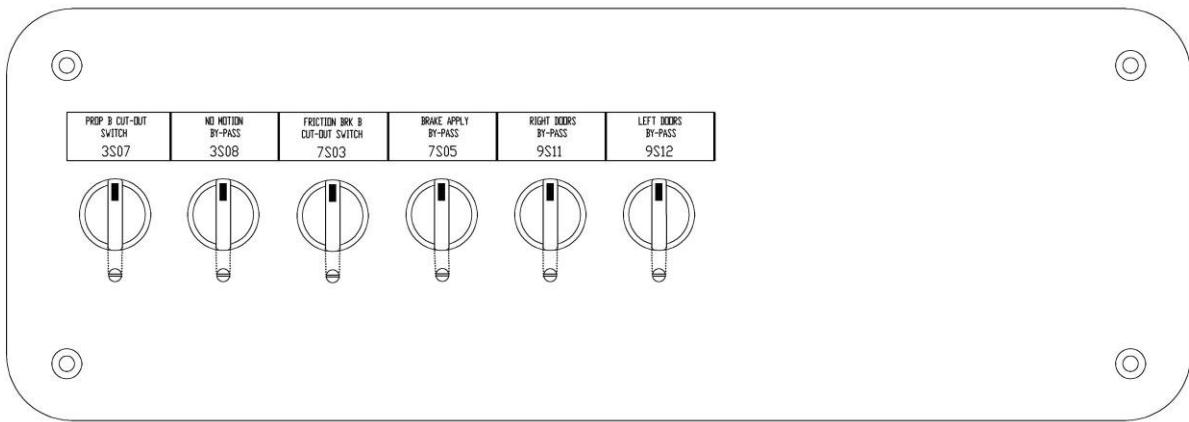
10-I-02.03.03.02 “A” Cab - By-pass panel
Table 10-I-02.31 Cab “A” - By-pass panel

Nr	Label	Description
1	3S07	TCU Cut-out Switch
2	3S08	No-motion By-pass
3	3S09	EM Monitor
4	6S01	6A02 Power Supply By-pass Switch
5	7S03	By-pass ECUs/b Switch
6	7S04	By-pass ECUs/c Switch
7	7S05	Brake Apply By-pass
8	9S11	Right Doors By-pass
9	9S12	Left Doors By-pass
10	11S03	TWC By-pass Switch
11	11S01	ATP By-pass Switch


Figure 10-I-02.57 “A” Cab - By-pass panel

10-I-02.03.03.03 “B” Cab - By-pass panel
Table 10-I-02.32 “B” Cab - By-pass panel

Nr	Code	Description
1	3S07	TCU Cut-out Switch
2	3S08	No-motion By-pass
3	7S03	By-pass ECUs/a/b Switch
4	7S05	Brake Apply By-pass
5	9S11	Right Doors By-pass
6	9S12	Left Doors By-pass


Figure 10-I-02.58 “A” Cab - By-pass panel

10-I-02.03.04 Operator Console

The Operator's Console contains all Controls, switches and indicators necessary to the driver to operate safely and to have the essential information needed for normal and emergency operation of the vehicle or the train consist.

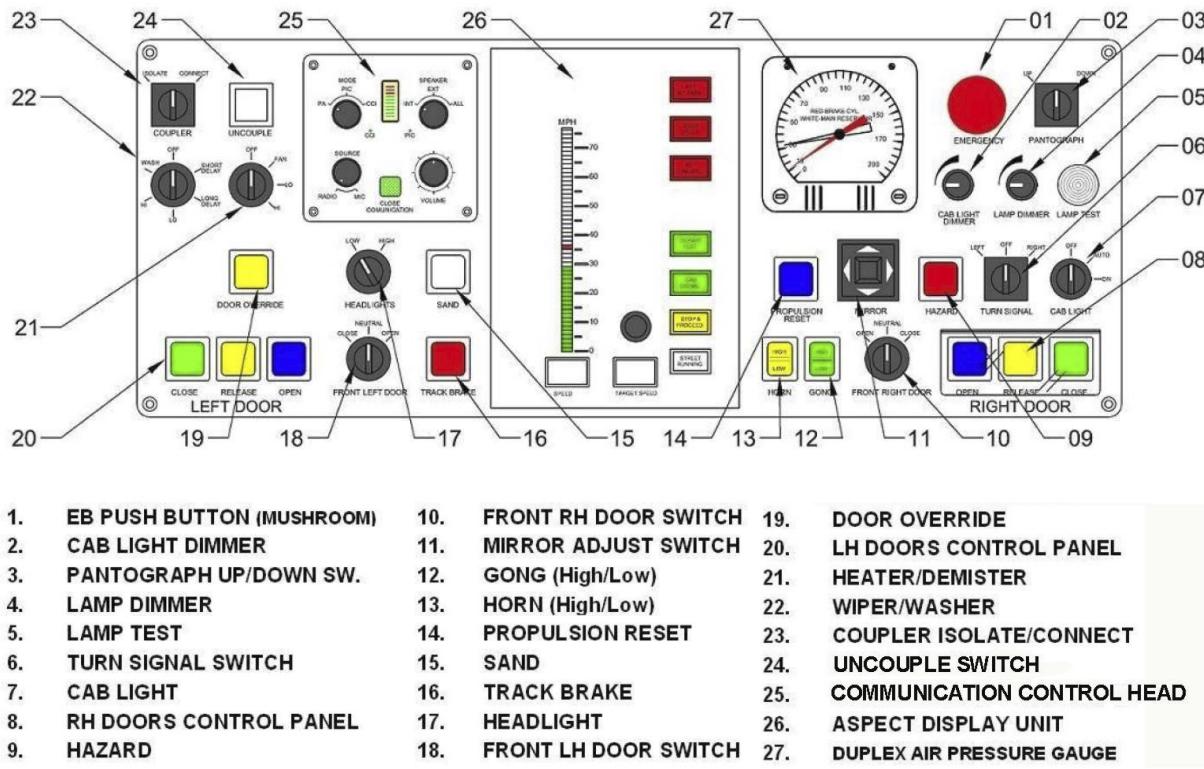
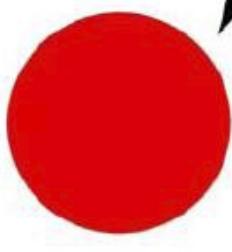
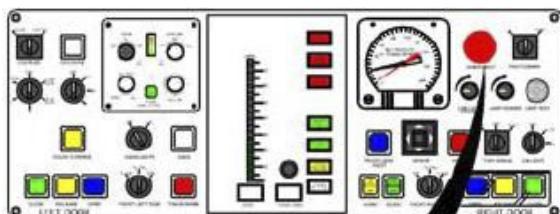


Figure 10-I-02.59 Operator's Console Overview

10-I-02.03.04.01 Emergency Brake Pushbutton (Panic Button)



EMERGENCY

The EB pushbutton (red) is used to stop the vehicle/train consist in emergency.

It has two positions: up (rest position) and down, when activated.

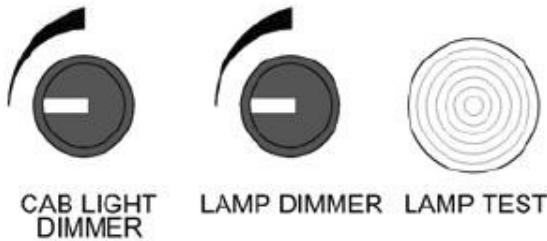
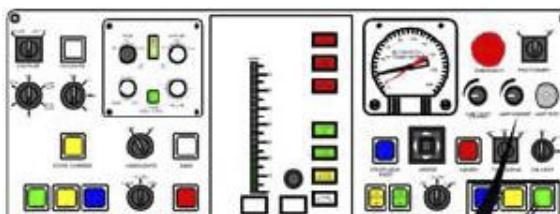
When pushed it activates the emergency braking of the vehicle/train consist.

The relevant sound alarm is also activated (from the activation of Track Brakes).

To set the PB back to its rest position after an emergency stop, the vehicle must be stopped, the Master Controller handle must be in FSB position and then the Operator must rotate the EB pushbutton, spring loaded to stay up, counterclockwise.

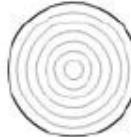
EB Pushbutton Label: 6S03.

10-I-02.03.04.02 Cab Light Dimmer, Lamp Light Dimmer, Lamp Test



CAB LIGHT
DIMMER

LAMP DIMMER



The Cab Light Dimmer (black knob) is used To adjust the luminous intensity of the Cab light.

The Lamp Light Dimmer (black knob) is used to adjust the luminous intensity of the Console Lamp lights.

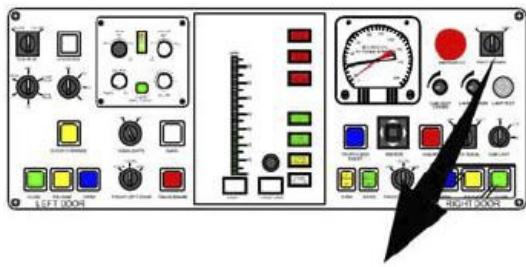
The Lamp Test pushbutton is used to test the Console Lamp lights, the TWC and the ADU indicators and displays.

Cab Light Dimmer Label: 8R01.

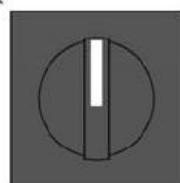
Lamp Dimmer Label: 3R01.

Lamp Test Pushbutton Label: 3S04.

10-I-02.03.04.03 Pantograph Switch



UP DOWN



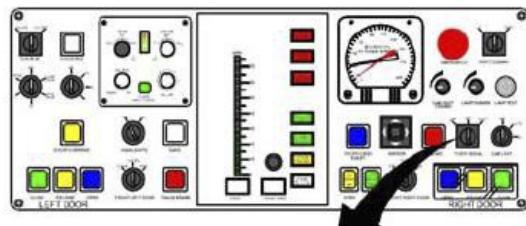
PANTOGRAPH

This two momentary (UP - DOWN) and one stable (neutral) position switch is used to raise or lower the pantograph from the console.

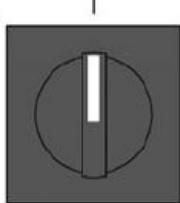
The switch can be operated from the lead cab only.

Pantograph Switch Label: 5S01.

10-I-02.03.04.04 Turn Signal



LEFT OFF RIGHT



TURN SIGNAL

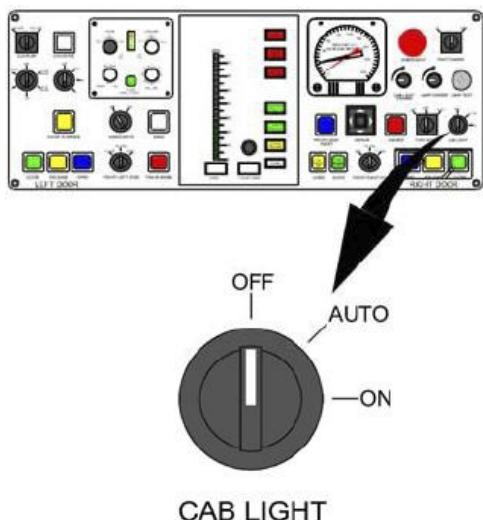
The Turn Signal switch (black knob) is a three stable position switch used to signal a right or left turn of the vehicle traveling in street-running mode.

It can be used only with Transfer Switch ON and Reverser Switch in Forward.

The turn signal is trainlined.

Turn Signal Switch Label: 5S01.

10-I-02.03.04.05 Cab Light



The Cab light three position switch is used to turn the Cab lights ON or OFF.

The "Auto" position makes the cab lights turn on when the cab is enabled.

Cab Light Label: 8S01.

10-I-02.03.04.06 RH Door Open, RH Door Release

The RH Door Open pushbutton (blue) opens all the RH doors.

The RH Door Open PB is usually protected by a rigid cover in order to avoid unwanted operations on the button itself.

The door opening also depends on the train speed (no-motion to allow door opening) and the train position (when ATP system is ON).

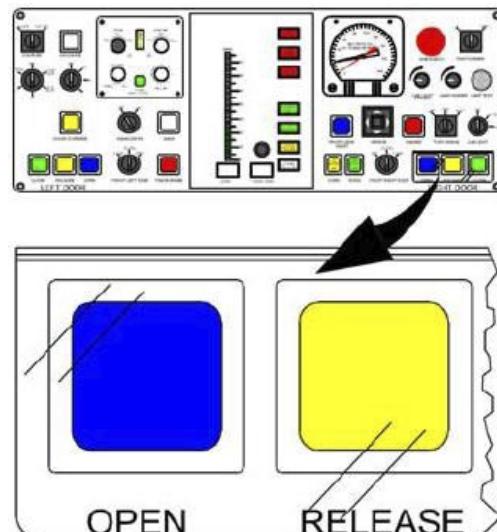
The RH Door Open signal is trainlined.

The RH Door Release pushbutton (yellow) unlocks all the RH doors in order to allow passengers to open any of them by pressing the relevant "Door Open" pushbutton.

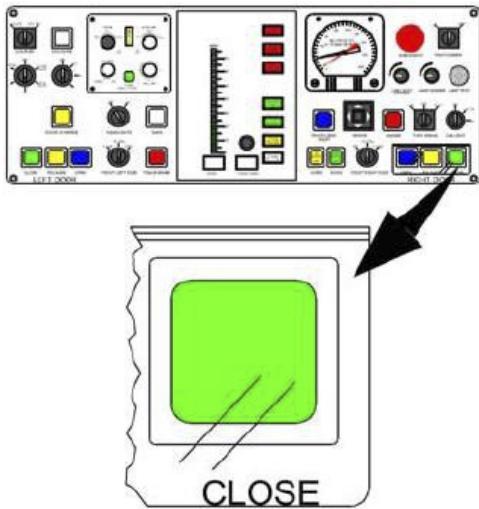
After a door has been opened by a passenger it closes automatically after a preset time interval or it can be closed by the Operator by means of the "Close" pushbutton.

The RH Door Release PB is usually protected by a rigid cover in order to avoid unwanted operations on the button itself.

The RH Door Release signal is trainlined. RH Open Pushbutton Label: 9S05. RH Door Release Pushbutton Label: 9S04.



10-I-02.03.04.07 RH Door Close



The RH Door Close pushbutton (Green) closes the RH doors.

The close command is delayed in order to give passengers time to exit the train.

As soon as the pushbutton is pressed a chime sounds until the associated door is closed.

As soon as any door is unlocked, open or released, the Door Open lamp associated with that door and located above it illuminates.

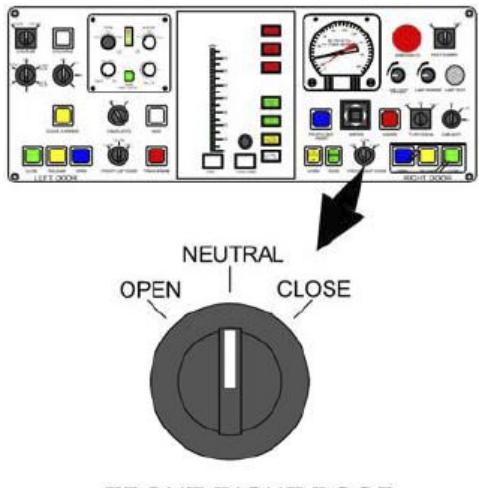
The Warning light (ADA lamp) located on top of each doorway flashes before opening and stays illuminated during the closing operation.

The RH Door Close PB is normally protected by a rigid cover in order to avoid unwanted operations on the button itself.

The RH Door Close signal is trainlined.

RH Door Close Pushbutton Label: 9S06.

10-I-02.03.04.08 Front RH Door

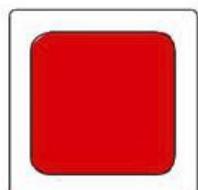
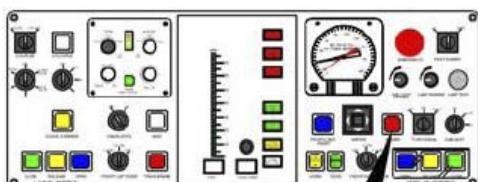


The Front RH Door switch (black knob) operates the RH Front Door (Door A1/A2 if operating from the "A" Cab, or Door B1/B2 if operating from the "B" Cab).

Front RH Doors can be operated by the Operator by means of the Front RH Switch or, from the outside, by means of the Crew Key and the Crew Switch, located at the left side of each Front Door.

Front RH Door Switch: 9S07.

10-I-02.03.04.09 Hazard



HAZARD

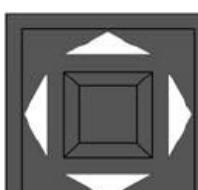
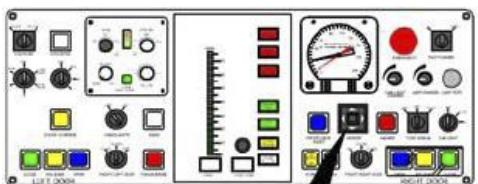
When pressed, the Hazard pushbutton (red) makes all turn lights flash at the same time, together with the pushbutton light itself and the turn signal indicator lights.

To operate the Hazard lights the Transfer switch must be set to ON.

The Hazard signal is trainlined.

Hazard Trainline Pushbutton Label: 8S04.

10-I-02.03.04.10 Mirror Adjuster



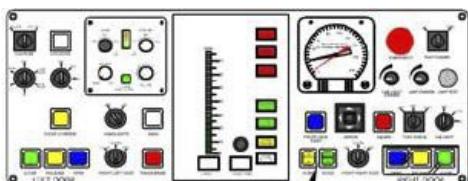
MIRROR

The Mirror adjuster switch controls the position of the (electrically operated) external mirrors.

After having selected the mirror to be adjusted by means of the switch in the center, the selected mirror can be oriented as required by pressing the four arrows (UP, DOWN, RIGHT, LEFT) of the switch, to get the correspondent movement of the mirror.

Mirror Adjuster Switch Label: 10S05.

10-I-02.03.04.11 Horn, Gong



The Horn pushbutton (yellow) has two positions (High and Low).

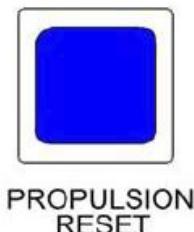
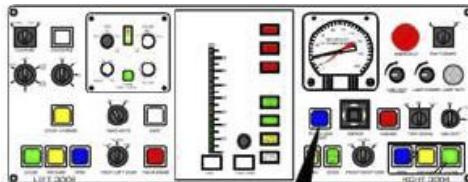
It operates the horn and makes the high beam headlights (not the roof headlight) flash alternatively.

The Electromechanical Gong pushbutton (green) activates the electromechanical gong, has two positions (High and Low) and makes the high beam headlights (not the roof headlight) flash alternatively.

Horn Pushbutton Label: 10S01.

Gong Pushbutton Label: 10S02.

10-I-02.03.04.12 Propulsion Reset



The Propulsion Reset PB (blue) shall be used every time the "HSCB open" indicator on the Indicators Panel "B" is lit.

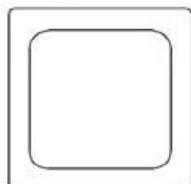
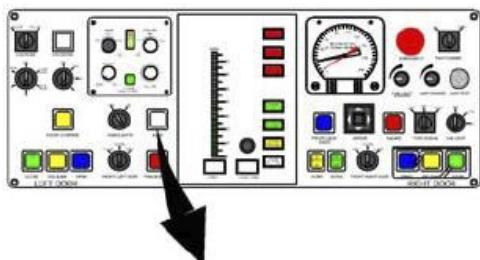
Same Train Systems send a command that opens (lock-out) the HSCB to protect the propulsion system every time the Transfer Switch is set to OFF or a major fault (Line Overcurrent, Filter Overvoltage, Ground Fault, IGBT Phase Module failure, EMI Alarm detection...) is detected or minor faults are detected to happen too frequently (refer to Section 09).

The Propulsion reset PB resets all HSCBs in the train consist.

To reset the system the Master Controller Handle must be in FSB position.

Propulsion Reset Pushbutton Label: 3S06.

10-I-02.03.04.13 Sanding Command



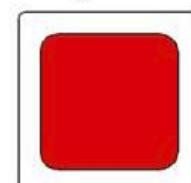
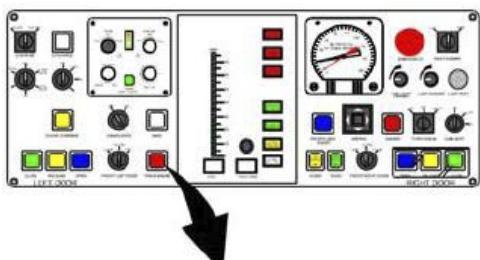
SAND

Momentary position PB (white) used to intentionally drop sand in front of the forward (in the direction of the train) couple of wheels of each vehicle in the consist.

It can be operated from the lead cab only.
The Sanding command signal is trainlined.

Sand Pushbutton Label: 7S01.

10-I-02.03.04.14 Track Brake



TRACK BRAKE

By keeping the Track Brake momentary position PB (red) pressed the track brakes of the entire train consist are activated and the indicator light (red) on the Indicators' Panel "A" turns ON.

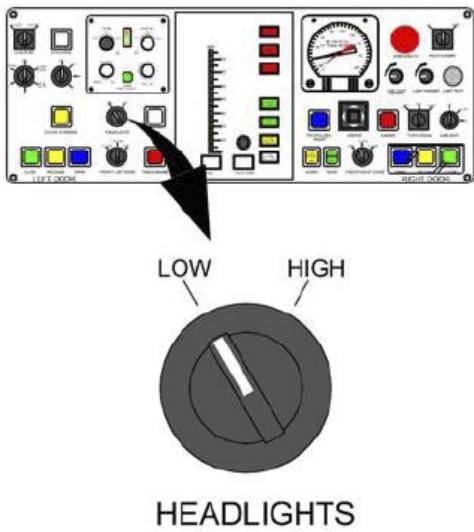
With the Track Brake PB pressed, a continuous tone alarm (Track Brake buzzer, on the ceiling of the Operator's cab) is activated (Label: 7H01).

Track Brakes can only be activated from the controlling cab.

The Track Brakes command is trainlined, therefore every time a Track Brake command is given, ALL Track Brakes in a Train consist are activated.

Track Brake Pushbutton Label: 7S02.

10-I-02.03.04.15 Headlights



Two-position switch (black knob) HIGH and LOW, that controls the train consist Front Head Lights (lead cab):

- HIGH position: High beam Front Head
- Lights of the lead vehicle front cab are ON. With the Head lights switch in this position, the relevant warning indicator (blue) on the Indicators' Panel "A" is ON
- LOW position: Low beam Front Head lights of the lead vehicle front cab are ON

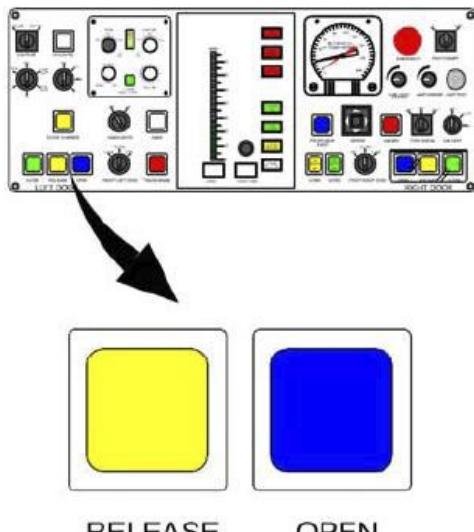
The High beam Front Head Lights flash automatically every time Horn or Gong are operated.

The Roof Head light of the lead cab stays ON as long as the vehicle is keyed up.

With TS in LOCAL, Headlights (together with tail lights and marker lights) will not be ON.

Headlights Switch Label: 8S02.

10-I-02.03.04.16 LH Door Open, LH Door Release



The LH Door Open pushbutton (blue) opens all the LH doors.

The LH Door Open signal is trainlined.

The LH Door Release pushbutton (yellow) releases all the LH doors in order to allow passengers to open any of them by pressing the Door Open pushbutton.

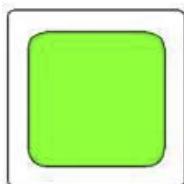
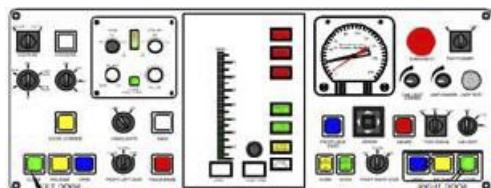
After a door has been opened by a passenger, it closes automatically after 30 seconds or it can be closed by the Operator by means of the "Close" pushbutton.

The LH Door Release signal is trainlined.

LH Open Pushbutton Label: 9S02.

LH Door Release Pushbutton Label: 9S01.

10-I-02.03.04.17 LH Door Close



CLOSE

The LH Door Close pushbutton (Green) closes the LH doors.

The close command is delayed in order to give passengers time to exit the train.

As soon as the pushbutton is pressed a chime sounds until the associated door is closed.

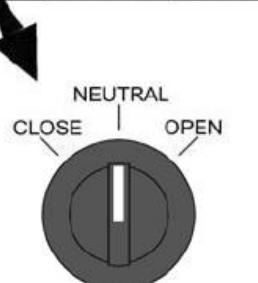
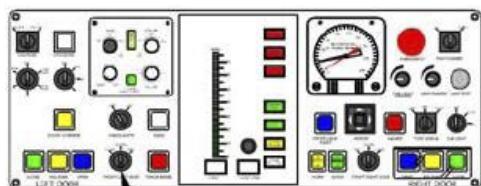
As soon as any door is unlocked, open or released, the Door Open lamp associated with that door and located above it illuminates.

The Warning light (ADA lamp) located on top of each doorway flashes before opening and stays illuminated during the closing operation.

The LH Door Close signal is trainlined.

LH Door Close Pushbutton Label: 9S03.

10-I-02.03.04.18 Front LH Door



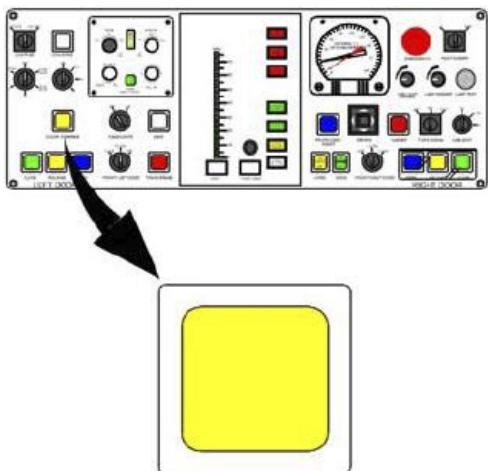
FRONT LEFT DOOR

The Front LH Door switch (black knob) operates the LH Front Door (Door #A7/A8 if operating from the Cab in Car "A", or Door B7/B8 if operating from the Cab in Car "B").

All Front LH Doors can be operated by the Operator by means of the Front LH Switch or, from the outside, by means of the Crew Key and the Crew Switch, located at the left side of each Front Door.

LH Front Door Switch Label: 9S09.

10-I-02.03.04.19 Door Override Pushbutton



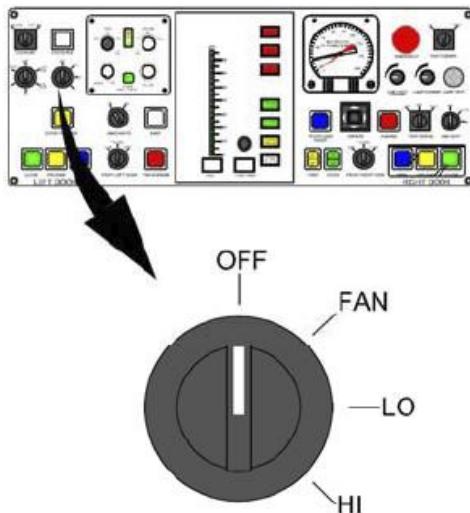
The Door Override Pushbutton (yellow) releases doors when disabled by the ATP system.

By using the Door Override PB, the Operator takes full responsibility of door opening and must act under strict MTA operating rules.

Door Override Pushbutton Label: 9S13.

DOOR OVERRIDE

10-I-02.03.04.20 Heater/Demister Switch



The Heater/Demister Switch (black knob) is a fourposition (OFF, FAN, LO, HI) knob for managing the Cab Heater/Demister.

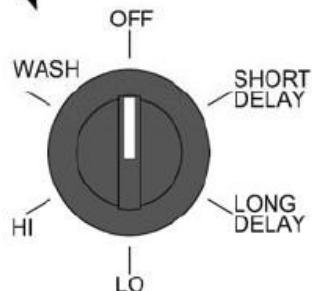
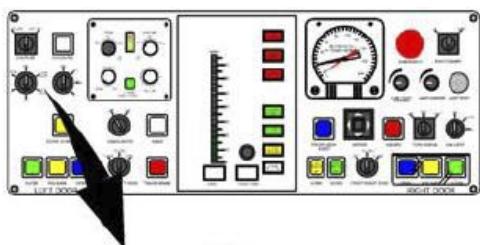
In FAN position it simply re-circulates the air with no heating switched on.

In LO position only one of the resistances is switched on and fan speed is low.

In HI position both resistances are switched on and fan speed is high.

Heater/Demister Switch Label: 10S06.

10-I-02.03.04.21 Wiper/Washer



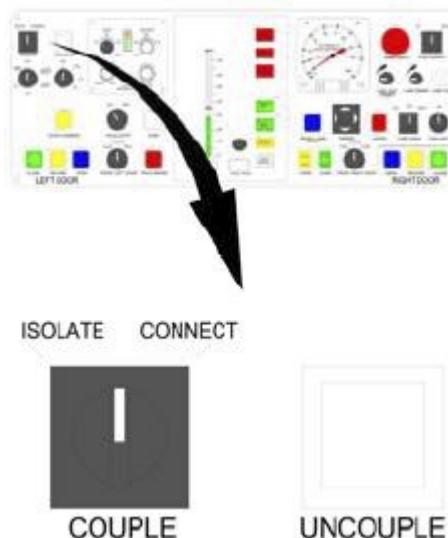
The Wiper/Washer Knob is a six positions switch with 1 momentary position for the WASH command and five stable positions for OFF, Long and Short Delay (for wiper timed operation adjustment) , LO and HIGH (for wiper speed operation adjustment) positions.

The Wiper/Washer Switch Label: 10S04.

10-I-02.03.04.22 Coupler Commands

The Coupler Control Panel includes all coupler's controls.

- ISOLATE/CONNECT switch (black knob): it electrically isolates/connects all train-line electric pins on coupler heads (LH and RH). It is a three position switch, one stable position (OFF) and two momentary positions (Isolate and Connect). For coupling, the switch must be turned to CONNECT. For uncoupling, the switch must be turned to ISOLATE position (refer to Section 4 for coupling/uncoupling operations).
- Uncouple PB (white): it is a one momentary position pushbutton. By pressing the pushbutton the mechanical uncoupling operation is started. It can be operated as soon as the drum switch has been turned to the uncoupled position (refer to Section 4 for coupling/uncoupling operations) and immediately after the coupler has been buffed.



Coupler Switch Label: 14S04.

Uncouple Pushbutton Label: 14S05

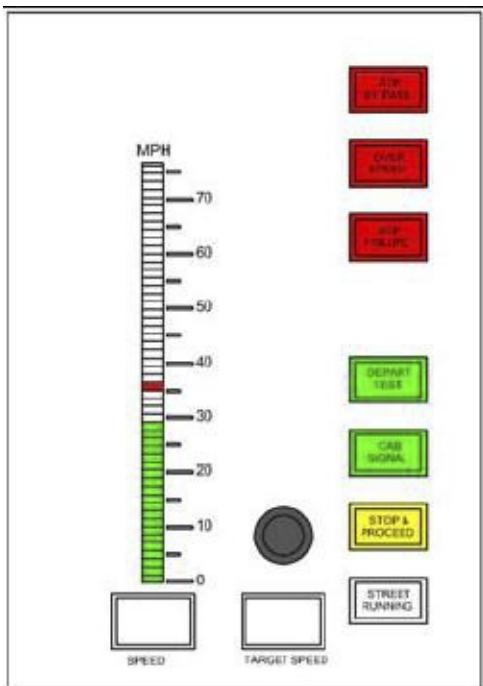
10-I-02.03.04.23 CCH (Communication Control Head)



The Communication Control Head (CCH) interfaces the Communication System with the Operator.

Refer to Section 14.

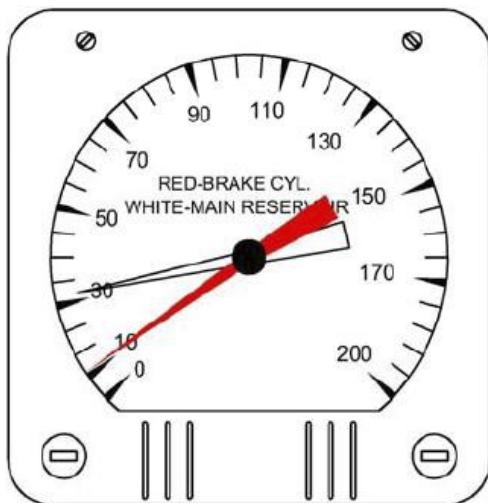
10-I-02.03.04.24 ADU (Aspect Display Unit)



The Aspect Display Unit (ADU) interfaces the ATP System with the Operator.

Refer to Section 15.

10-I-02.03.04.25 Dual Pressure Gauge

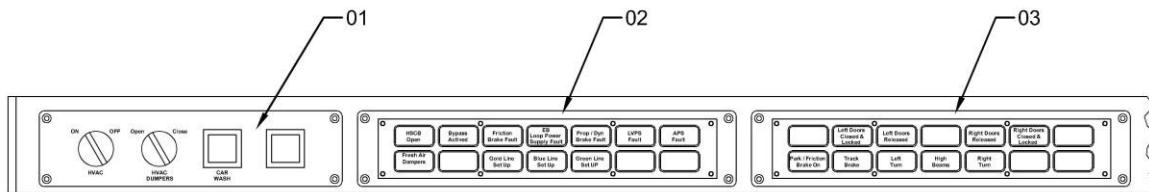


Located in the Operator Console, the Dual Pressure Gauge shows the two most important parameters of the Pneumatic System:

- Red Needle: Brake Cylinder air pressure
- White Needle: Main Reservoir air pressure

Refer to Section 13.

10-I-02.03.05 Indicator and Switch Panels



01. INDICATOR & SWITCH PANEL

02. INDICATOR PANEL "B"

03. INDICATOR PANEL "A"

Figure 10-I-02.60 Indicator and Switch Panels

One Indicator & Switch Panel and two Indicator Panels ("A" and "B") are placed overhead, at the top of the windshield.

They show the state of all major vehicle systems. Indicators are LED displays. Each indicator turns ON whenever the indicated condition occurs in a train consist and stays ON as long as the condition is in effect.

Colors of indicators represent the condition of the relevant system:

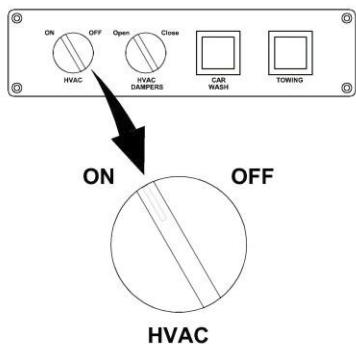
- **Green**: indicates a normal operation and/or a safe condition
- **Amber**: indicates a critical or abnormal operation condition
- **Red**: indicates a system fault and/or an unsafe condition

10-I-02.03.05.01 Indicator & Switch Panel (LH Side Panel)

It contains the following indicators/switches:

- HVAC ON-OFF SWITCH
- HVAC DAMPERS OPEN-CLOSE SWITCH
- CAR WASH MODE SWITCH
- TOW MODE SWITCH

a) HVAC ON-OFF Switch



It makes the Train Consist HVACs begin the starting/stopping process.

The HVAC ON-OFF signal is trainlined.

HVAC ON-OFF Switch Label: 12S01.

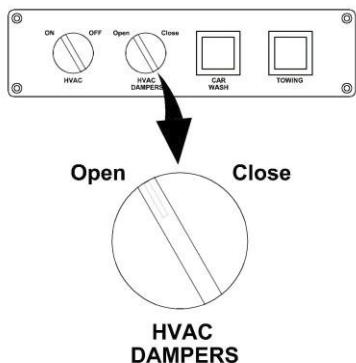
b) HVAC Dampers Open-Close Switch

It's a two-position switch which makes the Train Consist HVAC Dampers open or close.

When the dampers are closed a lamp on Indicators' Panel B illuminates the yellow indicator "Fresh Air Dampers Closed".

The purpose of this switch is to prevent smoke coming from the outside get into the passenger compartment.

The HVAC Dampers Open-Close signal is trainlined.



HVAC Dampers Open-Close Switch Label: 12S02

c) Car Wash Switch

To apply the Car Wash Mode MC Handle must be in FSB position and the Train Speed under the No-Motion speed threshold.

In Car Wash Mode speed will be controlled by the TCU and will be limited to 1.5 mph, compatible with the car-wash system.

The braking and coast can be obtained, as usual, by moving the Master Controller Handle to braking or Coast, respectively.

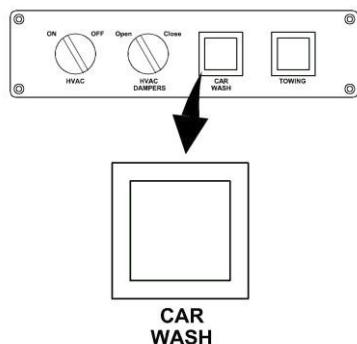
The Car Wash Mode signal is sent to the relevant TCU and, through it, to the other TCUs on the train through the MVB and the WTB buses.

To exit Car Wash Mode, the vehicle must be stopped and the MC handle must be in FSB.

The Car Wash Mode must be used also for coupling and uncoupling operations.

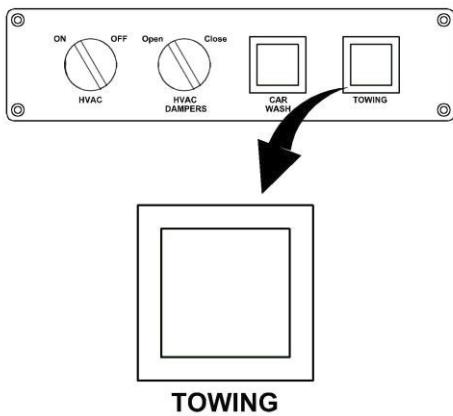
Input from Car Wash mode is also sent to the ATP that will supervise and enforce a speed limit of 5mph.

The ATP will provide overspeed protection in case of failure of the TCU to properly adjust the speed. The speed limit of 5mph is displayed on the ADU.



Car Wash Switch Label: 3S05.

d) Tow Mode Switch



The Tow Mode switch is meant to be used for towing a stranded or dead vehicle uphill.

There is no need to use the Tow Mode for towing a vehicle on level ground.

To start the TOW mode, the vehicle must be stopped with the Master Controller handle in FSB and the Tow Mode PB must be pressed for two seconds.

The Tow Mode signal is sent to the relevant TCU and, through it, to the other TCUs on the train through the MVB and the WTB buses.

By pressing the Tow Mode PB, the Operator makes the Propulsion System increase its torque by 20%.

To avoid overheating of the Inverters, the Tow Mode cannot be kept for long and the speed should be limited to 35 mph, to consider the increased weight and the relevant braking effort required in this condition.

To exit the Tow Mode, the vehicle must be stopped and the MC handle in FSB and the Tow Mode PB must be pressed.

Tow Mode Switch: 3S03.

10-I-02.03.05.02 Indicator Panel “A” (Central Panel)

a) Right Doors Closed & Locked, Right Doors Released

The “Right Doors Closed and Locked” indicator (green) is ON when all Right Doors are closed and locked.

If the “Right Doors Closed & Locked” indicator is not illuminated, the Operator must verify which door is still open from the external mirror and/or from the IDU.

Right Door Closed signal is trainlined.

The “Right Doors Released” indicator (yellow) is ON when all doors on the right side are released.

Right Door Released signal is trainlined.

Right Doors Released Lamp Label: 3H14

Right Doors Closed and Locked Lamp Label: 3H13.

b) Left Doors Closed And Locked, Left Doors Released

The “Left Doors Closed and Locked” indicator (green) is ON when all Left Doors are closed and locked.

If the “Left Doors Closed & Locked” indicator is not illuminated, the Operator must verify which door is still open from the external mirror and/or from the IDU.

Left Door Closed signal is trainlined.

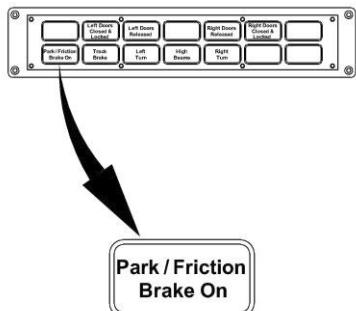
The “Left Doors Released” indicator (yellow) is ON when all doors on the right side are released.

Left Door Released signal is trainlined.

Left Doors Released Lamp Label: 3H16

Left Doors Closed and Locked Lamp Label: 3H15.

c) Park/Friction Brake On (red)

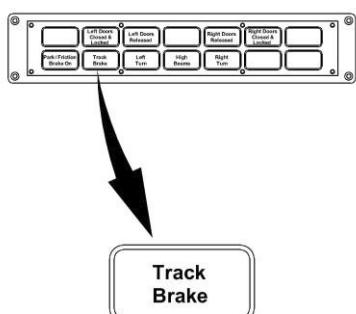


When illuminated it indicates that all Friction brakes and/or Park brakes of the train are applied.

Friction Brake Applied signal is trainlined.

Park/Friction Brake Lamp Label: 3H20.

d) Track Brake (red)



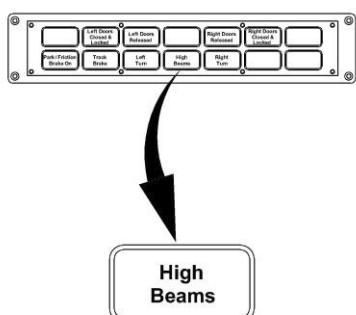
When illuminated it indicates that the track brakes are activated.

The Track Brakes indicator light will turn ON:

- By pressing the Track Brake PB
 - By setting the Master Controller Handle to HRSB or SCEB with speed >1.24mph
 - When the ATP requests an EB.
- The Track Brake signal is trainlined

Track Brake Lamp Label: 3H22.

e) High Beam (blue)

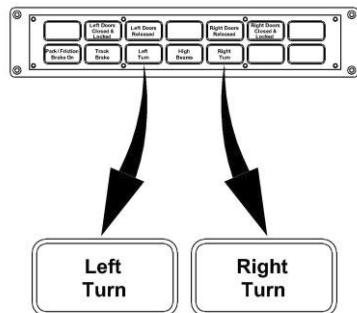


When illuminated it indicates that the Headlight switch on the Console has been turned to High Beam position.

The High Beam signal is local.

High Beams Lamp Label: 8H02.

f) Left Turn (green), Right Turn (green)



When illuminated they indicate that the Turn Signal switch on the Console has been turned to the left or right position.

Left and Right Turn signals are trainlined.

CAB_A:

Left Turn Lamp Label: 8H04.

Right Turn Lamp Label: 8H03.

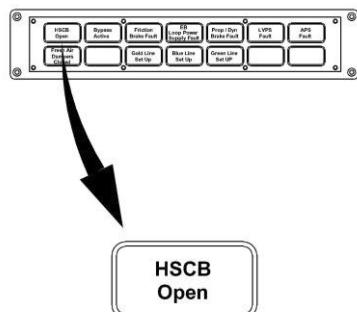
CAB_A:

Left Turn Lamp Label: 8H03.

Right Turn Lamp Label: 8H04.

10-I-02.03.05.03 Indicators Panel "B" (RH Side Panel)

a) HSCB Open (red)

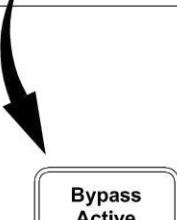


When illuminated it indicates that the High Speed Circuit Breaker is OPEN and no current is flowing from the pantograph.

HSCB Open signal is trainlined.

HSCB Open Lamp Label: 3H06.

b) By-Pass Active (red)



When illuminated it indicates that any by-pass switch on the vehicle/train consist is activated.

By-Pass Active signal is trainlined.

Bypass Active Lamp Label: 3H22.

c) Friction Brake Fault (red)



When illuminated it indicates a fault in one of the ECUs.

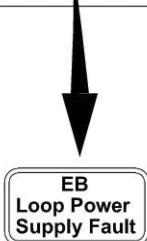
When the ECU is cut-out the lamp is OFF.

The ATP receives a Speed limit signal and limits the speed to 10mph.

The Friction Brake Fault signal is trainlined.

Friction Brake Fault Lamp Label: 3H09.

d) EB Loop Power Supply Fault (red)

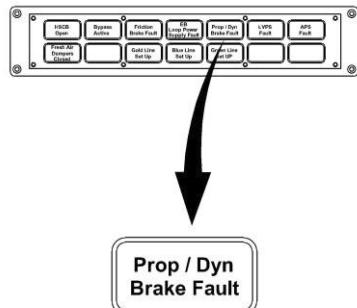


When illuminated it indicates that the Emergency Braking loop (DC/DC converter) is open.

The EB Loop Power Supply Fault signal is local since it refers to the EB Loop Power Supply Fault DC/DC converter on the relevant vehicle.

EB Loop Power Supply Fault Lamp Label: 3H24.

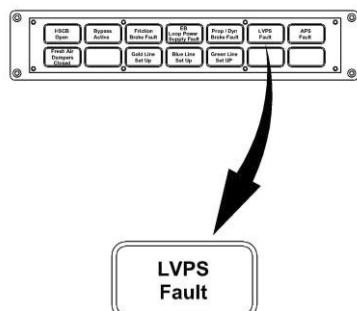
e) Propulsion/Dynamic Brake Fault (red)



When illuminated it indicates that there is a fault in the Propulsion/Dynamic Braking system.
Propulsion Fault signal is trainlined.

Prop/Dyn Brake Fault Lamp Label: 3H10.

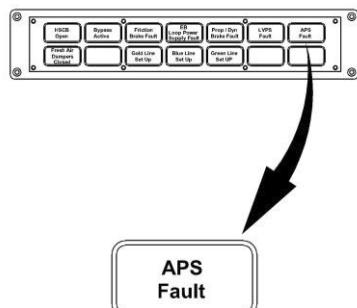
f) LVPS Fault (red)



When illuminated it indicates a fault in the Low Voltage Power Supply (LVPS).
LVPS fault signal is trainlined.

LVPS Fault Lamp Label: 3H08.

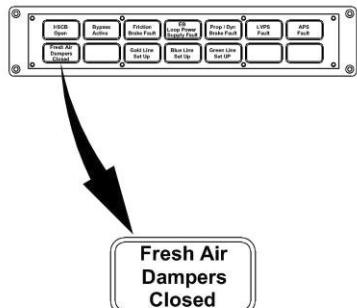
g) APS Fault (red)



When illuminated it indicates a fault in the Auxiliary Power Supply (APS).
APS Fault signal is trainlined.

APS Fault Lamp Label: 3H07.

h) Fresh Air Dampers Closed (yellow)



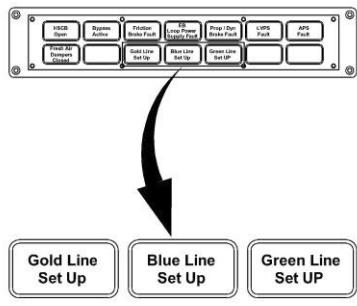
When illuminated it indicates that the dampers at the fresh air intake of the Conditioning Systems are closed and only re-circulated air is used.

The Fresh Air Dampers Closed signal is trainlined.

Fresh Air Dampers Closed Lamp Label: 12H01.

i) Gold Line, Blue Line, Green Line Modes

When illuminated it indicates that the Gold Line set-up is ON or Blue Line set-up is ON or Green Line set-up is ON.



To change the Line Mode, the Operator must use the Line Selector Switch located on the Data Download Panel in the Electronic equipment locker "A" of the keyed-up vehicle.

The Line Mode signal is local, since it refers to the selector on the relevant vehicle, which manages the Line Mode of the train consist through the local ATP system.

Gold Line Lamp Label: 3H03.

Blue Line Lamp Label: 3H02.

Green Line Lamp Label: 3H01.

10-I-02.04 Functional Schematics and Topographics

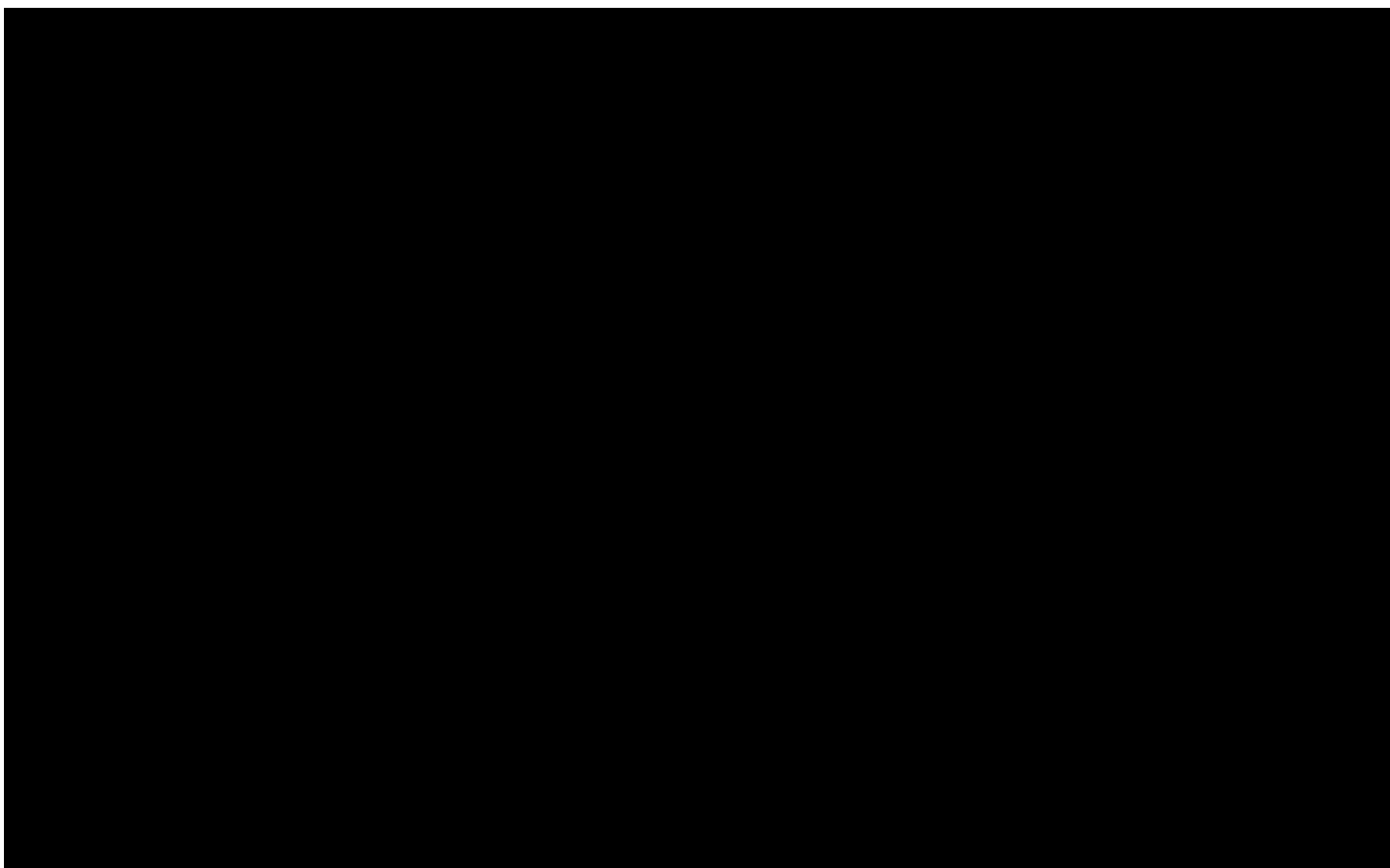
Refer to Section 00 for a detailed description on how to use the Functional Schematics and the Topographics.

10-I-02.04.01 APS/LVPS Functional Schematics

HV, MV and LV Functional Schematics take into consideration the vehicle as a whole. Nevertheless, any system/equipment is represented like a box and only the connections with the Functional Schematics are shown.

Figure 10-I-02.61 (sheet #24 of the LV Functional Schematic) shows the APS/LVPS System (label 2A01) like a box equipped with connectors COM1 and COM2 and the relevant pins.

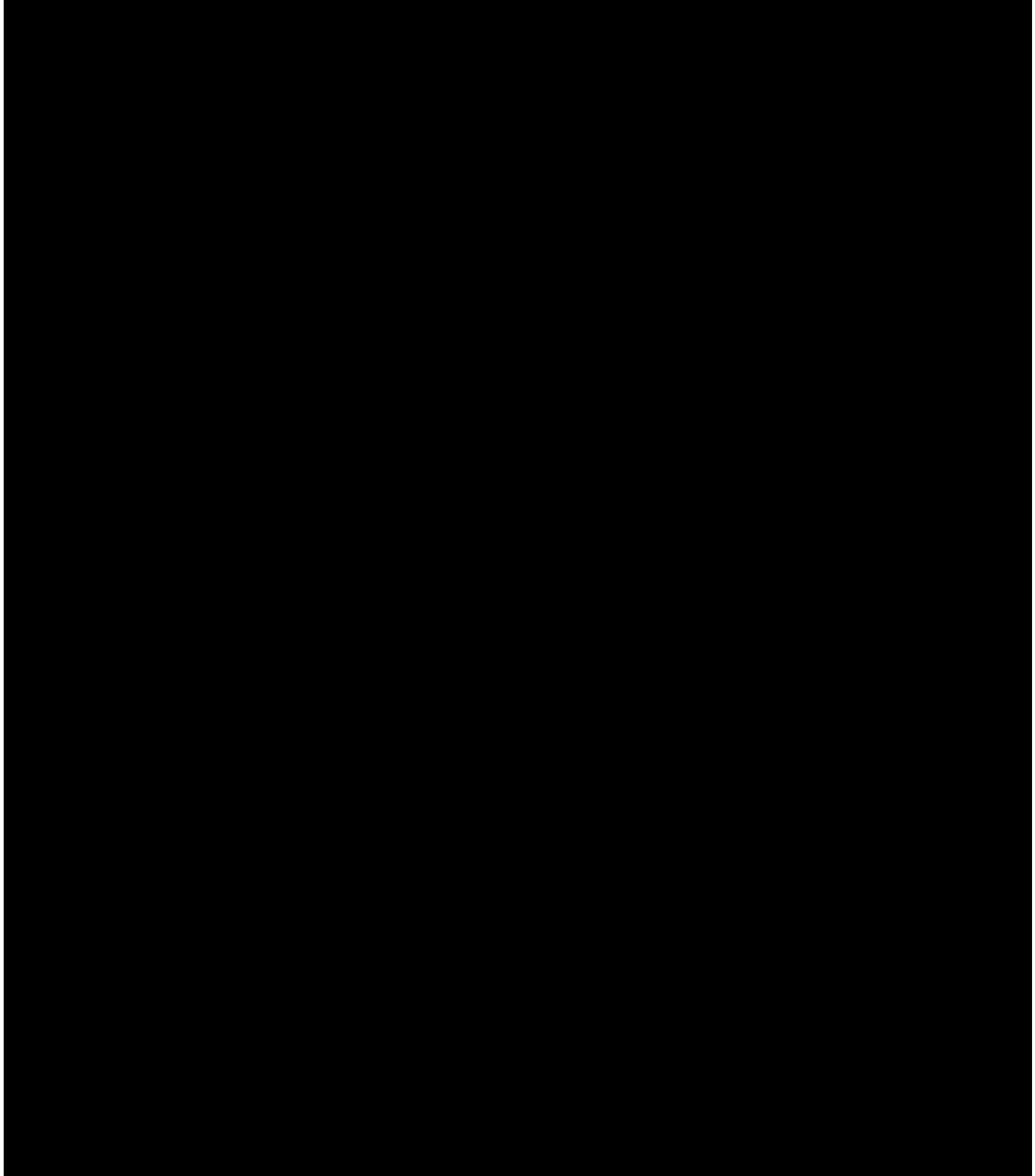
No specific information regarding the system internal wiring and components is given by the Functional Schematics.



To be able to understand how the system works internally, the specific Functional Schematics are needed.

To have a better idea of their interrelationship and of the hierarchy that rules their communications, refer to the block diagram in Figure 10-I-02.62 which shows all Functional Schematics related to the APS/LVPS System.

The following Figure 10-I-02.63 shows all the connections of the APS/LVPS with the outside world and among the system main components



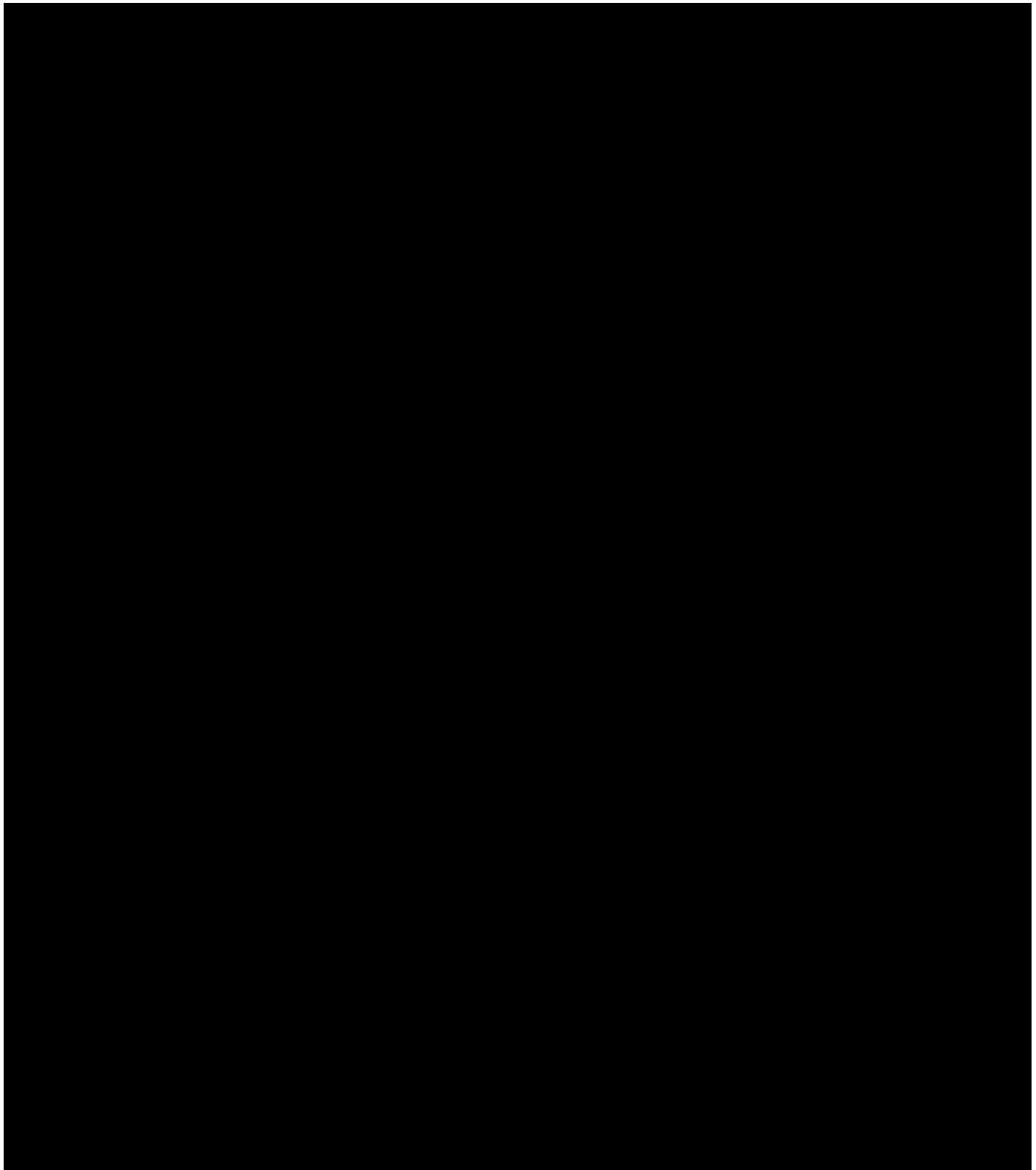


Figure 10-I-02.63 APS/LVPS Functional Schematic Connectors

10-I-03 APPENDIX

10-I-03.01 Inverter and IGBT Theory and PWM Modulation

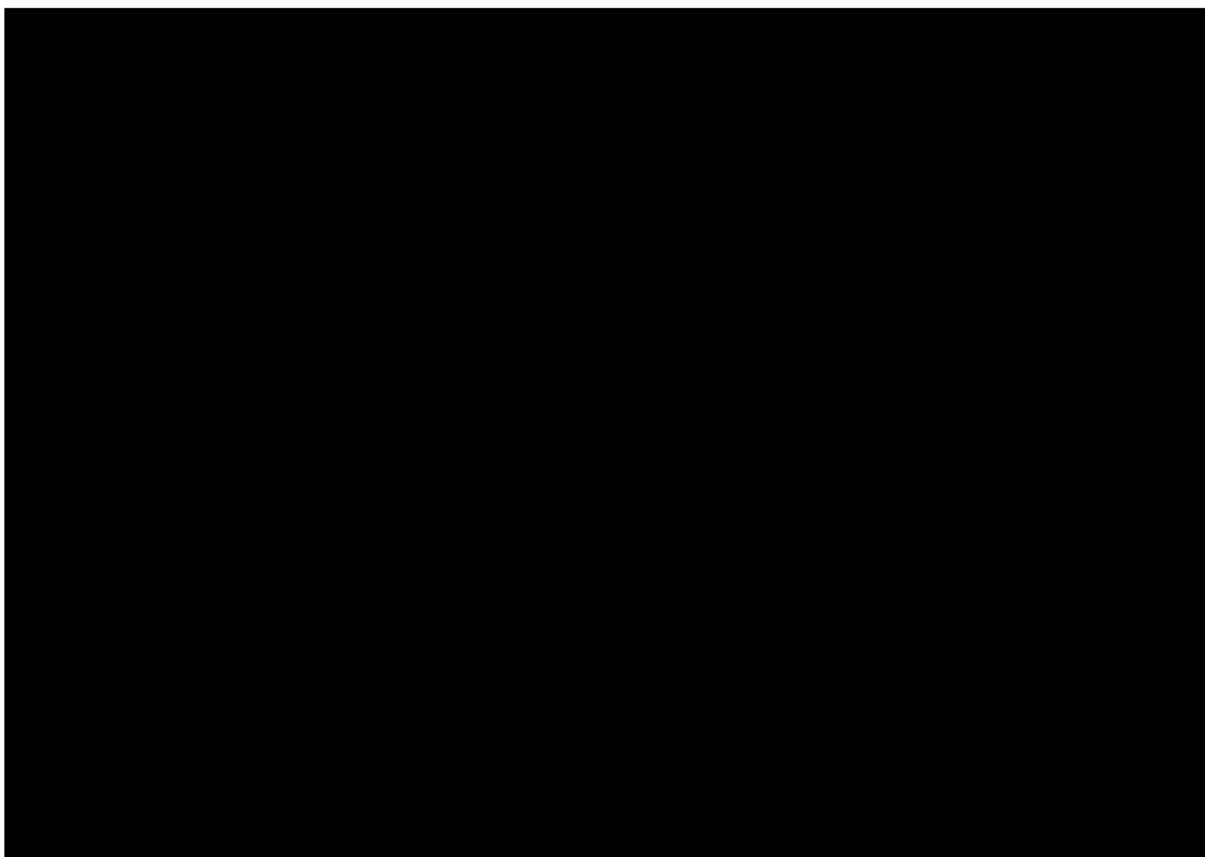
The Insulated Gate Bipolar Transistor (IGBT) is a three-terminal Power semiconductor device that combines the simple gate drive characteristics of the MOSFETs with the high current and low saturation voltage capability of bipolar transistors by combining an isolated gate for the control input with a bipolar power transistor as a switch, in a single device.

The IGBT is used in medium-high power applications such as Switched-mode power supply, traction motor control and induction heating.

Current flows into an IGBT only if the IGBT is turned ON and in one direction only: from the Collector to the Emitter.

An IGBT is turned ON when a high signal is present at the Gate connector. This signal is called Command Pulse and it often toggles from high to low, thus switching ON and OFF the relevant IGBT.

The IGBT Technology is used, inside the APS IGBT Module, to transform a Direct Voltage into a Three Phase Alternate Voltage.



The Command Pulses (sent by the CIA board) open or close the relative IGBT in order to obtain an alternate voltage, with a 60Hz frequency, at each Output (R, S and T). These Command Pulses are synchronized to obtain also a phase shifted by 120° among the three output phases.

In the APS IGBT Module, these three output voltages do not have a sinusoidal profile nor a correct Voltage Amplitude; both the Sinusoidal Profile and the right Voltage Amplitude are obtained by means of the auxiliary of a three phase transformer (the APS Transformer).

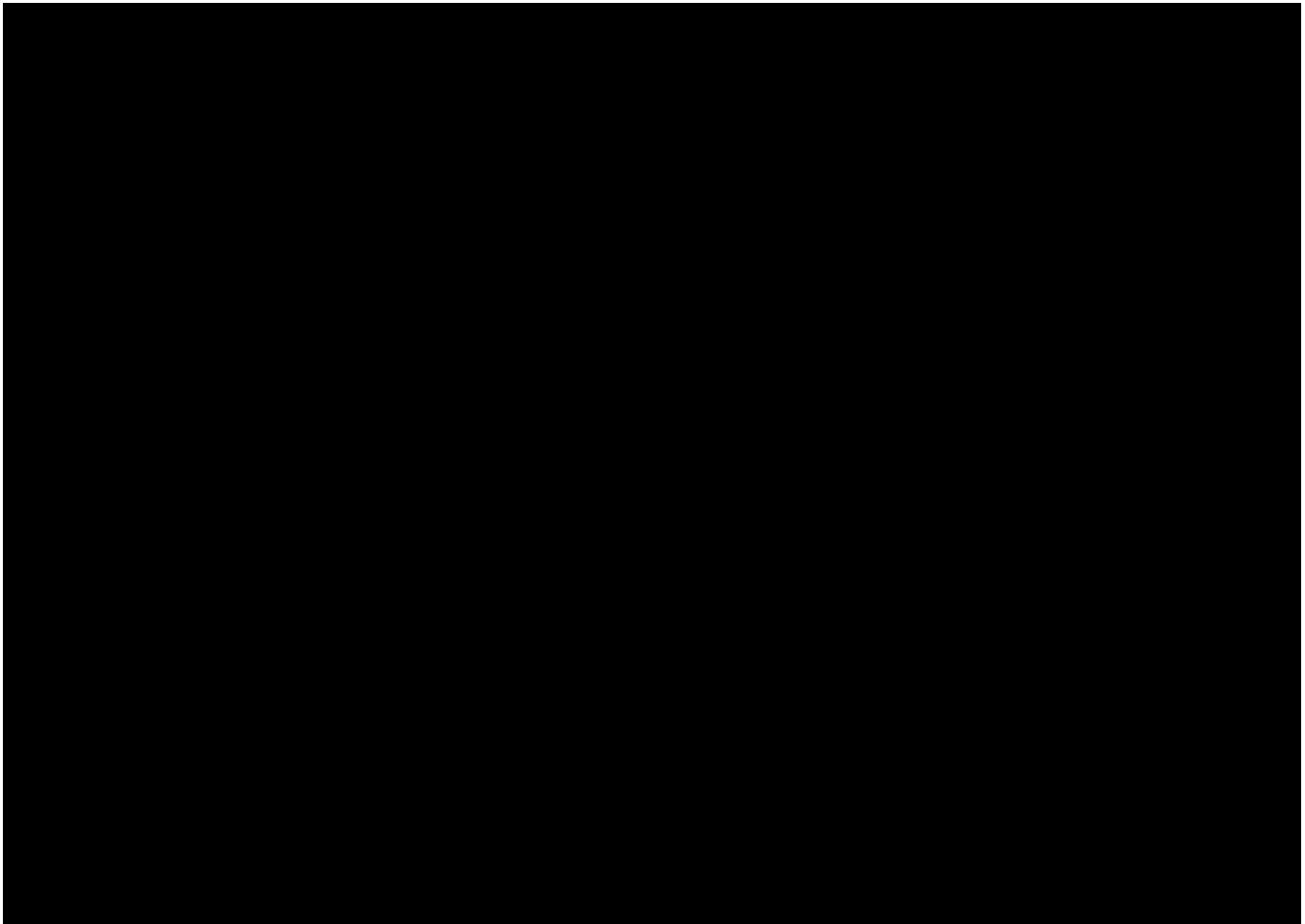
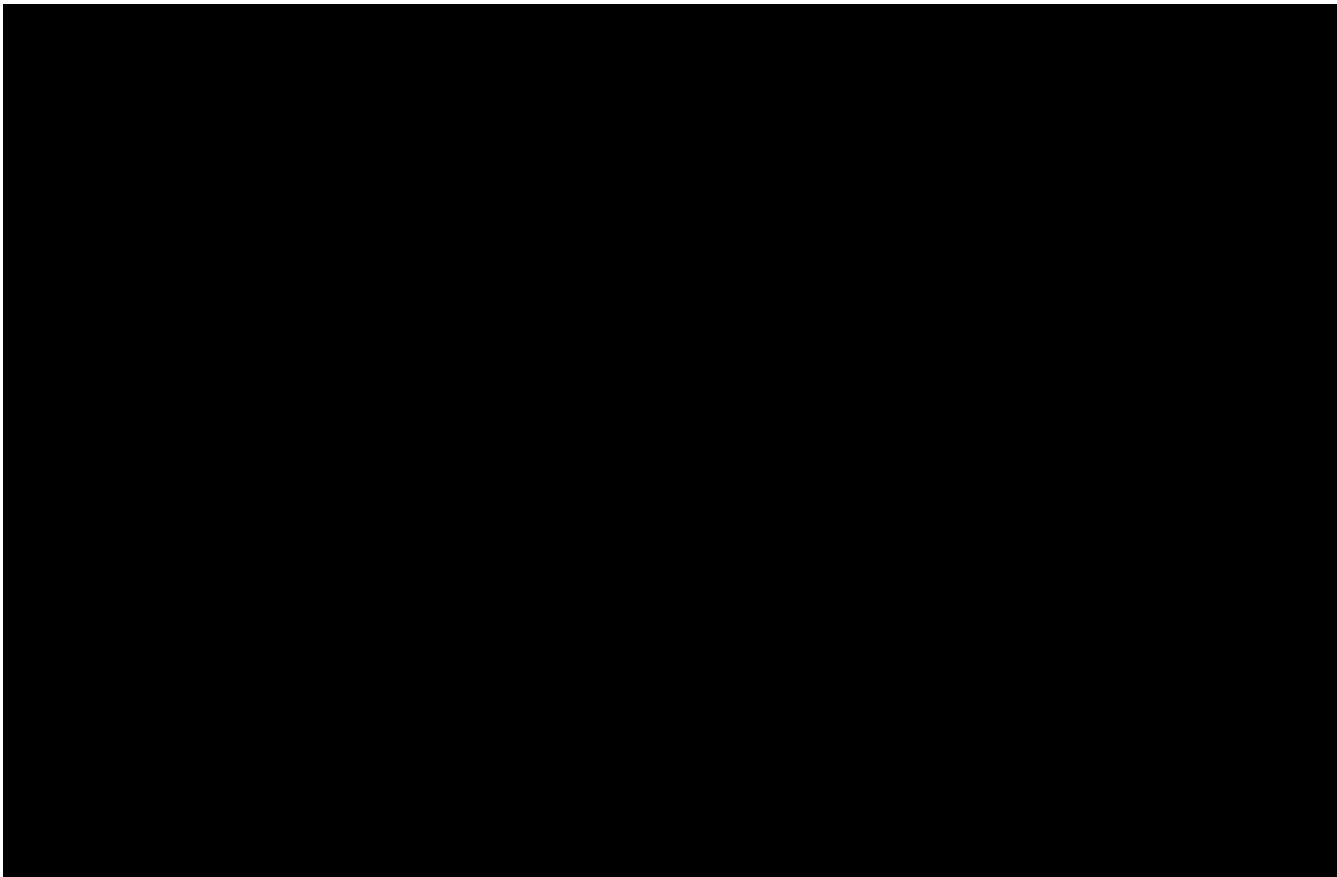


Figure 10-I-03.2 describes the Command Pulses of phase R (COMRH to drive the highest IGBT and the COMRL to drive the Lowest IGBT), through a PWM (Pulse Width Modulation): a reference sinusoid wave form with a frequency of 60Hz (the same frequency to be realized as an output) is compared with a triangular wave form (triangular wave form frequency much higher than sinusoidal frequency).

During positive sinusoidal half periods, the highest IGBT will toggle and the lowest will be open. Vice versa during the negative sinusoidal half period, the lowest IGBT will toggle and the highest will be open.

The Phase R (output) has the same wave form of COMR(t) - COMRL(t) with amplitude from 0 to 750 V (not considering the IGBT resistance when closed) (refer to Figure 10-I-03.3).



The same procedure as per phase R is followed to obtain Phase S and Phase T.

10-I-03.02 How to Use the Functional Schematics: Example

The following is an example on How to Use the Functional Schematic.

The example explains step by step, with the help of the Functional schematics, when and why the “Propulsion/Dynamic Brake Fault” lamp (located on the Indicator Panel of each Cab) switches ON.

First step: define if this topic is related to the LV Functional Schematic or to the MV Functional Schematic:

The Indicator Panel Lamps are Low Voltage supplied, so the LV Functional Schematic will be used.

Second Step: find the “Propulsion/Dynamic Brake Fault” lamp on the LV Functional Schematic.

To do that we must find the component on the Bill of Materials (refer to Section 00): the first number of its code is “3” because it is a component related to the function of “Forward and Brake” command; we also know that this component is an indicator so the label must contain the “H” letter.

Using this indication (label 3Hxx) and reading the component description, we will find the 3H10 component in the Bill of Materials.

The following Table shows what is reported in the relevant line of the Bill of Materials:

Table 10-I-03.1 LV Bill of Materials

Label	Description	Mod./Ch.	Specific.	Sh.	Position	car	Rev	Remark
3H10	Propulsion Fault Indicator			16	Warning Light Pan.	CA-CB		

Now we have the complete label of the component and the number of the sheet (of the LV Functional Schematics) where it can be found.

Sheet #16 of the LV Functional Schematics shows two 3H10 lamps: one per Body Section. For the purpose of this example, we will consider the A Body Section Lamp only.

Refer to Sheet #16 of LV Functional schematic:

In order to have the 3H10 lamp switched ON, the current coming from the 1501 wire, must flow through it and get connected to the ground (through cable 2403). There are several ways to have the lamp switched ON. The various conditions that can determine the 3H10 lamp to be switched ON are taken into consideration in the following, starting from sheet #16 of the LV Functional Schematics.

1st condition:

The A2-A3 contact of the 3K10 Relay is closed. The A2-A3 contact is normally closed, which means that it stays closed when the 3K10 Relay is de-energized.

The number in brackets at the side of the contact (2706) tells us that the 3K10 relay is represented on sheet #27 column #06.

Going to sheet #27 of the LV Functional schematic:

Considering all Circuit Breakers closed, the 3K10 Relay (Propulsion Fault Relay), is de-energized by the TCU_A which, when in fault, opens the contact to ground.

So, the 3H10 lamp is switched ON when the TCU_A is in fault condition.

2nd condition:

This condition is analogous to the previous one, but related to the B body section.

The current crosses the 3H10 lamp and goes to the ground (cable 2403) through the 3K10 A2-A3 Relay contact of the B Body Section. This Relay is de-energized when the TCU_B is in fault.

So, the 3H10 lamp is turned ON when the TCU_B is in fault condition.

3rd condition:

The current crosses the 3H10 lamp and flows through wire 1605.

To verify if the current has a path to the ground, we must follow the 1605 wire which continues on the left in [12701] (sheet #127, column 01) and on the right in [12901] (sheet #129, column 01).

Sheets #127 and 129 of the LV Functional schematic:

Wire 1605 is connected to the A Coupler (sheet #127) and the B Coupler (sheet #129) connectors 1.25 left and right. It means that the current on wire 1605 can flow to the ground if the A2-A3 contact of any 3K10 relay on the entire train consist is closed.

The Propulsion Dynamic Brake fault signal is trainlined.

So, the 3H10 lamp is switched ON when any TCU of any vehicle of the train consist is in fault condition.

4th condition:

The current crosses the 3H10 lamp and follows a path to ground through wire 1505. Following the wire from sheet #16 to the sheets #17 and 19, we can verify that the current cannot flow in this direction because of the diodes' orientation. On the other side, following the wire to sheet # 15 (column 11), we can see that the current through wire 1505 goes to ground if the 3S04 switch ("Indicator test push button") is closed.

So, the 3H10 lamp switches ON if the Indicator test PB is pressed.

The "Propulsion / Dynamic Brake Fault" Lamp is turned ON when any TCU on the train consist does not work properly or the Indicator Test PB is pressed in one of the consoles.

10-I-03.03 How to Read Topographics: Example

In this example, the Topographics are used to find the Air Compressor Power Supply Path and to explain how the Compressor is supplied by the APS system-

Using the Functional Schematics.

The path of the wires that connect the Compressor to the APS/LVPS can be followed using the Functional Schematics, which give us only an idea of where they pass through.

We know that the Air Compressor is supplied with MV current, so we need to start from the MV Functional Schematics (237VE06965C02).

In particular, we start from sheet # 11.

The Air Compressor, located in the A Body Section, receives the three-phase power supply through the VAC Connector (pin A cable 1114, pin B cable 1115 and pin C cable 1116).

Circuit Breaker 02F05 protects the Air Compressor from over-currents.

The wires, after the Circuit Breaker, change their names (the Circuit breaker can open the circuit) and become 1101, 1102 and 1103.

Wires 1101, 1102 and 1103 cross the articulation section and, on the B Body Section, get connected to the R, S and T Connectors of the APS.

To be able to physically follow the wires, we need the Topographics, specifically we need to start from the MV topographic carbody A (AA042BH):

The only MV Connector of the Air Compressor is “VAC” and the table related to this connector (in the same sheet) shows that

- Wire 1114 goes from pin A of VAC to pin 21 of connector C17
- Wire 1115 goes from pin B of VAC to pin 08 of connector C17
- Wire 1116 goes from pin C of VAC to pin 06 of connector C17

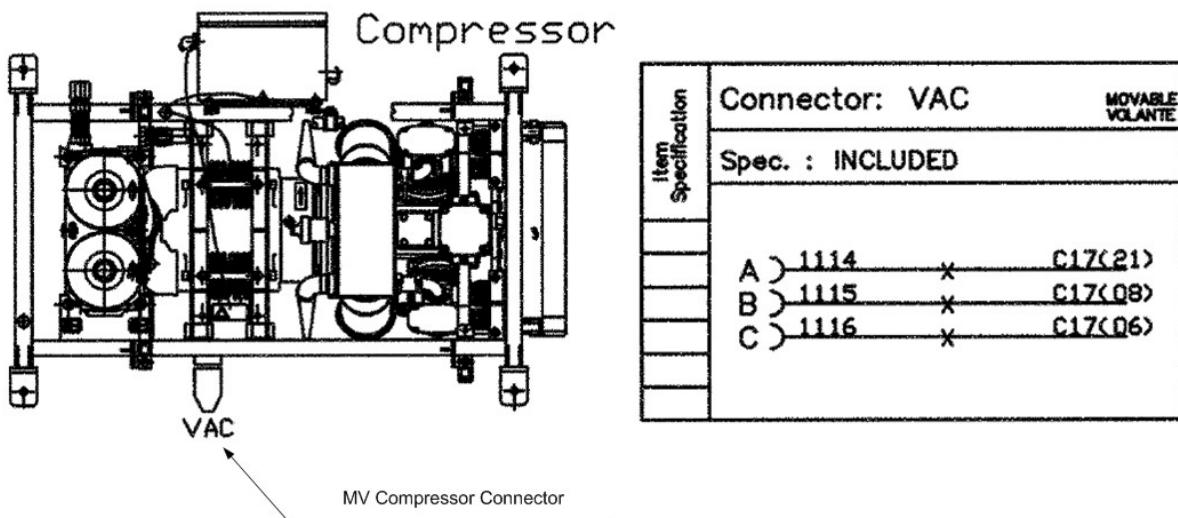


Figure 10-I-03.5 MV Compressor Connector (AA042BH Abstract)

The C17 Connector is located in the Electric Locker of the A Body Section.

The C17 (movable) connector is the connector at the end of the cable, and is connected to the A17 connector of the A Body Section Electric Locker (fixed to the

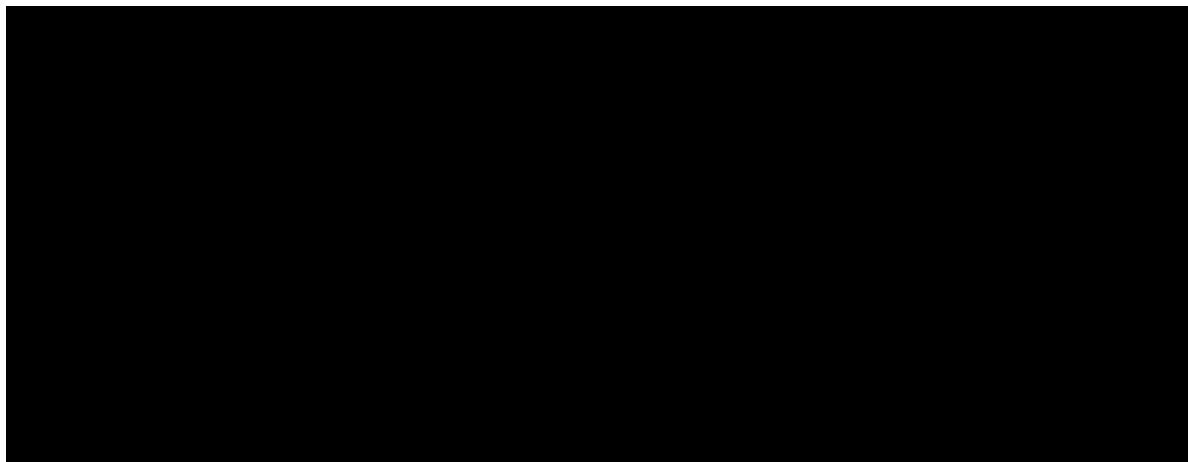


Figure 10-I-03.6 C17 Electric Locker Connector (AA042BH Abstract)

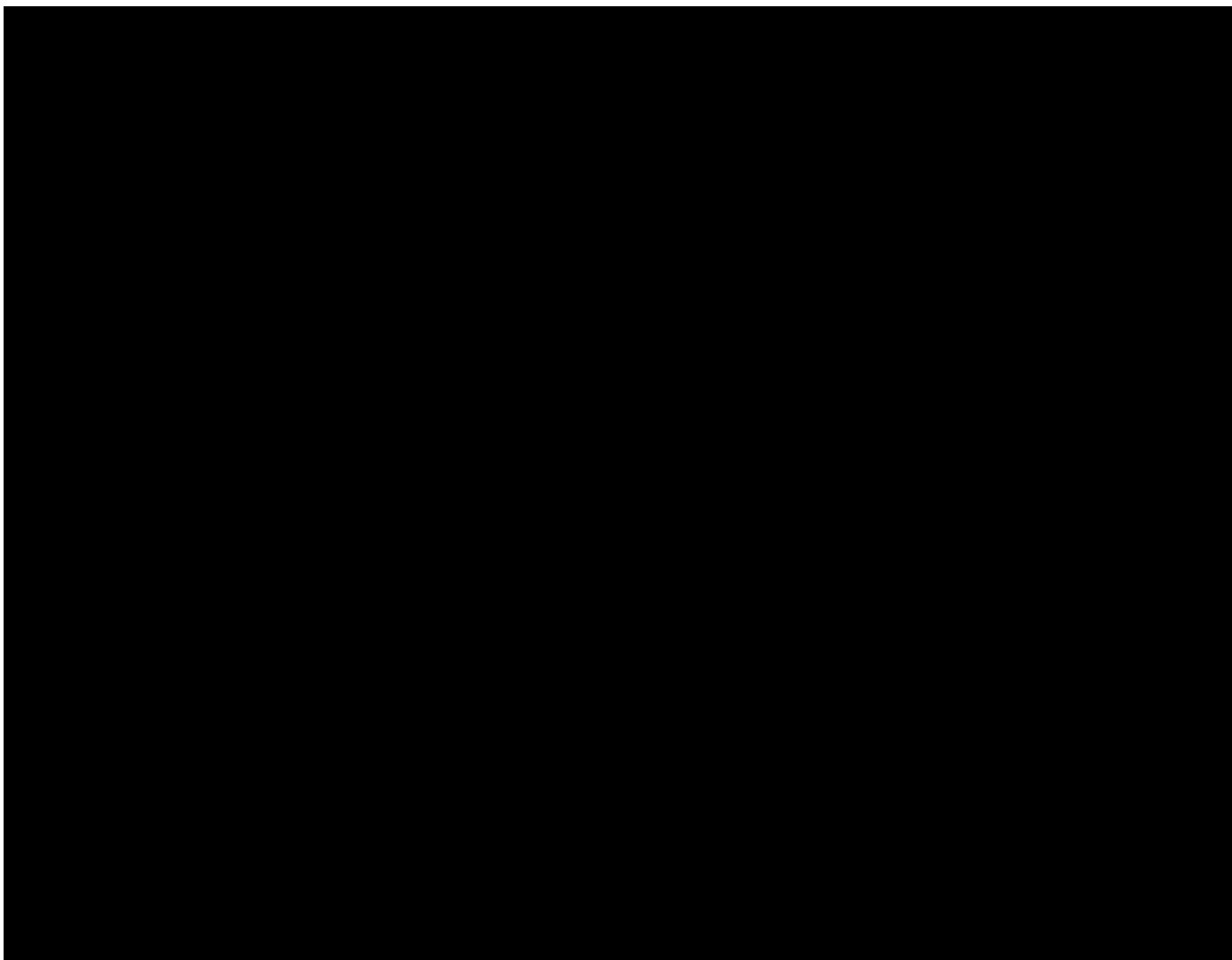
To follow the path, the next step will be to find the A17 connector in the Wiring Diagram of the A Body Section Electric Locker.

NOTE: Electric Locker Connectors are made up of a mobile connector part and a fixed connector part (attached to the electric locker itself):

- The “C” letter marks the mobile connector part
- The “A” letter marks the fixed connector part

The only way to do that is to go through all the sheets of the Topographics related to MV and look for the A17 connector.

We find it in the “Power Electric Cabinet Section MV Car “A” Wiring Diagram” (AA05H25, #17).



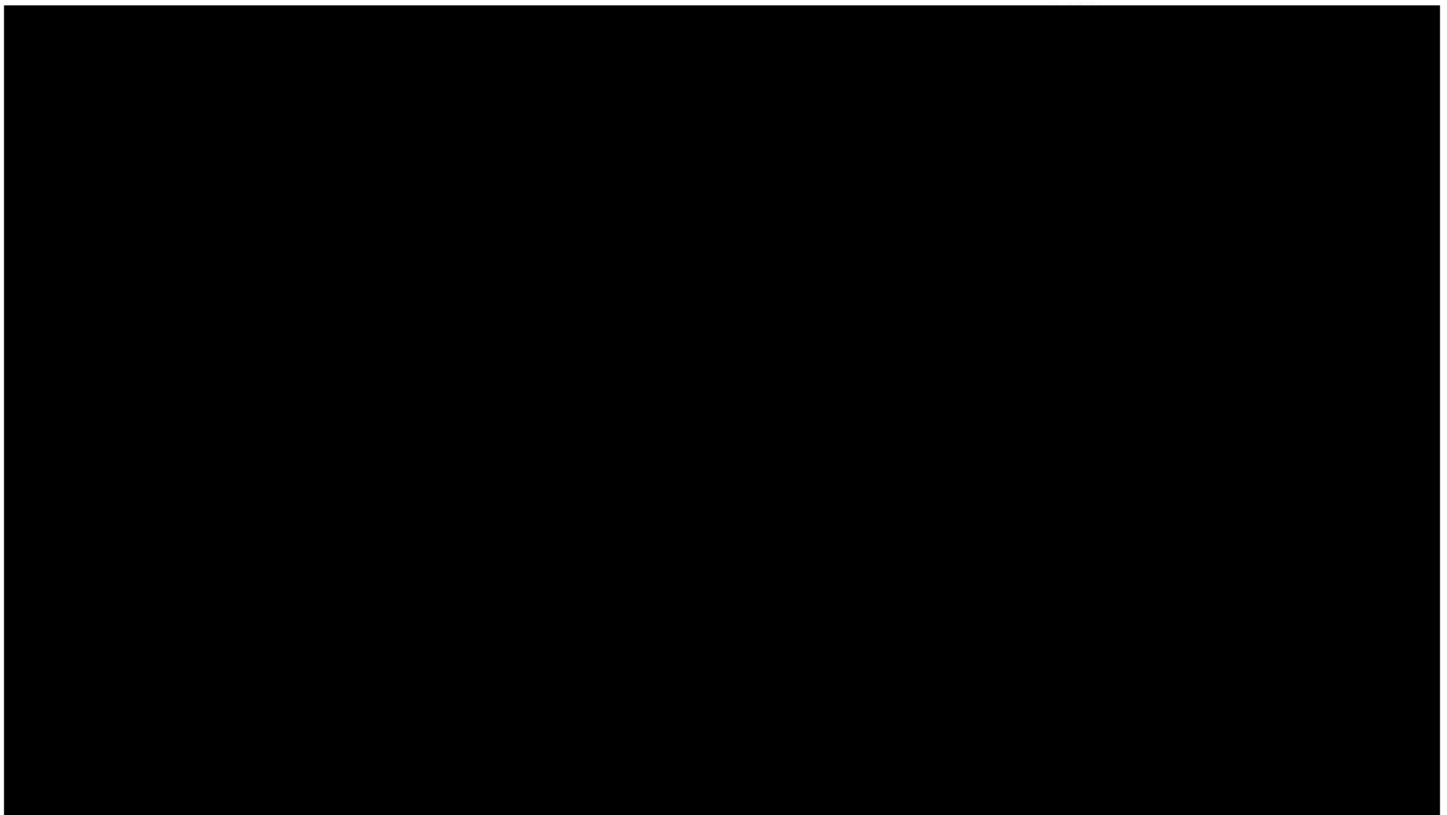
The A17 Connector Table (refer to Figure 10-I-03.7) shows that:

- Wire 1114 goes from pin 21 of A17 to pin M2 of 2F05
- Wire 1115 goes from pin 08 of A17 to pin M4 of 2F05
- Wire 1116 goes from pin 06 of A17 to pin M6 of 2F05

After the Circuit Breaker (that can open the circuit) the wire names change and go to the MT Connector:

- Wire 1114 becomes 1101 and is connected with pin 1 of MT Connector
- Wire 1115 becomes 1102 and is connected with pin 2 of MT Connector
- Wire 1116 becomes 1103 and is connected with pin 3 of MT Connector

So, we go back to MV Topographic Carbody A (AA042BH) where we find the MT Connector from where wires 1101, 1102 and 1103 are connected to the VMT1 connector, as follows:



- Wire 1101 from pin 1 of the MT Connector goes to pin 1 of the VMT1 Connector
- Wire 1102 from pin 2 of the MT Connector goes to pin 2 of the VMT1 Connector
- Wire 1103 from pin 3 of the MT Connector goes to pin 3 of the VMT1

Connector From the VMT1 connector of the A Body Section wires 1101, 1102 and 1103 cross the Articulation Section and get connected to the VMT1 of the B Body Section (refer to MV Topographic Carbody B AA042BJ and also to AA04EPD).

10-I-03.04 Vehicle Circuit Breakers

Table 10-I-03.2 Vehicle CB Location

Label	Description	Location	
		Body Section	Locker / Panel
02F04	HVAC	A	Electric Locker
02F05	Air Compressor	A	Electric Locker
02F06	Motor Fan Inverter	A and B	Electric Locker
02F07	Exterior Outlets	A and B	Cab
02F08	Exterior Outlets	A and B	Cab
02F09	Exterior Outlets	A and B	Electric Locker
02F11	Windshield Defroster/Demister	A and B	Cab
02F12	Motor Fan Auxiliary M.V.	A	Electric Locker
02F13	Exterior Outlets	A and B	Cab
02F14	Exterior Outlets	A and B	Cab
02F15	Exterior Outlets	A and B	Electric Locker
03F01	Battery	B	Battery Box
03F02	Battery	B	Battery Box
03F03	APS+LVPS Power Supply	B	Electric Locker
03F04	APS+LVPS Dead Battery Startup	B	Electric Locker
03F05	Desk Habilitation Contactor	A and B	Cab
03F06	Cab Enable Contactor	A and B	Cab
03F07	Cab Enable	A and B	Electric Locker
03F08	Cab Relay	A and B	Cab

Table 10-I-03.2 Vehicle CB Location

Label	Description	Location	
		Body Section	Locker / Panel
03F09	IDU power Supply	A and B	Electric Locker
03F10	Air Compressor Circuit Breaker	A	Electric Locker
03F11	Propulsion LV Power Supply	A and B	Electric Locker
03F12	Dynamic Brake Cut-Out	A and B	Cab
03F13	Fault Indicators	A and B	Electric Locker
03F14	Door & Brake Status Indicator	A and B	Electric Locker
03F15	Emergency Lighting	B	Battery Box
03F16	First Door Units	B	Battery Box
03F17	Battery Contactor	B	Battery Box
03F18	Rate Ref. Encoder Power Supply	A and B	Electric Locker
03F19	Status Acquisition	A	Electric Locker
03F20	Master Controller	A and B	Cab
03F21	GTW Power Supply	A	Electric Locker
03F22	GTW Power Supply	A	Electric Locker
03F23	35mph Speed Limit Trainline	A	Electric Locker
03F24	Auxiliary No Motion	A and B	Electric Locker
03F25	CEMIPS Power Supply Switch	A	Electric Locker
03F26	Auxiliary No Motion	A	Electric Locker
04F01	HSCB Control	A and B	Electric Locker
04F02	1Q02 Hold Coil Switch (HSCB)	A	Electric Locker
05F01	Pantograph UP/DOWN	A	Electric Locker
05F02	Pantograph Control Motor	A	Cab
05F03	Pantograph UP/DOWN Contactor	A	Electric Locker
06F01	Dead Man Control	A	Electric Locker
06F02	6A02 Power Supply	A	Cab
06F03	Security Brake Relay	A	Cab
07F01	Supply ECUs	A and B	Electric Locker
07F02	Supply ECUs	A	Electric Locker
07F04	Supply Track Brake Bogie 1-3	A and B	Electric Locker
07F05	Supply Track Brake Bogie 2	A	Electric Locker
07F06	Supply Contactor Track Brake Bogie 1-3	A and B	Electric Locker
07F07	Supply Contactor Track Brake Bogie 2	A	Electric Locker
07F08	Supply Sanders	A and B	Electric Locker
07F09	Supply By-Pass Brake System	A and B	Cab

Table 10-I-03.2 Vehicle CB Location

Label	Description	Location	
		Body Section	Locker / Panel
07F12	Supply Command Track Brake	A and B	Electric Locker
07F13	Supply Command Sanders	B	Electric Locker
07F14	Supply Valve BCU	A and B	Cab
07F15	Supply Valve BCU	A	Cab
08F01	Cab Lighting	A and B	Electric Locker
08F02	Compartment Lighting	B	Cab
08F03	A Compartment Lighting	B	Electric Locker
08F04	B Compartment Lighting	B	Electric Locker
08F05	Emergency Lighting	B	Cab
08F06	Hazard Lights	A and B	Electric Locker
08F07	Direction Indicators	A and B	Electric Locker
08F08	Direction Indicators	B	Electric Locker
08F09	Direction Indicators	B	Electric Locker
08F10	Marker Lights	A	Electric Locker
08F11	Headlights	A and B	Cab
08F12	Roof Headlight	A and B	Cab
08F13	Silent Alarm Switch	B	Electric Locker
08F14	Stop Indicator Lights	A	Electric Locker
08F15	Supply Tail Switch	B	Electric Locker
08F16	Active By-Pass Lights	B	Electric Locker
08F17	8A01 Power Supply	B	Electric Locker
08F18	Cabinet Lights	A and B	Electric Locker
09F02	Supply Command Doors	A and B	Cab
09F04	First Left Doors Control Unit	A and B	Electric Locker
09F05	First Right Door Control Unit	A and B	Electric Locker
09F06	Second Left Door Control Unit	A	Electric Locker
09F07	Second Right Door Control Unit	A and B	Electric Locker
09F08	Emergency CB for Doors	A	Cab
09F09	Door Closed Loop Circuit	A and B	Cab
09F10	End Train Relay	A and B	Electric Locker
09F11	Door Open Loop Circuit	A and B	Electric Locker
10F01	Horn & Gong	A and B	Electric Locker
10F02	Mirrors and Windshield Wiper and Washer	A and B	Electric Locker
10F03	Mirror Adjuster	A and B	Electric Locker

Table 10-I-03.2 Vehicle CB Location

Label	Description	Location	
		Body Section	Locker / Panel
10F04	Defroster	A and B	Cab
10F05	Defroster / Demister Motor Protection	A and B	Cab
11F01	ATP Protection	A	Electric Locker
11F02	ATP Display Protection	A and B	Electric Locker
11F03	TWC Protection	A	Electric Locker
12F01	HVAC Protection	A and B	Electric Locker
12F02	HVAC Protection	A and B	Cab
13F01	Communication System Protection	A and B	Cab
13F02	13K01 Protection	A and B	Cab
13F03	Signs Protection	A and B	Cab
14F01	Coupler Protection	A and B	Electric Locker
14F02	Coupler Protection	A and B	Drum Switch Junction Box
14F03	Coupler Protection	A and B	Drum Switch Junction Box
14F04	Coupler Protection	A and B	Drum Switch Junction Box
14F05	Coupler Protection	A and B	Drum Switch Junction Box
14F06	Coupler Protection	A and B	Drum Switch Junction Box
14F07	Coupler Protection	A and B	Drum Switch Junction Box
14F08	Coupler Protection	A and B	Electric Locker

10-I-03.05 Circuit Breakers - How They Work

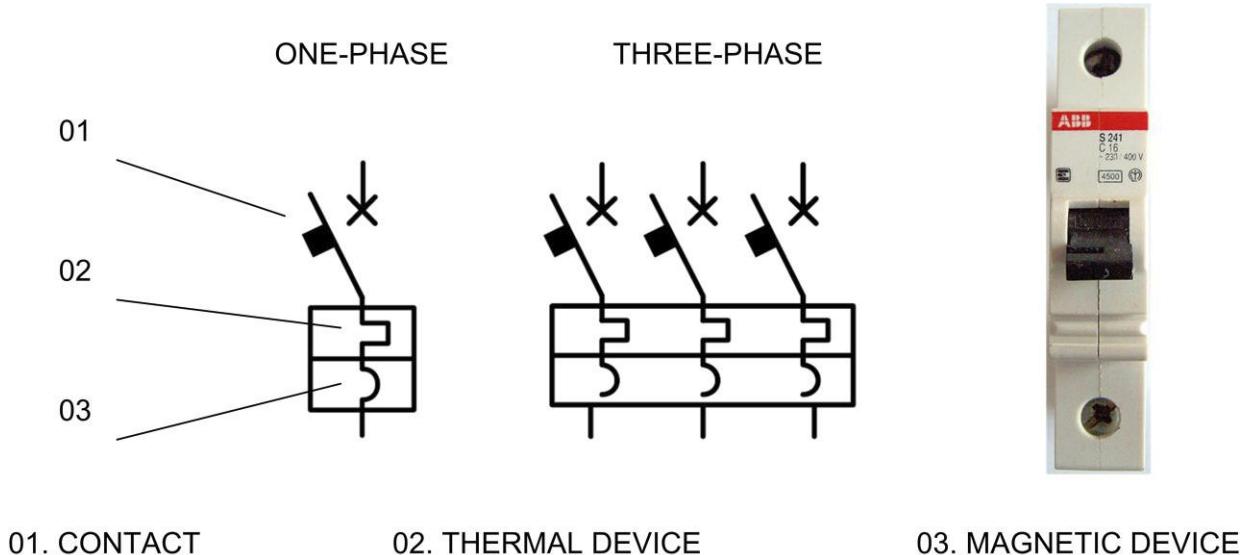


Figure 10-I-03.14 Circuit Breaker

A Circuit Breaker is a special type of breaker that automatically opens when a specific threshold current flowing through it, is exceeded, so that the current flow is interrupted. Circuit Breakers' function is to protect electric/electronic devices from over-currents.

To close a Circuit Breaker again, a manual action is necessary.

A Circuit Breaker can be opened manually whenever needed, for example to cut out the power to an electric/electronic device before removing it.

Usually Circuit Breakers have two opening devices: a thermal device and a magnetic device.

Thermal Device intervenes as soon as thermal current threshold is exceeded by the current flowing through the Circuit Breaker.

Its feedback speed is slow if the current is slightly above its threshold current and becomes faster and faster with the increase of the current.

The Magnetic Device almost immediately opens the contact when the magnetic threshold is exceeded by the current flowing through the Circuit Breaker (refer to Figure 10-I-03.15).

The Magnetic threshold is higher than thermal threshold; this difference defines the Circuit Breaker Type:

“B” Type: Magnetic threshold / Thermal threshold = above 3 up to and including 5.

“C” Type: Magnetic threshold / Thermal threshold = above 5 up to and including 10.

“D” Type: Magnetic threshold / Thermal threshold = above 10 up to and including 20.

The “B” Type is the most used to protect electronic devices while the “C” and “D” types are used to protect electric devices with an high current peak during start up (e.g. a motor).

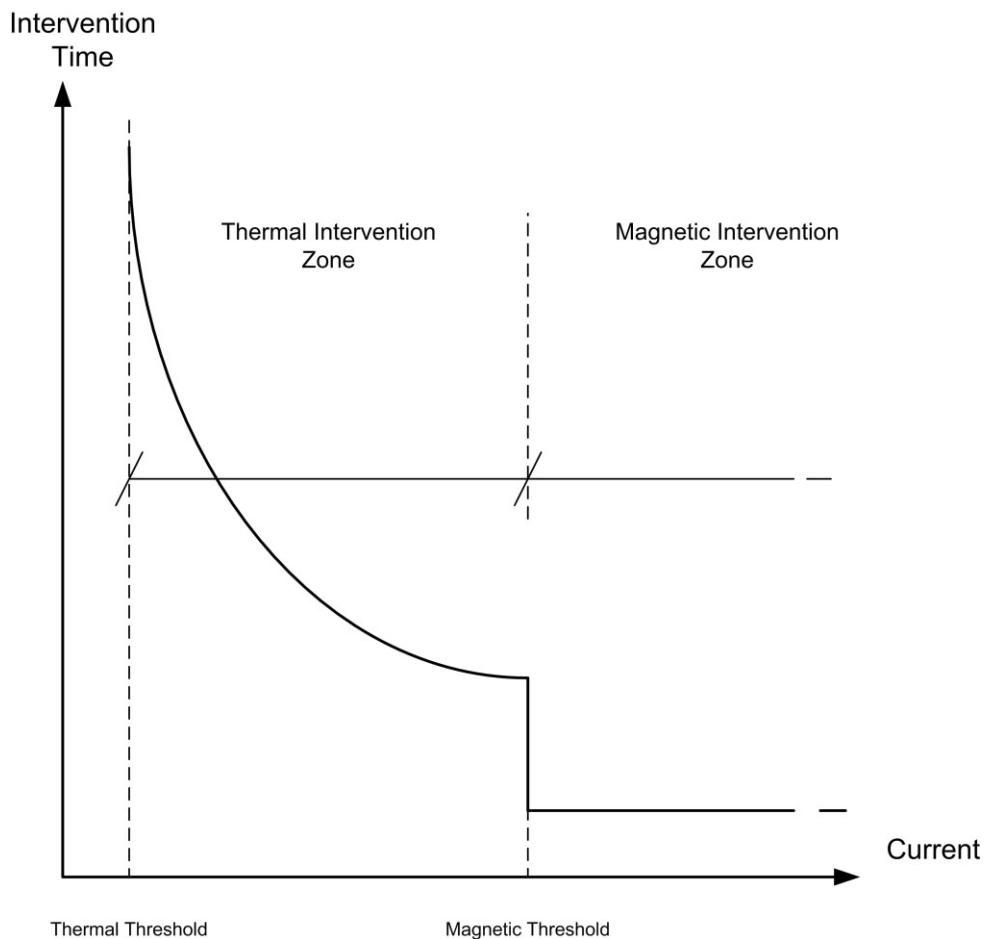


Figure 10-I-03.15 Circuit Breaker Characteristic Curve

10-I-03.06 Relays - How They Work

Relays (Magnetic Relays) are electric devices that use a current to open or close contactors of a second circuit.

The current flows through a coil thus creating an electromagnetic force. The created magnetic force opens or closes the relevant contacts. When the current stops flowing through the coil, the related contacts go back to the “Normal” position.

The Normal Position of a contactor is its position when the relay is de-energized.

A Contactor can be “Normally Open” (NO) or “Normally Closed” (NC).

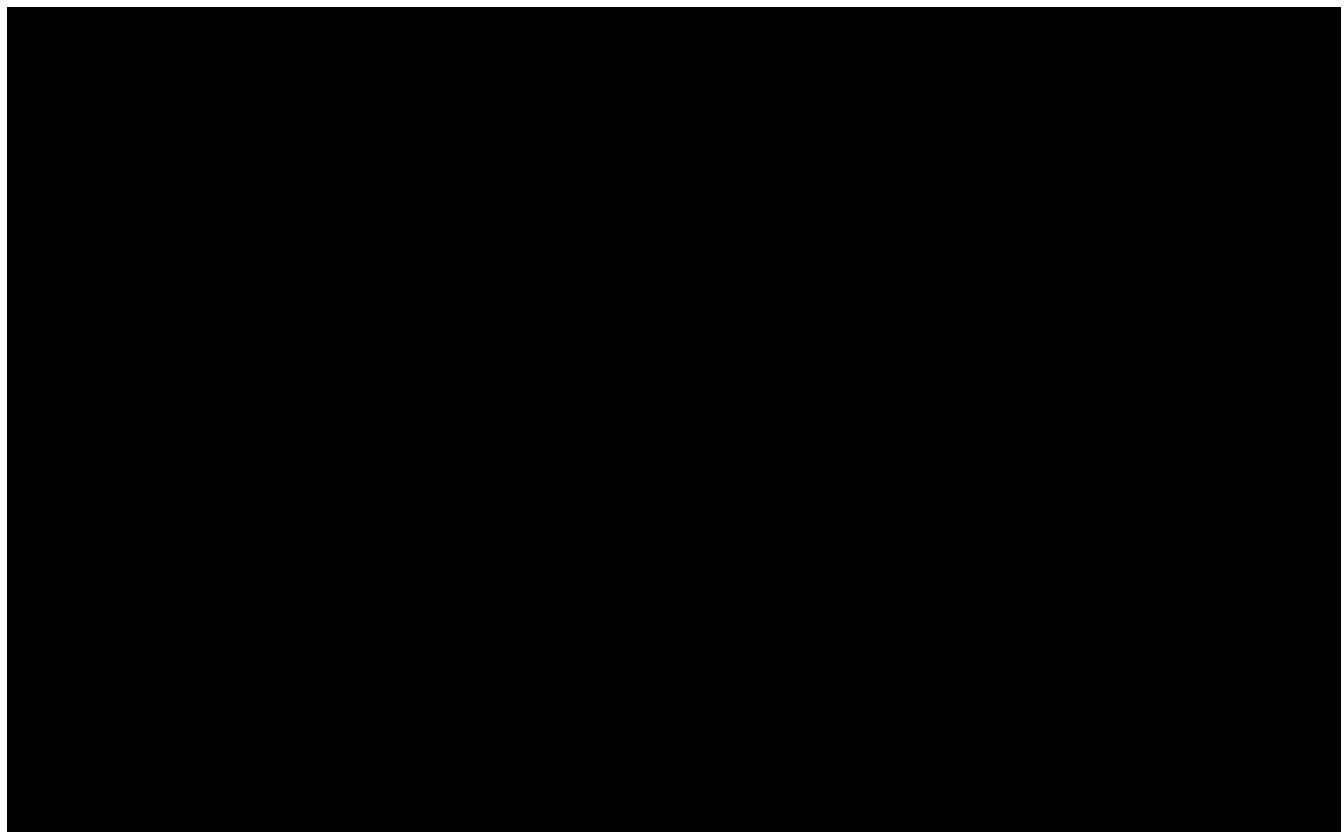
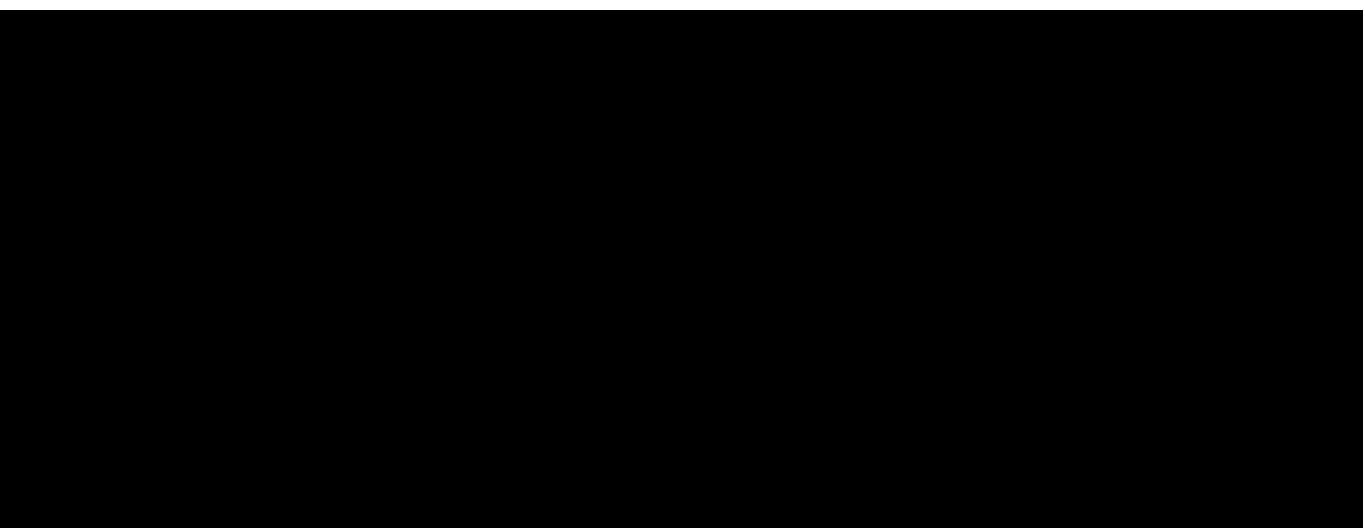


Figure 10-I-03.16 Relay Scheme

Relays have NO and NC contactors.

The contactors of a Relay are shown in the same column, at the bottom of the sheet. At the side of each contactor, a number (or more) within brackets (with page and column number) indicates where that contactor is used. In the same way, at the side of the contactor, a number in brackets (with the page and column number) indicates where the relay is used.

Some relays are associated with timing units used to get a delay in the intervention of the relay. Delayed relays need a double 37.5 line to be energized.



10-I-03.07 Ingress Protection Ratings (IP Codes)

As defined in international standard IEC 60529, the IP (Ingress Protection) Code consists of the letters IP followed by two digits and an optional letter.

IP Code classifies the degrees of protection provided against the intrusion of solid objects (including body parts like hands and fingers), dust, accidental contact, and water in electrical enclosures.

Where there is no protection rating with regard to one of the criteria, the digit is replaced with the letter X.

The standard aims to provide users with more detailed information than vague marketing terms such as "waterproof."

Table 10-I-03.3 Ingress Protection Ratings (IP Codes)

Ingress Protection Classification			
First Digit		Second Digit	
IP	Protection Provided	IP	Protection Provided
0	No Protection	0	No Protection
1	Protected against solid objects up to 50mm e.g. accidental touch by hands	1	Protected against vertically falling drops of water e.g. condensation
2	Protected against solid objects up to 12mm e.g. fingers	2	Protected against direct sprays of water up to 15 deg from the vertical
3	Protected against solid objects over 2.5mm e.g. tools	3	Protected against direct sprays of water up to 60 deg from the vertical
4	Protected against solid objects over 1mm e.g. wires	4	Protected against water sprayed from all directions - limited ingress permitted
5	Protected against dust - limited ingress (no harmful deposit)	5	Protected against low pressure jets of water from all directions - limited ingress permitted
6	Totally protected against dust	6	Protected against strong jets of water e.g. for use on shipdecks - limited ingress permitted
		7	Protected against the effects of immersion between 15cm and 1m
		8	Protected against long periods of immersion under pressure

10-I-03.08 Insulation Class

Standards established by the *National Electrical Manufacturers Association (NEMA)* to meet motor temperature requirements found in different operating environments.

When a motor is started its temperature will begin to rise above that of surrounding or ambient air.

Each insulation class has an allowable temperature rise which, when added to the ambient, gives the maximum winding temperature.

NEMA has standardized an ambient temperature of 104°F (40°C) with a defined attitude range. Allowance is made for a hot spot in the center of the motor's windings.

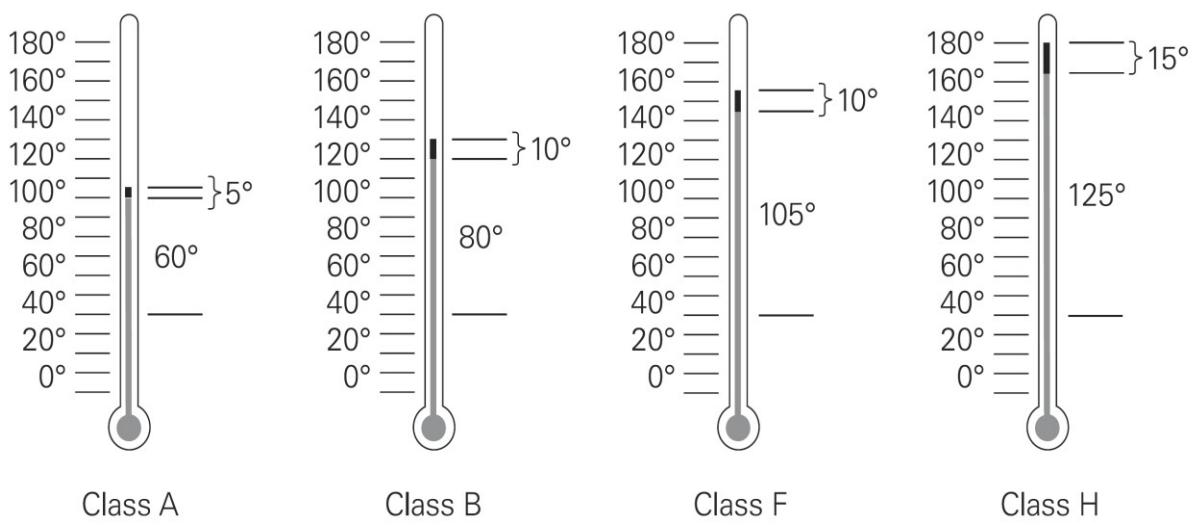


Figure 10-I-03.18 Insulation Class

Table 10-I-03.4 Insulation Class

Class	Rise	Hot Spot
Class A	140°F (60°C)	41°F (5°C)
Class B	176°F (80°C)	50°F (10°C)
Class F	221°F (105°C)	50°F (10°C)
Class H	257°F (125°C)	59°F (15°C)

Operating a motor above the limits of its insulation class reduces the motor's life expectancy.

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LOS ANGELES COUNTY

METROPOLITAN TRANSPORTATION AUTHORITY

LIGHT RAIL VEHICLE

P2550



RUNNING MAINTENANCE
AND
SERVICE MANUAL



VOLUME M-01
PART II
TROUBLESHOOTING
SECTION 10 - LVDS

SECTION 10

LOW VOLTAGE DISTRIBUTION SYSTEM

PART II

TROUBLESHOOTING

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TABLE OF CONTENTS

Section/ Para	Title	Page
10-II-01	INTRODUCTION.....	1
10-II-01.a	List of Abbreviations, Acronyms and Symbols	2
10-II-01.b	List of Definitions	4
10-II-01.c	List of Measurement Units and Symbols	5
10-II-02	TROUBLESHOOTING	7
10-II-02.01	Troubleshooting with the IDU	7
10-II-02.01.01	APS/LVPS System Status Screen.....	9
10-II-02.01.02	Control of Buses (IDU LONWorks Bus Screen)	12
10-II-02.01.03	IDU Fault List	13
10-II-02.02	Troubleshooting with the Portable Test Unit (PTU)	14
10-II-02.02.01	Software for Troubleshooting the APS/LVPS System.....	15
10-II-02.02.02	The Use of the PTU	15
10-II-03	Appendix 1.....	16
10-II-03.01	APS/LVPS IDU Fault List.....	16
10-II-03.01.01	Operating Mode.....	16
10-II-03.01.02	Maintenance Mode	18
10-II-04	Appendix 2.....	53
10-II-04.01	AUX IDU Fault List	53
10-II-04.01.01	Operating Mode.....	53
10-II-04.01.02	Maintenance Mode	61

LIST OF ILLUSTRATIONS

Figure	Title	Page
Figure 10-II-02.1	APS/LVPS System Status Screen	9
Figure 10-II-02.2	MVPD System Status Screen	10
Figure 10-II-02.3	LVPD System Status Screen	11
Figure 10-II-02.4	LONWorks Bus Life Signals	12
Figure 10-II-02.5	IDU Faults Screen	13
Figure 10-II-02.6	Data Download Panels	14
Figure 10-II-02.7	A Cab Download Panel - LON Connector	15
Figure 10-II-03.1	HV Wiring	45
Figure 10-II-03.2	LV Battery Connections	46
Figure 10-II-03.3	APS/LVPS Low Voltage Connections	47
Figure 10-II-03.4	Schematic Diagram Auxiliary Power Supply 2	48
Figure 10-II-03.5	Schematic Diagram Auxiliary Power Supply 3	49
Figure 10-II-03.6	Schematic Diagram Auxiliary Power Supply 4	50
Figure 10-II-03.7	Schematic Diagram Auxiliary Power Supply 5	51
Figure 10-II-03.8	Schematic Diagram Auxiliary Power Supply 6	52

LIST OF TABLES

Table	Title	Page
Table 10-II-02.1	"nvoAPSStatus" LONWorks Bus dataset	
Table 10-II-03.1	APS/LVPS Operating Mode Fault List	16
Table 10-II-03.2	APS/LVPS Operating Mode Fault Details	16
Table 10-II-03.3	APS/LVPS Maintenance Mode Fault List	18
Table 10-II-03.4	APS/LVPS Operating Mode and Maintenance Mode	19
Table 10-II-03.5	APS/LVPS Maintenance Mode Fault Details	20
Table 10-II-04.1	AUX Operating Mode Fault List	53
Table 10-II-04.2	AUX Operating Mode Fault Details	55
Table 10-II-04.3	AUX Maintenance Mode Fault List	62
Table 10-II-04.4	AUX Operating Mode and Maintenance Mode Fault Relationship	63
Table 10-II-04.5	AUX Maintenance Mode Fault Details	64

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SECTION 10

LOW VOLTAGE DISTRIBUTION SYSTEM

10-II-01 INTRODUCTION

This Section of the Running Maintenance and Service Manual is divided into three Parts:

- Part I: Theory of Operation
- Part II: Troubleshooting
- Part III: Maintenance

Each Paragraph is numbered accordingly, to avoid that paragraphs of the same Section, pertaining to a different Part, have the same number.

Part I - Theory of Operation

Part I gives a thorough overview of the System structure and operation, by means of descriptions, figures, photos, schematics, block diagrams and flow charts, together with references to other documents or Sections when needed.

Part II - Troubleshooting

It gives the Maintenance Technicians a path to troubleshoot the System in every condition by means of the available tools:

- The PTU, equipped with the specific SW program
- The IDU
- The Fault Isolation Table

The Part III - Maintenance consists of:

- Preventive Maintenance
- Corrective Maintenance
- Consumable Materials
- Test Equipment, Tools & Special Tools

10-II-01.a LIST OF ABBREVIATIONS, ACRONYMS AND SYMBOLS

The Abbreviations, Acronyms and Symbols commonly used throughout this manual are given below with their related meaning.

Abbreviation	Meaning
Δ/Y	Triangle - Star Transformer
AB.....	AnsaldoBreda
AC/DC	Alternate Current - Direct Current Converter
ADA.....	Americans with Disabilities Act
APS	Auxiliary Power Supply
ATP	Automatic Train Protection
BCU.....	Brake Control Unit
C/L.....	Centerline
CB	Circuit Breaker
CCH.....	Communication Control Head
CM.....	Coast Motoring
DC/AC	Direct Current - Alternate Current Converter
DC/DC	Direct Current - Direct Current Converter
EB.....	Emergency Brake
ECU.....	Electronic Control Unit (Brakes)
EDU.....	EMI Detector Unit
FSB	Full Service Brake
GTW.....	Gateway
HRSB	High Rate Service Brake
HSCB	High Speed Circuit Breaker
HV	High Voltage
HVAC	Heat Ventilation & Air Conditioning
HVDS	High Voltage Distribution System
HW	Hardware
IDU	Integrated Diagnostic Unit
IGBT.....	Insulated Gate Bipolar Transistor
IP	Ingress Protection Rating
KO	Out of Service
LED	Light Emitting Diode
LH.....	Left Hand Side
LON.....	Local Operative Network
LRV	Light Rail Vehicle
LV.....	Low Voltage
LVDS	Low Voltage Distribution System

Abbreviation	Meaning
LVPD.....	Low Voltage Power Distribution
LVPS.....	Low Voltage Power Supply
M.....	Motoring
MBL.....	Metro Blue Line
MV.....	Medium Voltage
MVB	Multifunction Vehicle Bus
MVPD.....	Medium Voltage Power Distribution
OK.....	Working
PGL.....	Pasadena Gold Line
PTU.....	Portable Test Unit
PWM	Pulse Width Modulation
RH.....	Right Hand Side
SB	Service Brake
SCEB	Slide Controlled Emergency Brake
SVM	Space Vector Modulation
SW	Software
TBS.....	To Be Supplied
TCMS.....	Train Communication System
TCN.....	Train Communication Network
TCU.....	Traction control Unit
THD.....	Total Harmonic Distortion
TWC.....	Train-to-Wayside Communication
WTB.....	Wired Train Bus

10-II-01.b LIST OF DEFINITIONS

The Definitions commonly used throughout this manual are given below with their related meaning.

Definition	Meaning
//	Parallel
'A' body section	The section of an articulated vehicle containing the pantograph
'B' body section	The section of an articulated vehicle not containing the pantograph
AW0.....	Empty car operating weight
AW1.....	Full seated load plus AW0
AW2.....	Standees at 4 persons per square meter plus AW1
AW3.....	Standees at 6 persons per square meter plus AW1
AW4.....	Standees at 8 persons per square meter plus AW1
Front door.....	The door close to the Operator's Cab
LC filter.....	Filter made up of Inductance and capacity
Rear door	The door close to the Articulation Section
RLC filter	Filter made up of Resistance, Inductance and Capacity
Sine-wave.....	Sinusoidal wave

10-II-01.c LIST OF MEASUREMENT UNITS AND SYMBOLS

The Measurement Units commonly used throughout this manual are given below with their related meaning.

Definition	Meaning
Ω	Ohm
μF	Micro Farad
$^{\circ}\text{C}$	Celsius degree
$^{\circ}\text{F}$	Fahrenheit degree
A.....	Ampere
ac.....	Alternate Current
dB.....	Decibel
dc.....	Direct Current
F.....	Farad
ft.....	Foot
gal.....	Gallon
H.....	Henry
Hz.....	Herz
in.....	Inch
$\text{k}\Omega$	Kilo Ohm
kg.....	Kilogram - approx 2.205 pounds
kHz.....	Kilo Herz
km.....	Kilometer - approx 0.621 miles
kN.....	Kilo-Newton - approx 224.809 pounds force
kVA.....	Kilo Volt Ampere
kW.....	Kilo Watt
lb.....	Pound
lb-ft.....	Pound force
lps.....	Liters per Second
m.....	Meter - approx 3.28 feet
$\text{m}\Omega$	Milliohm
mH.....	MilliHenry
mm.....	Millimeter - approx 0.0394 inches
ms.....	Millisecond
Pa.....	Pascal
rms.....	Root Mean Square Voltage
rpm.....	Revolution per Minute
V.....	Voltage
Vin.....	Input Voltage

Definition	Meaning
Vpp	Peak to Peak Voltage
W	Watt

10-II-02 TROUBLESHOOTING

The tools available on the P2550 for troubleshooting the APS/LVPS system and its components are:

- The IDU (Integrated Diagnostic Unit)
- The PTU (Portable Test Unit)

The IDU interface is made up by a display located in each vehicle cab. The IDU can be accessed in two Modes:

- Operating Mode, for the operators
- Maintenance Mode, for maintenance personnel, accessible by means of a numeric password

The Operating Mode provides few, essential information to help the operator start the troubleshooting or to pass the information on to the ROC (Railway Operating Center).

In Maintenance Mode the IDU can display more detailed information, thus giving the Maintenance personnel the possibility to troubleshoot more in depth and more accurately.

The APS/LVPS System is connected to the LONWorks bus only.

So, no signal coming or going to the APS/LVPS will be exchanged on the MVB bus (for a more detailed description of the IDU and of how to troubleshoot the APS/LVPS system with it, refer to Section 18- TCMS of this manual).

10-II-02.01 Troubleshooting with the IDU

The APS/LVPS status signals go from the APS/LVPS system to the IDU through the LON Works bus. These signals are collected in a single dataset called "nvoAPSStatus."

Byte	Bit	Signal	Scale
0	0	Not Used	
0	1	Not Used	
0	2	LVPSLineFuseKO	0=false; 1=true
0	3	APSLineFuseKO	0=false; 1=true
0	4	APSReset	0=false; 1=true
0	5	LVPSReset	0=false; 1=true
0	6	LVPSON	0=false; 1=true
0	7	APSON	0=false; 1=true
1	0	APSOvHeat	0=false; 1=true
1	1	APSModuleKO	0=false; 1=true

Byte	Bit	Signal	Scale
1	2	APSPhaseUmbal	0=false; 1=true
1	3	APSLineOverCur	0=false; 1=true
1	4	APSOutOverCur	0=false; 1=true
1	5	APSLineOverVolt	0=false; 1=true
1	6	APSOVERLOAD	0=false; 1=true
1	7	APSShortCircuit	0=false; 1=true
2	0	LVPSOverHeat	0=false; 1=true
2	1	LVPSModuleKO	0=false; 1=true
2	2	LVPSModOverCur	0=false; 1=true
2	3	LVPSLineOverCur	0=false; 1=true
2	4	LVPSLineOverVolt	0=false; 1=true
2	5	BatOverCurrent	0=false; 1=true
2	6	BatOverVoltage	0=false; 1=true
2	7	LVPSShortCircuit	0=false; 1=true
3	0	LVPSFailure	0=false; 1=true
3	1	Not Used	
3	2	SwitchRegWatchDog	0=false; 1=true
3	3	Not Used	
3	4	CIABoardFailure	0=false; 1=true
3	5	Not Used	
3	6	ClampActivation	0=false; 1=true
3	7	BlowerSwitchOpen	0=false; 1=true
4	0	LineCurFailure	0=false; 1=true
4	1	ApsLineCurFailure	0=false; 1=true
4	2	LvpsLineCurFailure	0=false; 1=true
4	3	BatCurFailure	0=false; 1=true
4	4	BatVolFailure	0=false; 1=true
4	5	APSPHRCurFailure	0=false; 1=true
4	6	APSPHSCurFailure	0=false; 1=true
4	7	APSPHTCurFailure	0=false; 1=true
5	0	Not Used	
6	0	VMT [Vrms]	
7	0	VBT [Vcc]	

The IDU screen shows the APS/LVPS status on the following screens:

- APS/LVPS System Status Screen
- Monitor - LON Bus Screen

10-II-02.01.01 APS/LVPS System Status Screen

In Maintenance Mode, by accessing the APS/LVPS System Status Screen (refer to Figure 10-II-02.1) the following information are shown:

- Line Voltage value
- APS output Voltage, Current and Power values
- APS status
- LVPS output Voltage, Current and Power values
- LVPS status
- The Battery Charge Level

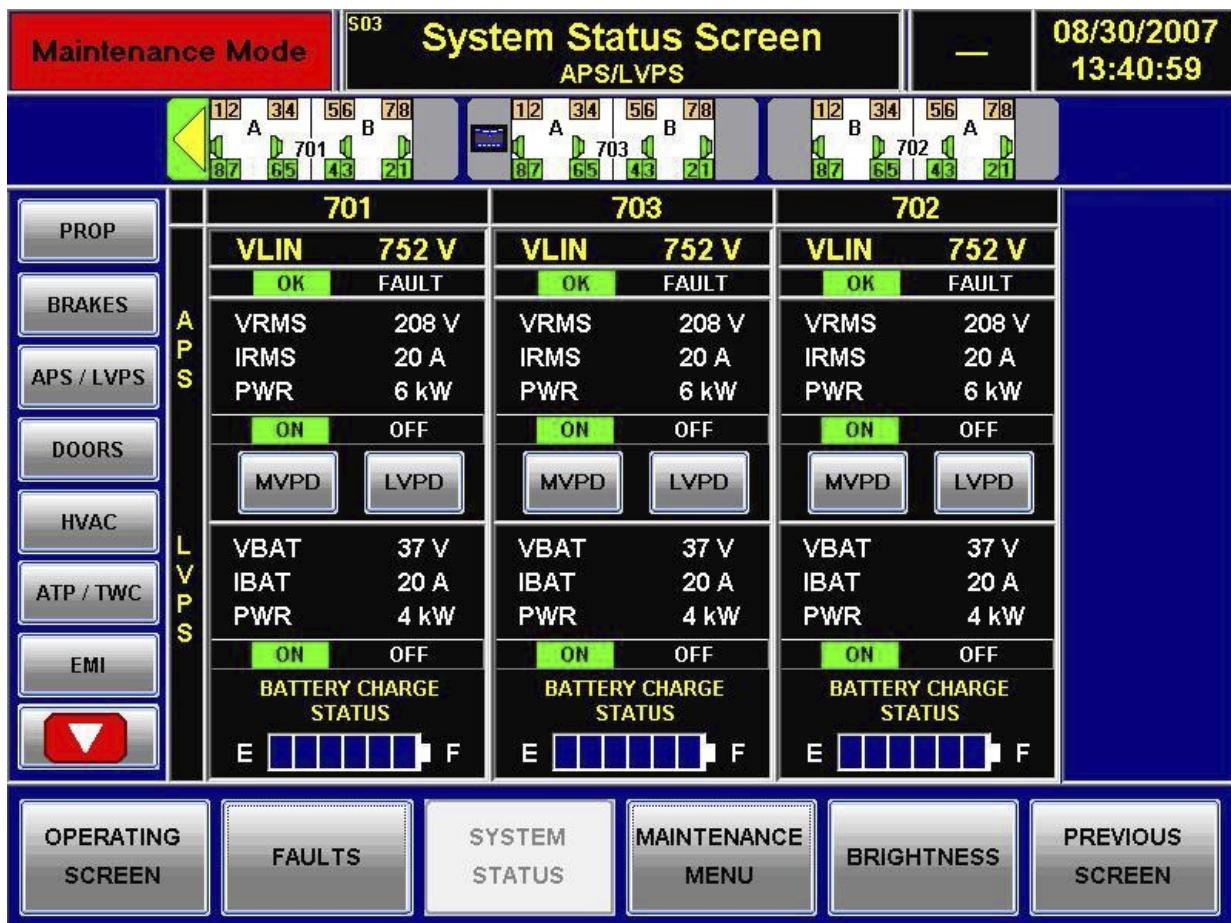


Figure 10-II-02.1 APS/LVPS System Status Screen

The APS/LVPS System Status Screen shows two more buttons for each vehicle in the train consist: MVPD and LVPD.

By touching them, the MVPD (Medium Voltage Power Distribution) and the LVPD (Low Voltage Power Distribution) screens are accessed.

10-II-02.01.01.01 MVPD (Medium Voltage Power Distribution) Screen

The MVPD System Status screen shows the most relevant information on the Medium Voltage Power Distribution.

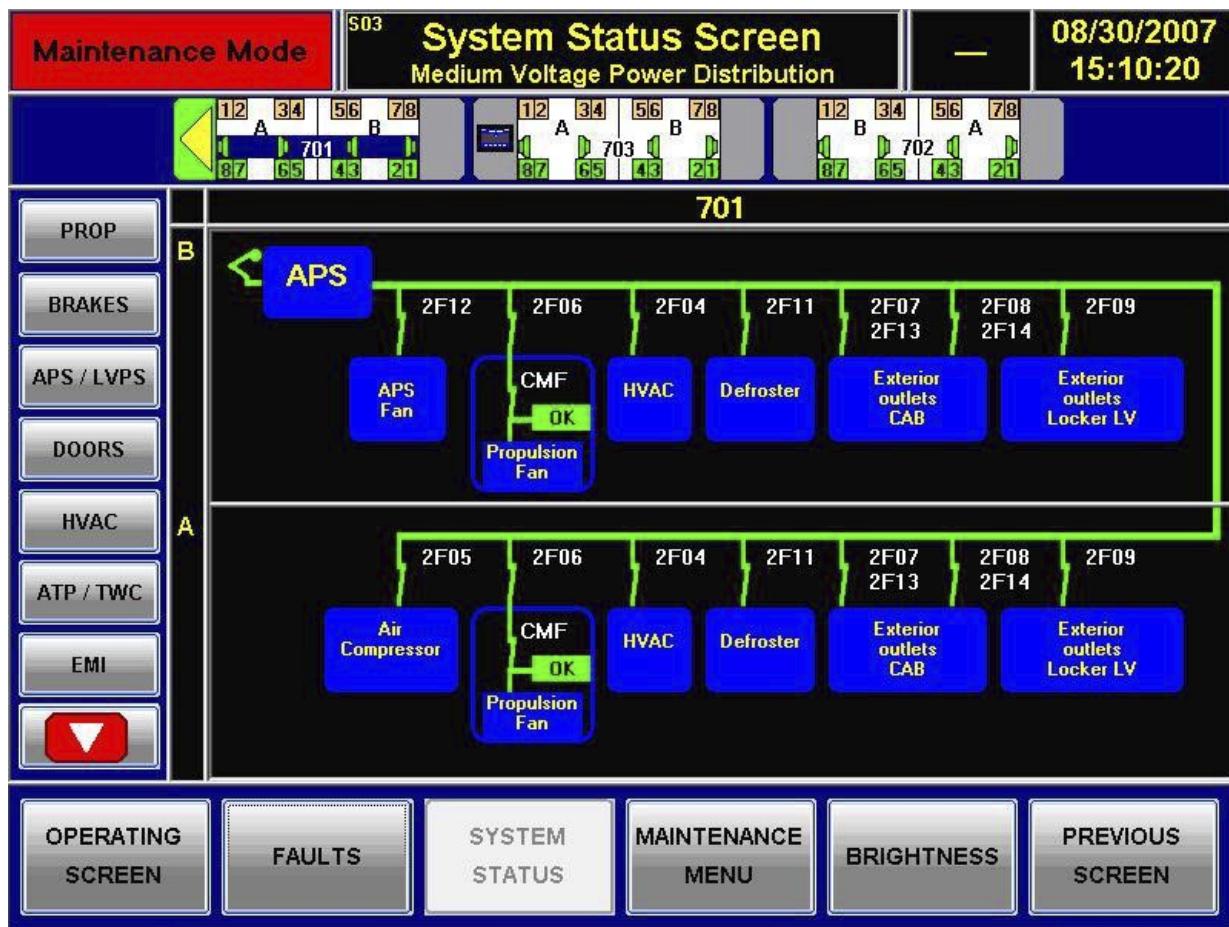


Figure 10-II-02.2 MVPD System Status Screen

The Circuit Breakers status is shown as follows:

- CLOSED: Contacts are closed and green
- NOT SUPPLIED: Contacts are closed and red
- OPEN: Contacts are open and red

10-II-02.01.01.02 LVPD (Low Voltage Power Distribution)

The LVPD System Status screen shows the most relevant information on the Low Voltage Power Distribution.

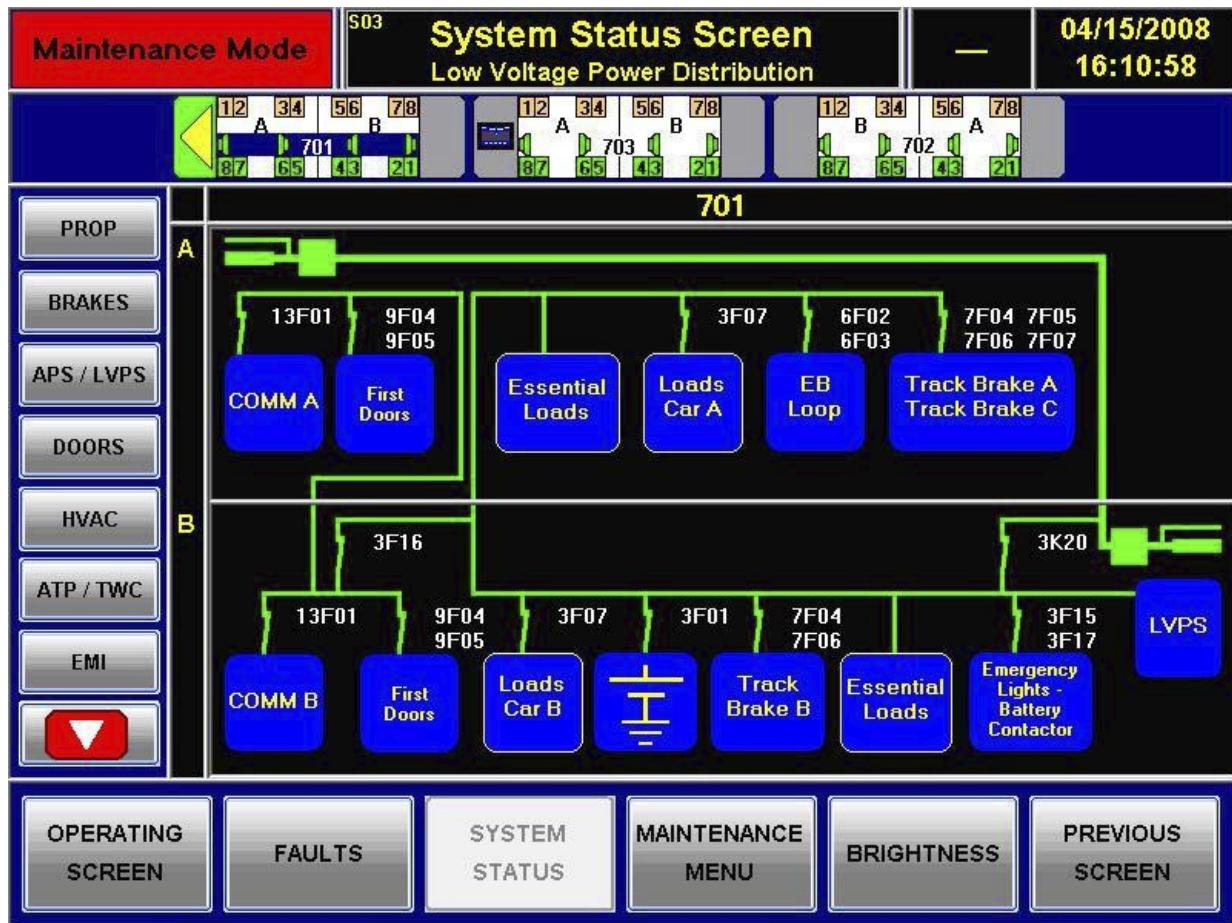


Figure 10-II-02.3 LVPD System Status Screen

The LVPD System Status screen shows the main Contactors and Circuit Breakers of the Low Voltage Power Distribution.

The Circuit Breakers' status is shown as follows:

- CLOSED: Contacts closed and green
- NOT SUPPLIED: Contacts closed and red
- OPEN: Contacts open and red

By touching the "Essential Loads" and the "Loads Car A" or "Loads Car B" buttons the relevant detailed screen pops up.

In this way the Circuit Breaker status of the entire LV load are indicated: the contactor color code is red when open, green when closed.

10-II-02.01.02 Control of Buses (IDU LONWorks Bus Screen)

By entering Maintenance Mode and touching the MONITOR button, the IDU monitor shows information related to both the local vehicle and the train.

By touching the LON BUS button, the signals (LON Life Signals) sent by the APS/LVPS system on the LONWorks bus can be monitored.

If no signal flow is shown on the APS/LVPS bar, it may mean that the APS/LVPS System is not working properly.

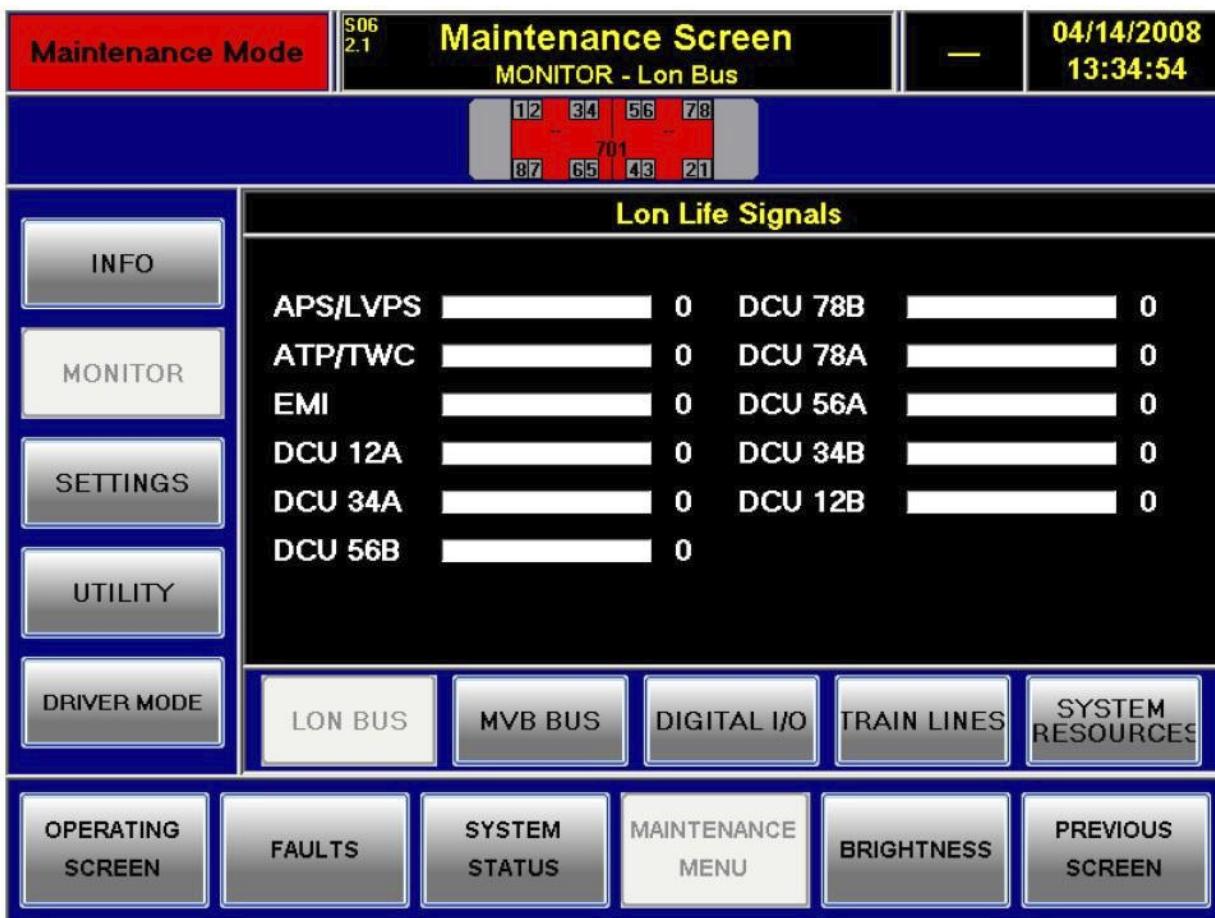


Figure 10-II-02.4 LONWorks Bus Life Signals

If no life signal is shown on the APS/LVPS System bar of the LONWorks bus:

- Check the APS/LVPS supply unit and replace it if not OK
- If the problem is still present, replace the PSC board and check the screen
- If the problem is still present, replace the CIA board and check the screen
- If the problem is still present, replace the Motherboard
- Check the LON board installed in the back of the APS/LVPS Mother board

10-II-02.01.03 IDU Fault List

By touching the “Troubles” button at the bottom of the IDU screen, the Faults Screen pops up with the list of the faults present in all train Systems, with date and time of the occurrence.

In this way the Maintenance personnel can detect a fault as soon as it occurs.

As soon as a fault occurs (fault “activated” - red characters), the Train Control and Monitoring System (TCMS - refer to Section 18 for a more detailed description) saves the “image” of the fault in a file of the “A” IDU memory (the B IDU has no memory) named “LogFile.dat”.

The system saves an image of the activated fault every 100 ms for a period from 1 s before and 5 s after the activation.

The system saves a sample of the deactivated faults (green characters) once and with the information present at the time of the memorization.

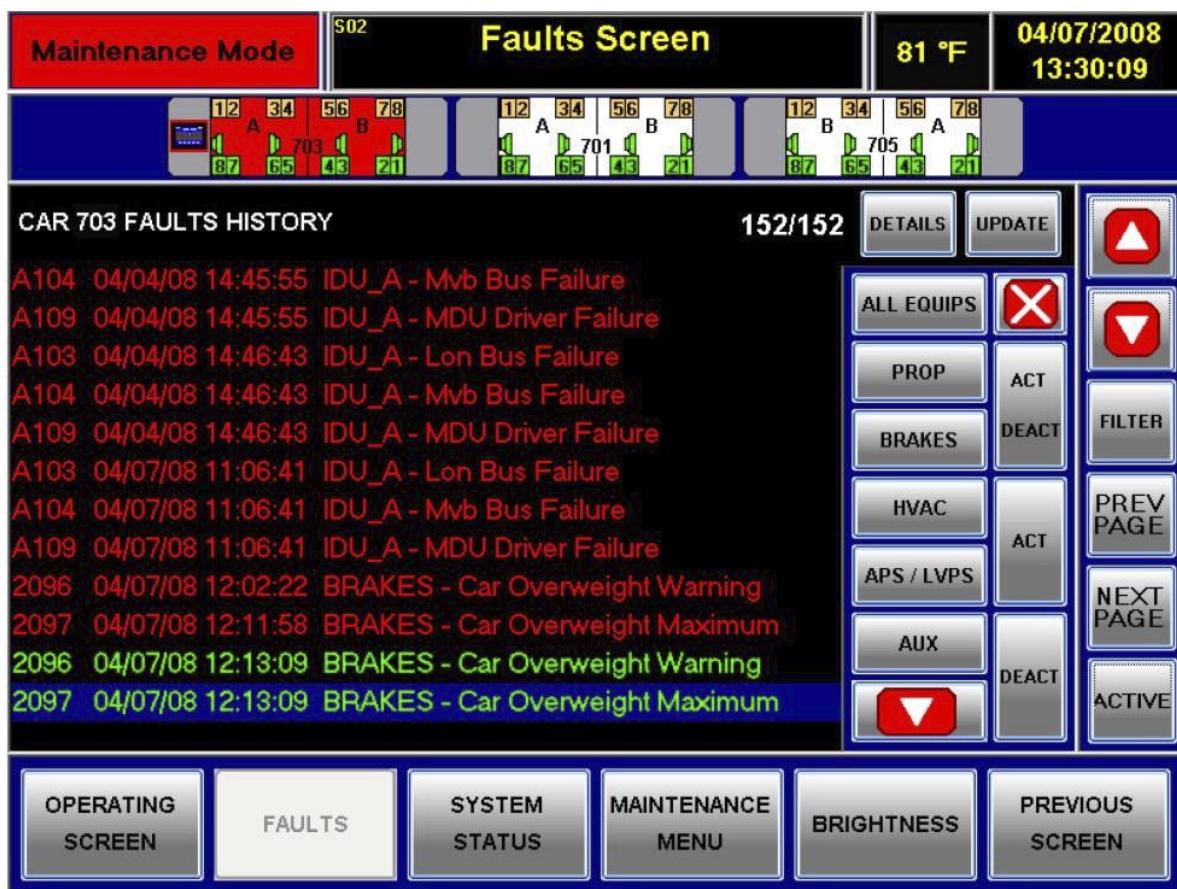


Figure 10-II-02.5 IDU Faults Screen

The “Complete APS/LVPS IDU Fault List and Reference Diagram” is listed paragraph 10-II-03.01 and it describes, for each fault type, how to troubleshoot the APS/LVPS System using the IDU, both in Normal and in Maintenance Mode.

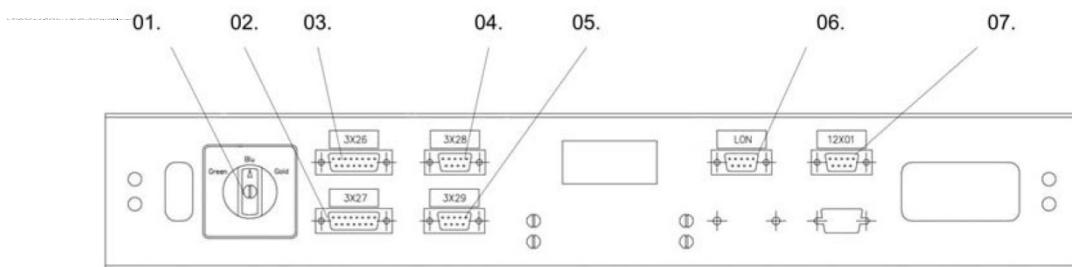
The suggested Maintenance Actions (troubleshooting procedures) are shown by pressing the “Details” Screen Button and are referred to the selected Fault shown on the IDU “Faults Screen”.

The Fault List can also be filtered by means of the system button (in this case the APS/LVPS button - refer to Figure 10-II-02.5).

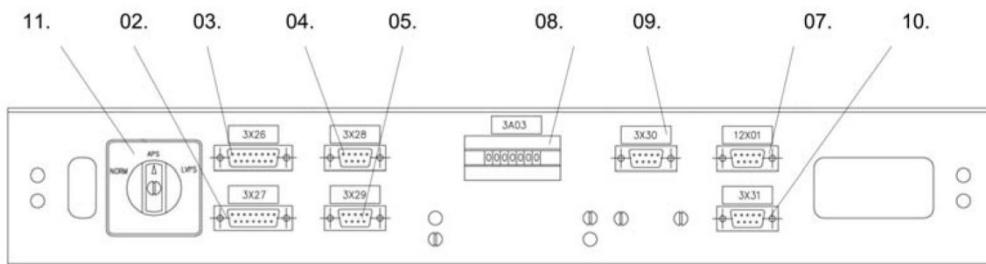
Refer to paragraph 10-II-03.01.02.01 for the Reference Diagrams.

10-II-02.02 Troubleshooting with the Portable Test Unit (PTU)

The PTU (Portable Test Unit) can be connected to the Data download panels in the Electronic lockers at the center of the train. By means of the PTU the maintenance personnel have more information available than by using the IDU.



A BODY SECTION



B BODY SECTION

- | | |
|--|--|
| 01. LINE SELECTOR | 07. (12X01) HVAC CONNECTOR |
| 02. (3X27) PCADAC CONNECTOR (PROPULSION) | 08. ODOMETER DISPLAY |
| 03. ((3X26) FBKDI CONNECTOR (PROPULSION) | 09. (3X30) JP1P (PSC) CONNECTOR (APS/LVPS) |
| 04. (3X28) PCA232 CONNECTOR (PROPULSION) | 10. (3X31) JP1C (CIA) CONNECTOR (APS/LVPS) |
| 05. (3X29) STB232 CONNECTOR (PROPULSION) | 11. APS/LVPS SELECTOR |
| 06. LONWORKS BUS CONNECTOR | |

Figure 10-II-02.6 Data Download Panels

These signals can be acquired by means of a PTU directly connected to the LONWorks bus through the LON connector (refer to Figure 10-II-02.7) of the Download Panel in the A cab electronic locker.

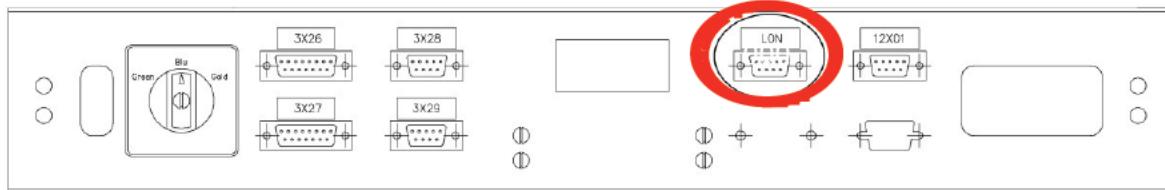


Figure 10-II-02.7 A Cab Download Panel - LON Connector

10-II-02.02.01 Software for Troubleshooting the APS/LVPS System

SYSTEM	TITLE	REVISION	DATE
APS	C4IVL03 (CIA-04 Board)	03	16/04/2008
LVPS	P4CBL5A (PSC-04 Board)	05	03/04/2008

10-II-02.02.02 The Use of the PTU

See the PTU's user manual.

10-II-03 APPENDIX 1

10-II-03.01 APS/LVPS IDU Fault List

10-II-03.01.01 Operating Mode

All faults related to the APS/LVPS System and monitored by the IDU, are listed in the IDU screen and described in the relevant Fault Charts.

The Operating Mode Fault Tables, listed below, include, for each fault, the relevant Operator Guide, which gives the Operator suggestions on how to overcome the fault.

The Operator Guide can be shown by touching the “Detail” button on the screen and is referred to the fault highlighted on the list.

Refer to Table 10-II-03. 1 for APS/LVPS Operating Mode Fault List

Refer to Table 10-II-03. 2 for APS/LVPS Operating Mode Fault Details

Refer to Table 10-II-03. 4 for APS/LVPS Operating Mode and Maintenance Mode Fault Relationship

Table 10-II-03.1 APS/LVPS Operating Mode Fault List

Code	Affected Subsystem	Description
4029	APS/LVPS	Fan Circuit Breaker Open
4030	APS/LVPS	Power Supply Circuit Breaker Open
4031	APS/LVPS	APS Fault Relay
4032	APS/LVPS	LVPS Fault Relay
4033	APS/LVPS	Battery Protection Open
4034	APS/LVPS	Fault
4035	APS/LVPS	Blower Switch Open

Table 10-II-03.2 APS/LVPS Operating Mode Fault Details

Fault#	Date	Time	Vehicle#	System	Description
4029	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	Fan Circuit Breaker Open
Operator Guide					
Check 2F12 circuit breaker (Electrical Cabinet Car B).					

Table 10-II-03.2 APS/LVPS Operating Mode Fault Details (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4030	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	Power Supply Circuit Breaker Open Operator Guide Check Power Supply circuit breaker (3F03 - Electrical Cabinet Car B) and/or Dead Battery StartUp Device circuit breaker (3F04 - Electrical Cabinet Car B).

Fault#	Date	Time	Vehicle#	System	Description
4031	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS Fault Relay Operator Guide 3K18 Relay Intervention (Electrical Cabinet Car B). No action required.

Fault#	Date	Time	Vehicle#	System	Description
4032	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS Fault Relay Operator Guide 3K04 Relay Intervention (Electrical Cabinet Car B). No action required.

Fault#	Date	Time	Vehicle#	System	Description
4033	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	Battery Protection Open Operator Guide Check 3F01 circuit breaker (Battery Pack).

Fault#	Date	Time	Vehicle#	System	Description
4034	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	Fault Operator Guide Try to reset by switching OFF and ON the switch 3F03 and 3F04 (electronic cabinet in carbody B).

Fault#	Date	Time	Vehicle#	System	Description
4035	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	Blower Switch Open Operator Guide Check if 2F12 switch (electronic cabinet in carbody B) is really open and in this case try to close.

10-II-03.01.02 Maintenance Mode

All faults related to the APS/LVPS System and monitored by the IDU in Maintenance Mode are listed in the following Fault Charts.

The Operator Guide pops up by touching the “Detail” button on the screen and is referred to the fault highlighted on the list.

Refer to Table 10-II-03.3 for APS/LVPS Maintenance Mode Fault List

Refer to Table 10-II-03.4 for APS/LVPS Operating Mode and Maintenance Mode Fault Relationship

Refer to Table 10-II-03.5 for APS/LVPS Maintenance Mode Fault Details

Table 10-II-03.3 APS/LVPS Maintenance Mode Fault List

Code	Affected Subsystem	Description
4001	APS/LVPS	LVPS line fuse KO
4002	APS/LVPS	Ground Fault
4003	APS/LVPS	APS module overtemperature
4004	APS/LVPS	APS KO -No output current detected
4005	APS/LVPS	APS currents unbalance
4006	APS/LVPS	APS line overcurrent
4007	APS/LVPS	APS output overcurrent
4008	APS/LVPS	APS line overvoltage
4009	APS/LVPS	APS overloaded
4010	APS/LVPS	APS output short circuit
4011	APS/LVPS	LVPS module overtemperature
4012	APS/LVPS	LVPS KO -output voltage or current fault
4013	APS/LVPS	LVPS module overcurrent
4014	APS/LVPS	LVPS line overcurrent
4015	APS/LVPS	LVPS line overvoltage
4016	APS/LVPS	LVPS output overcurrent
4017	APS/LVPS	LVPS output overvoltage
4018	APS/LVPS	LVPS output short circuit
4019	APS/LVPS	Power Good KO
4020	APS/LVPS	PSC Board hardware fault
4021	APS/LVPS	CIA board hardware fault
4022	APS/LVPS	Blower Switch Open
4023	APS/LVPS	APS line current transducer KO
4024	APS/LVPS	LVPS line current transducer KO

Table 10-II-03.3 APS/LVPS Maintenance Mode Fault List (cont'd)

Code	Affected Subsystem	Description
4025	APS/LVPS	LVPS output current transducer KO
4026	APS/LVPS	APS Phase R current transducer KO
4027	APS/LVPS	APS Phase S current transducer KO
4028	APS/LVPS	APS Phase T current transducer KO
4029	APS/LVPS	Fan Circuit Breaker Open
4030	APS/LVPS	Power Supply Circuit Breaker Open
4031	APS/LVPS	APS Fault Relay
4032	APS/LVPS	LVPS Fault Relay
4033	APS/LVPS	Battery Protection Open

Table 10-II-03.4 APS/LVPS Operating Mode and Maintenance Mode Fault Relationship

Operating Mode Fault Codes	Maintenance Mode Fault Codes							
4029	4029							
4030	4030							
4031	4031							
4032	4032							
4033	4033							
4034	4001	4002	4003	4004	4005	4006	4007	4008
	4009	4010	4011	4012	4013	4014	4015	4016
	4017	4018	4019	4020	4021	4023	4024	4025
	4026	4027	4028					
4035	4022							

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault Details

Fault#	Date	Time	Vehicle#	System	Description
4001	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS line fuse KO
Operator Guide					
Effect: LVPS stops working. APS continue working.					
Action:					
<ol style="list-style-type: none"> 1. Try to reset by switching off and on 3F03 and 3F04 (electronic cabinet in car section B). 2. Check Fuse labeled FCB inside the APS_LVPS Converter. 					
If FCB is OK the following must be done:					
<ol style="list-style-type: none"> 3. Replace the PSC board and check. 4. Replace the CIA board and check. 5. Replace the Control Rack (Mother Board) and check. 6. Check wirings between connector CA (Control Unit) and FCB. 					
If FCB is KO replace the fuse and check according to the followings sequence:					
<ol style="list-style-type: none"> 7. Replace LVPS Module (MCB) and check. 8. Replace Start Up Converter (SUC) and check. 9. Check HV cable between FCB and MCB, SUC. 					
Involved Components					
LVPS fuse (FCB), FCB fuse wiring, PSC board, Mother Board					
Reference Schematic Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4002	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	Ground Fault
Operator Guide					
Effect: None.					
Action:					
The following operation must be performed:					
<ol style="list-style-type: none"> 1. disconnect HV cable from -AT converter terminal. 2. measure the insulating resistance (R_{iso}) between -AT terminal and the converter Frame. 					
If R_{iso} is less than 1MegaOhm, there is a real ground fault problem and all HV cabling inside the converter must be checked.					
If R_{iso} is more than 1 MegaOhm try to:					
<ol style="list-style-type: none"> 1. replace the PSC board and check. 2. replace the rack Mother Board and check. 3. check wirings between the CA connector (control unit) and the VCOUT connector (GOB board). 4. replace the GOB board and check. 					
Involved Components					
In case of false Ground Fault detection, the component involved can be all the components for the acquisition from the current transducers (wirings, boards, mother board) and the current transducers themselves (TACB, TAIV or TAN).					
In case of a real Ground Fault, any element of the electric system of the train can be the cause of the fault.					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Threshold: $ value \text{ from } TAIV + value \text{ from } TACB - value \text{ from } TAN > 5A$					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4003	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS module overtemperature
Operator Guide					
<p>Effect: The APS stops working; the LVPS stops working after 4 minutes from the alarm to avoid over heating due to ventilation absence.</p> <p>Action:</p> <p>If the fault disappears after about 30 minutes with the APS stopped, it means that there is a real over-heating of the APS module. In this case the following checks must be carried out:</p> <ol style="list-style-type: none"> 1. Rotating direction of the motor blower. 2. Ventilation duct and air inlet window (must be free of dust). <p>If the fault is still active after 30 minutes with the APS not working, the following operations must be carried out:</p> <ol style="list-style-type: none"> 1. Replace the CIA board and check. 2. Replace the rack Mother Board and check. 3. Replace the APS module and check. 4. Check wirings between connector CA (control unit) and connector VCCIV. 					
Involved Components					
APS/LVPS fan, APS Inverter Module, APS dissipater, APS thermal Switch, Thermal Switch Wiring, CIA board, Mother Board, Board Feeder					
Reference Diagrams					
Figure 10-II-03.8 Schematic Diagram Auxiliary Power Supply 6					
Threshold: 212°F (100°C) (Temporary Protection)					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4004	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS KO - No output current detected
Operator Guide					
Effect: The APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.					
Action: The following operations must be carried out:					
1. Replace the CIA board and check. 2. Replace the rack Mother Board and check. 3. Replace the APS Module and check. 4. Check the wiring between connector CA (control unit) and TAR, TAS, TAT Transducers. 5. Check the wiring between connector CA (control unit) and CINV connector (APS module). 6. Check transducers TAR, TAS, TAT.					
Involved Components					
APS Inverter Module, CIA board, Mother Board, wiring between APS Module and CA Connector					
Reference Diagrams					
Figure 10-II-03.8 Schematic Diagram Auxiliary Power Supply 6					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4005	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS currents unbalance
Operator Guide					
<p>Effect: the APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.</p> <p>Action:</p> <p>Verify if the fault occurs in no load condition (use MV switch to cut out all MV loads except the APS blower).</p> <p>If the fault occurs in no load condition (internal problem), the following operations must be carried out:</p> <ol style="list-style-type: none"> 1. Replace the CIA board and check. 2. Replace the rack Mother Board and check. 3. Check the APS output transformer TRINV. 4. Check the wiring between connector CA (control unit) and TAR,TAS,TAT Transducers. 5. Check transducers TAR,TAS,TAT. 6. Check the APS output capacitors CF1 - CF6. 7. Check the APS output transformer TRINV. 					
Involved Components					
TAR, TAS or TAT transducer, wiring between these transducers and the CA connector, Mother Board, CIA board, APS Inverter Module, APS Transformer					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2 Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4 Threshold: load unbalance > 35% (Permanent Protection)					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4006	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS line overcurrent Operator Guide
Effect: the APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.					
Action: Verify if fuse 01F02 is melted/interrupted: in this case replace the fuse and carry out the following operations: <ol style="list-style-type: none"> 1. Verify if the APS Module IGBTs are exploded; in this case replace the APS Module and check. 2. Verify if the Active Clamp Module IGBTs are exploded; in this case replace & Check. 3. Verify the HV wiring between the LF2 terminal and the I (+AT) terminal (Active clamp module) and the PSA terminal (APS module). If fuse 01F02 isn't melted/interrupted the following operations must be carried out: <ol style="list-style-type: none"> 1. Replace the CIA board and check. 2. Check the wiring between the CA connector (control unit) and the TAIV Transducer. 					
Involved Components APS/LVPS fuse (01F02), TAIV transducer, APS Wirings, APS Inverter Module, APS Transformer Module, Active Clamp Module, Mother Board, CIA Board.					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					
Figure 10-II-03.1 HV Wiring					
Threshold: 408A (Permanent Protection)					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4007	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS output overcurrent
Operator Guide					
Effect: The APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.					
Action: If the fault also occurs in no load condition (internal problem) perform the following operations:					
<ol style="list-style-type: none"> 1. Replace the CIA board and check. 2. Replace the rack Mother Board and check. 3. Check the wiring between CA connector (control unit) and TAR,TAS,TAT,TVF Transducers. 4. Replace the APS module and check. 5. Replace TAR,TAS,TAT,TVF transducers and check. 6. Check the APS output capacitors CF1 - CF6. 7. Check the APS output transformer TRINV. 					
Involved Components					
TAS, TAT, TAR current transducers, Mother Board, CIA Board, Wiring between transducers and CA connector, APS Inverter Module, APS Transformer, APS Output Capacitors.					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.5 Schematic Diagram Auxiliary Power Supply 3					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					
Threshold: 805Apk (Memorized Protection)					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4008	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS line overvoltage Operator Guide
Effect: the APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.					
Action: If the fault also occurs in no load condition (internal problem) perform the following operations:					
<ol style="list-style-type: none"> 1. Replace the CIA board and check. 2. Replace the rack Mother Board and check. 3. Check the wiring between CA connector (control unit) and TAR,TAS,TAT,TVF Transducers. 4. Replace the APS module and check. 5. Replace TAR,TAS,TAT,TVF transducers and check. 6. Check the APS output capacitors CF1 - CF6. 7. Check the APS output transformer TRINV. 					
Involved Components					
TVF current transducer, Mother Board, CIA Board, Wiring between transducer and CA connector, APS Inverter Module, APS Transformer, APS Output Capacitors.					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.5 Schematic Diagram Auxiliary Power Supply 3					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					
Threshold: 1,135V (Memorized Protection)					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4009	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS overloaded
Operator Guide					
Effect: the APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over heating due to ventilation absence.					
Action: If the fault also occurs in no load condition (internal problem) perform the following operations:					
<ol style="list-style-type: none"> 1. Replace the CIA board and check. 2. Replace the rack Mother Board and check. 3. Check the wiring between CA connector (control unit) and TAR,TAS,TAT,TVF Transducers. 4. Replace the APS module and check. 5. Replace TAR,TAS,TAT,TVF transducers and check. 6. Check the APS output capacitors CF1 - CF6. 7. Check the APS output transformer TRINV. 					
Involved Components					
TAS, TAT, TAR current transducers, Mother Board, CIA Board, Wiring between transducers and CA connector, APS Inverter Module, APS Transformer, APS Output Capacitors, MV Loads (probably connected with the external outlets)					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.5 Schematic Diagram Auxiliary Power Supply 3					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					
Threshold: 1120kW per 30sec. (Memorized Protection)					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4010	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS output short circuit
Operator Guide					
Effect: the APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.					
Action:					
If the fault also occurs in no load condition (internal problem) perform the following operations:					
<ol style="list-style-type: none"> 1. Replace the CIA board and check. 2. Replace the rack Mother Board and check. 3. Check the wiring between CA connector (control unit) and TAR,TAS,TAT,TVF Transducers. 4. Replace the APS module and check. 5. Replace TAR,TAS,TAT,TVF transducers and check. 6. Check the APS output capacitors CF1 - CF6. 7. Check the APS output transformer TRINV. 					
Involved Components					
TAS, TAT, TAR current transducers, Mother Board, CIA Board, Wiring between transducers and CA connector, APS Inverter Module, APS Transformer, APS Output Capacitors, MV Loads.					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.5 Schematic Diagram Auxiliary Power Supply 3					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					
Threshold: 212°F (100°C) (Temporary Protection)					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4011	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS module overtemperature
Operator Guide					
Effect: The LVPS stops working. The APS continues working.					
Action:					
If the fault disappears after about 30 minutes with the LVPS not working, it means that there is a real over-heating of the LVPS module. In this case the following checks must be carried out:					
<ol style="list-style-type: none"> 1. Rotating direction of the motor blower. 2. Ventilation duct and air inlet window (must be free of dust). 					
If the fault is still active after 30 minutes with the LVPS not working, the following operation must be carried out:					
<ol style="list-style-type: none"> 1. Replace the PSC board and check. 2. Replace the rack Mother Board and check. 3. Replace the LVPS module and check. 4. Check the wirings between connector CA (control unit) and connector VCCB. 					
Involved Components					
APS/LVPS fan and Air Duct, LVPS Inverter Module, LVPS dissipater, Thermal Switch Wiring (from LVPS Inverter Module to the CA connector), PSC board, Mother Board, Board Feeder					
Reference Diagrams					
Figure 10-II-03.8 Schematic Diagram Auxiliary Power Supply 6					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4012	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS KO - output voltage or current fault
Operator Guide					
Effect: the LVPS stops working. The APS continues working.					
Action:					
The following operation must be performed:					
<ol style="list-style-type: none"> 1. Replace the PSC board and check. 2. Replace the LVPS module and check. 					
Involved Components					
LVPS inverter Module, PSC board, Mother Board, wiring between LVPS Inv. Module and CA connector.					
Reference Diagrams					
Figure 10-II-03.8 Schematic Diagram Auxiliary Power Supply 6					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4013	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS module overcurrent Operator Guide
Effect: the LVPS stops working. The APS continues working.					
Action:					
If the fault occurs also in no load condition (internal problem) perform the following operations:					
<ol style="list-style-type: none"> 1. Replace the PSC board and check. 2. Replace the rack Mother Board and check. 3. Check the wiring between CA connector (control unit) and TAB, TAC transducers. 4. Replace the LVPS module and check. 5. Replace TAB,TAC and check. 6. Check the LVPS output capacitors CU1 - CU4. 7. Check the LVPS output transformer TRCB. 					
Involved Components					
PSC Board, Mother Board, TAC, TAB Current Transducers, Wiring TAC, TAB - CA connector, LVPS Inverter Module, LVPS Transformer, LV Loads.					
Reference Diagrams					
Figure 10-II-03.5 Schematic Diagram Auxiliary Power Supply 3					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					
Threshold: 670Adc (Hardware, Memorized Protection), 427Adc (Software, Memorized Protection).					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4014	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS line overcurrent
Operator Guide					
Action:					
Verify if fuse FCB is melted/interrupted. In this case replace the fuse and perform the following operations:					
<ol style="list-style-type: none"> 1. Verify if the LVPS Module IGBTs are exploded; in this case replace the LVPS Module and check. 2. Verify the HV wiring between the LF3 terminal and the PCB terminal (LVPS module). 					
If the fuse FCB is not melted/interrupted, the following operations must be carried out:					
<ol style="list-style-type: none"> 1. Replace the PSC board and check. 2. Check the wiring between CA connector (control unit) and the TACB transducer. 					
Involved Components					
FCB Fuse, LVPS HV Wirings, LVPS Module, LVPS Transformer, TACB Current Transducer, PSc Board, Mother Board.					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.5 Schematic Diagram Auxiliary Power Supply 3					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					
Threshold: 202A (Permanent Protection)					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4015	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS line overvoltage Operator Guide
Effect: the LVPS stops working. The APS continues working.					
Action:					
If the fault occurs also in no load condition (internal problem) perform the following operations:					
<ol style="list-style-type: none"> 1. Replace the PSC board and check. 2. Replace the rack Mother Board and check. 3. Check the wiring between CA connector (control unit) and TAR,TAS,TAT,TVF Transducers. 4. Replace the APS module and check. 5. Replace TAR,TAS,TAT,TVF transducers and check. 6. Check the APS output capacitors CF1 - CF6. 7. Check the APS output transformer TRINV. 					
Involved Components					
TVF Transducer, PSC Board, Mother Board, Wiring between TVF and CA connector.					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					
Threshold: 1,203Vdc (Memorized Protection)					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4016	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS output overcurrent Operator Guide
Effect: the LVPS stops working. The APS continues working.					
Action:					
Verify if the fuse FCB is melted/interrupted. In this case replace the fuse and perform the following operations:					
<ol style="list-style-type: none"> 1. Verify if the LVPS Module IGBTs are exploded; in this case replace the LVPS Module and check. 2. Verify the HV cabling between the LF3 terminal and the PCB terminal (LVPS module). 					
If the fuse FCB isn't melted the following operations must be done:					
<ol style="list-style-type: none"> 1. Replace the PSC board and check. 2. Check the wiring between CA connector (control unit) and the TACB transducer. 					
Involved Components					
TAC, TAB transducers, PSC Board, Mother Board, Wiring between Transducers and CA connector, LV loads (or Battery)					
Reference Diagrams					
Figure 10-II-03.5 Schematic Diagram Auxiliary Power Supply 3					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					
Threshold: 670Adc (Hardware, Memorized Protection), 427Adc (Software, Memorized Protection).					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4017	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS output overvoltage Operator Guide
Effect: the LVPS stops working. The APS continues working.					
Action:					
The following operation must be performed:					
<ol style="list-style-type: none"> 1. Replace the PSC board and check. 2. Check the LVPS output capacitors. 3. Replace the LVPS Module and check. 					
Involved Components					
TVB transducer, PSC Board, Mother Board,, wiring between TVB and CA connector LVPS Inverter Module, LVPS Transformer, LVPS Output Capacitors.					
Reference Diagrams					
Figure 10-II-03.5 Schematic Diagram Auxiliary Power Supply 3					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					
Threshold: 43Vdc (Hardware, Memorized Protection), 42Vdc (Software, Memorized Protection).					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4018	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS output short circuit Operator Guide
Effect: the LVPS stops working. The APS continues working.					
Action: If the fault occurs also in no load condition (internal problem) perform the following operations: <ol style="list-style-type: none">1. Replace the PSC board and check.2. Replace the rack Mother Board and check.3. Check the wiring between CA connector (control unit) and TAB,TAC transducers.4. Replace the LVPS module and check.5. Replace TAB,TAC and check.6. Check the LVPS output capacitors CU1 - CU4.7. Check the LVPS output transformer TRCB.					
Involved Components TAB, TAC Transducers, Wiring between Transducers and CA connector, LVPS Inverter Module, LVPS Transformer, LVPS Output Capacitors.					
Reference Diagrams					
Figure 10-II-03.5 Schematic Diagram Auxiliary Power Supply 3					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					
Threshold: 43Vdc (Hardware, Memorized Protection), 42Vdc (Software, Memorized Protection).					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4019	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	Power Good KO Operator Guide
Effect: APS & LVPS stop working.					
Action:					
The following operation must be performed:					
<ol style="list-style-type: none"> 1. Check input voltage wiring. 2. Check output voltage indication. 3. Replace the Control Rack Mother Board and check. 4. Replace the PSC & APS boards and check. 					
Involved Components					
APS/LVPS Power Supply Unit, Mother Board					
Reference Diagrams					
Figure 10-II-03.7 Schematic Diagram Auxiliary Power Supply 5					

Fault#	Date	Time	Vehicle#	System	Description
4020	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	PSC Board hardware fault Operator Guide
Effect: APS & LVPS stop working.					
Action: The following operation must be performed: replace the PSC board.					
Involved Components					
PSC Board.					

Fault#	Date	Time	Vehicle#	System	Description
4021	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	CIA board hardware fault Operator Guide
Effect: APS & LVPS stop working.					
Action:					
The following operation must be performed:					
<ol style="list-style-type: none"> 1. Replace the CIA board. 					
Involved Components					
CIA Board					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4022	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	Blower Switch Open
Operator Guide					
Effect: the APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.					
Action: If the switch 2F12 is really open: 1. Check the stator impedance (line to line) of the motor blower. if the impedance measured is less than 9 Ohm: 1. Replace the motor blower and check.					
Involved Components					
2F12 Switch, APS/LVPS Fan.					
Reference Diagrams					
Figure 10-II-03.5 Schematic Diagram Auxiliary Power Supply 3					

Fault#	Date	Time	Vehicle#	System	Description
4023	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS line current transducer KO
Operator Guide					
Effect: the APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.					
Action: The following operation must be performed: 1. Replace the CIA board and check. 2. Replace the TAIV transducer and check.					
Involved Components					
TAIV Current Transducer, CIA Board, Mother Board, Wiring between TAIV and CA connector					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4024	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS line current transducer KO
Operator Guide					
Effect: the APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.					
Action: The following operation must be performed:					
1. Replace the PSC board and check. 2. Replace the TACB transducer and check.					
Involved Components					
TACB Current Transducer, PSC Board, Mother Board, Wiring between TACB and CA connector					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					

Fault#	Date	Time	Vehicle#	System	Description
4025	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS output current transducer KO
Operator Guide					
Effect: the APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.					
Action: The following operation must be performed:					
1. Replace the PSC board and check. 2. Replace the TAC transducer and check.					
Involved Components					
TAC Current Transducer, PSC Board, Mother Board, Wiring between TAC and CA connector					
Reference Diagrams					
Figure 10-II-03.5 Schematic Diagram Auxiliary Power Supply 3					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4026	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS Phase R current transducer KO
Operator Guide					
Effect: the APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.					
Action: The following operation must be performed: 1. Replace the CIA board and check. 2. Replace the TAR transducer and check.					
Involved Components					
TAR Current Transducer, CIA Board, Mother Board, Wiring between TAR and CA connector					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					

Fault#	Date	Time	Vehicle#	System	Description
4027	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS Phase S current transducer KO
Operator Guide					
Effect: the APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.					
Action: The following operation must be performed: 1. Replace the CIA board and check. 2. Replace the TAS transducer and check.					
Involved Components					
TAS Current Transducer, CIA Board, Mother Board, Wiring between TAS and CA connector					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4028	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS Phase T current transducer KO
Operator Guide					
Effect: the APS stops working; the LVPS stops working after 4 minutes from the alarm, to avoid over-heating due to ventilation absence.					
Action: The following operation must be performed: <ol style="list-style-type: none"> 1. Replace the CIA board and check. 2. Replace the TAT transducer and check. 					
Involved Components					
TAT Current Transducer, CIA Board, Mother Board, Wiring between TAT and CA connector					
Reference Diagrams					
Figure 10-II-03.4 Schematic Diagram Auxiliary Power Supply 2					
Figure 10-II-03.6 Schematic Diagram Auxiliary Power Supply 4					

Fault#	Date	Time	Vehicle#	System	Description
4029	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	Fan Circuit Breaker Open
Operator Guide					
Action: The following operation must be performed: <ol style="list-style-type: none"> 1. Check the 2F12 circuit breaker (LV Cabinet Car A). 					
Involved Components					
2F12 Switch, APS/LVPS Fan.					
Reference Diagrams					
Figure 10-II-03.5 Schematic Diagram Auxiliary Power Supply 3					

Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

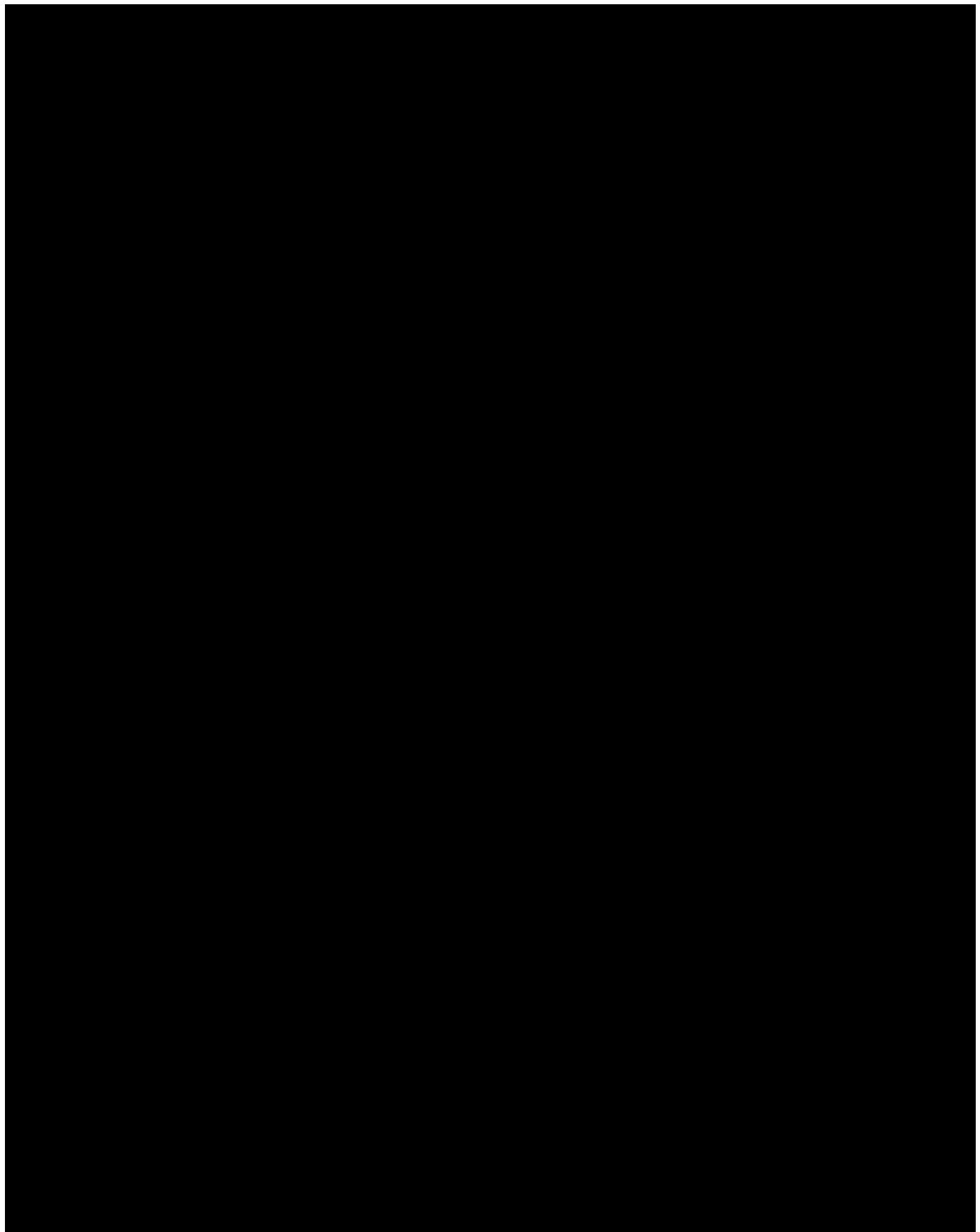
Fault#	Date	Time	Vehicle#	System	Description
4030	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	Power Supply Circuit Breaker Open
Operator Guide					
Action:					
1. Check the Power Supply Circuit breaker (3F03 - LV Cabinet Car B) and/or the Dead Battery Start-Up Device circuit breaker (3F04 - LV Cabinet Car B).					
Involved Components					
3F03 and 3F04 Circuit Breakers, Start-Up Circuit, APS/LVPS Power Supply					
Reference Diagrams					
Figure 10-II-03.3 APS/LVPS Low Voltage Connections					
Figure 10-II-03.7 Schematic Diagram Auxiliary Power Supply 5					

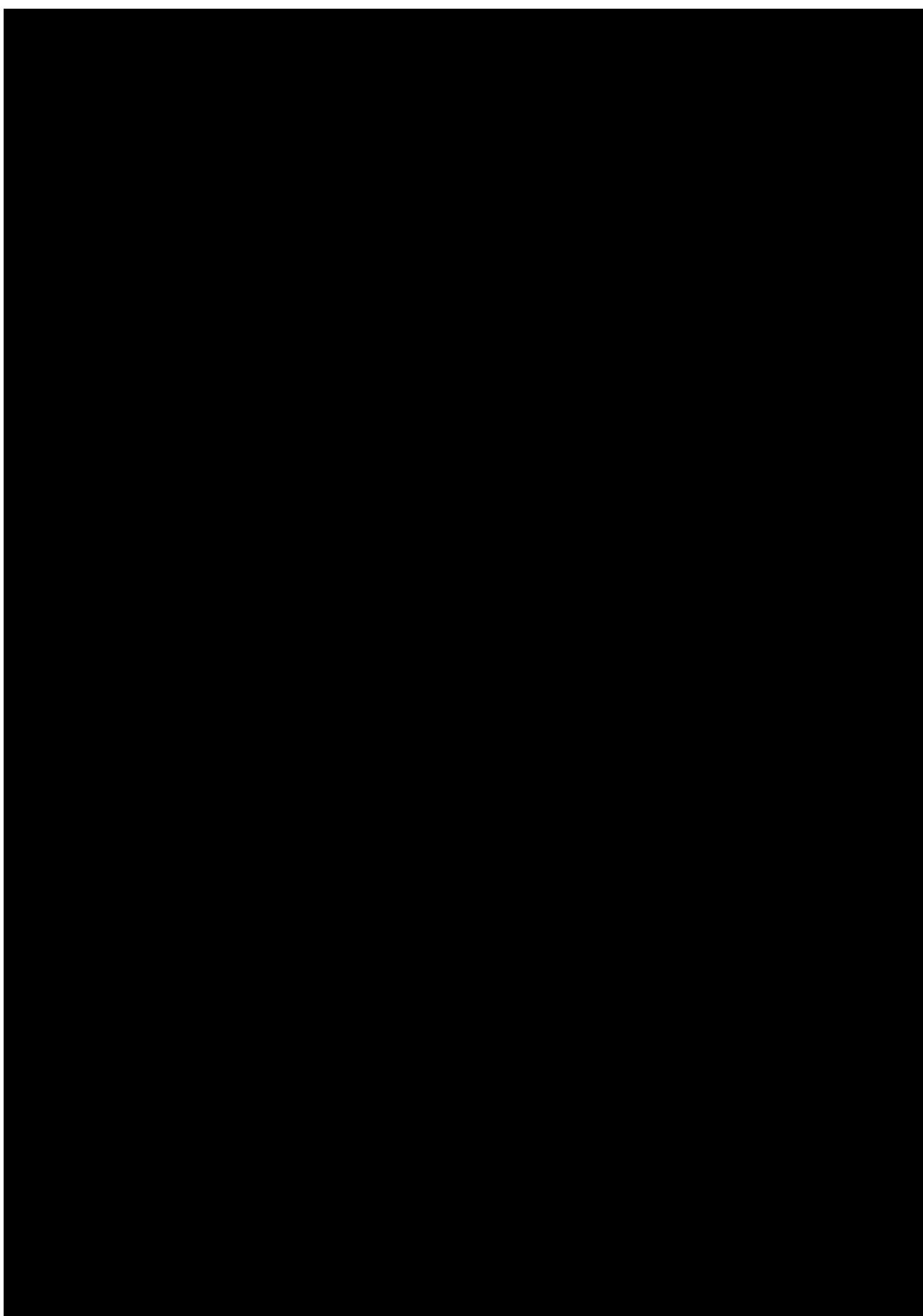
Fault#	Date	Time	Vehicle#	System	Description
4031	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	APS Fault Relay
Operator Guide					
Action:					
1. Check the 3K18 Relay (LV Cabinet Car B)					
Involved Components					
3K18 relay, 3K18 Wiring, Mother Board, CIA Board					
Reference Diagrams					
Figure 10-II-03.3 APS/LVPS Low Voltage Connections					
Figure 10-II-03.7 Schematic Diagram Auxiliary Power Supply 5					

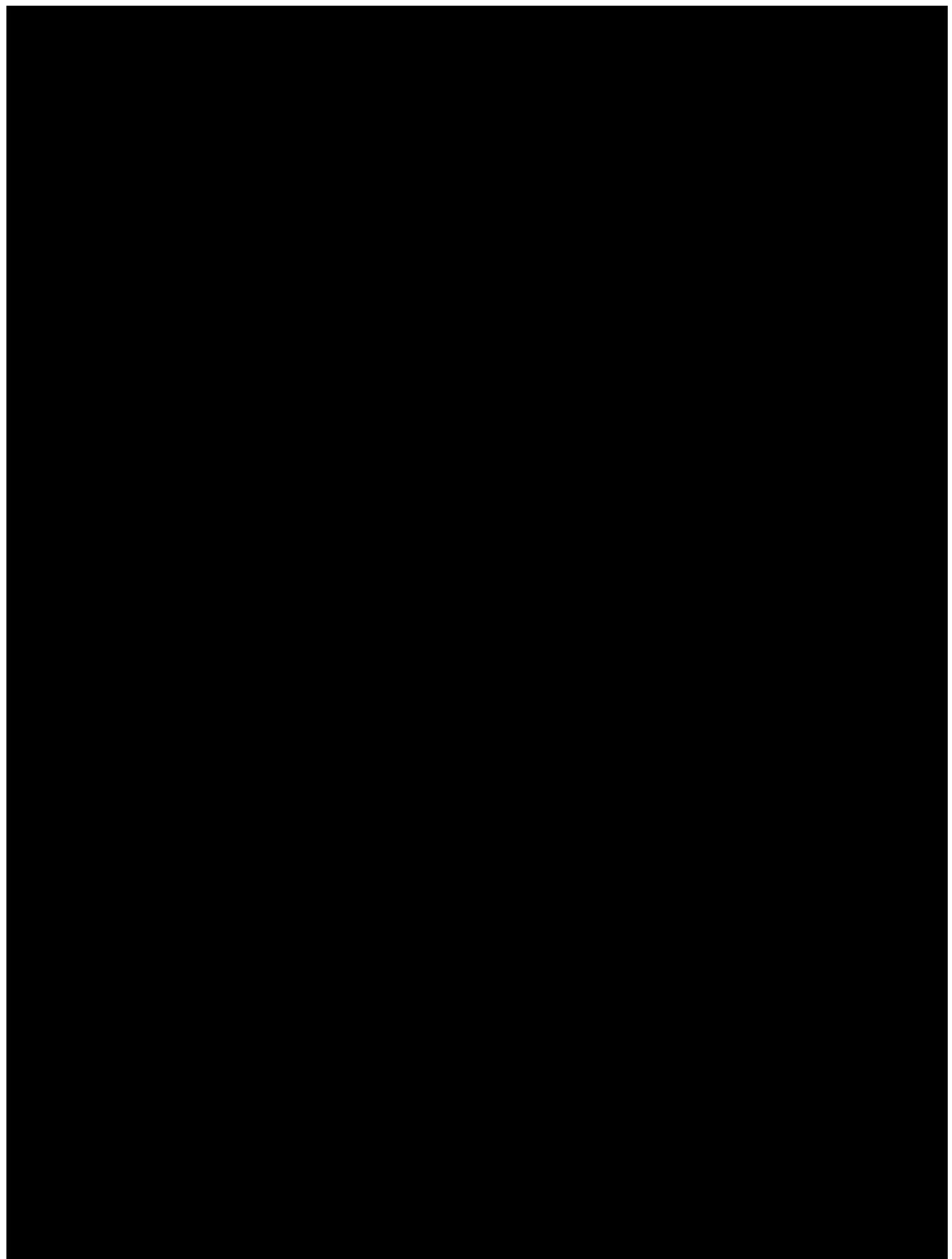
Table 10-II-03.5 APS/LVPS Maintenance Mode Fault List (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
4032	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	LVPS Fault Relay Operator Guide
Action:					
1. Check the 3K04 Relay (LV Cabinet Car B)					
Involved Components 3K04 relay, 3K04 Wiring, Mother Board, PSC Board					
Reference Diagrams					
Figure 10-II-03.3 APS/LVPS Low Voltage Connections					
Figure 10-II-03.7 Schematic Diagram Auxiliary Power Supply 5					

Fault#	Date	Time	Vehicle#	System	Description
4033	mm/dd/yy	hh:mm:ss	xxx	APS/LVPS	Battery Protection Open Operator Guide
Action:					
1. Check 3F01 circuit breaker (Battery Pack)					
Involved Components 3F02 and 3F01 Circuit Breaker, Battery					
Reference Diagrams					
Figure 10-II-03.2 LV Battery Connections					







10-II-04 APPENDIX 2

10-II-04.01 AUX IDU Fault List

10-II-04.01.01 Operating Mode

All faults related to the Circuit Breaker Status can be shown by the IDU in Operating Mode and the related Operator Guide actions are listed in the following Tables.

The Operating Mode Fault Tables, listed below, include, for each fault, the relevant Operator Guide, which gives the Operator suggestions on how to overcome the fault.

The Operator Guide can be shown by touching the “Detail” button on the screen and is referred to the fault highlighted on the list.

Refer to Table 10-II-04. 1 for Operating Mode Fault List

Refer to Table 10-II-04. 2 for Operating Mode Fault Details

Refer to Table 10-II-04. 4 for Operating Mode and Maintenance Mode Fault Relationship

Table 10-II-04.1 AUX Operating Mode Fault List

Code	Affected Subsystem	Description
5109	AUX_DEFRA	Circuit Breaker Open
5209	AUX_DEFRB	Circuit Breaker Open
5310	AUX_OUT_CAB_A	Circuit Breaker 1 Open
5410	AUX_OUT_CAB_B	Circuit Breaker 1 Open
5311	AUX_OUT_CAB_A	Circuit Breaker 2 Open
5411	AUX_OUT_CAB_B	Circuit Breaker 2 Open
5512	AUX_OUT_LCK_A	Circuit Breaker Open
5612	AUX_OUT_LCK_B	Circuit Breaker Open
5713	AUX_LIGHTS	Car A Lighting Circuit Brk Open
5714	AUX_LIGHTS	Car A Ext. Lighting Circ Brk Open
5715	AUX_LIGHTS	Marker Lights Circuit Breaker Open
5716	AUX_LIGHTS	Car B Ext. Lighting Circ Brk Open
5717	AUX_LIGHTS	Car B Lighting Circuit Brk Open
5718	AUX_LIGHTS	Direction Indicators Circuit Brk Open
5719	AUX_LIGHTS	Compartment Circuit Brk Open
5720	AUX_LIGHTS	Emergency Circuit Brk Open
5821	AUX_CAB	A -Console Circuit Brk Open
5822	AUX_CAB	Dead Man Active
5823	AUX_CAB	A -Horn and Bell Circuit Brk Open

Table 10-II-04.1 AUX Operating Mode Fault List (cont'd)

Code	Affected Subsystem	Description
5824	AUX_CAB	A -Coupler Protection Circuit Brk Open
5825	AUX_CAB	B -Console Circuit Brk Open
5826	AUX_CAB	Silent Alarm Circuit Brk Open
5827	AUX_CAB	B -Horn and Bell Circuit Brk Open
5828	AUX_CAB	B -Coupler Protection Circuit Brk Open
5929	AUX_SND&TRK	Car A Sanders Circ Brk Open
5930	AUX_SND&TRK	Car A Track Brake Circ Brk Open
5931	AUX_SND&TRK	Car B Sanders Circ Brk Open
5932	AUX_SND&TRK	Car B Track Brake Circ Brk Open
5A33	AUX_PANTO	Pantograph Cmd Circ Brk Open
5A34	AUX_PANTO	Panto Engine Cmd Circ Brk Open
5B35	AUX_TRAINLINE	No Motion Circ Brk Open
5B36	AUX_TRAINLINE	Emerg. Brake Loop Circ Brk Open

Table 10-II-04.2 AUX Operating Mode Fault Details

Fault#	Date	Time	Vehicle#	System	Description
5109	mm/dd/yy	hh:mm:ss	xxx	AUX_DEF_R_A	Circuit Breaker Open
5209	mm/dd/yy	hh:mm:ss	xxx	AUX_DEF_R_B	Circuit Breaker Open
Operator Guide					
Auxiliary - Defroster Circuit Breaker Open. Check 2F11 circuit breaker (Cab Panel Car A for Defroster A - Cab Panel Car B for Defroster B) and/or check 10F04 circuit breaker (Cab Locker MV/LV Car A for Defroster A - Cab Locker MV/LV Car B for Defroster B) and/or 10F05 circuit breaker (Cab Locker MV/LV Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5310	mm/dd/yy	hh:mm:ss	xxx	AUX_OUT_CAB_A	Circuit Breaker 1 Open
5410	mm/dd/yy	hh:mm:ss	xxx	AUX_OUT_CAB_B	Circuit Breaker 1 Open
Operator Guide					
Auxiliary - Exterior Outlets CAB Circuit Breaker 1 Open. Check 2F07 circuit breaker (Cab Panel Car A for Exterior Outlets CAB A - Cab Panel Car B for Exterior Outlets CAB B) and/or 2F13 circuit breaker (Cab Panel Car A for Exterior Outlets CAB A - Cab Panel Car B for Exterior Outlets CAB B).					

Fault#	Date	Time	Vehicle#	System	Description
5311	mm/dd/yy	hh:mm:ss	xxx	AUX_OUT_CAB_A	Circuit Breaker 2 Open
5411	mm/dd/yy	hh:mm:ss	xxx	AUX_OUT_CAB_B	Circuit Breaker 2 Open
Operator Guide					
Auxiliary - Exterior Outlets CAB Circuit Breaker 2 Open. Check 2F08 circuit breaker (Cab Panel Car A for Exterior Outlets CAB A - Cab Panel Car B for Exterior Outlets CAB B) and/or 2F14 circuit breaker (Cab Panel Car A for Exterior Outlets CAB A - Cab Panel Car B for Exterior Outlets CAB B).					

Fault#	Date	Time	Vehicle#	System	Description
5512	mm/dd/yy	hh:mm:ss	xxx	AUX_OUT_LCK_A	Circuit Breaker Open
5612	mm/dd/yy	hh:mm:ss	xxx	AUX_OUT_LCK_B	Circuit Breaker Open
Operator Guide					
Auxiliary - Exterior Outlets Locker Circuit Breaker Open. Check 2F09 circuit breaker (LV Cabinet Car A for Exterior Outlets Locker A - LV Cabinet Car B for Exterior Outlets					

Table 10-II-04.2 AUX Operating Mode Fault Details (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
5713	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Car A Lightning Circuit Brk Open
Operator Guide					
Auxiliary - Car A, Check Cab Lightning circuit breaker (8F01 - LV Cabinet Car A) and/or Headlights circuit breakers (8F11, 8F12 - Cab Panel Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5714	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Car A Ext. Lightning Circ Brk Open
Operator Guide					
Auxiliary - Car A, Check Direction Indicators command circuit breaker (8F07 - LV Cabinet Car A) and/or Hazard Lights Command circuit breaker (8F06 - LV Cabinet Car A) and/or Stop Indicators circuit breaker (8F14 - LV Cabinet Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5715	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Marker Lights Circuit Breaker Open
Operator Guide					
Auxiliary - Check Marker circuit breaker (8F10 - LV Cabinet Car A) and/or By Pass Lights circuit breaker (8F16 - LV Cabinet Car B).					

Fault#	Date	Time	Vehicle#	System	Description
5716	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Car B Ext. Lightning Circ Brk Open
Operator Guide					
Auxiliary - Check Direction Indicators Command circuit breaker (8F07 - LV Cabinet Car B) and/or Hazard Lights Command circuit breaker (8F06 - LV Cabinet Car B) and/or Turn-Aux Lights Command circuit breaker (8F15 - LV Cabinet Car B).					

Fault#	Date	Time	Vehicle#	System	Description
5717	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Car B Lightning Circuit Brk Open
Operator Guide					
Auxiliary - Car B, Check Cab Lightning circuit breaker (8F01 - LV Cabinet Car B) and/or HeadLights circuit breaker (8F11, 8F12 - LV Cabinet Car B) and/or Light circuit breaker (8F17 - LV Cabinet Car B).					

Table 10-II-04.2 AUX Operating Mode Fault Details (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
5718	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Indicators Supply Circuit Brk Open
Operator Guide					
Auxiliary - Check Direction Indicators Power Supply circuit breakers (8F08, 8F09 - LV Cabinet Car B)					

Fault#	Date	Time	Vehicle#	System	Description
5719	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Compartment Circuit Brk Open
Operator Guide					
Auxiliary - Check Compartment Lightning circuit breakers (8F02 - Cab Panel Car B; 8F03, 8F04 - LV Cabinet Car B).					

Fault#	Date	Time	Vehicle#	System	Description
5720	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Emergency Circuit Brk Open
Operator Guide					
Auxiliary - Check Emergency Lightning circuit breaker (8F05 - Cab Panel Car B).					

Fault#	Date	Time	Vehicle#	System	Description
5821	mm/dd/yy	hh:mm:ss	xxx	AUX CAB	A - Console Circuit Brk Open
Operator Guide					
Auxiliary - Cab A, Check Enable circuit breaker (3F06 - Cab Panel Car A) and/or Key Switch circuit breaker (3F05 - Cab Panel Car A) and/or Loads Car circuit breaker (3F07 - LV Cabinet Car A) and/or Console Contactor and Relays circuit breakers (3K06 - LV Cabinet Car A; 3F08 - Cab Panel Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5822	mm/dd/yy	hh:mm:ss	xxx	AUX CAB	Dead Man Circuit Brk Open
Operator Guide					
Auxiliary - Check Dead Man Circuit Breaker (6F01 - LV Cabinet Car A) and/or Relays (6K01, 6K02 - LV Cabinet Car A).					

Table 10-II-04.2 AUX Operating Mode Fault Details (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
5823	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	A - Horn and Bell Circuit Brk Open Operator Guide Auxiliary - Cab A, Check Horn and Bell circuit breaker (10F01 - LV Cabinet Car A) and/or Wing Mirrors circuit breaker (10F02 - LV Cabinet Car A) and/or Wipers circuit breaker (10F03 - LV Cabinet Car A).

Fault#	Date	Time	Vehicle#	System	Description
5824	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	A - Coupler Protection Circuit Brk Open Operator Guide Auxiliary - Cab A, Check Coupler Protection circuit breakers (14F01 - LV Cabinet Car A; 14F02, 14F03, 14F04, 14F05, 14F06, 14F07 - Junction Box Car A).

Fault#	Date	Time	Vehicle#	System	Description
5825	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	B - Console Circuit Brk Open Operator Guide Auxiliary - Cab B, Check Enable circuit breaker (3F06 - Cab Panel Car B) and/or Key Switch circuit breaker (3F05 - Cab Panel Car B) and/or Loads Car circuit breaker (3F07 - LV Cabinet Car B) and/or Console Contactor and Relays (3K06 - LV Cabinet Car B; 3F08 - Cab Panel Car B).

Fault#	Date	Time	Vehicle#	System	Description
5826	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	Silent Alarm Circuit Brk Open Operator Guide Auxiliary - Check Silent Alarm circuit breaker (8F13 - LV Cabinet Car B).

Fault#	Date	Time	Vehicle#	System	Description
5827	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	B - Horn and Bell Circuit Brk Open Operator Guide Auxiliary - Cab B, Check Horn and Bell circuit breaker (10F01 - LV Cabinet Car B) and/or Wing Mirrors circuit breaker (10F02 - LV Cabinet Car B) and/or Wipers circuit breaker (10F03 - LV Cabinet Car B).

Table 10-II-04.2 AUX Operating Mode Fault Details (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
5828	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	B - Coupler Protection Circuit Brk Open
Operator Guide					
Auxiliary - Cab B, Check Coupler Protection circuit breakers (14F01 - LV Cabinet Car B; 14F02, 14F03, 14F04, 14F05, 14F06, 14F07 - Junction Box Car B).					

Fault#	Date	Time	Vehicle#	System	Description
5929	mm/dd/yy	hh:mm:ss	xxx	AUX_SANDER S	Car A Sanders Supply Crc Brk Open
Operator Guide					
Auxiliary - Car A, Check Sanders Power Supply (7F08 - LV Cabinet Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5930	mm/dd/yy	hh:mm:ss	xxx	AUX_SANDER S	Car A Sanders Cmd Cir Brk Open
Operator Guide					
Auxiliary - Car A, Check Sanders Command circuit breaker (7F12 - LV Cabinet Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5931	mm/dd/yy	hh:mm:ss	xxx	AUX_SANDER S	Car B Sanders Supply Crc Brk Open
Operator Guide					
Auxiliary - Car B, Check Sanders Power Supply (7F08 - LV Cabinet Car B).					

Fault#	Date	Time	Vehicle#	System	Description
5932	mm/dd/yy	hh:mm:ss	xxx	AUX_SANDER S	Car B Sanders Cmd Circ Brk Open
Operator Guide					
Auxiliary - Car B, Check Sanders Command circuit breaker (7F12 - LV Cabinet Car B) and/or Emergency Sanders Command circuit breaker (7F13 - LV Cabinet Car B).					

Table 10-II-04.2 AUX Operating Mode Fault Details (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
5A33	mm/dd/yy	hh:mm:ss	xxx	AUX_PANTO	Command Circ Brk Open Operator Guide Auxiliary - Check Pantograph Command circuit breaker (5F01 - LV Cabinet Car A) and/or Pantograph Power Supply circuit breaker (5F03 - LV Cabinet Car A).

Fault#	Date	Time	Vehicle#	System	Description
5A34	mm/dd/yy	hh:mm:ss	xxx	AUX_PANTO	Engine Command Circ Brk Open Operator Guide Auxiliary - Check Pantograph Engine Command circuit breaker (5F02 - Cab Panel Car A).

Fault#	Date	Time	Vehicle#	System	Description
5B35	mm/dd/yy	hh:mm:ss	xxx	AUX_TRAINLIN_E	No Motion Circ Brk Open Operator Guide Auxiliary - Check No Motion circuit breaker (3F26 - LV Cabinet Car A) and/or Loop By Pass and CutOut circuit breaker (3F23 - LV Cabinet Car A).

Fault#	Date	Time	Vehicle#	System	Description
5B36	mm/dd/yy	hh:mm:ss	xxx	AUX_TRAINLIN_E	Emerg. Brake Loop Circ Brk Open Operator Guide Auxiliary - Check Emergency Loop Transformer circuit breaker (6F02 - Cab Panel Car A) and/or Emergency Loop circuit breaker (6F03 - Cab Panel Car A).

10-II-04.01.02 Maintenance Mode

All faults related to the Circuit Breaker Status can be shown by the IDU in Operating Mode and the related Operator Guide actions are listed in the following Tables.

The Operator Guide pops up by touching the “Detail” button on the screen and is referred to the fault highlighted on the list.

For the Auxiliary system the Maintenance faults are perfectly the same of the Operating fault, refer to:

Refer to Table 10-II-04.3 for Maintenance Mode Fault List

Refer to Table 10-II-04.4 for Operating Mode and Maintenance Mode Fault Relationship

Refer to Table 10-II-04.5 for Maintenance Mode Fault Details

Table 10-II-04.3 AUX Maintenance Mode Fault List

Code	Affected Subsystem	Description
5109	AUX_DEF_R_A	Circuit Breaker Open
5209	AUX_DEF_R_B	Circuit Breaker Open
5310	AUX_OUT_CAB_A	Circuit Breaker 1 Open
5410	AUX_OUT_CAB_B	Circuit Breaker 1 Open
5311	AUX_OUT_CAB_A	Circuit Breaker 2 Open
5411	AUX_OUT_CAB_B	Circuit Breaker 2 Open
5512	AUX_OUT_LCK_A	Circuit Breaker Open
5612	AUX_OUT_LCK_B	Circuit Breaker Open
5713	AUX_LIGHTS	Car A Lighting Circuit Brk Open
5714	AUX_LIGHTS	Car A Ext. Lighting Circ Brk Open
5715	AUX_LIGHTS	Marker Lights Circuit Breaker Open
5716	AUX_LIGHTS	Car B Ext. Lighting Circ Brk Open
5717	AUX_LIGHTS	Car B Lighting Circuit Brk Open
5718	AUX_LIGHTS	Direction Indicators Circuit Brk Open
5719	AUX_LIGHTS	Compartment Circuit Brk Open
5720	AUX_LIGHTS	Emergency Circuit Brk Open
5821	AUX_CAB	A -Console Circuit Brk Open
5822	AUX_CAB	Dead Man Active
5823	AUX_CAB	A -Horn and Bell Circuit Brk Open
5824	AUX_CAB	A -Coupler Protection Circuit Brk Open
5825	AUX_CAB	B -Console Circuit Brk Open
5826	AUX_CAB	Silent Alarm Circuit Brk Open
5827	AUX_CAB	B -Horn and Bell Circuit Brk Open
5828	AUX_CAB	B -Coupler Protection Circuit Brk Open
5929	AUX_SND&TRK	Car A Sanders Circ Brk Open
5930	AUX_SND&TRK	Car A Track Brake Circ Brk Open
5931	AUX_SND&TRK	Car B Sanders Circ Brk Open
5932	AUX_SND&TRK	Car B Track Brake Circ Brk Open
5A33	AUX_PANTO	Pantograph Cmd Circ Brk Open
5A34	AUX_PANTO	Panto Engine Cmd Circ Brk Open
5B35	AUX_TRAINLINE	No Motion Circ Brk Open
5B36	AUX_TRAINLINE	Emerg. Brake Loop Circ Brk Open

Table 10-II-04.4 AUX Operating Mode and Maintenance Mode Fault Relationship

Operating Mode Fault Codes	Maintenance Mode Fault Codes							
5109	5109							
5209	5209							
5310	5310							
5410	5410							
5311	5311							
5411	5411							
5512	5512							
5612	5612							
5713	5713							
5714	5714							
5715	5715							
5716	5716							
5717	5717							
5718	5718							
5719	5719							
5720	5720							
5821	5821							
5822	5822							
5823	5823							
5824	5824							
5825	5825							
5826	5826							
5827	5827							
5828	5828							
5929	5929							
5930	5930							
5931	5931							
5932	5932							
5A33	5A33							
5A34	5A34							
5B35	5B35							
5B36	5B36							

Table 10-II-04.5 AUX Maintenance Mode Fault Details

Fault#	Date	Time	Vehicle#	System	Description
5109	mm/dd/yy	hh:mm:ss	xxx	AUX_DEF_R_A	Circuit Breaker Open
5209	mm/dd/yy	hh:mm:ss	xxx	AUX_DEF_R_B	Circuit Breaker Open
Operator Guide					
Auxiliary - Defroster Circuit Breaker Open. Check 2F11 circuit breaker (Cab Panel Car A for Defroster A - Cab Panel Car B for Defroster B) and/or check 10F04 circuit breaker (Cab Locker MV/LV Car A for Defroster A - Cab Locker MV/LV Car B for Defroster B) and/or 10F05 circuit breaker (Cab Locker MV/LV Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5310	mm/dd/yy	hh:mm:ss	xxx	AUX_OUT_CAB_A	Circuit Breaker 1 Open
5410	mm/dd/yy	hh:mm:ss	xxx	AUX_OUT_CAB_B	Circuit Breaker 1 Open
Operator Guide					
Auxiliary - Exterior Outlets CAB Circuit Breaker 1 Open. Check 2F07 circuit breaker (Cab Panel Car A for Exterior Outlets CAB A - Cab Panel Car B for Exterior Outlets CAB B) and/or 2F13 circuit breaker (Cab Panel Car A for Exterior Outlets CAB A - Cab Panel Car B for Exterior Outlets CAB B).					

Fault#	Date	Time	Vehicle#	System	Description
5311	mm/dd/yy	hh:mm:ss	xxx	AUX_OUT_CAB_A	Circuit Breaker 2 Open
5411	mm/dd/yy	hh:mm:ss	xxx	AUX_OUT_CAB_B	Circuit Breaker 2 Open
Operator Guide					
Auxiliary - Exterior Outlets CAB Circuit Breaker 2 Open. Check 2F08 circuit breaker (Cab Panel Car A for Exterior Outlets CAB A - Cab Panel Car B for Exterior Outlets CAB B) and/or 2F14 circuit breaker (Cab Panel Car A for Exterior Outlets CAB A - Cab Panel Car B for Exterior Outlets CAB B).					

Fault#	Date	Time	Vehicle#	System	Description
5512	mm/dd/yy	hh:mm:ss	xxx	AUX_OUT_LCK_A	Circuit Breaker Open
5612	mm/dd/yy	hh:mm:ss	xxx	AUX_OUT_LCK_B	Circuit Breaker Open
Operator Guide					

Auxiliary - Exterior Outlets Locker Circuit Breaker Open. Check 2F09 circuit breaker (LV Cabinet Car A for Exterior Outlets Locker A - LV Cabinet Car B for Exterior Outlets Locker B)

Table 10-II-04.2 AUX Maintenance Mode Fault Details (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
5713	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Car A Lightning Circuit Brk Open
Operator Guide					
Auxiliary - Car A, Check Cab Lightning circuit breaker (8F01 - LV Cabinet Car A) and/or Headlights circuit breakers (8F11, 8F12 - Cab Panel Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5714	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Car A Ext. Lightning Circ Brk Open
Operator Guide					
Auxiliary - Car A, Check Direction Indicators command circuit breaker (8F07 - LV Cabinet Car A) and/or Hazard Lights Command circuit breaker (8F06 - LV Cabinet Car A) and/or Stop Indicators circuit breaker (8F14 - LV Cabinet Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5715	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Marker Lights Circuit Breaker Open
Operator Guide					
Auxiliary - Check Marker circuit breaker (8F10 - LV Cabinet Car A) and/or By Pass Lights circuit breaker (8F16 - LV Cabinet Car B).					

Fault#	Date	Time	Vehicle#	System	Description
5716	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Car B Ext. Lightning Circ Brk Open
Operator Guide					
Auxiliary - Check Direction Indicators Command circuit breaker (8F07 - LV Cabinet Car B) and/or Hazard Lights Command circuit breaker (8F06 - LV Cabinet Car B) and/or Turn-Aux Lights Command circuit breaker (8F15 - LV Cabinet Car B).					

Fault#	Date	Time	Vehicle#	System	Description
5717	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Car B Lightning Circuit Brk Open
Operator Guide					
Auxiliary - Car B, Check Cab Lightning circuit breaker (8F01 - LV Cabinet Car B) and/or HeadLights circuit breaker (8F11, 8F12 - LV Cabinet Car B) and/or Light circuit breaker (8F17 - LV Cabinet Car B).					

Table 10-II-04.2 AUX Maintenance Mode Fault Details (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
5718	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Indicators Supply Circuit Brk Open
Operator Guide					
Auxiliary - Check Direction Indicators Power Supply circuit breakers (8F08, 8F09 - LV Cabinet Car B)					

Fault#	Date	Time	Vehicle#	System	Description
5719	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Compartment Circuit Brk Open
Operator Guide					
Auxiliary - Check Compartment Lightning circuit breakers (8F02 - Cab Panel Car B; 8F03, 8F04 - LV Cabinet Car B).					

Fault#	Date	Time	Vehicle#	System	Description
5720	mm/dd/yy	hh:mm:ss	xxx	AUX_LIGHTS	Emergency Circuit Brk Open
Operator Guide					
Auxiliary - Check Emergency Lightning circuit breaker (8F05 - Cab Panel Car B).					

Fault#	Date	Time	Vehicle#	System	Description
5821	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	A - Console Circuit Brk Open
Operator Guide					
Auxiliary - Cab A, Check Enable circuit breaker (3F06 - Cab Panel Car A) and/or Key Switch circuit breaker (3F05 - Cab Panel Car A) and/or Loads Car circuit breaker (3F07 - LV Cabinet Car A) and/or Console Contactor and Relays circuit breakers (3K06 - LV Cabinet Car A; 3F08 - Cab Panel Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5822	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	Dead Man Circuit Brk Open
Operator Guide					
Auxiliary - Check Dead Man Circuit Breaker (6F01 - LV Cabinet Car A) and/or Relays (6K01, 6K02 - LV Cabinet Car A).					

Table 10-II-04.2 AUX Maintenance Mode Fault Details (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
5823	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	A - Horn and Bell Circuit Brk Open Operator Guide Auxiliary - Cab A, Check Horn and Bell circuit breaker (10F01 - LV Cabinet Car A) and/or Wing Mirrors circuit breaker (10F02 - LV Cabinet Car A) and/or Wipers circuit breaker (10F03 - LV Cabinet Car A).

Fault#	Date	Time	Vehicle#	System	Description
5824	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	A - Coupler Protection Circuit Brk Open Operator Guide Auxiliary - Cab A, Check Coupler Protection circuit breakers (14F01 - LV Cabinet Car A; 14F02, 14F03, 14F04, 14F05, 14F06, 14F07 - Junction Box Car A).

Fault#	Date	Time	Vehicle#	System	Description
5825	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	B - Console Circuit Brk Open Operator Guide Auxiliary - Cab B, Check Enable circuit breaker (3F06 - Cab Panel Car B) and/or Key Switch circuit breaker (3F05 - Cab Panel Car B) and/or Loads Car circuit breaker (3F07 - LV Cabinet Car B) and/or Console Contactor and Relays (3K06 - LV Cabinet Car B; 3F08 - Cab Panel Car B).

Fault#	Date	Time	Vehicle#	System	Description
5826	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	Silent Alarm Circuit Brk Open Operator Guide Auxiliary - Check Silent Alarm circuit breaker (8F13 - LV Cabinet Car B).

Fault#	Date	Time	Vehicle#	System	Description
5827	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	B - Horn and Bell Circuit Brk Open Operator Guide Auxiliary - Cab B, Check Horn and Bell circuit breaker (10F01 - LV Cabinet Car B) and/or Wing Mirrors circuit breaker (10F02 - LV Cabinet Car B) and/or Wipers circuit breaker (10F03 - LV Cabinet Car B).

Table 10-II-04.2 AUX Maintenance Mode Fault Details (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
5828	mm/dd/yy	hh:mm:ss	xxx	AUX_CAB	B - Coupler Protection Circuit Brk Open
Operator Guide					
Auxiliary - Cab B, Check Coupler Protection circuit breakers (14F01 - LV Cabinet Car B; 14F02, 14F03, 14F04, 14F05, 14F06, 14F07 - Junction Box Car B).					

Fault#	Date	Time	Vehicle#	System	Description
5929	mm/dd/yy	hh:mm:ss	xxx	AUX_SANDERS	Car A Sanders Supply Crc Brk Open
Operator Guide					
Auxiliary - Car A, Check Sanders Power Supply (7F08 - LV Cabinet Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5930	mm/dd/yy	hh:mm:ss	xxx	AUX_SANDERS	Car A Sanders Cmd Cir Brk Open
Operator Guide					
Auxiliary - Car A, Check Sanders Command circuit breaker (7F12 - LV Cabinet Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5931	mm/dd/yy	hh:mm:ss	xxx	AUX_SANDERS	Car B Sanders Supply Crc Brk Open
Operator Guide					
Auxiliary - Car B, Check Sanders Power Supply (7F08 - LV Cabinet Car B).					

Fault#	Date	Time	Vehicle#	System	Description
5932	mm/dd/yy	hh:mm:ss	xxx	AUX_SANDERS	Car B Sanders Cmd Circ Brk Open
Operator Guide					
Auxiliary - Car B, Check Sanders Command circuit breaker (7F12 - LV Cabinet Car B) and/or Emergency Sanders Command circuit breaker (7F13 - LV Cabinet Car B).					

Table 10-II-04.2 AUX Maintenance Mode Fault Details (cont'd)

Fault#	Date	Time	Vehicle#	System	Description
5A33	mm/dd/yy	hh:mm:ss	xxx	AUX_PANTO	Command Circ Brk Open
Operator Guide					
Auxiliary - Check Pantograph Command circuit breaker (5F01 - LV Cabinet Car A) and/or Pantograph Power Supply circuit breaker (5F03 - LV Cabinet Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5A34	mm/dd/yy	hh:mm:ss	xxx	AUX_PANTO	Engine Command Circ Brk Open
Operator Guide					
Auxiliary - Check Pantograph Engine Command circuit breaker (5F02 - Cab Panel Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5B35	mm/dd/yy	hh:mm:ss	xxx	AUX_TRAINLIN_E	No Motion Circ Brk Open
Operator Guide					
Auxiliary - Check No Motion circuit breaker (3F26 - LV Cabinet Car A) and/or Loop By Pass and CutOut circuit breaker (3F23 - LV Cabinet Car A).					

Fault#	Date	Time	Vehicle#	System	Description
5B36	mm/dd/yy	hh:mm:ss	xxx	AUX_TRAINLIN_E	Emerg. Brake Loop Circ Brk Open
Operator Guide					
Auxiliary - Check Emergency Loop Transformer circuit breaker (6F02 - Cab Panel Car A) and/or Emergency Loop circuit breaker (6F03 - Cab Panel Car A).					

LOS ANGELES COUNTY

METROPOLITAN TRANSPORTATION AUTHORITY

LIGHT RAIL VEHICLE

P2550



**RUNNING MAINTENANCE
AND
SERVICE MANUAL**

**VOLUME M-01-A
PART III
MAINTENANCE
SECT 10 LOW VOLTAGE DISTRIBUTION SYSTEM**



SECTION 10

LOW VOLTAGE DISTRIBUTION SYSTEM (LVDS)

PART III

MAINTENANCE

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SECTION 10

LOW VOLTAGE DISTRIBUTION SYSTEM (LVDS)

TABLE OF CONTENTS

Section / Para	Title	Page
10-III-01	INTRODUCTION	1
10-III-01.a	List of Abbreviations, Acronyms & Symbols	2
10-III-01.b	List of Definitions	4
10-III-01.c	List of Measurement Units	5
10-III-01.d	References	6
10-III-02	P2550 ANSALDOBREDA MAINTENANCE PLAN	7
10-III-03	RUNNING -PREVENTIVE MAINTENANCE	8
10-III-03.01	Running -Preventive Maintenance Matrixes (R-PMM).....	8
10-III-03.01.01	Definitions	9
10-III-03.01.02	Inspection Intervals.....	9
10-III-03.01.03	Safety Critical Preventive Maintenance (SCPM) Tasks	9
10-III-03.01.04	Sheet Code.....	10
10-III-03.01.05	Person Hours.....	10
10-III-03.01.06	Running Preventive Maintenance Matrix (Component Based).....	11
10-III-03.01.07	Running Preventive Maintenance Matrix (Mileage Based).....	11
10-III-03.02	Running -Preventive Maintenance Reports (R-PMR/Job Cards).....	12
10-III-03.02.01	R-PMR/Job Card Form Content	12
10-III-03.02.02	R-PMR/Job Card Sequence	15
10-III-03.02.03	Running -Preventive Maintenance Cycle & R-PMR/Job Card Content	16
10-III-03.02.04	R-PMR/Job Card Data Presentation Sequence	16
10-III-03.02.05	Running Preventive Maintenance Reports R-PMR/Job Cards	17
10-III-03.03	Running -Preventive Maintenance Sheets (R-PMS)	21
10-III-03.03.01	Running- Preventive Maintenance Sheet (R-PMS) Form	21
10-III-03.03.02	How to Use the R-PM Sheets and R-PMR /Job Cards	26
10-III-03.03.03	Running- Preventive Maintenance Sheet (R-PMS) List	28
10-III-03.03.04	Running- Preventive Maintenance Sheets (R-PMS)	29
10-III-04	RUNNING -CORRECTIVE MAINTENANCE.....	75
10-III-04.01	Running -Corrective Maintenance Sheets (R-CMS)	75
10-III-04.01.01	Running- Corrective Maintenance Sheet (R-CMS) Form	76
10-III-04.01.02	How to Use the R-CM Sheets.....	80
10-III-04.01.03	Running- Corrective Maintenance Sheet (R-CMS) List	82
10-III-04.01.04	Running- Corrective Maintenance Sheets (R-CMS).....	85
10-III-05	CONSUMABLE MATERIALS LIST (R-CML)	317
10-III-06	TEST EQUIPMENT & SPECIAL TOOLS LIST (R-TESTL)	317

LIST OF ILLUSTRATIONS

Figure	Title	Page
Figure 10-III-03.1	R-PMR/Job Card Form -Example	15
Figure 10-III-03.2	R-PMS Form	24
Figure 10-III-04.1	R-CMS Form	78

LIST OF TABLES

Table N°	Title	Page
Table 10-III-03.1	Running Preventive Maintenance Matrix (Component Based)	11
Table 10-III-03.2	Running Preventive Maintenance Matrix (Mileage Based)	11
Table 10-III-03.3	Running Preventive Maintenance Sheets List	28
Table 10-III-04.1	Running Corrective Maintenance Sheets List.....	83
Table 10-III-05.1	Running Maintenance Consumable Materials List (R-CML).....	317
Table 10-III-06.1	Running -Test Equipment & Special Tools List (R-TESTL)	317

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SECTION 10

LOW VOLTAGE DISTRIBUTION SYSTEM

(LVDS)

10-III-01 INTRODUCTION

The Low Voltage Distribution System (LVDS) Part III - Maintenance consists of:

- Preventive Maintenance
- Corrective Maintenance
- Consumable Materials
- Test Equipment & Special Tools

10-III-01.a List of Abbreviations, Acronyms & Symbols

The Abbreviations, Acronyms and Symbols commonly used throughout this Section are given below with their relevant meaning.

Abbreviation	Meaning
AB	AnsaldoBreda
AC	Alternate Current
AC/DC	Alternate Current - Direct Current Converter
ADA	Americans with Disabilities Act
A/H	Ampere Per Hour
APS	Auxiliary Power Supply
ASSY	Assembly
CB	Circuit Breaker
DC	Direct Current
DC/AC	Direct Current - Alternate Current Converter
DC/DC	Direct Current - Direct Current Converter
ECU	Electronic Control Unit
ELE	Electronic
H-CML	Heavy Consumable Material List
H-CMS	Heavy Corrective Maintenance Sheet
HV	High Voltage
HW	Hardware
IDU	Integrated Diagnostic Unit
IGBT	Insulated Gate Bipolar Transistor
IPC	Illustrated Parts Catalog
LED	Light Emitting Diode
LH	Left Hand Side
LRV	Light Railway Vehicle
LV	Low Voltage
LVDC	Low Voltage Direct Current
LVDS	Low Voltage Distribution System
LVPD	Low Voltage Power Distribution
LVPS	Low Voltage Power Supply
M	Motoring
MV	Medium Voltage
MVPD	Medium Voltage Power Distribution
PS	Power Supply
PTU	Portable Test Unit
R-CML	Running Consumable Material List
R-CMS	Running Corrective Maintenance Sheet
RH	Right Hand Side
RMSM	Running Maintenance & Service Manual
R-PMM	Running Preventive Maintenance Matrix
R-PMR	Running Preventive Maintenance Report
R-PMS	Running Preventive Maintenance Sheet

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Abbreviation	Meaning
R-TESTL	Running Test Equipment & Special Tools List
SCPM	Safety Critical Preventive Maintenance
SYS	System
SW	Software
TBD	To Be Defined
TBS	To Be Supplied
TOC	Table Of Content
TTEM	Tools & Test Equipment Manual
VAC	Voltage Alternate Current
VDC	Voltage Direct Current
W/	With
W/O	Without

10-III-01.b List of Definitions

The Definitions commonly used throughout this Section are given below with their relevant meaning.

Definition	Meaning
'A' body section	The section of an articulated vehicle containing the pantograph
'B' body section	The section of an articulated vehicle not containing the pantograph
AW0	Empty car operating weight
AW1	Full seated load plus AW0
AW2	Standees at 4 persons per square meter plus AW1
AW3	Standees at 6 persons per square meter plus AW1
AW4	Standees at 8 persons per square meter plus AW1
Front door	The door close to the Operator's Cab
Rear door	The door close to the Articulation Section
MC Handle	Master Controller Handle
"A" Cab (or Cab A)	Operator Cab in the A body section
"B" Cab (or Cab B)	Operator Cab in the B body section

10-III-01.c List of Measurement Units

The Measurement Units commonly used throughout this Section are given below with their relevant meaning.

Definition	Meaning
ft	Foot (Length)
gal	Gallon (Volume)
in	Inch (Length)
kg	Kilogram - approx 2.205 pounds (Weight)
km	Kilometer - approx 0.621 miles (Length)
lb	Pound (Weight)
lb-ft	Pound force (Force)
m	Meter - approx 3.28 feet (Length)
mm	Millimeter - approx 0.0394 inches (Length)
mph	Miles per hour (Velocity)
Km/h	Kilometers per hour (Velocity)
s	Seconds (Time)
V	Volt (Tension)
Vdc	Direct Voltage (Tension)
Vac	Alternate Voltage (Tension)
kVA	Kilo-Volt-Ampere (Power)
kW	Kilo-Watt (Power)
W	Watt (Power)
F	Farad (Capacity)
H	Henry (Inductance)
Ω	Ohm (Resistance)
$^{\circ}\text{F}$	Fahrenheit (Temperature)
$^{\circ}\text{C}$	Celsius (Temperature)
A	Ampere (Current)
Hz	Hertz (Frequency)
rpm	Revolution per Minute (Frequency)
N	Newton (Force)
Nm	Newton-Meter (Torque)
mphs	Mile Per Hour Per Second (Acceleration)

10-III-01.d References

Refer to Section 00 of this RMSM for details relevant to the following Topics:

Topic	Paragraph
MANUAL PURPOSE	00-02
MANUAL ARRANGEMENT	00-03
MANUAL APPLICABILITY	00-04
ACQUISITION OF COPIES, REVISIONS AND CHANGES	00-05
TECHNICAL PUBLICATIONS DISCREPANCY REPORT	00-06
UPDATING	00-07
MANUAL CONTENT	00-08
MANUAL ILLUSTRATIONS	00-09
REFERENCE TO MAINTENANCE MANUALS SET	00-10
 MTA PHILOSOPHY OF MAINTENANCE	 00-11
 SAFETY	 00-12
Vehicle Hazard Areas	00-12.01
General Safety Precautions	00-12.02
Safety Precautions around Electrical Equipment	00-12.03
Safety & Environmental Precautions with Chemicals	00-12.04
 GENERAL MAINTENANCE GUIDE	 00-13
Hardware	00-13.01
Cable Ties (Tie Wraps)	00-13.02
Wiring	00-13.03
Fuses	00-13.04
Lubrication and Cleaning	00-13.05
 ELECTROSTATIC DISCHARGE	 00-14
Description	00-14.01
Methods of Protection	00-14.02
 STORAGE AND HANDLING	 00-15
General Storage Requirements	00-15.01
Special Storage Requirements	00-15.02
 P2550 SOFTWARE CONFIGURATION	 00-21
 P2550 PTU /LAPTOP SOFTWARE LIST	 00-22
P2550 STANDARD TORQUE LIST	00-23
 HOW TO USE IPC	 00-24
HOW TO USE THE FUNCTIONAL SCHEMATICS	00-25
HOW TO USE THE TOPOGRAPHIC SCHEMATICS	00-26
HOW TO USE THE ANSALDOBREDA DATABASE	00-27

10-III-02 P2550 ANSALDOBREDA MAINTENANCE PLAN

The AB Preventive Maintenance Plan (PMP) has been designed in order to permit a 30-year Structural and Service Vehicle Life with the following basic assumptions:

- Yearly mileage: 120,000 Miles
- Motor and Trailer Truck removal: every 5 years. (600,000 Miles)

The AB Preventive Maintenance Plan (PMP) provides the Preventive Maintenance Tasks to be performed according the following Mileage Intervals:

Running Maintenance		Heavy Maintenance
Daily		
10,000 Miles		
30,000 Miles	600,000 Miles	
60,000 Miles	1,200,000 Miles	
120,000 Miles	1,800,000 Miles	

In accordance with the Preliminary Version of the AB Preventive Maintenance Plan, the Scheduled Maintenance Tasks for the entire Vehicle Life have been grouped into:

- Running Preventive Maintenance
- Heavy Preventive Maintenance

In accordance with the AB Corrective Maintenance Analysis, the Corrective Maintenance Tasks for the entire Vehicle Life have been grouped into:

- Running Corrective Maintenance
- Heavy Corrective Maintenance

10-III-03 RUNNING -PREVENTIVE MAINTENANCE

10-III-03.01 Running -Preventive Maintenance Matrixes (R-PMM)

The LVDS Running -Preventive Maintenance Matrix (R-PMM) provides the Preventive Maintenance Plan of the LVDS up to 120,000 Miles.

The LVDS (R-PMM) is provided in two different arrangements as follows:

- **R-PMM Component Based**

It lists the LVDS Running - Preventive Maintenance Tasks ordered by Subsystem /Assemblies / Component break down, followed by the PM Task Description and Scheduled Task Interval and linked to the relevant R-PM Sheet Code.

The R-PMM Component Based provides the Maintainer with the following data:

- SUBSYSTEM /ASSEMBLY/UNIT/COMPONENT
- TASK
- SCPM
- INSPECTION INTERVAL
- SHEET CODE

- **R-PMM Mileage Based**

It lists the LVDS Running - Preventive Maintenance Tasks ordered by Scheduled Maintenance Interval and broken down into the related Subsystem /Assemblies/Component followed by the PM Task Description and Person Hours and linked to the relevant R-PM Sheet Code.

The R-PMM Mileage Based provides the Maintainer with the following data:

- INSPECTION INTERVAL
- SYSTEM/SUBSYSTEM /ASSEMBLY/UNIT/COMPONENT
- TASK
- SCPM
- PERSON HOURS
- SHEET CODE

The data listed in this Matrix are the same of those listed in the R-PMM Component Based with the exception of the PERSON HOURS.

10-III-03.01.01 Definitions

The following definitions are applicable to both types of R-PMM

Tasks

- Cleaning:** Methods and processes required (Step-By-Step Procedural Instructions) for cleaning specific parts or areas of the Vehicle.
- Inspection:** Preventive Maintenance procedures such as those required to ascertain the serviceability of a Part, Assembly, System or the specific interrelationship of Parts that perform a functional operation.
- Lubrication:** Provides component lubrication Instructions.
- Replacement** Provides the Components / Assemblies and Subassemblies removal & installation in a logical sequential order.
Maintenance procedures identified in this topic include Components that are replaced within a 4 hours window.
- Service:** Operation performed to replenish Sand, Windshield Wiper Washer Fluid, HVAC Coolant, Gear and Compressor Oil, and Vehicle Lubrication.
- Test:** Procedures and Parameters to evaluate the operational efficiency and integrity of a System /Subsystem/Component and the interrelationship of Parts performing functional operations.

10-III-03.01.02 Inspection Intervals

The Running - Preventive Maintenance Intervals for the P2550 LRV Fleet are scheduled as follows:

Daily	10,000 Miles	30,000 Miles	60,000 Miles	120,000 Miles
-------	--------------	--------------	--------------	---------------

The marker "●" in the INSPECTIONS INTERVAL column, indicates the periodicity of the corresponding Task.

10-III-03.01.03 Safety Critical Preventive Maintenance (SCPM) Tasks

The marker "☒" in the SCPM column, indicates that the corresponding Task is a Safety Critical Preventive Maintenance (SCPM) Task, as per the results of the Safety Analyses performed, on Vehicle Subsystems, according to Vehicle Specification.

10-III-03.01.04 Sheet Code

The Sheet Code column, indicates the reference to Running -Preventive Maintenance Sheet where the Procedure to be performed is described and illustrated.

**THE SHEET CODE IS THE EXPLICIT LINK BETWEEN
R-PM MATRIXES, R-PMR /JOB CARDS AND R-PM SHEETS**

Refer to Paragraph 10-III-03.03.01 for Running- Preventive Maintenance Sheet (R-PMS) Form for detailed explanation.

10-III-03.01.05 Person Hours

It indicates the time required to perform the corresponding Task with the basic assumption that the Vehicle is on an Inspection Pit or Stand Up Rail and the Consumables, Tools and Spare Parts needed to accomplish the Task are available at the Location of the Equipment to be maintained.

Refer to:

- Table 10-III-03.1 for Running - Preventive Maintenance Matrix (R-PMM)
(Component Based)
- Table 10-III-03.2 for Running - Preventive Maintenance Matrix (R-PMM)
(Mileage Based)

10-III-03.01.06 Running Preventive Maintenance Matrix (Component Based)
Table 10-III-03.1 Running Preventive Maintenance Matrix (Component Based)

SYSTEM 10 LOW VOLTAGE DISTRIBUTION		SUBSYSTEM ASSY/UNIT/COMPONENT	TASK	S C P M	INSPECTION INTERVAL MILES					SHEET CODE
Daily	10K	30K	60K	120K						
-LOW VOLTAGE DISTRIBUTION CIRCUITRY	INSPECTION							•		R-P-10-03-00-00/I-00
-SAFETY CIRCUITS	INSPECTION	<input checked="" type="checkbox"/>						•		R-P-10-04-00-00/I-00

10-III-03.01.07 Running Preventive Maintenance Matrix (Mileage Based)
Table 10-III-03.2 Running Preventive Maintenance Matrix (Mileage Based)

SYSTEM 10 LOW VOLTAGE DISTRIBUTION		SUBSYSTEM	TASK	S C P M	PERSON HOURS		SHEET CODE
120,000 MILES							
-LOW VOLTAGE DISTRIBUTION CIRCUITRY	INSPECTION				1		R-P-10-03-00-00/I-00
-SAFETY CIRCUITS	INSPECTION	<input checked="" type="checkbox"/>			1		R-P-10-04-00-00/I-00

10-III-03.02 Running -Preventive Maintenance Reports (R-PMR/Job Cards)

This paragraph describes the contents of the LVDS Running -Preventive Maintenance Reports (R-PMR/Job Cards) for the Running - Preventive Maintenance Tasks.

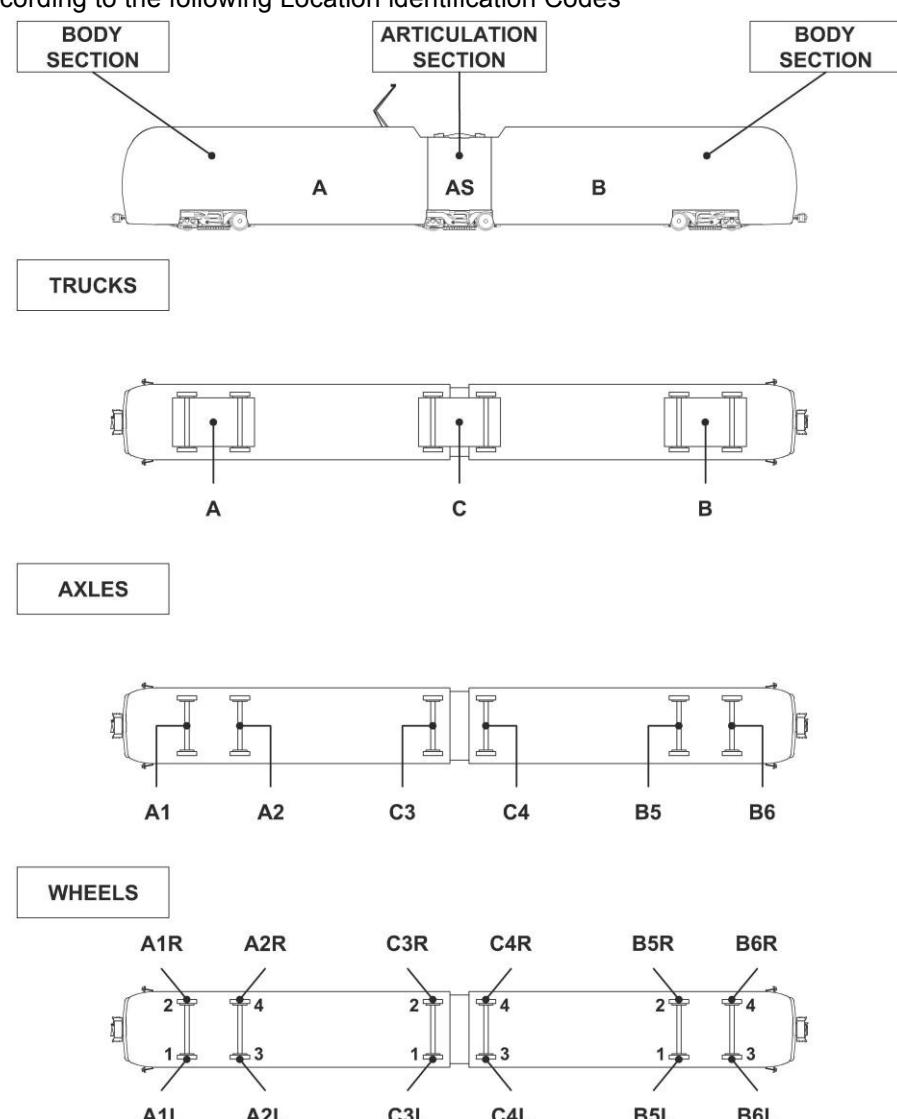
10-III-03.02.01 R-PMR/Job Card Form Content

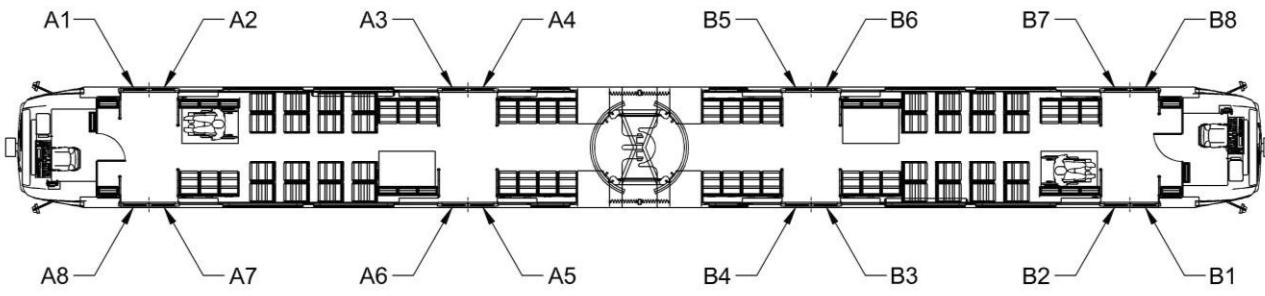
The R-PMR/JOB CARDS are broken down into two main topics:

Specific Data and R-PM Data

Refer to Figure 10-III-03.1 for R-PMR/JOB CARD Form example

RUNNING PREVENTIVE MAINTENANCE REPORTS (R-PMR/JOB CARDS) FORM		
SPECIFIC DATA TO BE FILLED IN BY THE MAINTAINER		
ITEM #	TITLE	EXPLANATORY NOTE
1	VEHICLE #	This field indicates the Vehicle Identification Number
2	DATE	This field indicates the Date on which the Vehicle entered the Maintenance Shop
3	RUNNING HOURS	This field indicates the Vehicle Running Hours at the above Date
4	MILES	This field indicates the Vehicle Running Miles at the above Date.
5	EMPLOYEE # & SIGNATURE	This Field indicates the Employee # & Signature of the Maintainer(s) that perform the referred Task(s)
6	STARTING DATE	This field indicates the Starting Date of the referred Task(s).
7	WORK HOURS	This field indicates the Work duration to perform the referred Task(s).
8	COMPLETION DATE	This field indicates the Completion Date of the referred Task(s).
9	DEFECT FOUND/COMMENTS	This field indicates the result of the Task (S) execution and/ or note related to any items of the maintained Equipment requiring Corrective Maintenance
A	P2550 RUNNING PREVENTIVE MAINTENANCE REPORT SYSTEM (Maintenance Interval) JOB CARD	<p>This field provides R-PMR Title.</p> <p>The R-PM Maintenance Intervals are the following:</p> <p>Daily; 10,000 Miles; 30,000 Miles; 60,000 Miles; 120,000 Miles</p>
B	WORK AREA	<p>This column lists the On Vehicle Areas where the Equipment to be maintained is located</p> <p>The Work Areas are provided to optimize the jobs organization of the Preventive Maintenance tasks in order to:</p> <ul style="list-style-type: none"> 1- respect the Safety Precautions to be followed 2- complete the preparation and the availability of the Consumables, Tools and Spare Parts, needed to perform the referred Task. 3- respect the time (PERSON HOURS) established to perform the referred Task (with the basic assumption that the Vehicle is on an Inspection Pit or Stand Up Rail and the Consumables, Tools and Spare Parts are available at the location of the Equipment to be maintained.) <p>The On Vehicle Work Areas are the following:</p> <p>Exterior - Interior - Roof - Truck - Undercar - Vehicle (Vehicle as a whole)</p>

RUNNING PREVENTIVE MAINTENANCE REPORTS (R-PMR/JOB CARDS) FORM		
SPECIFIC DATA TO BE FILLED IN BY THE MAINTAINER		
ITEM #	TITLE	EXPLANATORY NOTE
C	ITEM	This column lists the Subsystem/Assembly, Unit, Component to be maintained
D	TASK	<p>This column lists the R-PM tasks to be performed for each Assembly/Unit/Component (i.e., Cleaning, Inspection, Test)</p> <p>The R-PM Tasks are the following:</p> <ul style="list-style-type: none"> - Cleaning - Inspection -Lubrication - - Replacement - Service- Test
E	LOCATION	<p>This column lists the On Board Vehicle Location of all Equipment to be maintained according to the following Location identification Codes</p>  <p>BODY SECTION</p> <p>ARTICULATION SECTION</p> <p>TRUCKS</p> <p>AXLES</p> <p>WHEELS</p>

RUNNING PREVENTIVE MAINTENANCE REPORTS (R-PMR/JOB CARDS) FORM		
SPECIFIC DATA TO BE FILLED IN BY THE MAINTAINER		
ITEM #	TITLE	
E (cont'd)	LOCATION (cont'd)	
EXPLANATORY NOTE		
 <p>CAR "A"</p> <p>CAR "B"</p>		
Door Numbering		
ITEM #	TITLE	EXPLANATORY NOTE
F	PM SHEET CODE	<p>This column lists the reference to Running-Preventive Maintenance Sheet where the Procedure to be performed is described and illustrated.</p> <p>Refer to Running-Preventive Maintenance Sheet (R-PMS) Form for detailed explanation.</p>
G	SHEETOF.....	This field indicates the progressive sheet page number of each R-PMR/JOB CARD

 AnsaldoBreda	P2550 RUNNING PREVENTIVE MAINTENANCE REPORT PROPULSION 30,000 MILES JOB CARD	 Metro					
VEHICLE#	DATE / /	RUNNING HOURS	MILES	SHEET 1 OF 2			
WORK AREA	ITEM	TASK	LOCATION				PM SHEET CODE
			BODY SECTION	TRUCK	AXLE	SIDE	
ROOF	BRAKING RESISTOR	CLEANING	A				R-P-07-03-06-00/C-00
	BRAKING RESISTOR	CLEANING	B				R-P-07-03-06-00/C-00
TRUCK	GEARBOX	INSPECTION	A	A	A1		R-P-07-06-01-00/I-00
	GEARBOX	INSPECTION	A	A	A2		R-P-07-06-01-00/I-00
	GEARBOX	SERVICE	A	A	A1		R-P-07-06-01/S-00
	GEARBOX	SERVICE	A	A	A2		R-P-07-06-01/S-00
	GEARBOX	SERVICE	A	A1			R-P-07-06-01/S-01

 AnsaldoBreda	P2550 RUNNING PREVENTIVE MAINTENANCE REPORT PROPULSION 30,000 MILES JOB CARD	 Metro		
VEHICLE#	DATE / /	RUNNING HOURS	MILES	SHEET 2 OF 2
DEFECT FOUND / COMMENTS				
1	2	3	4	9
EMPLOYEE# & SIGNATURE				
STARTING DATE				
WORK HOURS				
COMPLETION DATE				
5	6	7	8	

Page 7-2
Draft Ch. 01

FINAL VERSION APPROVAL DATE

Figure 10-III-03.1 R-PMR/Job Card Form -Example

10-III-03.02.02 R-PMR/Job Card Sequence

The R-PMR/JOB CARDS provided in this Section are grouped according to the following sequence:

Daily 10,000 Miles 30,000 Miles 60,000 Miles 120,000 Miles

10-III-03.02.03 Running -Preventive Maintenance Cycle & R-PMR/Job Card Content

The Running -Preventive Maintenance Cycle and the relevant R-PMR/JOB CARD content are as follows:

MAINTENANCE INTERVAL	PMR /JOB CARD TITLE	PMR /Job Card CONTENT
DAILY	DAILY JOB CARD	<ul style="list-style-type: none"> • List of Assemblies/Components and related Tasks to be performed DAILY
10,000 Miles	10,000 MILES JOB CARD	<ul style="list-style-type: none"> • DAILY Job Card content + List of Assemblies/Components and related Tasks to be performed at 10,000 Miles
30,000 Miles	30,000 MILES JOB CARD	<ul style="list-style-type: none"> • DAILY Job Card content + 10,000 Job Card content + List of Assemblies/Components and related Tasks to be performed at 30,000 Miles
60,000 Miles	60,000 MILES JOB CARD	<ul style="list-style-type: none"> • DAILY Job Card content + 10,000 Job Card content + 30,000 Job Card content + List of Assemblies/Components and related Tasks to be performed at 60,000 Miles
120,000 MILES	120,000 MILES JOB CARD	<ul style="list-style-type: none"> • DAILY Job Card content + 10,000 Job Card content + 30,000 Job Card content + 60,000 Job Card content + List of Assemblies/Components and related Tasks to be performed at 120,000 Miles

10-III-03.02.04 R-PMR/Job Card Data Presentation Sequence

The Subsystems / Assemblies / Units / Components listed in the ITEMS column of each R-PMR/JOB CARD are grouped by Work Area and Vehicle Systems' and sequenced, in alphabetical order, in conjunction with their On Vehicle Locations and Tasks to be performed.

10-III-03.02.05 Running Preventive Maintenance Reports R-PMR/Job Cards

LOW VOLTAGE DISTRIBUTION SYSTEM (LVDS)

Running - Preventive Maintenance Reports

R-PMR/JOB CARDS

INTENTIONALLY LEFT BLANK

**LOW VOLTAGE DISTRIBUTION SYSTEM
RUNNING PREVENTIVE MAINTENANCE REPORT
120,000 MILES JOB CARD**

VEHICLE #		DATE		RUNNING HOURS		MILES		SHEET 1 OF 2
-----------	--	------	--	---------------	--	-------	--	--------------

WORK AREA	SYSTEM	ITEM	TASK	LOCATION				PM SHEET CODE
				BODY SECT	TRUCK	AXLE	SIDE	
INTERIOR	LOW VOLTAGE DISTRIBUTION	LOW VOLTAGE DISTRIBUTION - SWITCHES CAB PANEL	INSPECTION	A				R-P-10-03-00-00/I-00
		LOW VOLTAGE DISTRIBUTION - SWITCHES LV LOCKER	INSPECTION	A				R-P-10-03-00-00/I-00
		SAFETY CIRCUITS - CAB	INSPECTION	A				R-P-10-04-00-00/I-00
		SAFETY CIRCUITS - LV LOCKER & COMPARTMENT	INSPECTION	A				R-P-10-04-00-00/I-00
		LOW VOLTAGE DISTRIBUTION - SWITCHES CAB PANEL	INSPECTION	B				R-P-10-03-00-00/I-00
		LOW VOLTAGE DISTRIBUTION - SWITCHES LV LOCKER	INSPECTION	B				R-P-10-03-00-00/I-00
		SAFETY CIRCUITS - CAB	INSPECTION	B				R-P-10-04-00-00/I-00
		SAFETY CIRCUITS - LV LOCKER & COMPARTMENT	INSPECTION	B				R-P-10-04-00-00/I-00

(cont'd)

LVDS - RUNNING PREVENTIVE MAINTENANCE REPORT - 120,000 MILES JOB CARD

VEHICLE # DATE RUNNING HOURS MILES SHEET 2 OF 2

DEFECT FOUND / COMMENTS

10-III-03.03 Running -Preventive Maintenance Sheets (R-PMS)

Each R-PMS provides the following data consistent with Preventive Maintenance Plan (PMP), AB Design Documentation and Vehicle Systems Functional Tree:

- **R-PM Sheet Code**
- **SYSTEM, SUBSYSTEM /ASSEMBLY, UNIT, Component (Names)**
- **SYSTEM, SUBSYSTEM /ASSEMBLY, UNIT, Component (Location)**
- **Maintenance Interval (Miles)**
- **Maintenance Task,**
- **Man Hours**, needed to perform the Task
- **SPARE PARTS**, needed to perform the Task

Each R-PMS also provides:

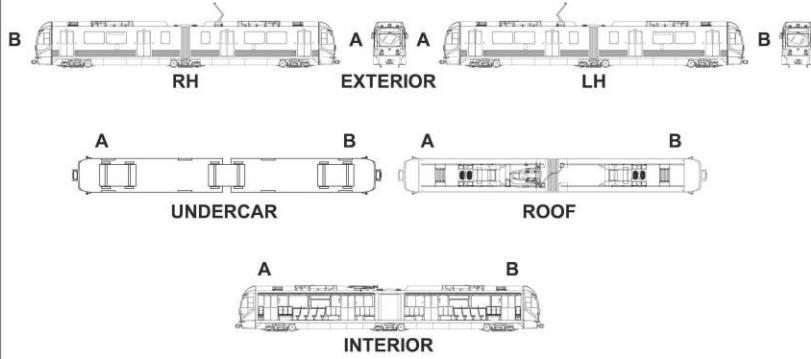
- **SAFETY PRECAUTIONS**, to be followed to safely accomplish the Task
- **TOOLS**, including Special Tools and Test Equipment needed to accomplish the Task
- **CONSUMABLES**, required to accomplish the Task and consistent with those used by MTA
- **PROCEDURE**, consisting of **Preliminary Operations** and **Procedural Steps**, to be followed while performing Maintenance Tasks
- **Illustrations** and **Pictures** are inserted in the text to facilitate the understanding of the topics and/or to explain step-by-step procedure

10-III-03.03.01 Running- Preventive Maintenance Sheet (R-PMS) Form

The R-PMS Form (refer to Figure 10-III-03.2) consists of several fields containing the following data/ information:

RUNNING -PREVENTIVE MAINTENANCE SHEET (RPMS) Form			
ITEM #	TITLE	CONTENT	EXPLANATORY NOTES
1	Card code	Sheet code	<p>The Sheet Code is an alphanumerical code that identifies each R-PM Sheet.</p> <p>THE SHEET CODE IS THE EXPLICIT LINK BETWEEN R-PM MATRIXES, R-PMR /JOB CARDS AND R-PM SHEETS</p> <p>The Sheet Code consists of letters R-P followed by an 11 digit code number as follows:</p> <p>R-P-nn-mm-zz-ww/Y-kk</p> <p>R = Running P = Preventive</p> <p>nn may vary from 02 to 19, identifying the System/ Manual Section number.</p> <p>mm-zz-ww each one may vary from 00 to 99, according to AB System Functional Tree, allowing the identification of the Assembly/Unit/Component</p> <p>Y Maintenance Task Code. It may be one of the following:</p> <p>C=Cleaning I=Inspection L=Lubrication</p> <p>R=Replacement S=Service T=Test</p> <p>Test</p> <p>kk It may vary from 00 to 99.</p> <p>It is a progressive number allowing the explicit identification of RPMS when one of the following cases occur:</p> <ul style="list-style-type: none"> 1- same Maintenance Task pertaining to vehicle as a whole or to the same System/Subsystem/Assembly to be performed at same Maintenance Interval in different Vehicle Area (i.e Vehicle as a Whole DAILY Exterior /Interior INSPECTION) 2- same Maintenance Task pertaining to the same Assembly/Unit/Component to be performed at different Maintenance Intervals and for this reason consisting of different Maintenance Procedure
2	System	System name	This field indicates the System to which the Assembly/Unit/Component belongs.
3	Subsystem/ Assembly	Subsystem/ Assembly name	This field indicates the Subsystem/Assembly to which the Unit/Component belongs.
4	Unit	Unit name	This field indicates the Unit to which the Component belongs.
5	Component	Component name	This field indicates the Component the Maintenance Task is referring to
6	Maintenance Task	Maintenance Task name	This field indicates the Maintenance Task to be performed.
7	Interval Miles	Number	This field indicates the maintenance Interval Miles. It may be DAILY, 10,000 Miles, 30,000 Miles, 60,000 Miles, 120,000 Miles

RUNNING -PREVENTIVE MAINTENANCE SHEET (RPMS) Form (cont'd)			
ITEM #	TITLE	CONTENT	EXPLANATORY NOTES
8	Man Hours	Number	The Man Hour field indicates the time needed to perform the corresponding Maintenance Task, with the basic assumption that the Vehicle is staged on an Inspection Pit/Jacking tracks with the required Consumables, Tools And Materials Available.
9	Sheet	Pages numbering	This field indicates the progressive R-PMS sheet page number.
10	LOCATION	Illustration	This field indicates the On Board Location of the Equipment to be maintained The following Graphic Symbols are used for: Assembly/Unit/Component  for System/Subsystem/Vehicle as a Whole 
11	R	Letter	This field indicates that the Sheet pertains to Running Maintenance
12	P	Letter	This field indicates that the Sheet pertains to Preventive Maintenance
13	nn	Number	This field indicates the System/Manual Section number to which the Sheet pertains. It may vary from 01 to 19
14	rr	Number	This field indicates the Sheet Revision number
15	Page ##	Page ##	This field indicates the RMSM Section Page number
16	-#	Number	This field indicates the RMSM Section Revision number
17	SAFETY PRECAUTIONS	Text	This field presents the General and/or specific Safety Precautions to be followed to safely accomplish the relevant Maintenance Tasks.
18	TOOLS	Text	This field lists the description and the P/N of the Standard tools, Special Tools and Test Equipment needed to accomplish the Maintenance Task. Refer to the TTE Manual for the TE and Special Tools detailed descriptions and tools maintenance.
19	CONSUMABLES	Text	This field lists the Consumables Materials (consistent with those used by MTA with the related P/N.) needed to accomplish the Maintenance Task. Cleaning agents are included
20	SPARE PARTS	Text	This field lists the Description and PN of Spare Parts (consistent with Illustrated Parts Catalog) needed to accomplish the Maintenance Task.
21	PROCEDURE	Text	The Procedure field provides Preliminary Operations and Procedural step by step Instructions to be followed while performing the Maintenance Task. Illustrations and Pictures are inserted in the text to facilitate the understanding of the topics and/or to explain step-by-step procedure.

	LACMTA P2550 LRV Running Maintenance and Servicing Manual - Section 01
P2550 PREVENTIVE MAINTENANCE SHEET	
System: Card Code: R-P-nn-mm-zz-ww/Y-kk	
Subsystem/Assy: Sheet: x/z	
Component: Man Hours:	
Maintenance Task: Interval/Miles:	
LOCATION:	
	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
R P nn mm zz ww Y kk	
M Metro	
Page 011 Draft	

**Figure 10-III-03.2 R-PMS Form
(Sheet 1 of 2)**

LACMTA P2550 LRV Running Maintenance and Servicing Manual - Section 01		 AnsaldoBreda				
P2550 PREVENTIVE MAINTENANCE SHEET						
Card Code: R-P-nn-mm-zz-ww/Y-kk						
System: _____		Sheet: x/z				
Subsystem/Assy: _____		Unit: _____				
Component: _____		Man Hours: _____				
Maintenance Task: _____		Interval/Miles: _____				
SAFETY PRECAUTIONS:						
17. _____						
18. _____						
19. _____						
20. _____						
21. _____						
TOOLS: _____						
CONSUMABLES: _____						
SPARE PARTS: _____						
PROCEDURE: PRELIMINARY OPERATIONS						
Page 01-2 Draft						
						
<table border="1" style="margin-left: auto; margin-right: 0; border-collapse: collapse;"> <tr> <td style="padding: 2px;">R</td> <td style="padding: 2px;">P</td> <td style="padding: 2px;">nn</td> <td style="padding: 2px;">rr</td> </tr> </table>			R	P	nn	rr
R	P	nn	rr			

**Figure 10-III-03.2 R-PMS Form
(Sheet 2 of 2)**

10-III-03.02 How to Use the R-PM Sheets and R-PMR /Job Cards

To optimize the job organization, proceed as follows:

1. At Scheduled Preventive Maintenance Interval Expiration Date

- a) Use the relevant (Maintenance Interval) R-PMR/JOB CARD where the Subsystems/Assemblies/Units/ Components, listed in the ITEMS column, are grouped by Work Area and Vehicle System and sequenced, in alphabetical order, in conjunction with their On Vehicle Location and Task to be performed.
- b) Select the Work Area and the System
- c) Select the first Equipment listed in the ITEMS column and the Sheet Code listed in conjunction with the Task to be performed and gather the relevant Sheet
- d) Read carefully the Sheet to fully understand the provided Data/Instructions.
- e) Carefully read:
 - The Safety Precautions to perform the Task safely.
 - The Preliminary Operations to set the Vehicle in safety conditions according to MTA Maintenance Shop Regulations
 - The Tools, Consumables and Spare Parts listed in each Sheet which are needed to accomplish the Task, in order to have all of them available next to the location of the Equipment to be maintained before starting the activities
- f) Fill the R-PMR/JOB CARD with the data required by the Maintainer at the start of the Maintenance Activities

2. Task Execution

- a) Follow carefully the prescribed Safety Precautions and Maintenance Procedural Steps provided in the R-PM Sheet.
- b) Perform the Maintenance Task Procedure on the first Equipment (listed in the ITEMS column of the relevant R-PMR /JOB CARD) at its On Vehicle LOCATION. as indicated in the LOCATION column of the R-PMR /JOB CARD.
- c) Upon completing the Maintenance Task on the first Equipment, highlight (with a flag) its LOCATION field on the R-PMR / JOB CARD.
- d) Note Equipment Defect Found and / or your Comments on the End Page of the R-PMR / JOB CARD
- e) Proceed to perform the same Task on the second (same) Equipment listed in the R-PMR / JOB CARD at its On Vehicle LOCATION, (different from the previous one) as indicated in the LOCATION column of the R-PMR /JOB CARD.
- f) Proceed as above to perform the same Task on every Equipment (to which the same Sheet Code refers) listed in the ITEMS column of the relevant (Maintenance Interval) R-PMR /JOB CARD.
- g) During Task execution, note any Areas / Items of the Assembly / Unit/ Component under Preventive Maintenance Process requiring Corrective Maintenance.
- h) Gather as much information about the Equipment as is practical to increase your Equipment knowledge (i.e. knowledge about the malfunction in terms of correctly operating and incorrectly operating equipment processes).

3. At every Task Completion

- a) Follow carefully the prescribed Safety Precautions before restoring Electrical Power to Vehicle.
- b) Check the correct operation and/or functions of the Subsystem to which the maintained Equipment pertains.
- c) Perform this check on the IDU "A" as follows:

NOTE: Through the IDU you can check if all Systems are exchanging data through the MVB or LonWorks Bus and the Trainlines Status.

The IDU Display also shows in real time the Status of all Vehicle Systems.

Reading the IDU Fault List it is possible to immediately detect a fault. Using the IDU in the Operating Mode the Fault Indications are generic,

Using the IDU in Maintenance Mode the same Fault has a detailed description.

For more in depth troubleshooting use the PTU connected to the relevant system that requires further troubleshooting.

1. On IDU "A" access to the Maintenance Menu first and then to the "Faults" Screen by selecting, in sequence, the relevant icons.
2. Check, On IDU "A" through the list of the Current Active Faults shown in the "Faults" Screen, for "Fault" Codes related to the Subsystem to which the maintained Equipment pertains.
Refer to Section 18 of RMSM for Fault Signals Details.
3. As per "Fault" Codes check results proceed as follows:

➤ **No Faults are listed in the "Faults" Screen**

- a) Key OFF the Vehicle.
- b) Record Service and Test results on the Defect Report Card for administrative and maintenance planning.
- c) Fill the R-PMR /JOB CARD with the data required from the Maintainer at the completion of the Maintenance Activities and include your comments

➤ **Fault Codes are listed in the “Faults” Screen**

- a) Investigate/troubleshoot the Equipment previously maintained first and then the System/Subsystem/Assembly/Unit for Fault Probable Causes
- b) Gather as much information about the failure symptoms as is practical.
- c) Refer to Section 18 of RMSM for Fault Signals Details
- d) Try to identify the malfunction in terms of correctly operating and incorrectly operating equipment processes.
- e) Identify which equipment signals or parameters will best help you to localize the failure.
- f) Identify the source of the problem.
- g) Repair or replace the defective component.
- h) Verify that the repair is effective in eliminating all of the failure symptoms.
- i) Evaluate whether or not the defective component was the root cause of the failure.
- j) Once the Fault Codes are not found in the “Faults” Screen perform steps from 3-a through 3-c (previous subparagraph **“No Faults are listed in the “Faults” Screen”**).

10-III-03.03.03 Running- Preventive Maintenance Sheet (R-PMS) List

The LVDS Running- Preventive Maintenance Sheets (R-PMS) List is provided in the following pages

The R-PM Sheets are listed by Subsystem / Assembly / Unit / Component and sequenced by Maintenance Interval in conjunction with their Sheet Codes and Tasks (including SCPM flag) to be performed

Table 10-III-03.3 Running Preventive Maintenance Sheets List

SYSTEM 10 LOW VOLTAGE DISTRIBUTION SYSTEM					
SUBSYSTEM/ ASSY	ASSY /UNIT/ COMPONENT	SCPM	TASK	MAINTEN. INTERVAL (MILES)	SHEET CODE
LOW VOLTAGE DISTRIBUTIUN CIRCUITRY	LOW VOLTAGE DISTRIBUTION CIRCUITRY		INSPECTION	120,000	R-P-10-03-00-00/I-00
SAFETY CIRCUITS	SAFETY CIRCUITS	✓	INSPECTION	120,000	R-P-10-04-00-00/I-00

10-III-03.03.04

Running- Preventive Maintenance Sheets (R-PMS)

LOW VOLTAGE DISTRIBUTION SYSTEM (LVDS)

Running - Preventive Maintenance Sheets

R-PMS

INTENTIONALLY LEFT BLANK

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/28

Subsystem/Assy:

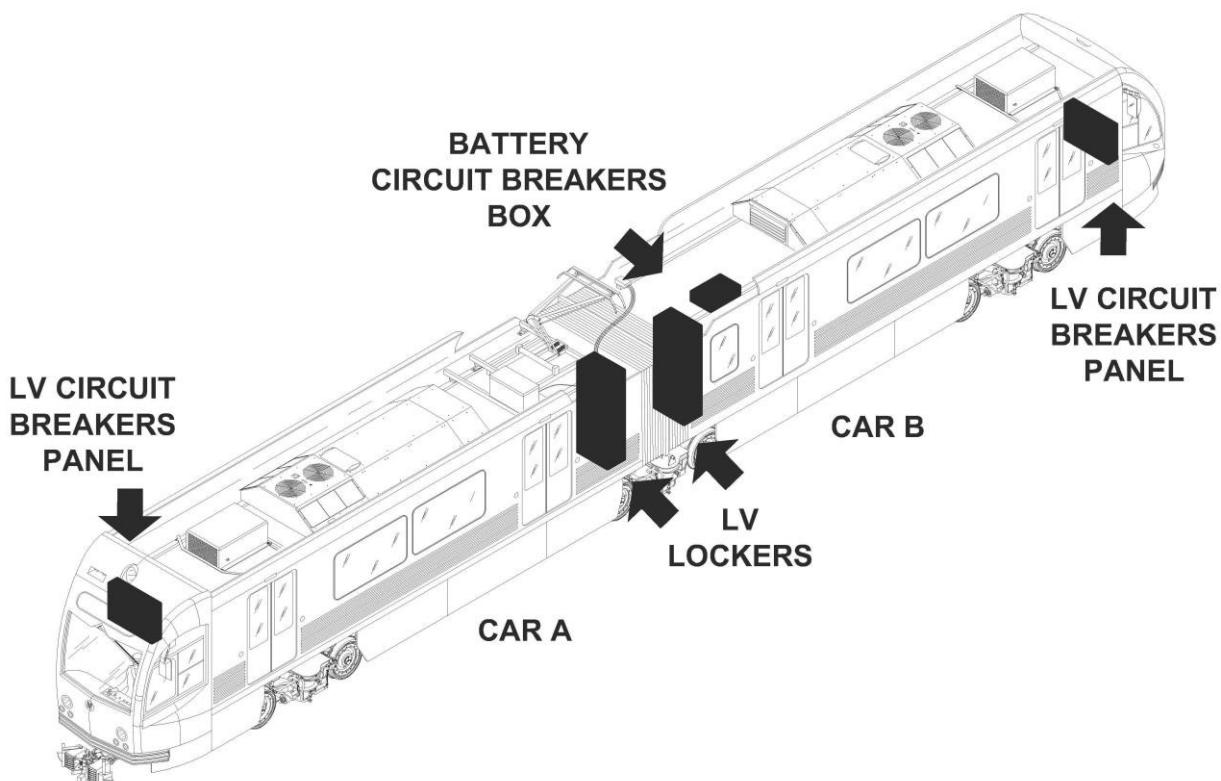
**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:
1

Maintenance Task:

INSPECTIONInterval/Miles:
120,000**LOCATION:**

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/28

Subsystem/Assy:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000**SAFETY PRECAUTIONS:**

WARNING: NO SMOKING. NO OPEN FLAME, EMBERS OR SPARKS NEAR THE BATTERY, TO AVOID RISK OF EXPLOSION AND FIRE.

WARNING: BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.

CAUTION: AVOID USING NON-INSULATED TOOLS OR METAL OBJECTS AROUND THE TERMINALS OF CB 3F01. THIS IS TO ENSURE THAT YOU WILL NOT SHORT THE TERMINALS TO EACH OTHER OR TO GROUND AND THEREBY PREVENT DAMAGING THE BATTERY.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit.

Vacuum Cleaner

CONSUMABLES:

CRC Industrial - Precision Cleaner M3 PN 147535

Dry Compressed Air for Electronic Equipment (commercial).

SPARE PARTS:

Battery Circuit Breakers Box -Front Cover Gasket	(PN AA03 MXV)
Battery Circuit Breakers Box -Side Cover Gasket	(PN AA03 MXW)
Circuit Breaker 3F01	(PN AA03V2E)
Circuit Breaker 3F02	(PN AA03V2F)
Circuit Breaker 3F15	(PN AA03V2H)
Circuit Breaker 3F16	(PN AA03V2H)
Circuit Breaker 3F17	(PN AA03V2J)
Insulator	(PN AA03P5K)

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

3/28

Subsystem/Assy:

Unit:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle in the Maintenance Shop.
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

INSPECTION

The Task consists of the following Maintenance Activities

1. Battery Contactor 3K01 Inspection & Checking.
2. Battery Protection Circuit Breaker CB 3F01 Inspection & Checking.
3. Battery Circuit Breaker Box & Components Inspection.
4. Battery Circuit Breakers Box Inspection & Cleaning.
6. LV (A/B) Lockers Equipment Inspection & Cleaning.
7. LV Circuit Breakers Panels (A / B Cab) Inspection and Cleaning.

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/28

Subsystem/Assy:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

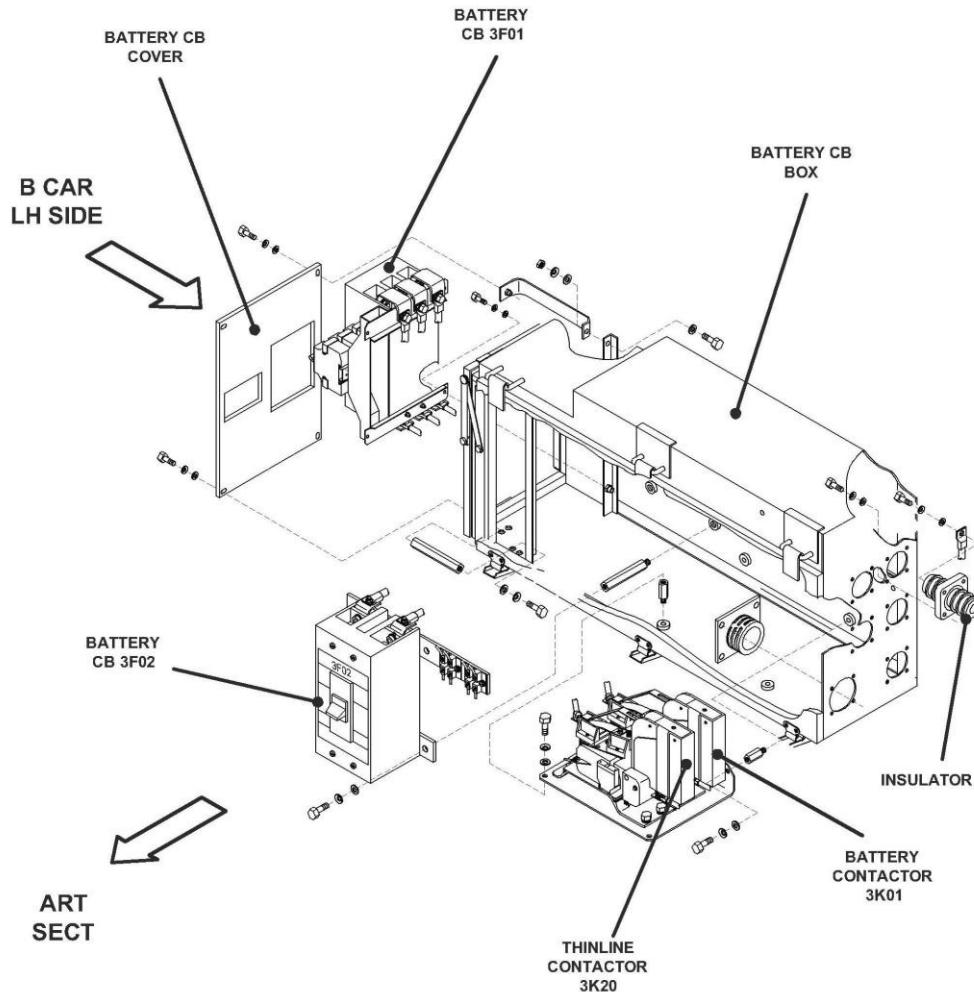


Figure 1 - BATTERY CIRCUIT BREAKERS BOX

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

5/28

Subsystem/Assy:

Unit:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE (CONT'D):

To perform the Tasks proceed as follows:

(Refer to Figures 1 and 2):

1. Open the Battery Box Side Skirt, using the Maintenance Key.
2. Remove Box Front and Side Covers disengaging the relevant Safety Latches.

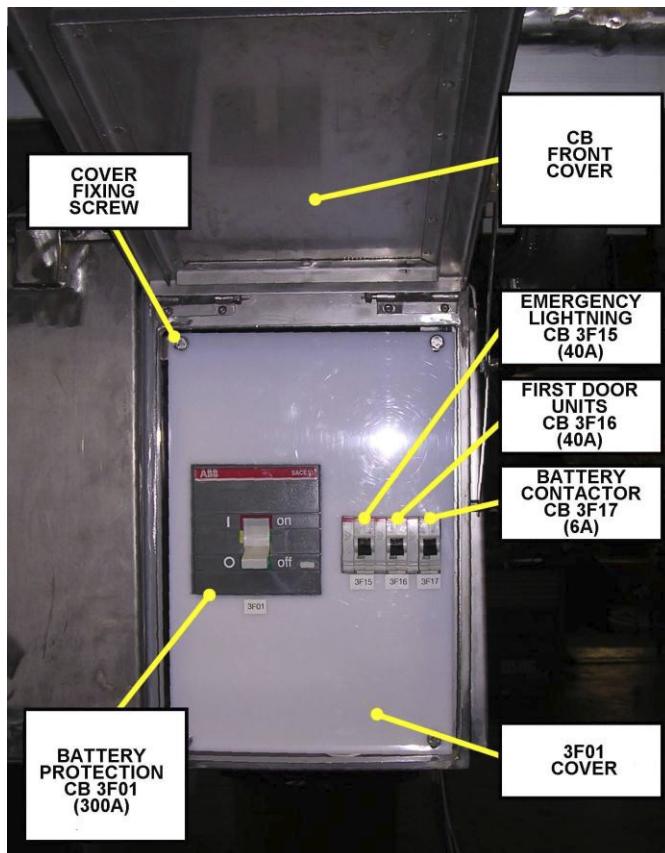


Figure 2 - BATTERY CIRCUIT BREAKER BOX- FRONT - EXTERIOR

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/28

Subsystem/Assy:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

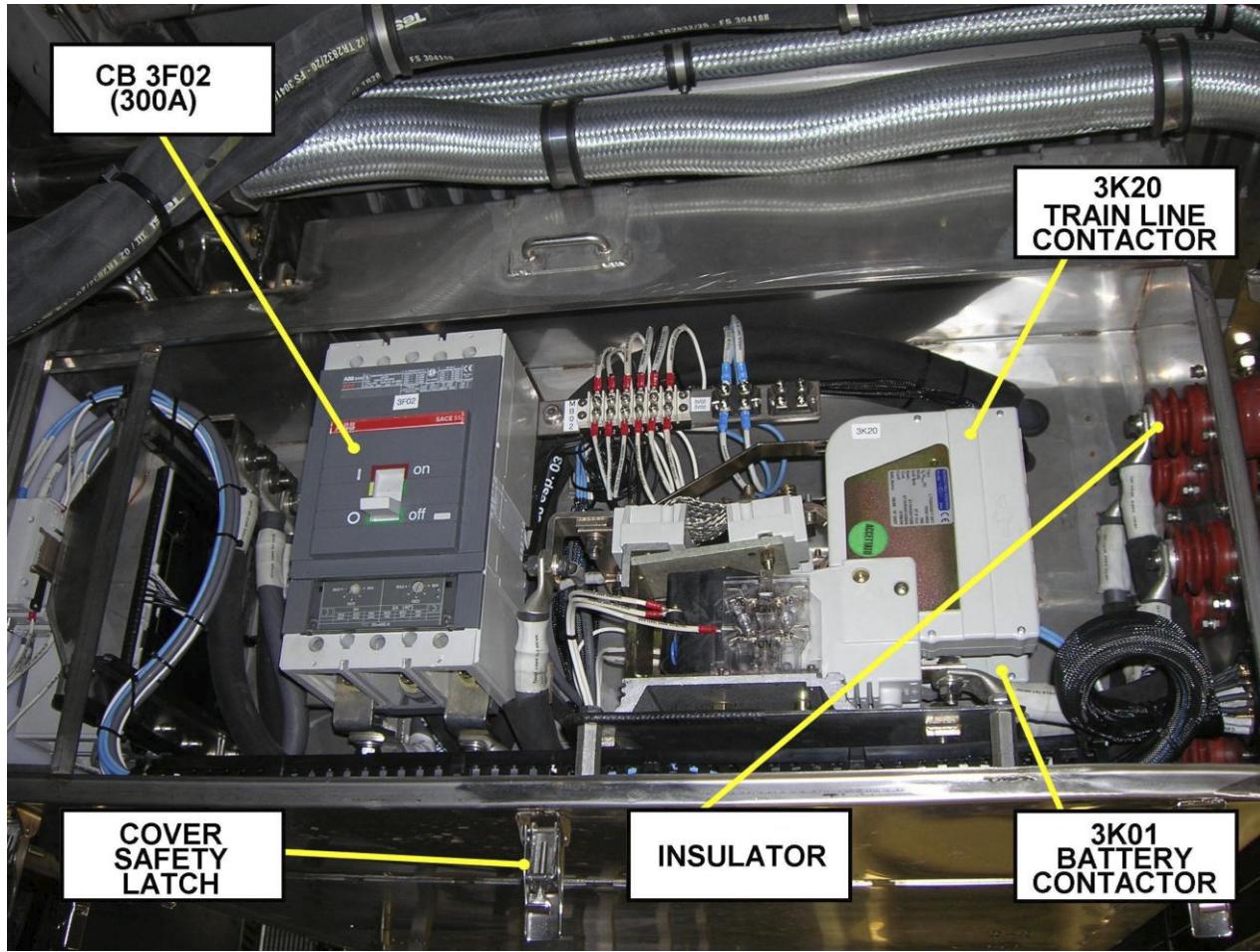


Figure 3 - BATTERY CIRCUIT BREAKER BOX- SIDE - INTERIOR

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

7/28

Subsystem/Assy:

Unit:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE (CONT'D):

BATTERY CONTACTOR 3K01 INSPECTION AND CHECKING

(Refer to Figures 1 and 2):

To inspect the Contactor proceed as follows:

1. Inspect the Contactor for visible damage such as broken or missing parts, sign of overheating.
2. Check that the Contactor moving parts can be moved freely.
3. Check the Main and Auxiliary Contact Terminals & Connections for loose / missing parts. Tighten as per check result.
4. Note any areas / items requiring corrective maintenance.
5. Replace the Contactor, as per check result, according to the procedure provided in the relevant Sheet

R-C -11-07-00-00 / R-00.

6. Clean the Component using recommended cleaner / agent and clean lint - free rags.

To check the Contactor proceed as follows:

1. Verify that the following Circuit Breakers are in ON position. Set the CBs as per check result.
 - a) Battery Protection Circuit Breaker (CB 3F01)
 - b) Battery Contactor CB (CB 3F17)
 - c) Battery Circuit Breaker (CB 3F02)
2. Visually verify that the 3K01 Contactor is in OPEN position.
3. Energize the 3K01 Contactor coil to close by turning the Transfer Switch ("A" Cab) to "LOCAL" position. Visually verify that the 3K01 Contactor is in CLOSE position.
4. De-Energize the 3K01 Contactor coil to open by turning the Transfer Switch ("A" Cab) to "OFF" position.
5. Visually verify that the 3K01 Contactor is in OPEN position.
6. Record inspection result on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the maintained Equipment pertains.

Refer to **HOW TO USE THE R-PM SHEETS** (para 10-III-03-03-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/28

Subsystem/Assy:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

BATTERY PROTECTION CIRCUIT BREAKER CB 3F01 INSPECTION AND CHECKING

(Refer to Figures 3 through 8):

To inspect the Circuit Breaker 3F01 proceed as follows:

1. Inspect the Circuit Breaker for visible damage such as broken or missing parts, sign of overheating.
2. Check that the Circuit Breaker moving parts can be moved freely and are easy to operate.
3. Check the Circuit Breaker for proper settings according to the following Setting Knob Positions (Refer to Figure 4).

Magnet Current: Setting Knob Position = MINIMUM (~2000,00 A)

Thermal Current: Setting Knob Position = MAXIMUM (~400,00 A)

4. Note any areas / items requiring corrective maintenance.
Replace, as per check result, according to the procedure provided in the relevant Sheet.
R-C -11-03-00-00 / R-00
5. Check the Main and Auxiliary Contact Terminals & Connections for loose. / missing parts. Torque, as per check result, to 12.5 ft-lb.
6. Clean the Circuit Breaker using recommended cleaner and clean lint - free rags.
7. Record Inspection result on the Defect Report Card for administrative and maintenance planning.

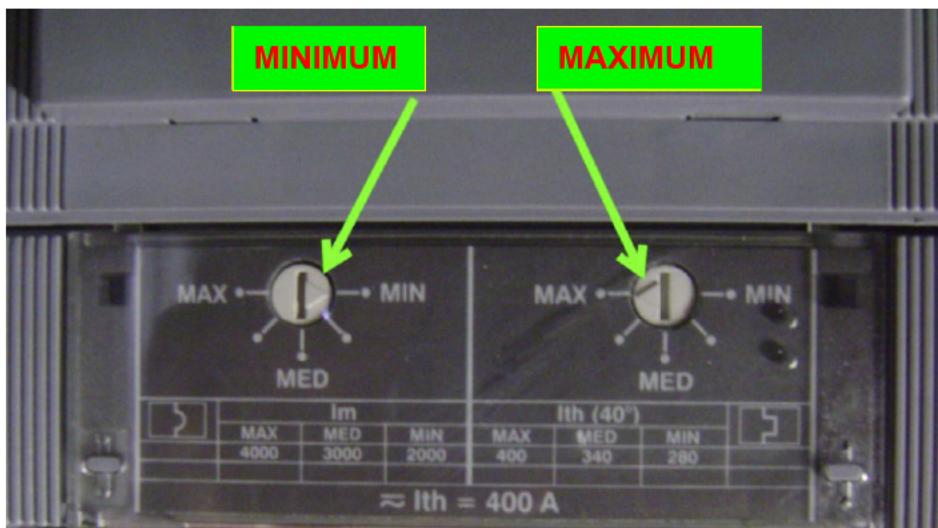


Figure 4 - 3F01 CB -MAGNET & THERMAL CURRENT SETTINGS

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

9/28

Subsystem/Assy:

Unit:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE (CONT'D):

To check the Circuit Breaker 3F01 proceed as follows:

1. Verify that CB 3F01 is OFF.
2. Supply power to IDU "A" by turning the Transfer Switch ("A" Cab) to the "LOCAL" position.
3. On IDU, access to the APS/LVPS System Status Screen by selecting, in sequence, the relevant icons.
4. Check, on the APS/LVPS System Status Screen, for LVPS OFF.

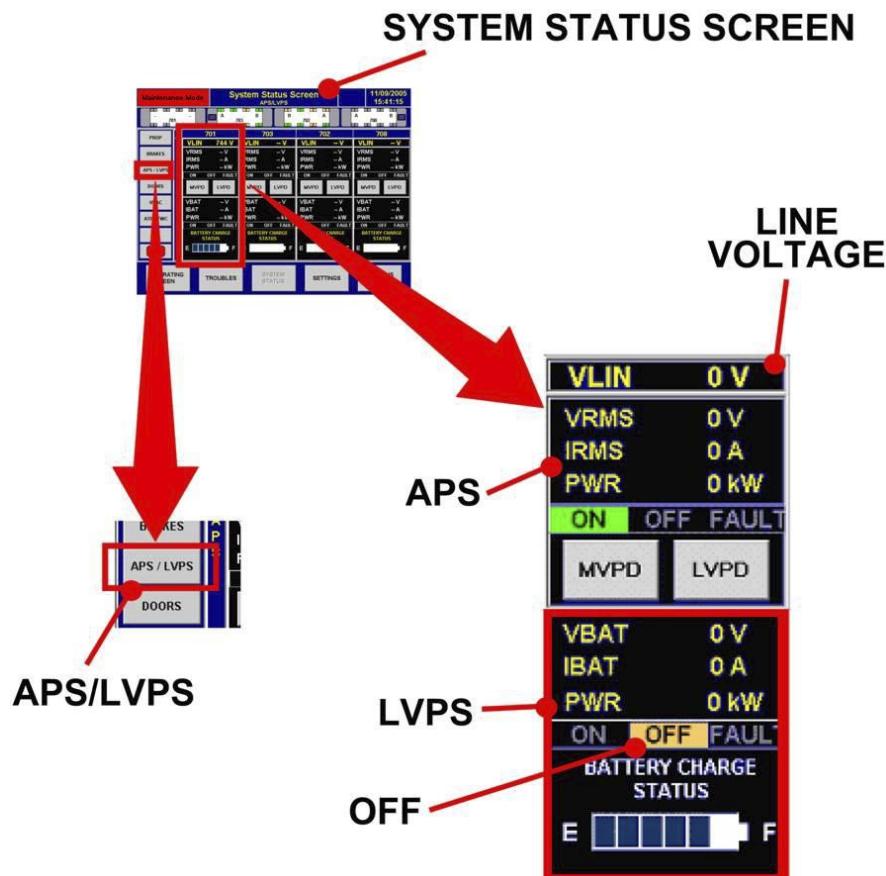


Figure 5 - IDU - SYSTEM STATUS SCREEN - APS LVPS -OFF

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

10/28

Subsystem/Assy:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

5. Access to Maintenance Menu first and then to the "Fault" Screen by selecting, in sequence, the relevant icons.
6. Check, through the List of the Current Active "Faults" shown in the "Faults" Screen, for the following Fault Code:

4033 APS / LVPS BatteryProtectionOpen

7. Switch OFF CB 3F01.
8. Remove the CB 3F01 Cover by loosening relevant screws. Retain them for later use.
9. Disconnect the three CB 3F01 Wires in sequence starting from 2402 wire (Vehicle +), then 2119 wire (Battery +) and finally 2120 wire (Battery -).
10. Be sure to properly insulate each wire as it is disconnected.

CAUTION: BE EXTREMELY CAREFUL TO AVOID TOUCHING THE TERMINALS OF THE (CB 3F01) WIRES WITH ANY METALLIC ITEMS OR TO EACH OTHER, IN ORDER TO NOT CAUSE A SHORT CIRCUIT OR DAMAGE TO THE BATTERY.

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

11/28

Subsystem/Assy:

Unit:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE (CONT'D):

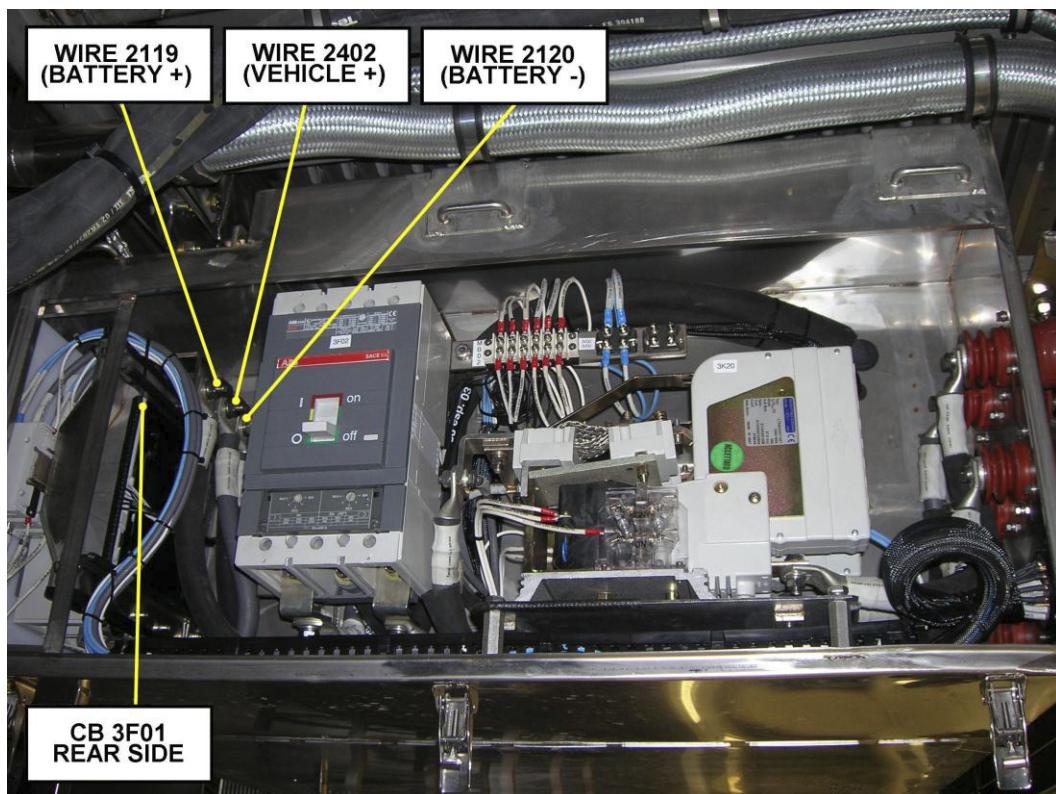


Figure 6 - CB 3F01 - CABLES AND TERMINALS

11. Connect to the CB 3F01 at (Battery +) and (Battery -) Terminals, through suitable Test Wires and Connections, an External 50 VDC Power Supply Source provided with Output Voltage Control Device.

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

12/28

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

12. Switch ON CB 3F01.
13. Apply to the CB 3F01 the Nominal Voltage of 37.5 VDC and then decrease the Test Voltage, using Output Voltage Control, to 26.25 VDC to verify that the CB 3F01 switches off.
NOTE: The Value of 26.25 VDC (CB Minimum Voltage Operating Time) is equal to 70 % of 37.5 VDC (CB Nominal Voltage).
14. On IDU, access to the APS/LVPS System Status Screen by selecting, in sequence, the relevant icons.
15. Check, on the APS/LVPS System Status Screen, for LVPS FAULT.

SYSTEM STATUS SCREEN

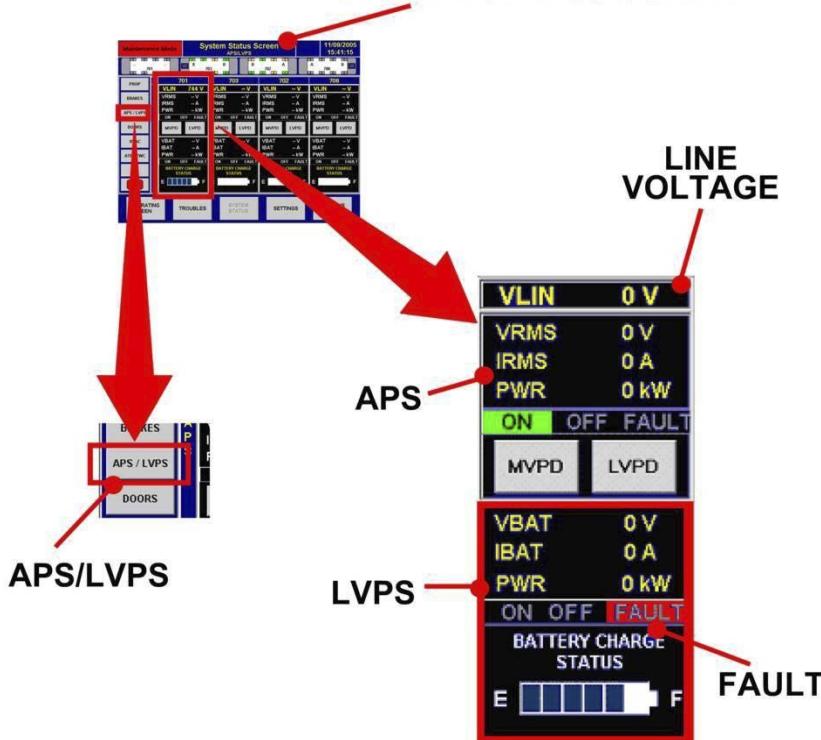


Figure 7 - IDU - SYSTEM STATUS SCREEN - APS LVPS -FAULT

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
13/28

Subsystem/Assy:

Unit:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION
120,000

PROCEDURE (CONT'D):

16. Access to Maintenance Menu first and then to the "Fault" Screen by selecting, in sequence, the relevant icons.

17. Check, through the list of the Current Active Faults shown in the "Fault" Screen, for the following Fault Code:

4033 APS / LVPS BatteryProtectionOpen

18. Switch ON CB 3F01.

19. Apply to the CB 3F01 the Nominal Voltage of 37.5VDC and then increase the Test Voltage, using Output Voltage Control, to 41.25 VDC to verify that the CB 3F01 switches off.

NOTE: The Value of 41.25 VDC (CB Maximum Voltage Operating Time) is equal to 110 % of 37.5 VDC (CB Nominal Voltage).

20. On IDU, access to the APS/LVPS System Status Screen by selecting, in sequence, the relevant icons.

21. Check, on the APS/LVPS System Status Screen, for LVPS FAULT.

22. Access to Maintenance Menu first and then to the "Fault" Screen by selecting, in sequence, the relevant icons.

23. Check, through the list of the current active Faults shown in the "Fault" Screen, for the following Fault Code:

4033 APS / LVPS BatteryProtectionOpen

24. Remove power from IDU "A" by turning the Transfer Switch ("A" Cab) to "OFF" position.

25. Shut Down the External Power Supply.

26. Remove Test Wires from CB 3F01 Terminals.

27. Remove the insulation applied to each CB 3F01 Wire Terminal and reconnect each Wire Terminal to CB 3F01 in sequence, starting from 2120 wire (Battery -), then 2119 wire (Battery +) and finally 2402 wire (Vehicle +)

28. Torque the Terminal Nuts to **15.2 ft-lb**.

29. Reinstall the CB 3F01 Cover and secure it by tightening the relevant Fixing Screws.

30. Switch ON CB 3F01.

31. Record Inspection result on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the maintained Equipment pertains.

Refer to **HOW TO USE THE R-PM SHEETS** (para 10-III-03-03-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

14/28

Subsystem/Assy:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000**PROCEDURE (CONT'D):****BATTERY CIRCUIT BREAKERS BOX & COMPONENTS INSPECTION**

To inspect the Circuit Breaker Box & Component proceed as follows:

1. Inspect the Circuits Breakers & Components installed in the Battery Circuit Breakers Box for visible damage such as broken or missing parts, sign of overheating. Replace Components, as per check result.
2. Check the 3F02 Circuit Breaker for proper settings according to the following Setting Knob Positions (Refer to Figure 8)

Magnet Current: Setting Knob Position = MINIMUM ($\sim 2000,00$ A)

Thermal Current: Setting Knob Position = MAXIMUM ($\sim 400,00$ A)

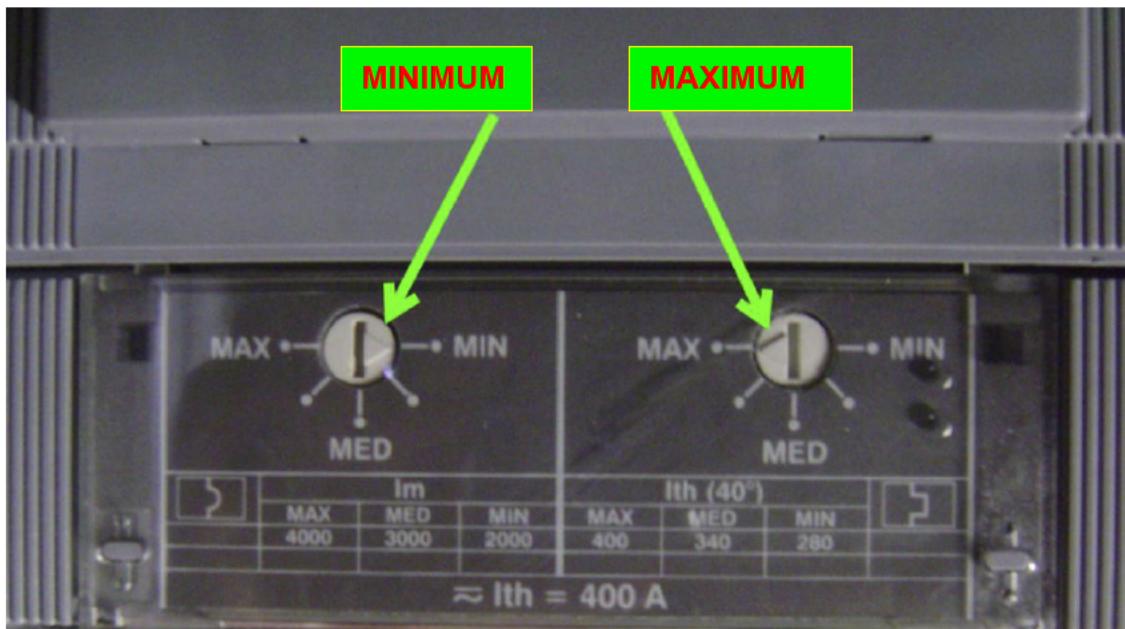


Figure 8 - 3F02 CB -MAGNET & THERMAL CURRENT SETTINGS

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

15/28

Subsystem/Assy:

Unit:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Component:

Man Hours:
1

Maintenance Task:

Interval/Miles:
120,000

PROCEDURE (CONT'D):

BATTERY CIRCUIT BREAKERS BOX & COMPONENTS INSPECTION (CONT'D)

3. Replace Circuits Breakers, as per check result, according to the procedures provided in the relevant Sheets listed in Table 1.

TABLE 1 BATTERY CIRCUIT BREAKERS BOX CB REPLACEMENT

LABEL	DESCRIPTION	SHEET CODE						
3F02	BATTERY C.B.	R	C	11	04	00	00	/ R-00
3F15	EMERGENCY LIGHTING C.B.	R	C	10	00	00	00	/ R-00
3F16	FIRST DOORS UNITS C.B.	R	C	10	00	00	00	/ R-00
3F17	BATTERY CONTACTOR C.B.	R	C	11	05	00	00	/ R-00
3K20	CONTACTOR + TRAIN LINE	R	C	10	00	00	00	/ R-02

4. Check that Circuit Breakers and Contactors moving parts are easy to operate and can be moved freely.
5. Check each Terminal & Connection of Main and Auxiliary Contact for loose / missing items. Tighten as per check result.
6. Note any areas / items requiring corrective maintenance.
7. Clean the Circuit Breakers, Contactors and Components using recommended cleaner / agent and clean lint - free rags.

BATTERY CIRCUIT BREAKERS BOX INSPECTION & CLEANING

To perform the Battery Circuit Breakers Box Cleaning proceed as follows:

1. Check Box (Front & Side) Case for damage / deformation, missing loose attaching parts.
2. Check Box (Front & Side) Covers for damage / deformation and damaged / missing Safety Latches
3. Check Box Case Interior for dirty / signs of water penetration.
4. Check Box (Front & Side) Covers Gaskets for damage / deformation. Replace as per check result.
5. Clean Box Case Interior using carefully a Vacuum Cleaner and clean wiping rags.
6. Reinstall each Box Cover and secure it by engaging the relevant Safety Latches.
7. Record Inspection result on the Defect Report Card for administrative and maintenance planning.

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION**16/28**

Subsystem/Assy:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:
1

Maintenance Task:

INSPECTIONInterval/Miles:
120,000

PROCEDURE (CONT'D):

LV (A/B) LOCKERS EQUIPMENT INSPECTION AND CLEANING

(Refer to Figures 9 through 16)

To perform the Task proceed as follows:

1. Gain access to the Circuit Breakers Rack installed in the LV Locker, by opening the relevant LV Locker Door using the Maintenance Key.

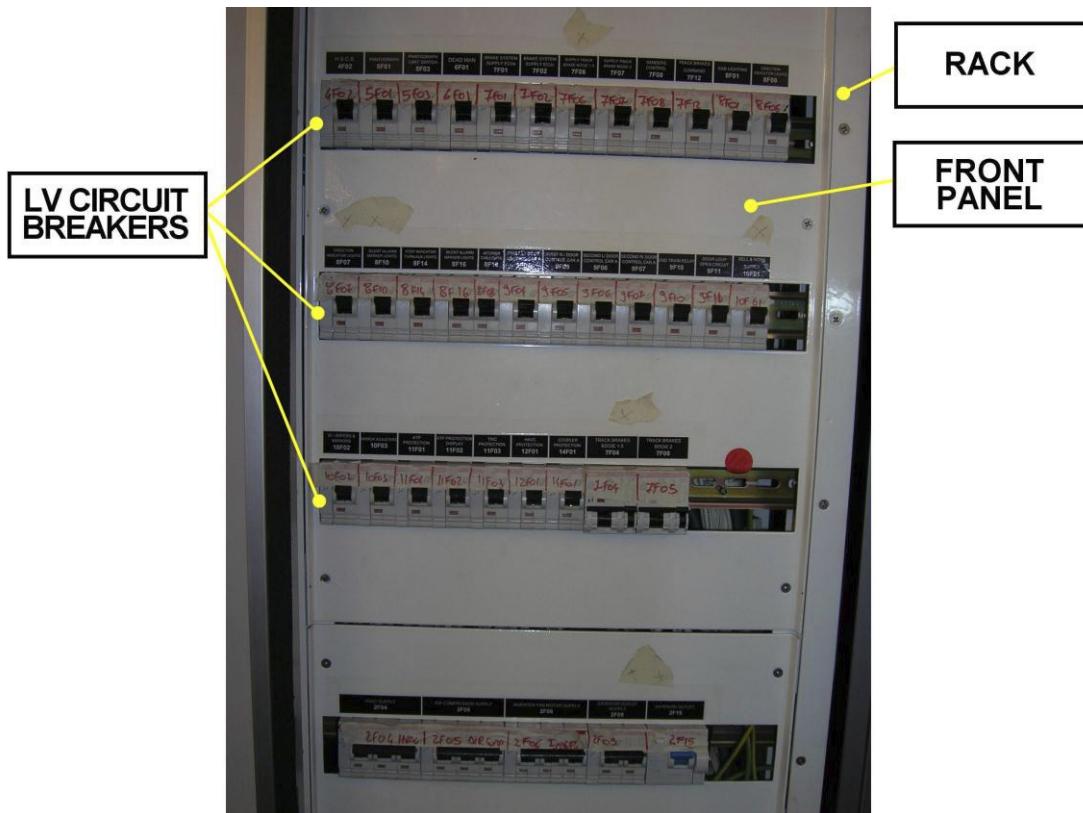


Figure 9 - LV LOCKER -CIRCUIT BREAKERS RACK

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

17/28

Subsystem/Assy:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

2. Check that LV Locker Light come on when the Locker Door is opened.
3. Inspect for damage or missing parts on the Circuit Breaker Front Panel.
4. Inspect for damaged or missing the Circuit Breakers Labels.



Figure 10 - LV LOCKER -CIRCUIT BREAKERS FRONT PANEL INSTALLED

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

18/28

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

5. Remove Circuit Breakers Front Panel by loosening relevant Fixing Screws. Retain them for later use.

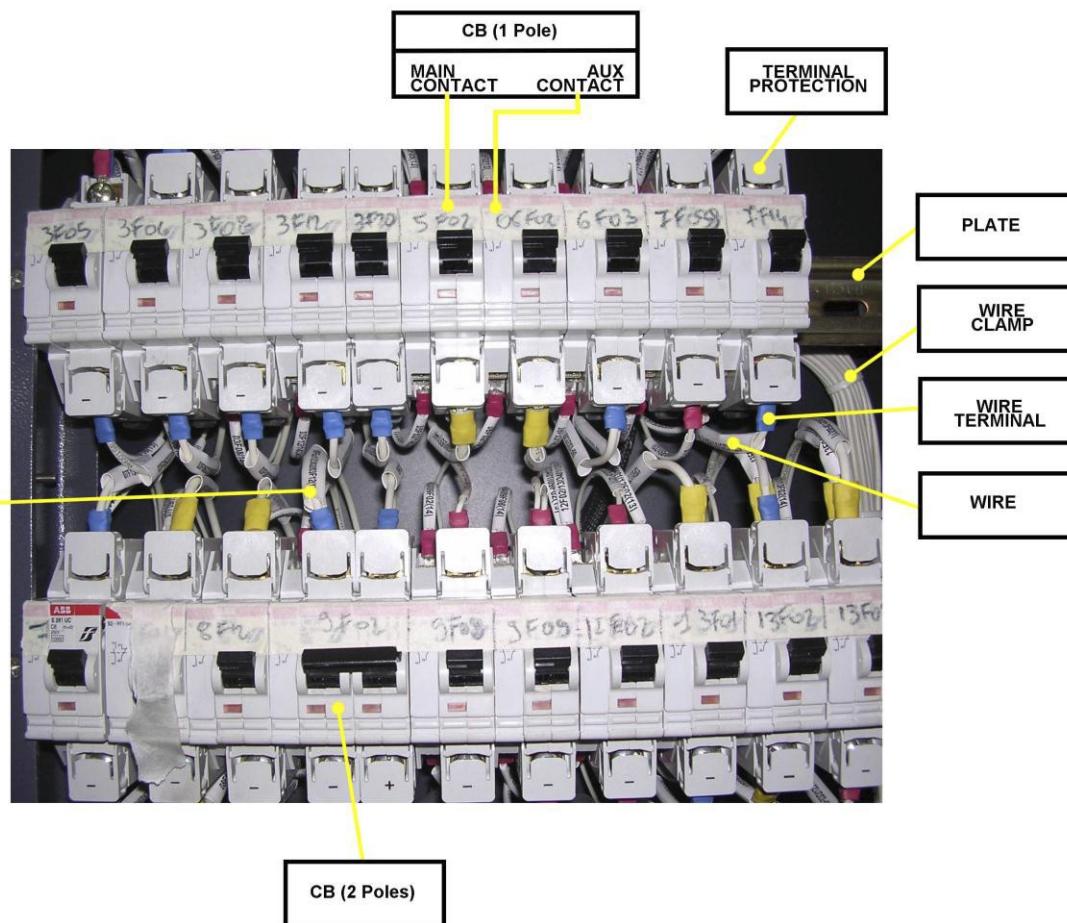


Figure 11 - LV LOCKER -CIRCUIT BREAKERS FRONT PANEL REMOVED

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

19/28

Subsystem/Assy:

Unit:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE (CONT'D):

6. Check CB Plates for installation / missing loose hardware. Torque, as per check result, to **15.2 ft-lb**.

NOTE: To gain access to the CB Plate Fixing Screws it may be necessary to disengage the Circuit Breakers from the Adapter Plates.

HOW TO DO: this information is provided in figures 10 and 11.

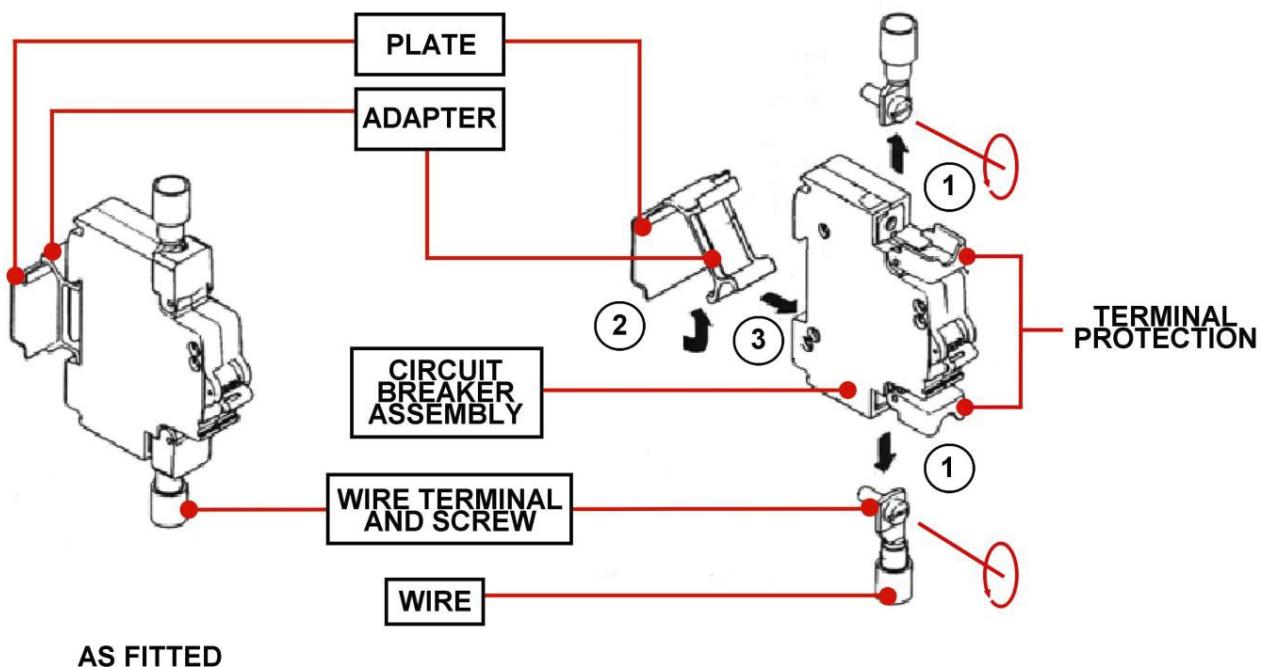


Figure 12 - LV LOCKER -TYPICAL CIRCUIT BREAKER REMOVAL

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

20/28

Subsystem/Assy:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

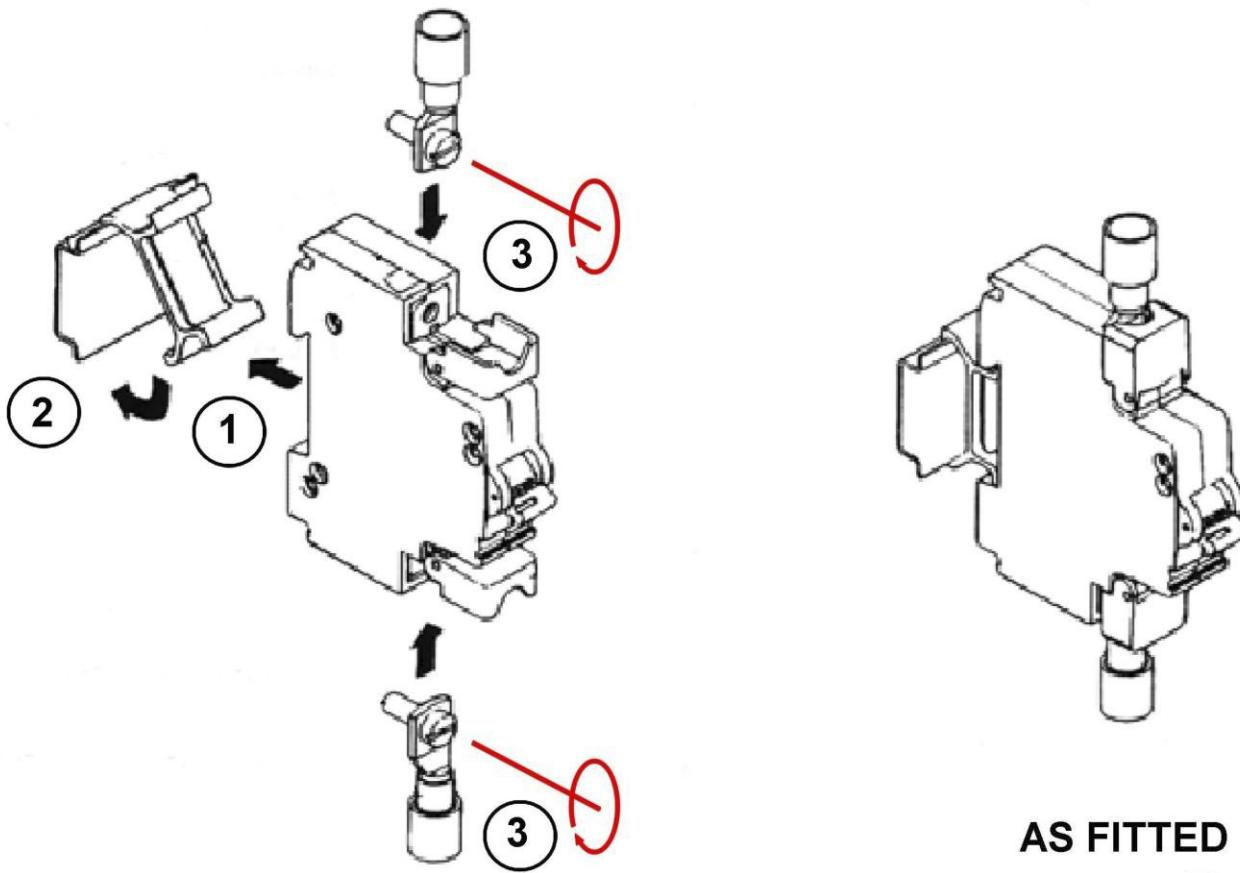


Figure 13 - LV LOCKER -TYPICAL CIRCUIT BREAKER INSTALLATION

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

21/28

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

7. Check the Circuit Breakers equipped with Auxiliary Contact for Connection damage / deformation.

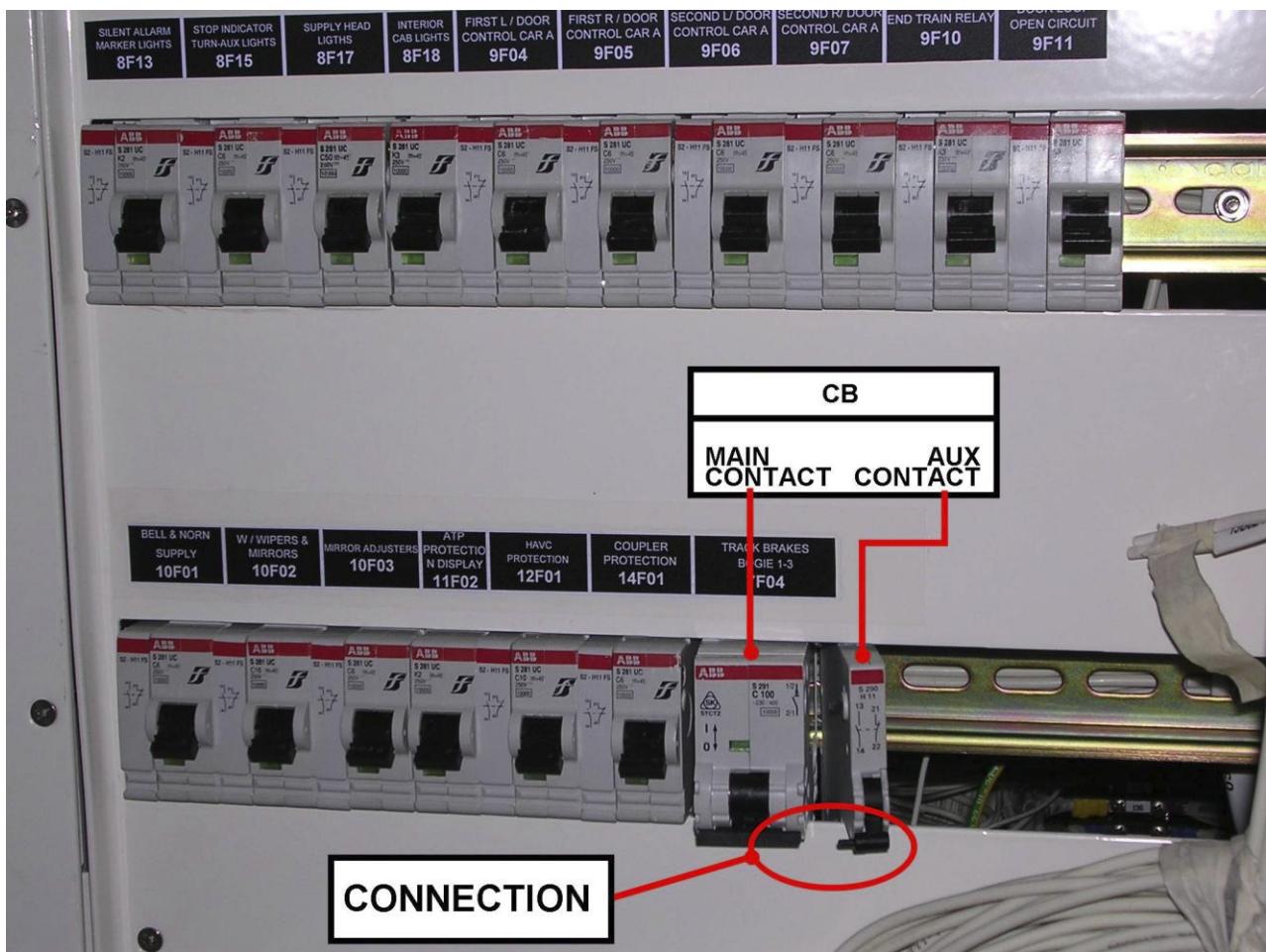


Figure 14 - LV LOCKER -CIRCUIT BREAKER MAIN & AUX CONTACTS CONNECTION

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

22/28

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

8. Check the Wires for signs of overheating and the Wire Terminals for tightness.

NOTE: The Reference Torque values for the Wire Terminals are as follows:

5 ft-*lb for M5 screw (Main contact I)
3 ft-*lb for M3 screw (Aux contact)

9. Check that the Circuit Breakers moving parts can be moved freely and are easy to operate.
10. Check Relays for installation / loose / missing parts. Tighten as required.

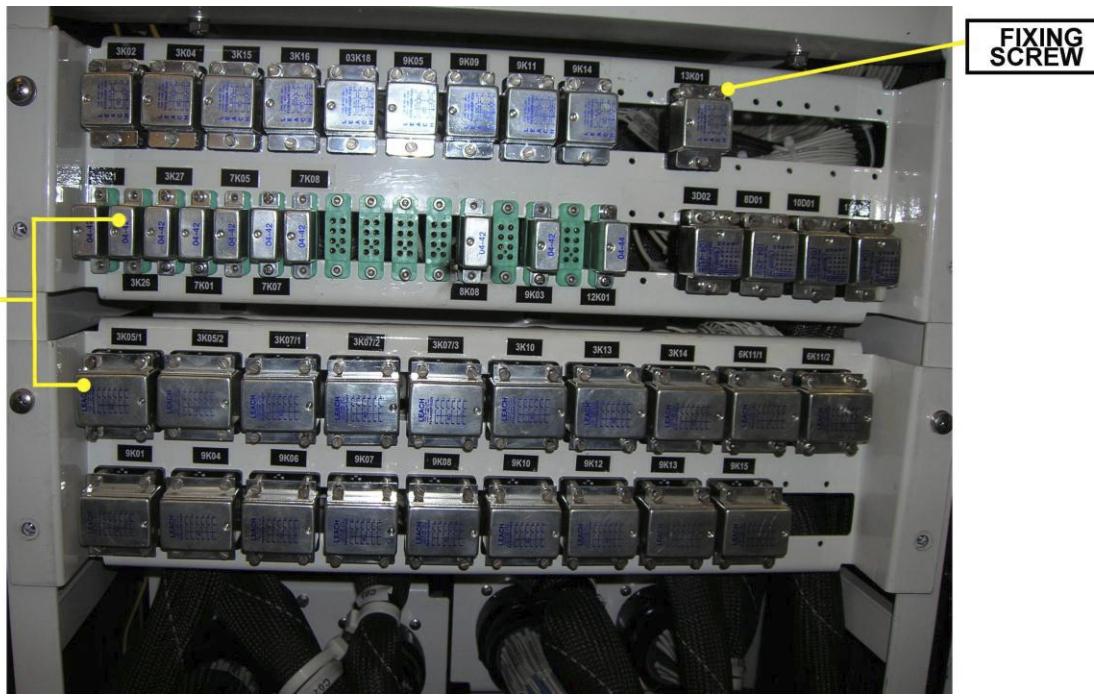


Figure 15 - LV LOCKER -RELAYS SECTION

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

23/28

Subsystem/Assy:

Unit:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE (CONT'D):

11. Check Connectors for installation / loose / missing parts.

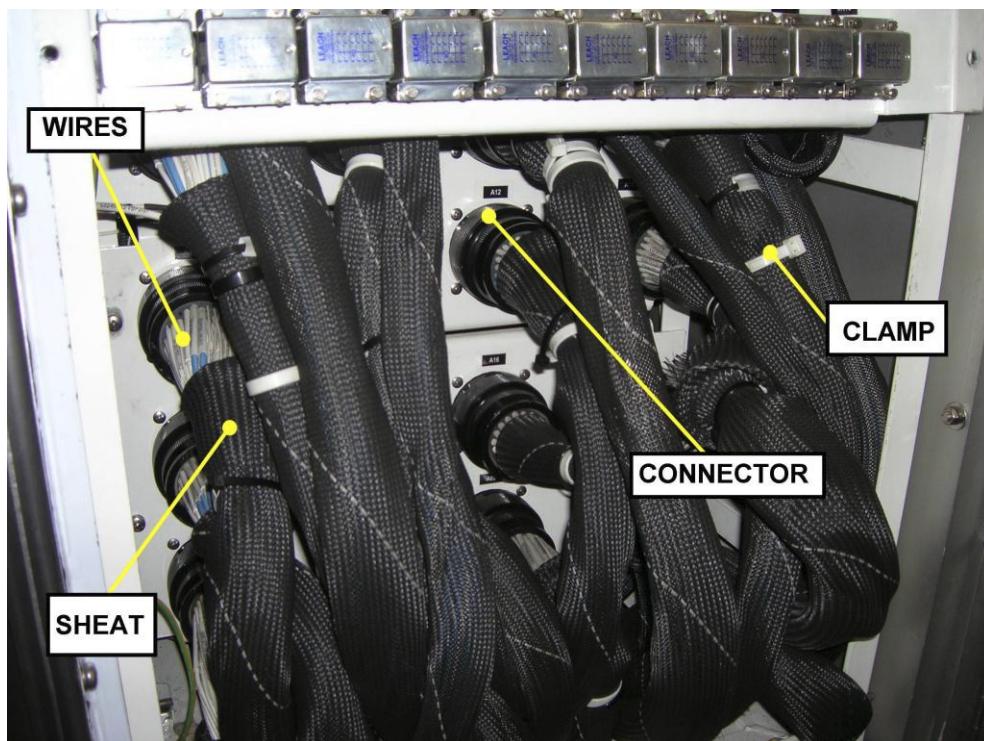


Figure 16 - LV LOCKER -CONNECTORS SECTION

12. Check Terminal Boards and Diodes for installation / loose / missing parts.
13. Note any areas / items requiring Corrective Maintenance.
14. Clean the Equipment installed on the LV Locker using recommended Cleaner / Agent and lint-free rags.
15. Vacuum clean the LV Locker Interior.
16. Close and secure the LV Locker Door using the Maintenance Key.
17. Record Inspection result on the Defect Report Card for administrative and maintenance planning.

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

24/28

Subsystem/Assy:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

LV CIRCUIT BREAKERS PANELS (A / B CAB) INSPECTION & CLEANING:

(Refer to Figures 17 through 20)

To perform the Task proceed as follows:

1. Locate the LV Circuit Breaker Panel.

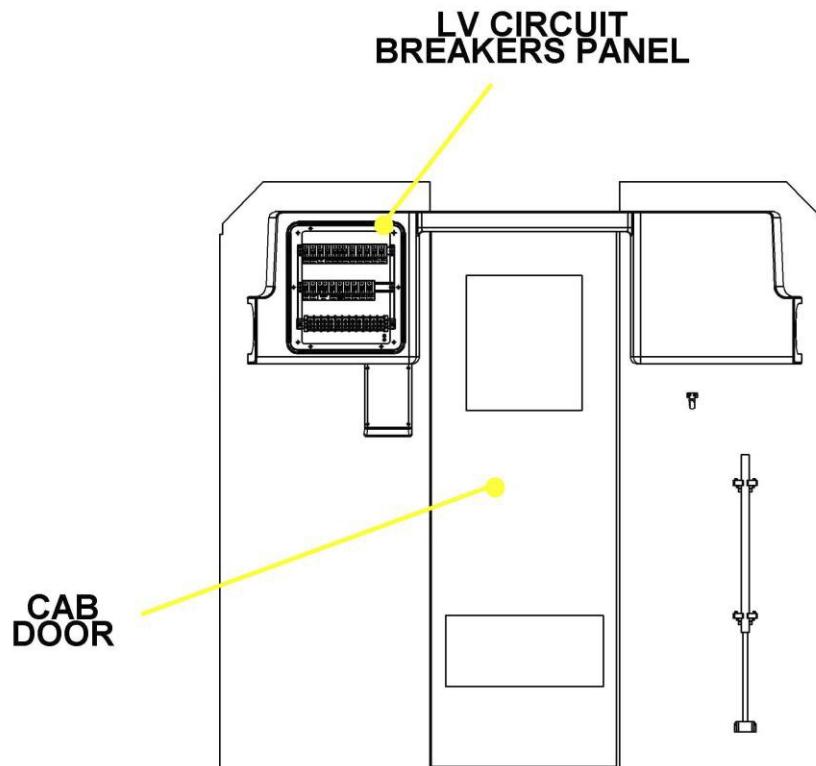


Figure 17 - LV CIRCUIT BREAKERS PANEL (A/B CAB) Location

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

25/28

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Unit:

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE (CONT'D):

2. Inspect the Front Panel (for the Circuit Breakers) for damaged or missing parts.
3. Inspect for missing or damaged the Circuit Breaker Labels.

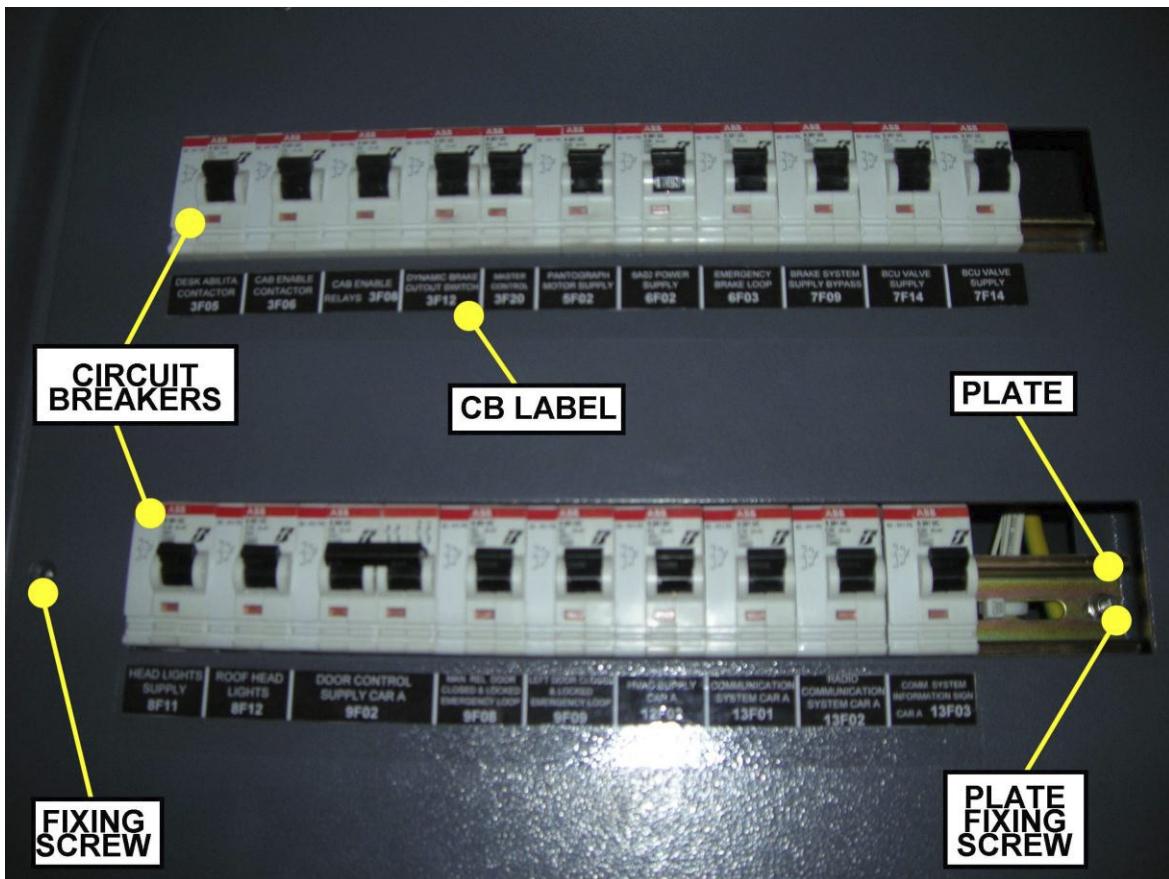


Figure 18 - LV CIRCUIT BREAKERS PANEL (FRONT)

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

26/28

Subsystem/Assy:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

4. Remove Circuit Breakers Front Panel by loosening relevant Fixing Screws. Retain them for later use.
5. Check CB Plates for installation / missing or loose hardware.
Torque, as per check result, to **15.2 ft-lb**.

NOTE: To gain access to the CB Plate Fixing Screws it may be necessary to disengage the Circuit Breakers from the Adapter Plates. HOW TO DO: this information is provided in figures 17 and 18.

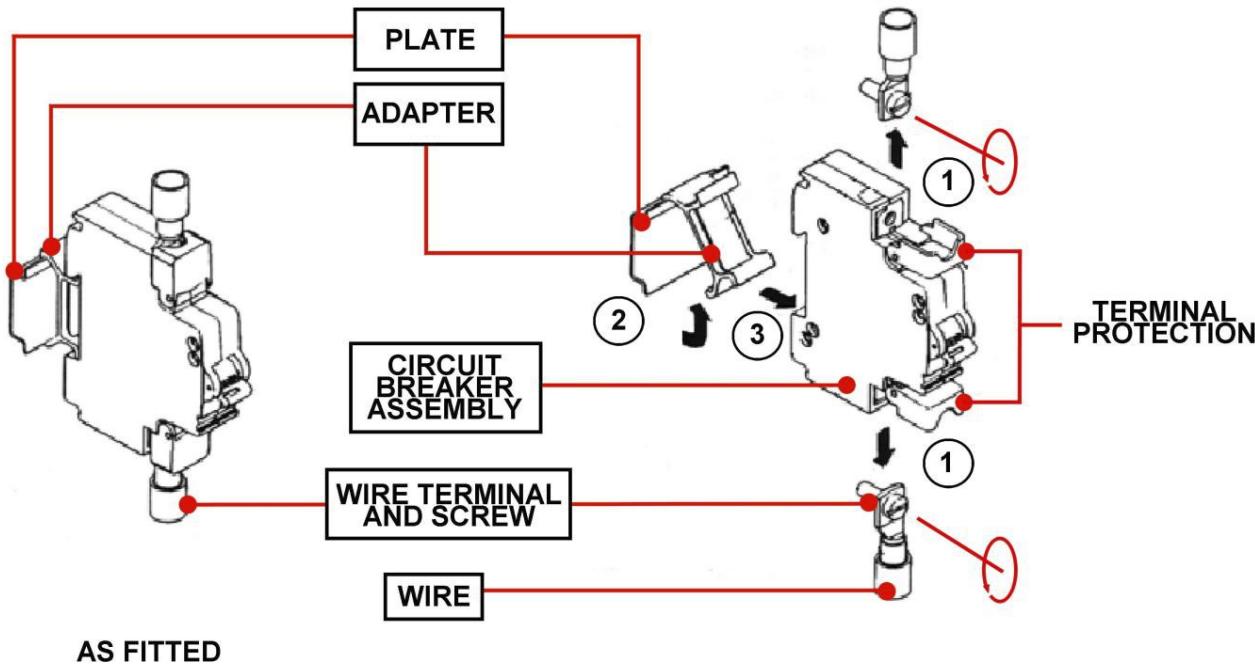


Figure 19 - LV CB PANEL -TYPICAL CIRCUIT BREAKER REMOVAL

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

27/28

Subsystem/Assy:

Unit:

LOW VOLTAGE DISTRIBUTION CIRCUITRY

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE (CONT'D):

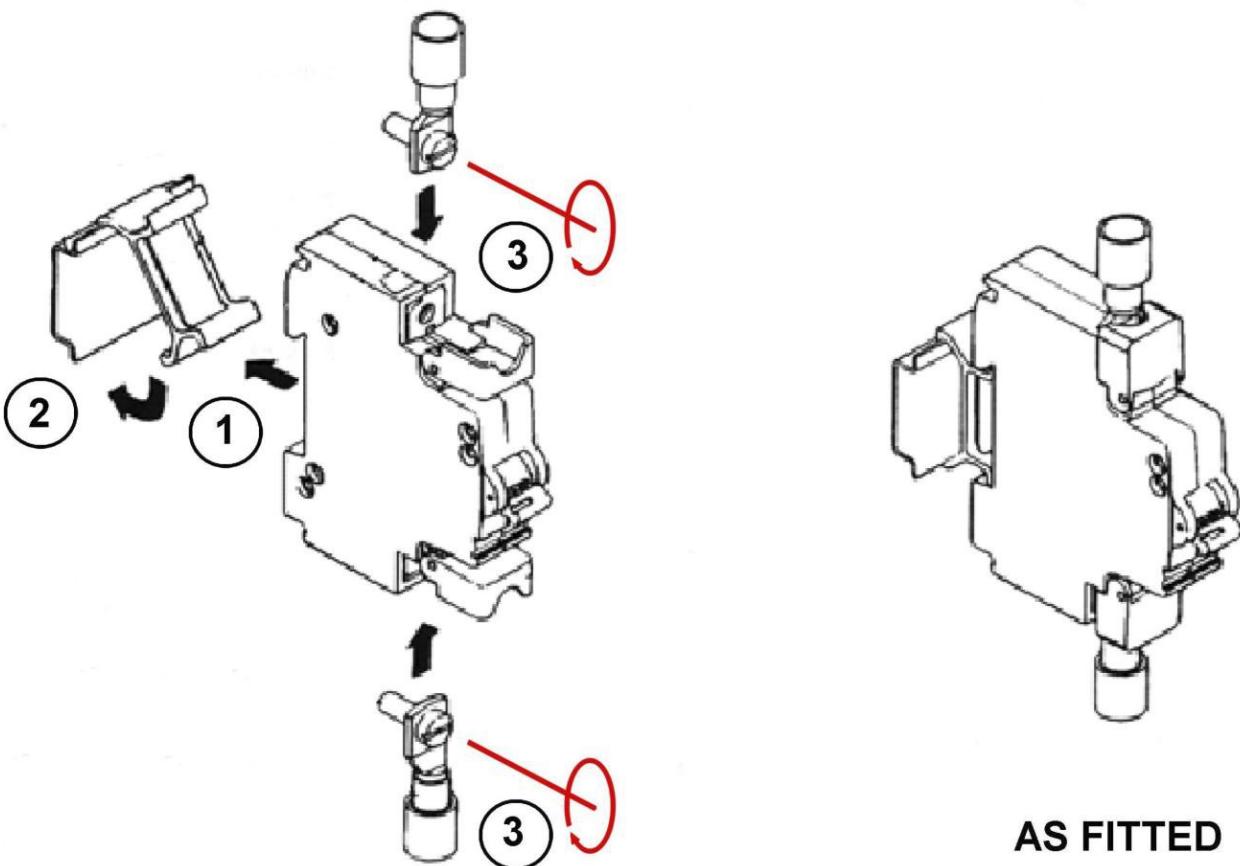


Figure 20 - LV CB PANEL -TYPICAL CIRCUIT BREAKER INSTALLATION

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-03-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

28/28

Subsystem/Assy:

**LOW VOLTAGE DISTRIBUTION
CIRCUITRY**

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

6. Check Wires for signs of overheating and the Wires Terminals for tightening.

NOTE: The Reference Torque for the Wire Terminals is as follows:

5 ft-*lb for M5 screw (Main contact I).

7. Check that the Circuit Breakers moving parts can be moved freely and are easy to operate.
8. Note any areas / items requiring Corrective Maintenance.
9. Clean the Equipment installed on the Rack using recommended Cleaner / Agent and lint-free rags.
10. Vacuum clean the LV Panel Interior.
11. Reinstall the Front Panel and secure it by tightening the relevant Fixing Screws.
12. Record Inspection result on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the maintained Equipment pertains.

Refer to **HOW TO USE THE R-PM SHEETS** (para 10-III-03-03-02 of this Section) and follow the prescriptions provided at Step 3 “**At every Task Completion.**”

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

1/16

Subsystem/Assy:

Unit:

SAFETY CIRCUITS

Component:

Man Hours:

1

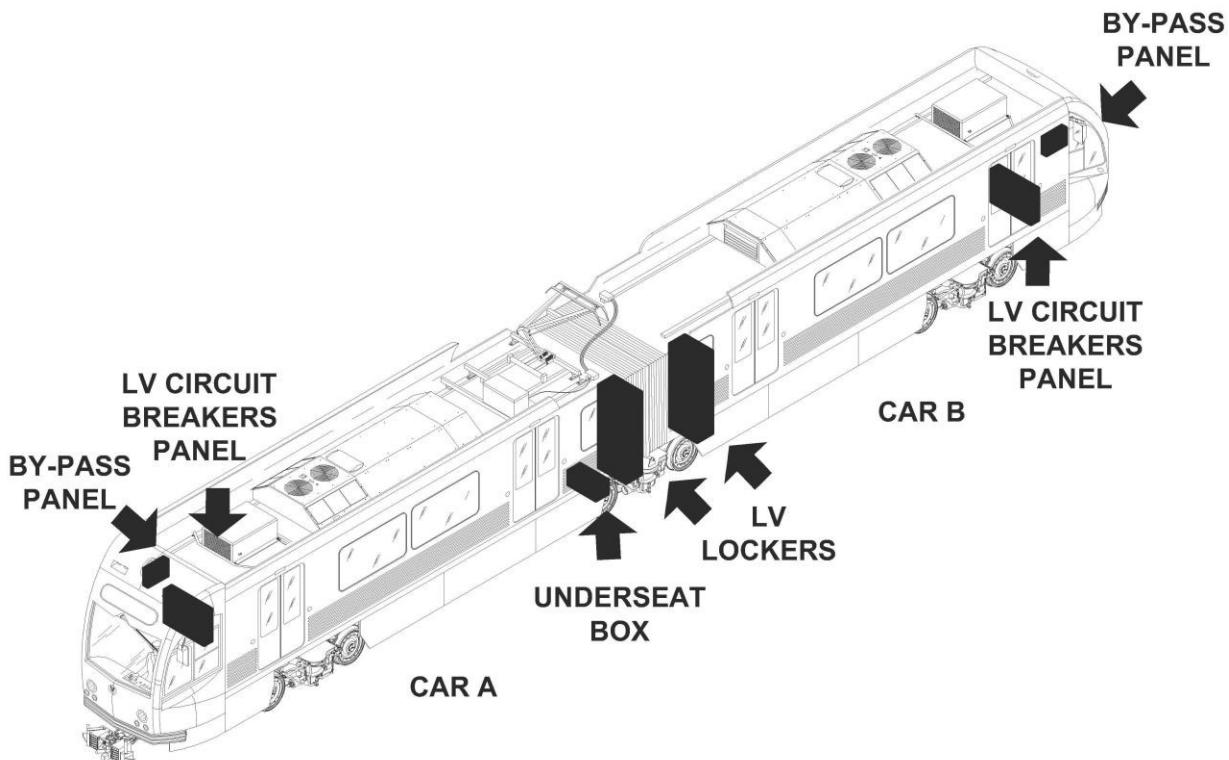
Maintenance Task:

Interval/Miles:

INSPECTION

120,000

LOCATION:



P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/16

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000**SAFETY PRECAUTIONS:**

LACMTA WORKSHOP SAFETY REGULATION

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit.

CONSUMABLES:

Contact Cleaner

SPARE PARTS:

LABEL	DESCRIPTION	P/N
3K26	NO-MOTION RELAY	211VK01374B0801
3K27	STOPPING BRAKE RELAY	211VK01374B0801
3K28	SCEB RELAY	211VK01374B0803
3K29	FSB RELAY	211VK01374B0802
3S08	BY PASS NO-MOTION SWITCH	211VQ00840B03
6A02	SAFETY BRAKE LOOP POWER SUPPLY DC/DC CONVERTER 400 W	211EG23870B
6D04	RELAY TIMING UNIT	211VD00903B04
6D05		
6F01	DEAD MAN CONTROL CIRCUIT BREAKER	211EK22984B13
6F02	SAFETY BRAKE LOOP POWER SUPPLY CIRCUIT BREAKER	211EK22984B06
6F03	SAFETY BRAKE LOOP CIRCUIT BREAKER	211EK22984B01
6S01	SAFETY BRAKE LOOP POWER SUPPLY BY-PASS SWITCH	211VQ00840B
6K01	DEAD MAN OPERATIVE RELAY	211VK01374B0802
6K02		
6K11/1	SAFETY BRAKE LOOP RELAY	211VK01374B0803
6K11/2	SAFETY BRAKE LOOP RELAY'	211VK01374B0803
6S03	EMERGENCY BRAKE PUSH BUTTON	TBD

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

3/16

Subsystem/Assy:

Unit:

SAFETY CIRCUITS

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle on a Maintenance Shop Track.
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

INSPECTION

The aim of this Task is the Visual Inspection of the Items pertaining to the relevant Safety Circuits and relevant Electric Plant listed in.

- a) Table 1 for A Section.
- b) Table 2 for B section.

NOTE: The items are listed by Location and sequenced by Identification Label and Safety Circuit to which they pertain. Reference to Functional Schematic are also provided.

NOTE: It is advisable to inspect the items by Location, in sequence as indicated in Table 1 and 2, starting from "A" Cab.

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/16

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

**TABLE 1
CAR "A" LIST OF SAFETY CIRCUITS COMPONENTS**

LOCATION		LABEL	DESCRIPTION	SAFETY CIRCUIT	FUNCTIONAL SCHEMATICS
					SHEET #
CAB	OPERATOR CONSOLE	6S03	EMERGENCY BRAKE PUSH BUTTON (RED)	EMERGENCY BRAKE LOOP	53
	LV CIRCUITS BREAKER PANEL	6F02	SAFETY BRAKE LOOP POWER SUPPLY CIRCUIT BREAKER	EMERGENCY BRAKE LOOP	53
	LV CIRCUITS BREAKER PANEL	6F03	SAFETY BRAKE LOOP CIRCUIT BREAKER	EMERGENCY BRAKE LOOP	53
	BY-PASS PANEL	3S08	BY PASS NO-MOTION SWITCH	NO-MOTION LOOP	26
	BY-PASS PANEL	6S01	SAFETY BRAKE LOOP POWER SUPPLY BY-PASS SWITCH	EMERGENCY BRAKE LOOP	53
LV LOCKER	RELAYS SECTION	3K26	NO-MOTION RELAY	NO-MOTION LOOP	28
	RELAYS SECTION	3K27	STOPPING BRAKE RELAY	PARKING BRAKE LOOP	27
	RELAYS SECTION	3K28	SCEB RELAY	EMERGENCY BRAKE LOOP	32
	RELAYS SECTION	3K29	FSB RELAY	FULL SERVICE BRAKE LOOP	32
	RELAYS SECTION	6D04	RELAY TIMING UNIT	DEAD MAN LOOP	52
	RELAYS SECTION	6D05	RELAY TIMING UNIT	DEAD MAN LOOP	52
	RELAYS SECTION	6K01	DEAD MAN OPERATIVE RELAY	DEAD MAN LOOP	52
	RELAYS SECTION	6K02	DEAD MAN OPERATIVE RELAY	DEAD MAN LOOP	52
	RELAYS SECTION	6K11/1	SAFETY BRAKE LOOP RELAY	EMERGENCY BRAKE LOOP	53
	RELAYS SECTION	6K11/2	SAFETY BRAKE LOOP RELAY	EMERGENCY BRAKE LOOP	53
COMPARTMENT	UNDER SEAT BOX	6A02	SAFETY BRAKE LOOP POWER SUPPLY DC/DC CONVERTER 400 W	EMERGENCY BRAKE LOOP	53

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

5/16

Subsystem/Assy:

Unit:

SAFETY CIRCUITS

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE (CONT'D):

**TABLE 2
CAR "B" LIST OF SAFETY CIRCUITS COMPONENTS**

LOCATION		LABEL	DESCRIPTION	SAFETY CIRCUIT	FUNCTIONAL SCHEMATICS SHEET #
CAB	OPERATOR CONSOLE	6S03	EMERGENCY BRAKE PUSH BUTTON (RED)	EMERGENCY BRAKE LOOP	53
	BY-PASS PANEL	3S08	BY PASS NO-MOTION SWITCH	NO-MOTION LOOP	26
LV LOCKER	RELAYS SECTION	3K26	NO-MOTION RELAY	NO-MOTION LOOP	28
	RELAYS SECTION	3K27	STOPPING BRAKE RELAY	PARKING BRAKE LOOP	27
	RELAYS SECTION	6K11/1	SAFETY BRAKE LOOP RELAYS	EMERGENCY BRAKE LOOP	53
	RELAYS SECTION	6K11/2	SAFETY BRAKE LOOP RELAY	EMERGENCY BRAKE LOOP	53

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/16

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (cont'd):

Perform the following procedure for each "Item" listed in the previous Tables 1 and 2.

NOTE: It is advised to record the Inspection Results in the Specific (" A " and " B ") Section Forms provided for this purpose in the next pages of this Sheet.

To perform the Task proceed as follows:

1. Inspect for damaged or missing Item Labels.
2. Check that the "Item" is easy to operate.
3. Inspect the "Item" for installation, visible damage such as broken or missing parts and sign of overheating. Replace "Item" as per check result.
4. Access the back side of the panel and check "Item" Terminals and connectors for loose / missing items. Tighten as per check result.
5. Clean the "Item" using recommended cleaner / agent and clean lint - free rags.
6. Check the "Item" Wires for signs of overheating and the Wires Terminals for tightening.
7. Note any Areas/ Items requiring Corrective Maintenance.
8. Restore Electrical Power.
9. Record Inspection results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the maintained Equipment pertains.

Refer to **HOW TO USE THE R-PM SHEETS** (para 10-III-03-03-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

7/16

Subsystem/Assy:

Unit:

SAFETY CIRCUITS

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE (CONT'D):

A SECTION

LOCATION

CAB -CONSOLE

INSPECTION RESULT

ITEM

PASS

REPLACED

NOTE

6S03

Emergency Brake Pushbutton (Red)



Figure 1 - EMERGENCY BRAKE PUSHBUTTON

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/16

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

Component:

Man Hours:

1

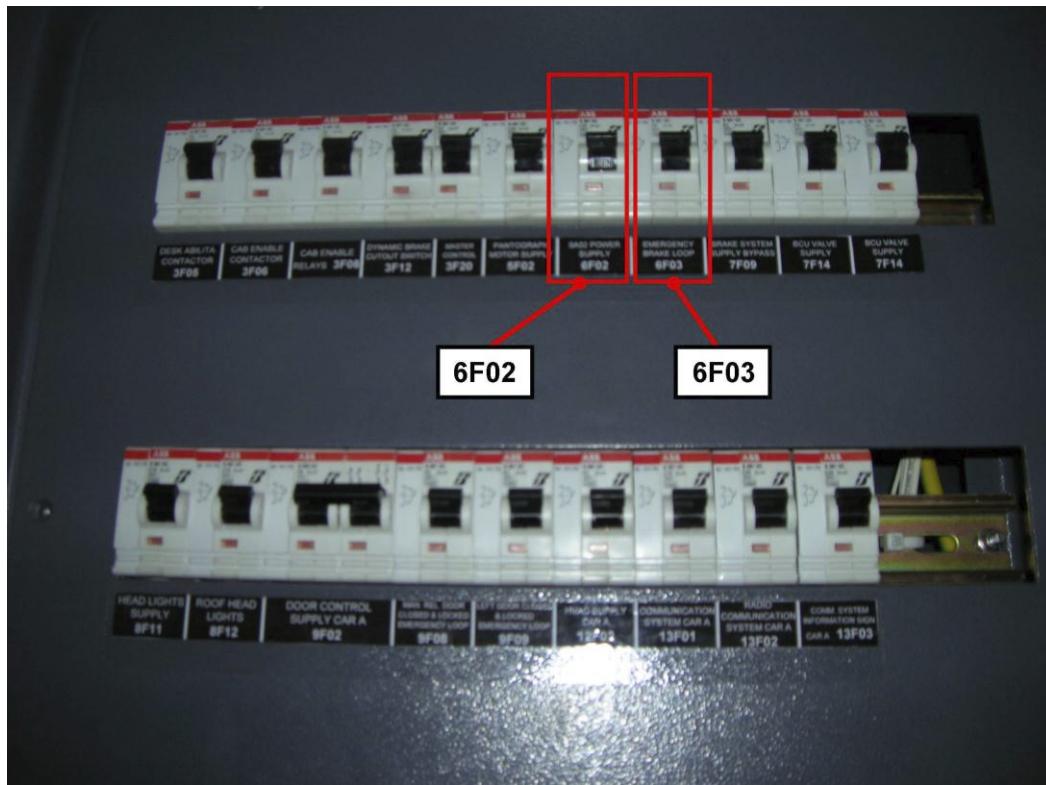
Maintenance Task:

INSPECTION

Interval/Miles:

120,000**PROCEDURE (CONT'D):****A SECTION****LOCATION****CAB -LV CIRCUIT BREAKERS PANEL****INSPECTION RESULT**

ITEM		PASS	REPLACED	NOTE
6F02	Safety Brake Loop Power Supply Circuit Breakers Dc/Dc Converter 400 W			
6F03	Safety Brake Loop Power Supply Circuit Breakers			

**Figure 2 - SAFETY BRAKE LOOP POWER SUPPLY CIRCUIT BREAKERS**

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

9/16

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

A SECTION

LOCATION
CAB - BY-PASS PANEL

INSPECTION RESULT

	ITEM	PASS	REPLACED	NOTE
3S08-	By Pass No-Motion Switch			
6S01	Safety Brake Loop Power Supply By-Pass Switch			



Figure 3 - CAB - BY-PASS PANEL-SAFETY CIRCUIT-BY PASSES

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

10/16

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

A SECTION			
LOCATION		LV LOCKER	RELAYS SECTION
INSPECTION RESULT			
ITEM	PASS	REPLACED	NOTE
3K26 No-Motion Relay			
3K27 Stopping Brake Relay			
3K28 Sceb Relay			
3K29 Fsb Relay			
6D04 Relay Timing Unit			
6D05 Relay Timing Unit			
6K01 Dead Man Operative Relay			
6K02 Dead Man Operative Relay			
6K11/1 Safety Brake Loop Relay			
6K11/2 Safety Brake Loop Relay '			

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

11/16

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

Component:

Man Hours:

1

Maintenance Task:

Interval/Miles:

INSPECTION

120,000

PROCEDURE (CONT'D):

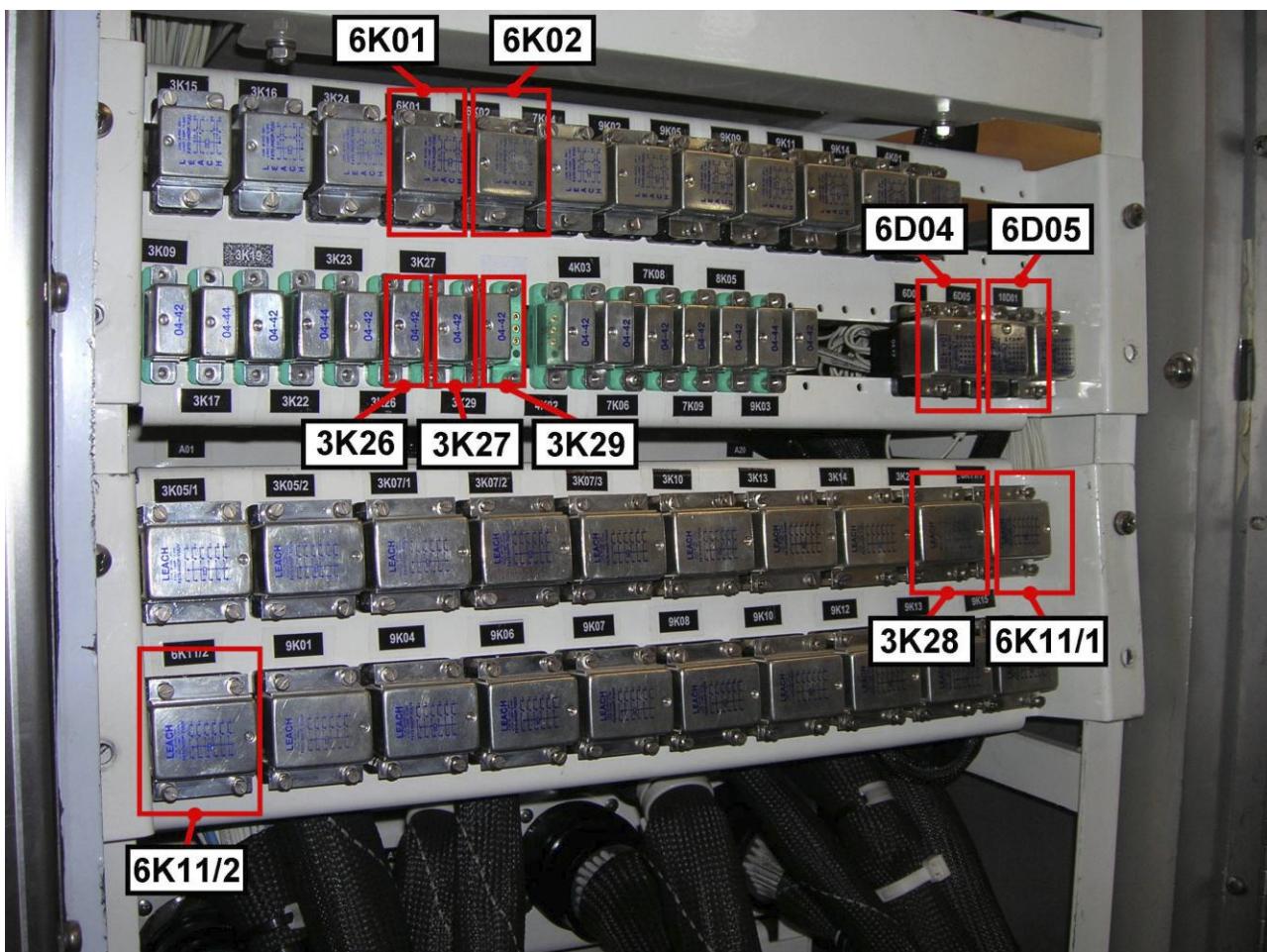


Figure 4 - LV LOCKER- RELAYS SECTION -SAFETY CIRCUIT RELAYS

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

12/16

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

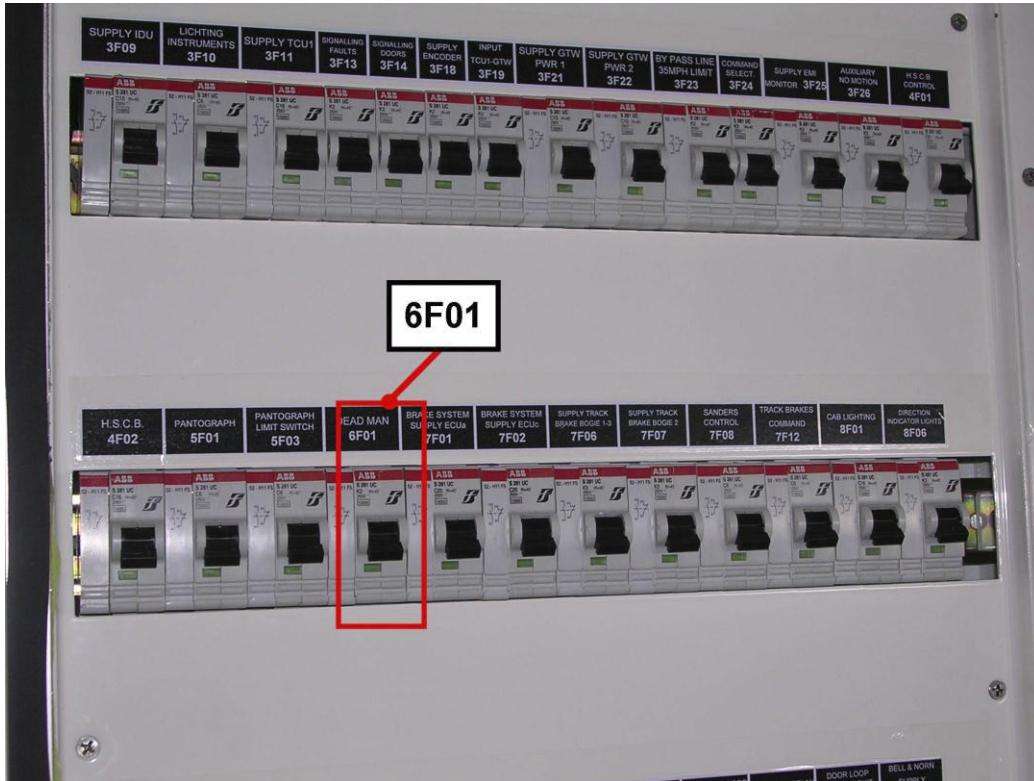
Interval/Miles:

120,000**PROCEDURE (CONT'D):****A SECTION**

LOCATION	LV LOCKER	CIRCUIT BREAKER SECTION
----------	-----------	-------------------------

INSPECTION RESULT

ITEM	PASS	REPLACED	NOTE
6F01 Dead Man Control Circuit Breaker			



**Figure 5 - LV LOCKER- CIRCUIT BREAKER SECTION
DEAD MAN CONTROL CIRCUIT BREAKER**

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

13/16

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

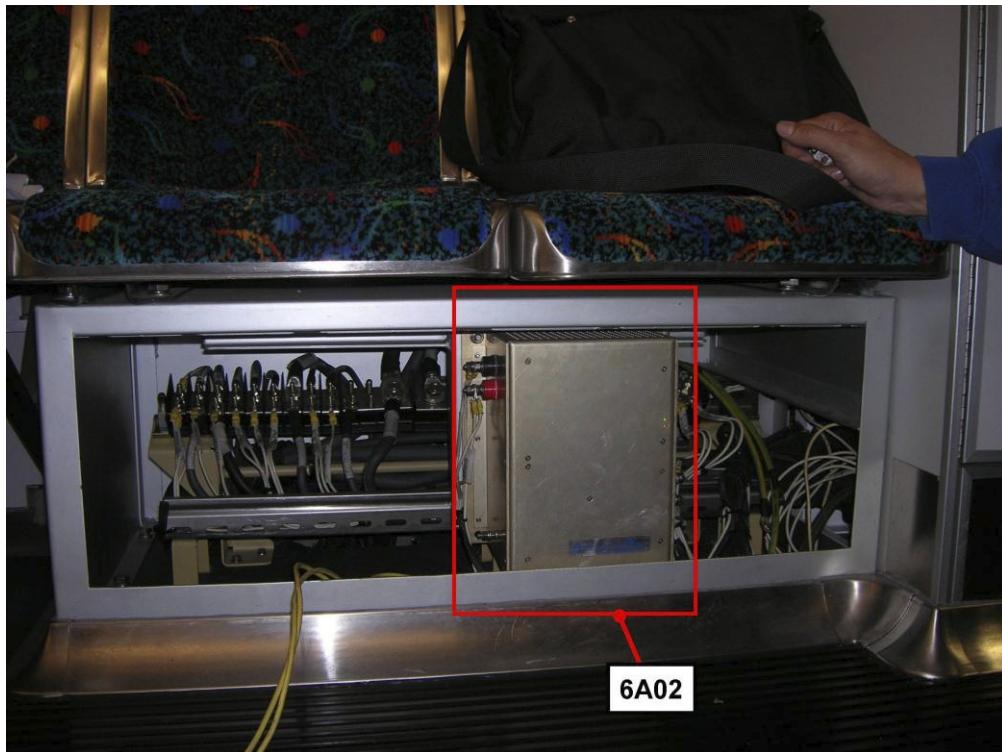
A SECTION

LOCATION

UNDER SEAT BOX

INSPECTION RESULT

ITEM	PASS	REPLACED	NOTE
6A02 Safety Brake Loop Power Supply Dc/Dc Converter 400 W			



**Figure 6 - UNDER SEAT BOX
SAFETY BRAKE LOOP POWER SUPPLY DC/DC CONVERTER 400 W**

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

14/16

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000**PROCEDURE (CONT'D):****B SECTION****LOCATION****CAB -CONSOLE****INSPECTION RESULT**

ITEM	PASS	REPLACED	NOTE
6S03 Emergency Brake Pushbutton (Red)			

**Figure 7 - EMERGENCY BRAKE PUSHBUTTON**

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

15/16

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000

PROCEDURE (CONT'D):

B SECTION

LOCATION

CAB - BY-PASS PANEL

INSPECTION RESULT

ITEM	PASS	REPLACED	NOTE
3S08 By Pass No-Motion Switch			



Figure 8 - CAB - BY-PASS PANEL-3S08 BY PASS NO-MOTION SWITCH

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code:

R-P-10-04-00-00/I-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

16/16

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

Component:

Man Hours:

1

Maintenance Task:

INSPECTION

Interval/Miles:

120,000**PROCEDURE (CONT'D):****B SECTION**

LOCATION	LV LOCKER RELAYS SECTION
-----------------	---------------------------------

INSPECTION RESULT

ITEM		PASS	REPLACED	NOTE
3K26	No-Motion Relay			
3K27	Stopping Brake Relay			
6K11/1	Safety Brake Loop Relay			
6K11/2	Safety Brake Loop Relay '			

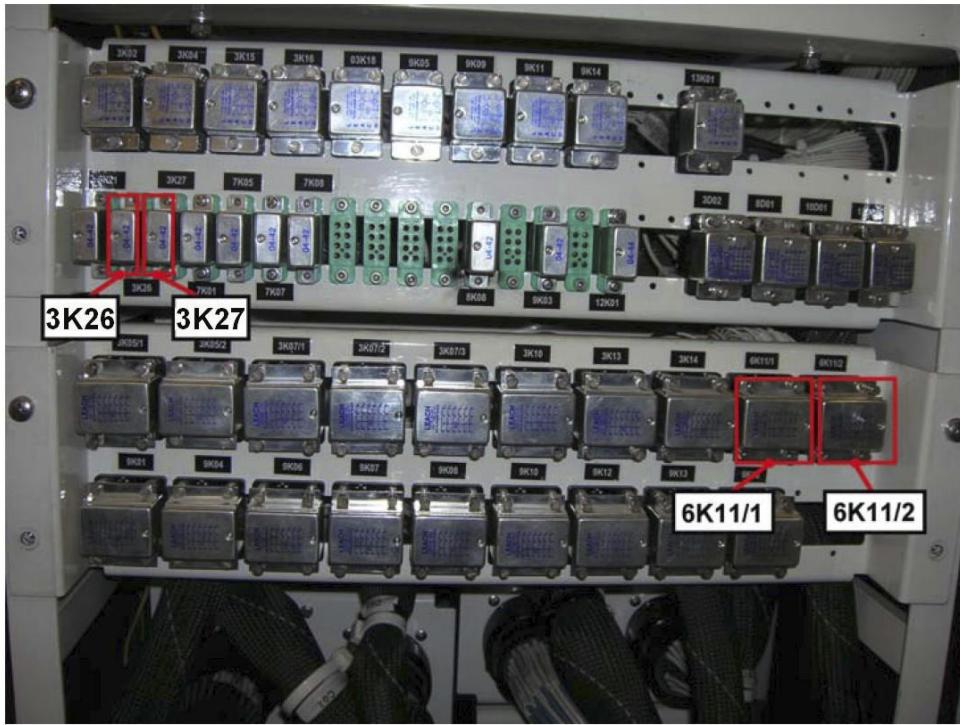


Figure 9 - LV LOCKER- RELAYS SECTION -SAFETY CIRCUIT RELAYS

10-III-04 RUNNING -CORRECTIVE MAINTENANCE

10-III-04.01 Running -Corrective Maintenance Sheets (R-CMS)

Each R-CMS provides the following data consistent with Corrective Maintenance Analysis (CMA), AB Design Documentation and Vehicle Systems Functional Tree:

- **R-CM Sheet Code**
- **SYSTEM, SUBSYSTEM /ASSEMBLY, UNIT, Component** (Names)
- **SYSTEM, SUBSYSTEM /ASSEMBLY, UNIT, Component** (Location)
- **Maintenance Task,**

The following definitions are applicable to the R-CM Tasks

Inspection:	Maintenance procedures such as those required to ascertain the serviceability of a Part, Assembly, System or the specific interrelationship of Parts that perform a functional operation.
Leveling:	Procedure to adjust the distance between the Vehicle Floor to the Top Of Rail and the designated Vehicle Height
Replacement:	Provides the Components / Assemblies and Subassemblies removal & installation in a logical sequential order.
Re-Profiling:	Provides the procedure to maintain the safe and proper "wheel profile".
Repair:	Provides detailed procedures for the repair of a specific Equipment / Component
Service:	Operation performed to replenish Sand, Windshield Wiper Washer Fluid, HVAC Coolant, Gear and Compressor Oil, and Vehicle Lubrication.

- **Man Hours**, needed to perform the Task
- **SPARE PARTS**, needed to perform the Task

Each R-CMS also provides:

- **SAFETY PRECAUTIONS**, to be followed to safely accomplish the Task
- **TOOLS**, including Special Tools and Test Equipment, needed to accomplish the Task
- **CONSUMABLES**, required to accomplish the Task and consistent with those used by MTA
- **PROCEDURE**, consisting of Preliminary Operations and Procedural Steps, to be followed while performing Maintenance Tasks
- **Illustrations and Pictures** are inserted in the text to facilitate the understanding of the topics and/or to explain step-by-step procedure

Each R-CM Sheet refers to one Task and consists of several pages where Safety Precautions and Maintenance Instructions to perform safely the Task are provided by Procedural Steps in conjunction with Illustrations and Pictures.

10-III-04.01.01 Running- Corrective Maintenance Sheet (R-CMS) Form

The R-CMS Form (refer to Figure 10-III-04.1) consists of several fields containing the following data/ information:

RUNNING -CORRECTIVE MAINTENANCE SHEET (R-CMS) Form			
ITEM #	TITLE	CONTENT	EXPLANATORY NOTES
1	Card code	Sheet code	<p>The Sheet Code is an alphanumerical code that identifies each R-CM Sheet.</p> <p>THE SHEET CODE IS EXPLICIT</p> <p>The Sheet Code consists of letters R-C followed by an 11 digit code number as follows:</p> <p>R-C-nn-mm-zz-ww/Y-kk</p> <p>R = Running C = Corrective</p> <p>nn may vary from 02 to 19, identifying the System/ Manual Section number.</p> <p>mm-zz-ww each one may vary from 00 to 99, according to AB System Functional Tree, allowing the identification of the Assembly/Unit/Component</p> <p>Y Maintenance Task Code. It may be one of the following:</p> <p>I = Inspection LL =Leveling</p> <p>R = Replacement RP= Re-Profilng</p> <p>RR = Repair S = Service</p> <p>SP = Safety Precautions</p> <p>kk It may vary from 00 to 99. It is a progressive number allowing the univocal identification of R-CMS</p> <p>NOTE:</p> <p>The code R-C-nn-00-00-00-R-kk identifies a Typical Replacement Procedure</p> <p>The Typical Replacement Procedure is provided for the following items:</p> <p>Board, Circuit Breaker, Diode, Indicator Lamp, Main Contactor, Switch & Relays.</p>
2	System	System name	This field indicates the System to which the Assembly/Unit/Component belongs.
3	Subsystem/ Assembly	Subsystem/ Assembly name	This field indicates the Subsystem/Assembly to which the Unit/Component belongs.
4	Unit	Unit name	This field indicates the Unit to which the Component belongs.
5	Component	Component name	This field indicates the Component the Maintenance Task is referring to
6	Maintenance Task	Maintenance Task name	This field indicates the Maintenance Task to be performed.
7	Man Hours	Number	The Man Hour field indicates the time needed to perform the corresponding Maintenance Task. with the basic assumption that the Vehicle is staged on an Inspection Pit/Jacking tracks with the required Consumables, Tools and Materials available.

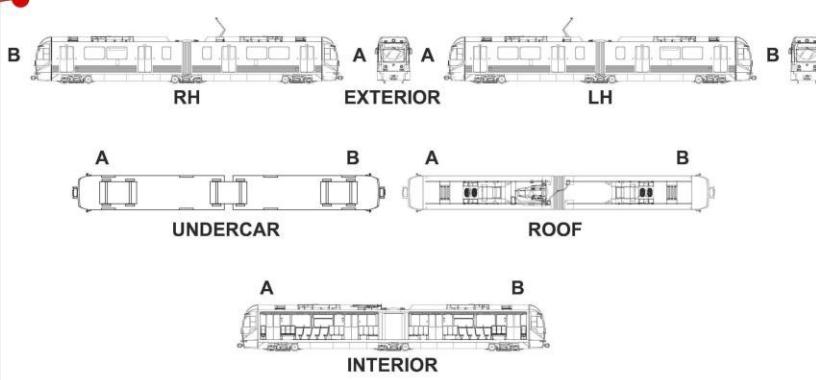
RUNNING -CORRECTIVE MAINTENANCE SHEET (R-CMS) Form (cont'd)			
ITEM #	TITLE	CONTENT	EXPLANATORY NOTES
8	Sheet	Pages numbering	This field indicates the progressive R-CMS sheet page number.
9	LOCATION	Illustration	This field indicates the On Board Location of the Equipment to be maintained The following Graphic Symbols are used for: Assembly/Unit/Component  for System/Subsystem/Vehicle as a Whole 
10	R	Letter	This field indicates that the Sheet pertains to Running Maintenance
11	C	Letter	This field indicates that the Sheet pertains to Corrective Maintenance
12	nn	Number	This field indicates the System/Manual Section number to which the Sheet pertains. It may vary from 01 to 19
13	rr	Number	This field indicates the Sheet Revision number
14	Page ##	Page ##	This field indicates the RMSM Section Page number
15	-#	Number	This field indicates the RMSM Section Revision number
16	SAFETY PRECAUTIONS	Text	This field presents the General and/or specific Safety Precautions to be followed to accomplish safely the relevant Maintenance Tasks.
17	TOOLS	Text	This field lists the description and the P/N of the Standard tools, Special Tools and Test Equipment needed to accomplish the Maintenance Task. Refer to the TTE Manual for the TE and Special Tools detailed descriptions and tools maintenance.
18	CONSUMABLES	Text	This field lists the Consumables Materials (consistent with those used by MTA with the related P/N.) needed to accomplish the Maintenance Task. Cleaning agents are included
19	SPARE PARTS	Text	This field lists the Description and PN of Spare Parts (consistent with Illustrated Parts Catalog) needed to accomplish the Maintenance Task.
20	PROCEDURE	Text	The Procedure field provides Preliminary Operations and Procedural step by step Instructions to be followed while performing the Maintenance Task. Illustrations and Pictures are inserted in the text to facilitate the understanding of the topics and/or to explain step-by-step procedure.

LACMTA P2550 LRV
Running Maintenance and Servicing Manual - Section 01

P2550 CORRECTIVE MAINTENANCE SHEET

System:	Sheet:	Card Code:
Subsystem/Assy:	Unit:	x/z
Component:	Man Hours:	
Maintenance Task:		
LOCATION:		

R-C-nn-mm-zz-ww/Y-kk



M_{Metro}

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Page 011 Draft

**Figure 10-III-04.1 R-CMS Form
(Sheet 1 of 2)**

LACMTA P2550 LRV Running Maintenance and Servicing Manual - Section 01		 AnsaldoBreda				
P2550 CORRECTIVE MAINTENANCE SHEET						
Card Code: R-C-nn-mm-zz-ww/Y-kk						
System:	Sheet:	x/z				
Subsystem/Assy:	Unit:					
Component:	Man Hours:					
Maintenance Task:						
SAFETY PRECAUTIONS:						
16						
TOOLS:						
17						
CONSUMABLES:						
18						
SPARE PARTS:						
19						
PROCEDURE:						
PRELIMINARY OPERATIONS						
20						
Page 01-2 Draft						
						
<table border="1" style="display: inline-table; vertical-align: middle; text-align: center;"> <tr> <td style="width: 10px; height: 10px;"></td> </tr> </table>						

**Figure 10-III-04.1 R-CMS Form
(Sheet 2 of 2)**

10-III-04.01.02 How to Use the R-CM Sheets

To optimize the job organization it is suggested to proceed as follows:

1. Before Task Execution

- a) Carefully read the sheets to ensure that you fully understand all safety precautions, preliminary conditions required, warnings, notes & procedures that will be followed.
- b) Particularly read:
 - The Safety Precautions to perform safely the Task
 - The Preliminary Operations to set the Vehicle in safety conditions according to MTA Maintenance Shop Regulations
 - The Tools, Consumables and Spare Parts listed in each Sheet that are needed to accomplish the Task and to have all of them available next the location of the Equipment to be maintained before starting the activities

2. During Task Execution

- a) Follow accurately the prescribed Safety Precautions and Maintenance Procedural Steps.
- b) Note any Areas/Items of the Assembly/Unit/Component under Corrective Maintenance Process requiring further Corrective Maintenance.
- c) Gather as much information about the Equipment as is practical.
(i.e knowledge about the malfunction in terms of correctly operating and incorrectly operating equipment processes) to increase your equipment knowledge.

3. At every Task Completion

- a) Carefully follow the prescribed Safety Precautions before restoring the Electrical Power to Vehicle.
- b) Check the correct operation and/or functions of the Subsystem to which the maintained Equipment pertains.
- c) It is suggested to perform this check on the IDU "A" as follows:

NOTE: Through the IDU you can check if all Systems are exchanging data by MVB or LonWorks Bus and the Trainlines Status.

The IDU Display also shows in real time the Status of all Vehicle Systems. Reading the IDU Fault List it is possible to immediately detect a fault. Using the IDU in the Operating Mode the Fault Indications are generic. Using the IDU in Maintenance Mode the same Fault has a detailed description.

For more in depth troubleshooting use the PTU connected to the relevant system that requires further troubleshooting.

1. On IDU "A" access to the Maintenance Menu first and then to the "Faults" Screen by selecting, in sequence, the relevant icons.
2. Check, On IDU "A" through the list of the Current Active Faults shown in the "Faults" Screen, for Fault Codes related to the Subsystem to which the maintained Equipment pertains.

Refer to Section 18 of RMSM for Fault Signals Details.

3. As per "Fault" Codes check results proceed as follows:

➤ **No Faults are listed in the "Faults" Screen**

- a) Key OFF the Vehicle
- b) Record Service and Test results on the Defect Report Card for administrative and maintenance planning.

➤ **Fault Codes are listed in the "Faults" Screen**

- a) Investigate/troubleshoot the Equipment previously maintained first and then the System/Subsystem/Assembly/Unit for Fault Probable Causes.
- b) Gather as much information about the failure symptoms as is practical. Refer to Section 18 of RMSM for Fault Signals Details.
- c) Try to identify the malfunction in terms of correctly operating and incorrectly operating equipment processes.
- d) Identify which equipment signals or parameters will best help you to localize the failure.
- e) Identify the source of the problem.
- f) Repair or replace the defective component.
- g) Verify that the repair is effective in eliminating all of the failure symptoms.
- h) Evaluate whether or not the defective component was the root cause of the failure.
- i) Once the Fault Codes are not found in the "Faults" Screen perform steps from 3-a through 3-b (previous subparagraph **"No Faults are listed in the "Faults" Screen"**).

10-III-04.01.03 Running- Corrective Maintenance Sheet (R-CMS) List

The LVDS Running- Corrective Maintenance Sheets (R-CMS) List is provided in the following Table 10-III-04.1

The R-CM Sheets are listed by Subsystem / Assembly / Unit / Component and sequenced by Sheet Codes and Tasks to be performed.

Table 10-III-04.1 Running Corrective Maintenance Sheets List

SYSTEM 10 LOW VOLTAGE DISTRIBUTION SYSTEM				
SUBSYSTEM / ASSY	UNIT	COMPONENT	TASK	SHEET CODE
MVPS / LVPS & SAFETY / CUT OUT CIRCUITS		CIRCUIT BREAKER TYPE S280	REPLACEMENT (TYPICAL)	R-C-10-00-00-00/R-00
LOW VOLTAGE DISTRIBUTION & SAFETY CIRCUITS		RELAY	REPLACEMENT (TYPICAL)	R-C-10-00-00-00/R-01
LOW VOLTAGE DISTRIBUTION		MAIN CONTACTOR	REPLACEMENT (TYPICAL)	R-C-10-00-00-00/R-02
LV DISTRIBUTION / SAFETY & CUT OUT CIRCUITRY		SWITCH / PUSHBUTTON	REPLACEMENT (TYPICAL)	R-C-10-00-00-00/R-03
LV DISTRIBUTION CIRCUITRY		INDICATOR LEDS BOARD	REPLACEMENT (TYPICAL)	R-C-10-00-00-00/R-05
APS-LVPS	APS/LVPS CONTROL	BOARD	REPLACEMENT (TYPICAL)	R-C-10-00-00-00/R-06
LV DISTRIBUTION CIRCUITRY		DIODE	REPLACEMENT (TYPICAL)	R-C-10-00-00-00/R-07
APS-LVPS	INVERTER (APS) MODULE		REPLACEMENT	R-C-10-01-01-00/R-00
APS-LVPS	CB (LVPS) MODULE		REPLACEMENT	R-C-10-01-02-00/R-00
APS-LVPS	CARD		REPLACEMENT	R-C-10-01-07-00/R-00
APS-LVPS	ELECTROLYTIC CAPACITOR		REPLACEMENT	R-C-10-01-09-00/R-00
APS-LVPS	CA FILTER CAPACITOR		REPLACEMENT	R-C-10-01-10-00/R-00
APS-LVPS	SK START UP CARD		REPLACEMENT	R-C-10-01-11-00/R-00
APS-LVPS	CONNECTOR (9 PINS)	RESISTOR 1W	REPLACEMENT	R-C-10-01-12-00/R-00
APS-LVPS	TRANSDUCER LT305-S/SP6		REPLACEMENT	R-C-10-01-13-00/R-00
APS-LVPS	TRANSFORMER APS		REPLACEMENT	R-C-10-01-14-00/R-00
APS-LVPS	MAGNETIC GROUP		REPLACEMENT	R-C-10-01-15-00/R-00
APS-LVPS	MOTOR FAN		REPLACEMENT	R-C-10-01-16-00/R-00
APS-LVPS	RESISTORS		REPLACEMENT	R-C-10-01-17-00/R-00
APS-LVPS	CURRENT TRANSDUCER		REPLACEMENT	R-C-10-01-19-00/R-00
APS-LVPS	FUSE 63A		REPLACEMENT	R-C-10-01-21-00/R-00
APS-LVPS	ACTIVE CLAMP MODULE		REPLACEMENT	R-C-10-01-22-00/R-00
APS-LVPS	LINE REACTOR		REPLACEMENT	R-C-10-01-23-00/R-00
LV DISTRIBUTION CIRCUITRY	MAIN CIRCUIT BREAKER (3F07)		REPLACEMENT	R-C-10-03-06-00/R-00
LV DISTRIBUTION CIRCUITRY	DOUBLE GAUGE LAMP (3P04-H1)		REPLACEMENT	R-C-10-03-55-00/R-00
SAFETY CIRCUITS	SAFETY LOOP DC \ DC CONVERTER (6A02)		REPLACEMENT	R-C-10-04-01-00/R-00

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10-III-04.01.04 **Running- Corrective Maintenance Sheets (R-CMS)**

LOW VOLTAGE DISTRIBUTION SYSTEM (LVDS)

Running - Corrective Maintenance Sheets

R-CMS

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P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION**1/12**

Subsystem/Assy:

Unit:

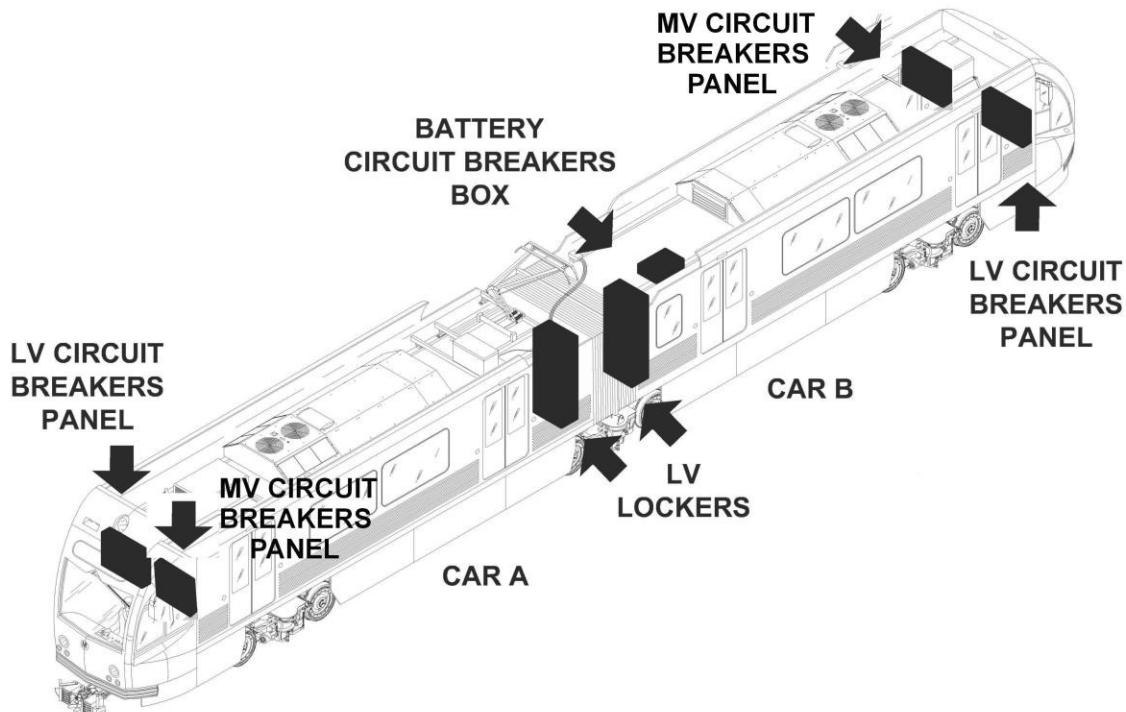
MVPS / LVPS & SAFETY / CUT OUT CIRCUITS

Component:

Man Hours:

CIRCUIT BREAKER TYPE S280**1.0**

Maintenance Task:

REPLACEMENT (TYPICAL)**LOCATION:****APPLICABILITY:**

This Replacement procedure is applicable to the following Items:

TABLE 1 CIRCUIT BREAKERS IDENTIFICATION & LOCATIONS

LABEL	DESCRIPTION	TYPE	P/N	CAR	LOCATION	FUNCTIONAL DIAGRAMS	
						SCHEMATICS	SHEET#
3F15	EMERGENCY LIGHTING C.B.	S281 C 40A	211EK22984B08	B	BATTERY BOX	LV	21
3F16	FIRST DOORS UNITS C.B.	S281 C 40A	211EK22984B08	B	BATTERY BOX	LV	21

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/12

Subsystem/Assy:

MVPS / LVPS & SAFETY / CUT OUT CIRCUITS

Unit:

Component:

CIRCUIT BREAKER TYPE S280

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)**APPLICABILITY:****TABLE 1 CIRCUIT BREAKERS IDENTIFICATION & LOCATIONS (cont'd)**

LABEL	DESCRIPTION	TYPE	P/N	CAR	LOCATION	FUNCTIONAL DIAGRAMS	
						SCHEMATICS	SHEET
02F07	EXTERIOR OUTLETS SWITCH	S282 UC C	211EK22984B35	A - B	CAB-MV CB PANEL	MV	12
02F08	EXTERIOR OUTLETS SWITCH	S282 UC C	211EK22984B35	A - B	CAB-MV CB PANEL	MV	12
02F11	WINDSHIELD DEFROSTER\DEMISTER SWITCH	S282 UC C	211EK22984B37	A - B	CAB-MV CB PANEL	MV	12
3F05	DESK ABILITATION CONTACTOR SWITCH(LOCAL)	S281 C 6A	211EK22984B01	A - B	CAB. LV CB PANEL	LV	22
3F06	CAB ENABLE CONTACTOR C.B.	S281 C 6A	211EK22984B01	A - B	CAB. LV CB PANEL	LV	23
3F08	CAB RELAYS C.B.	S281 C 6A	211EK22984B01	A - B	CAB. LV CB PANEL	LV	23
3F12	DYNAMIC BRAKE CUTOOUT SWITCH	S281 C 6A	211EK22984B01	A - B	CAB. LV CB PANEL	LV	27
3F20	MASTER CONTROLLER C.B.	S281 K 3A	211EK22984B14	A - B	CAB. LV CB PANEL	LV	32
6F02	6A02 POWER SUPPLY SWITCH	S281 C 25A	211EK22984B06	A	CAB. LV CB PANEL	LV	53
6F03	SECURITY BRAKE RELAY SWITCH	S281 C 6A	211EK22984B01	A	CAB. LV CB PANEL	LV	53
LABEL	DESCRIPTION	TYPE	P/N	CAR	LOCATION	FUNCTIONAL DIAGRAMS	
						SCHEMATICS	SHEET #
02F04	HVAC SWITCH	S283 UC K	211EK22984B77	B	LV LOCKER (MV)	MV	11
02F05	AIR COMPRESSOR SWITCH	S283 UC K	211EK22984B76	A	LV LOCKER (MV)	MV	11
02F06	MOTOR FAN INVERTER SWITCH	S283 UC K	211EK22984B70	A - B	LV LOCKER (MV)	MV	11
02F09	EXTERIOR OUTLETS SWITCH	S282 UC C	211EK22984B35	A - B	LV LOCKER (MV)	MV	12
02F12	MOTOR FAN AUXILIARY M.V. SWITCH	S283 UC K	211EK22984B70	A	LV LOCKER (MV)	MV	11

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

3/12

Subsystem/Assy:

Unit:

MVPS / LVPS & SAFETY / CUT OUT CIRCUITS

Component:

Man Hours:

CIRCUIT BREAKER TYPE S280

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE (CONT'D):

TABLE 1 CIRCUIT BREAKERS IDENTIFICATION & LOCATIONS (cont'd)

LABEL	DESCRIPTION	TYPE	P/N	CAR	LOCATION	FUNCTIONAL DIAGRAMS	
						SCHEMATICS	SHEET#
3F03	APS+LVPS POWER SUPPLY C.B.	S281 C 6A	211EK22984B01	B	LV LOCKER	LV	24
3F04	APS+LVPS DEAD BATTERY STARTUP C.B.	S281 K 2A	211EK22984B13	B	LV LOCKER	LV	24
3F09	IDU POWER SUPPLY C.B.	S281 C 10A	211EK22984B03	A - B	LV LOCKER	LV	25
3F10	AIR COMPRESSOR CIRCUIT BREAKER	S281 C 6A	211EK22984B01	A	LV LOCKER	LV	25
3F11	PROPULSION LV POWER SUPPLY C.B.	S281 C 16A	211EK22984B04	A - B	LV LOCKER	LV	27
3F13	FAULT INDICATORS C.B.	S281 K 2A	211EK22984B13	A - B	LV LOCKER	LV	15
3F14	DOORS & BRAKES STATUS INDICATOR C.B.	S281 K 2A	211EK22984B13	A - B	LV LOCKER	LV	17
3F18	RATE REF. ENCODER POWER SUPPLY C.B.	S281 K 2A	211EK22984B13	A - B	LV LOCKER	LV	31
3F19	CIRCUIT BREAKERS STATUS ACQUISITION C.B.	S281 K 2A	211EK22984B13	A	LV LOCKER	LV	34
3F21	GTW POWER SUPPLY C.B.	S281 C 10A	211EK22984B03	A	LV LOCKER	LV	25
3F22	GTW POWER SUPPLY C.B.	S281 C 10A	211EK22984B03	A	LV LOCKER	LV	25
3F23	35MPH SPEED LIMIT TRAINLINE C.B.	S281 C 2A	211EK22984B13	A	LV LOCKER	LV	26
3F24	DESK COMMANDS C.B.	S281 K 3A	211EK22984B14	A - B	LV LOCKER	LV	43
3F25	CEMIPS POWER SUPPLY SWITCH	S281 K 3A	211EK22984B14	A	LV LOCKER	LV	25
6F01	DEAD MAN CONTROL SWITCH	S281 K 2A	211EK22984B13	A	LV LOCKER	LV	52

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/12

Subsystem/Assy:

MVPS / LVPS & SAFETY / CUT OUT CIRCUITS

Unit:

Component:

CIRCUIT BREAKER TYPE S280

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

SAFETY PRECAUTIONS:

LACMTA Maintenance Shop Safety Rules & Regulations

CAUTION: SWITCH OFF THE 3F01 CB (BATTERY BOX) BEFORE STARTING TO PERFORM THE
REPLACEMENT OF ANY CB LISTED IN THE PREVIOUS TABLE 1

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC 2000 Contact Cleaner

SPARE PARTS:

Refer to Table 1 Circuit Breakers Identification & Locations

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/12

Subsystem/Assy:

MVPS / LVPS & SAFETY / CUT OUT CIRCUITS

Unit:

Component:

CIRCUIT BREAKER TYPE S280

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle in the Maintenance Shop.
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

CAUTION: SWITCH OFF THE 3F01 CB (BATTERY BOX) BEFORE STARTING TO PERFORM THE REPLACEMENT OF ANY CB LISTED IN THE PREVIOUS TABLE 1.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/12

Subsystem/Assy:

MVPS / LVPS & SAFETY / CUT OUT CIRCUITS

Unit:

Component:

CIRCUIT BREAKER TYPE S280

Man Hours:

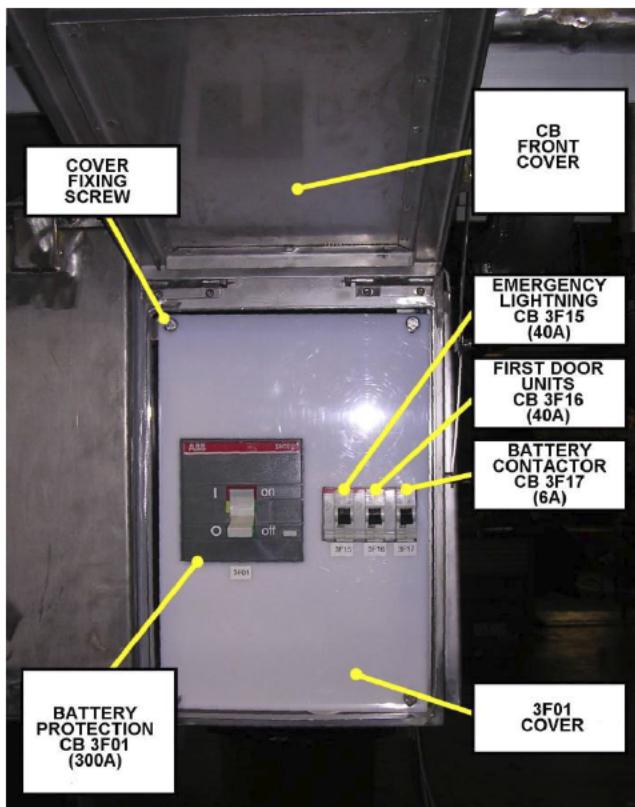
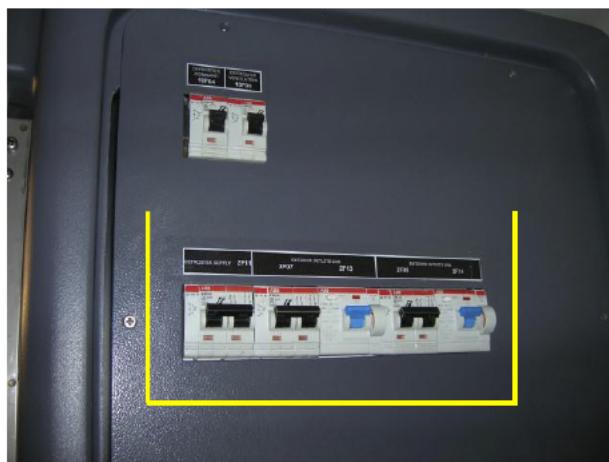
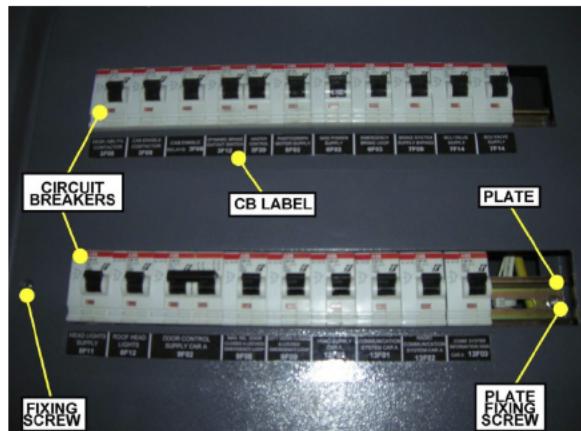
1.0

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE (CONT'D):** (Refer to Figures 1 through 8)**REMOVAL**

To perform the Task proceed as follows:

1. Locate the Circuit Breaker to be replaced according to the Label identification and the Location provided in the previous Table 1.

**FIG 1 BATTERY BOX LV CB LOCATION****FIG 2 CAB MV CB PANEL****FIG 3 CAB LV CB PANEL**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

7/12

Subsystem/Assy:

MVPS / LVPS & SAFETY / CUT OUT CIRCUITS

Unit:

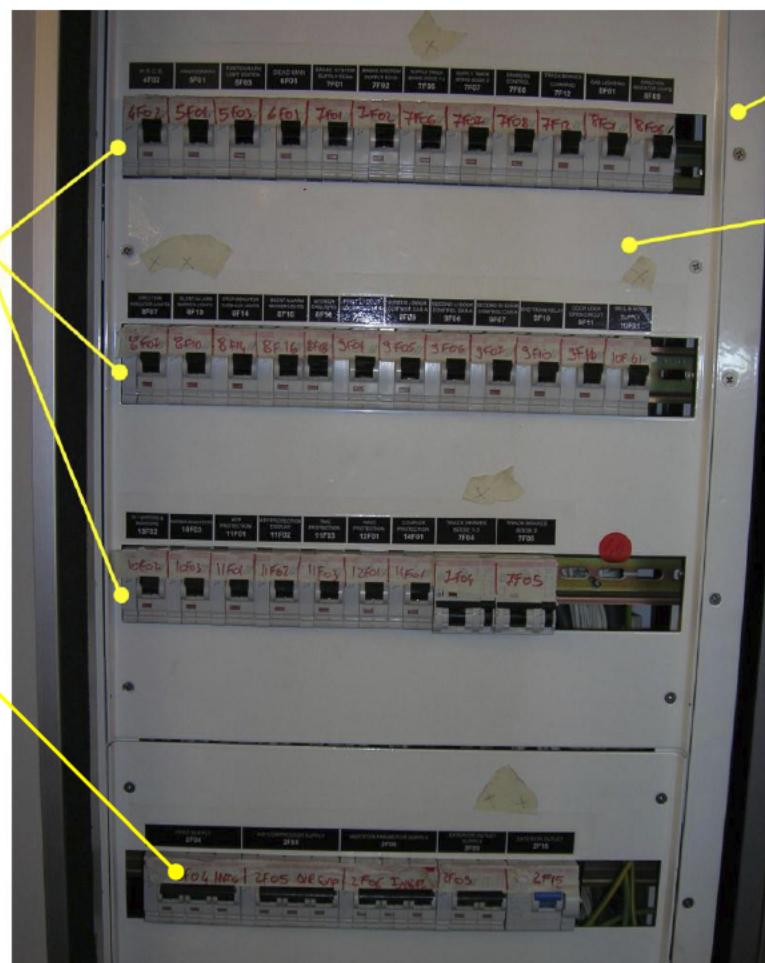
Component:

CIRCUIT BREAKER TYPE S280

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE:****FIG 4 CAB****LV LOCKER LV & MV CB RACK RACKS**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/12

Subsystem/Assy:

MVPS / LVPS & SAFETY / CUT OUT CIRCUITS

Unit:

Component:

CIRCUIT BREAKER TYPE S280

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE (CONT'D):

2. Remove the Circuit Breaker Front Panel by loosening the relevant Fixing Screws.
Retain them for later use.

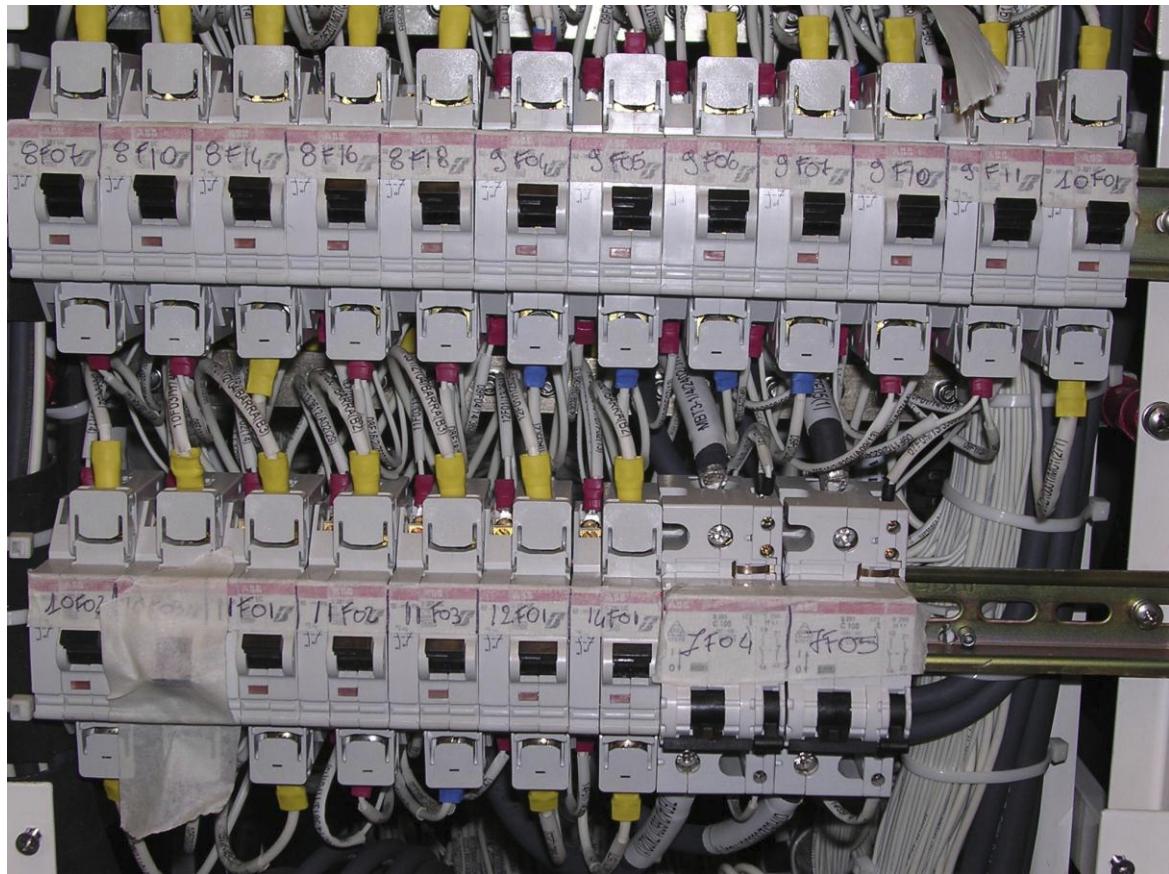


FIG 5 LV CB CONNECTIONS (TYPICAL)

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

9/12

Subsystem/Assy:

MVPS / LVPS & SAFETY / CUT OUT CIRCUITS

Unit:

Component:

CIRCUIT BREAKER TYPE S280

Man Hours:

1.0

Maintenance Task:

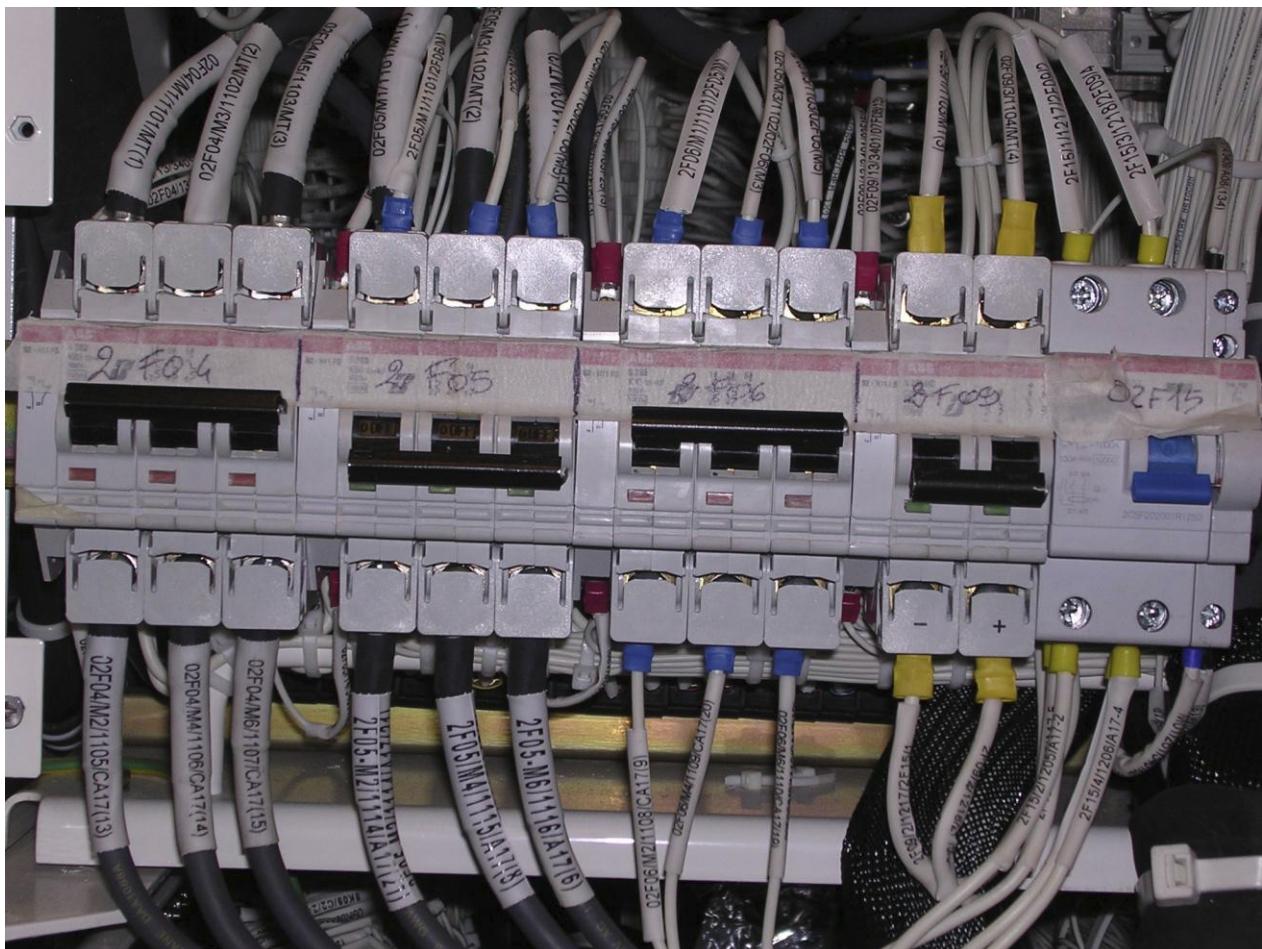
REPLACEMENT (TYPICAL)**PROCEDURE (CONT'D):**

FIG 6 MV CB CONNECTIONS (TYPICAL)

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

10/12

Subsystem/Assy:

MVPS / LVPS & SAFETY / CUT OUT CIRCUITS

Unit:

Component:

CIRCUIT BREAKER TYPE S280

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE:

3. Remove and discard the Circuit Breaker according to the Instructions provided in the following figure 7.

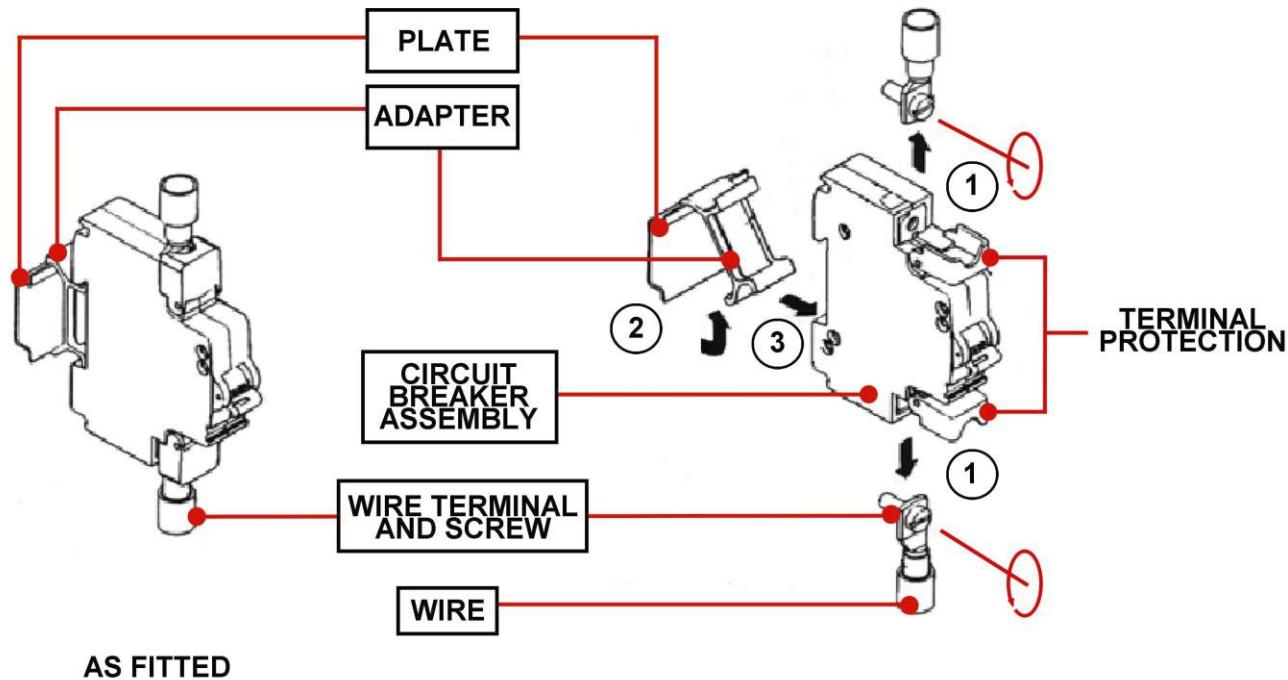


FIGURE 7 -CIRCUIT BREAKER REMOVAL

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

11/12

Subsystem/Assy:

MVPS / LVPS & SAFETY / CUT OUT CIRCUITS

Unit:

Component:

CIRCUIT BREAKER TYPE S280

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE (CONT'D):

INSTALLATION

To perform the Task proceed as follows:

1. Clean the Circuit Breaker Seat using recommended Cleaner / Agent and lint-free rags.
2. Check CB Plate for installation / missing / loose Hardware. Torque, as per check result, to **15.2 ft-lb**.
3. Check Wires and Wire Terminals for signs of overheating.
4. Install the "new" Circuit Breaker according to the instructions provided in the following figure 8.

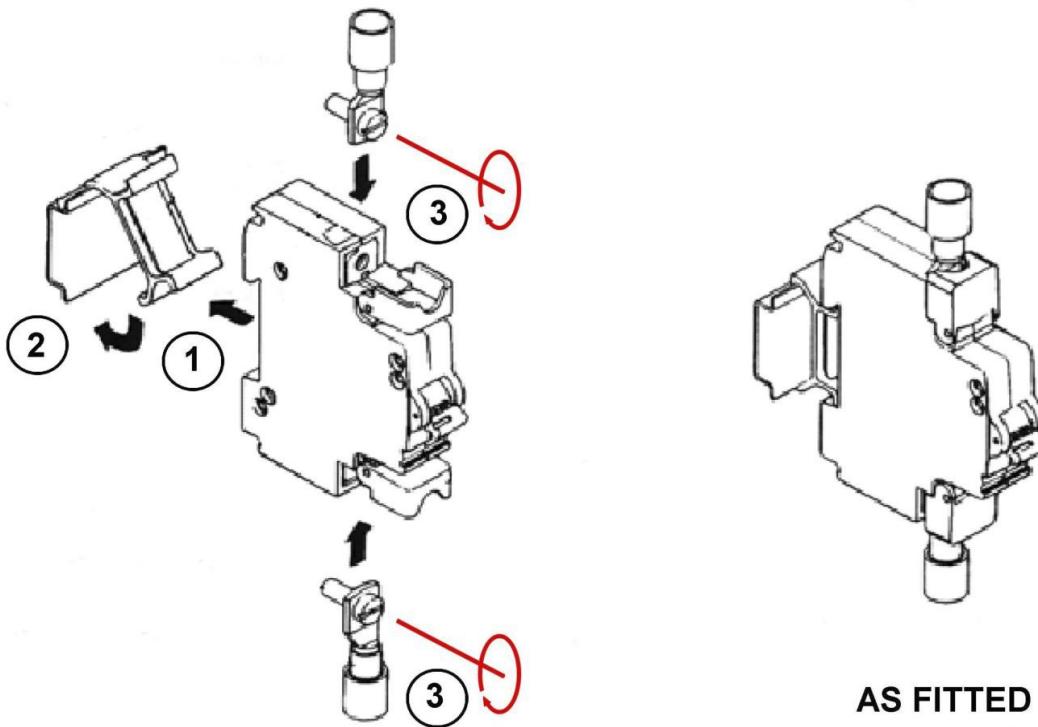


FIGURE 8 -CIRCUIT BREAKER INSTALLATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

12/12

Subsystem/Assy:

MVPS / LVPS & SAFETY / CUT OUT CIRCUITS

Unit:

Component:

CIRCUIT BREAKER TYPE S280

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE (CONT'D):

5. Torque the Wires Terminals Screws according to the following Torque Values:

MAIN CONTACTS AUX CONTACTS

SCREW	M5	M3
TORQUE	5 ft-*lb	4 ft-*lb

6. Install the Circuit Breakers Front Panel and secure it by installing and tightening the relevant Fixing Screws.

7. Restore Electrical Power.

8. Record Task Result on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-01

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/8

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION & SAFETY CIRCUITS

Unit:

Component:

RELAY

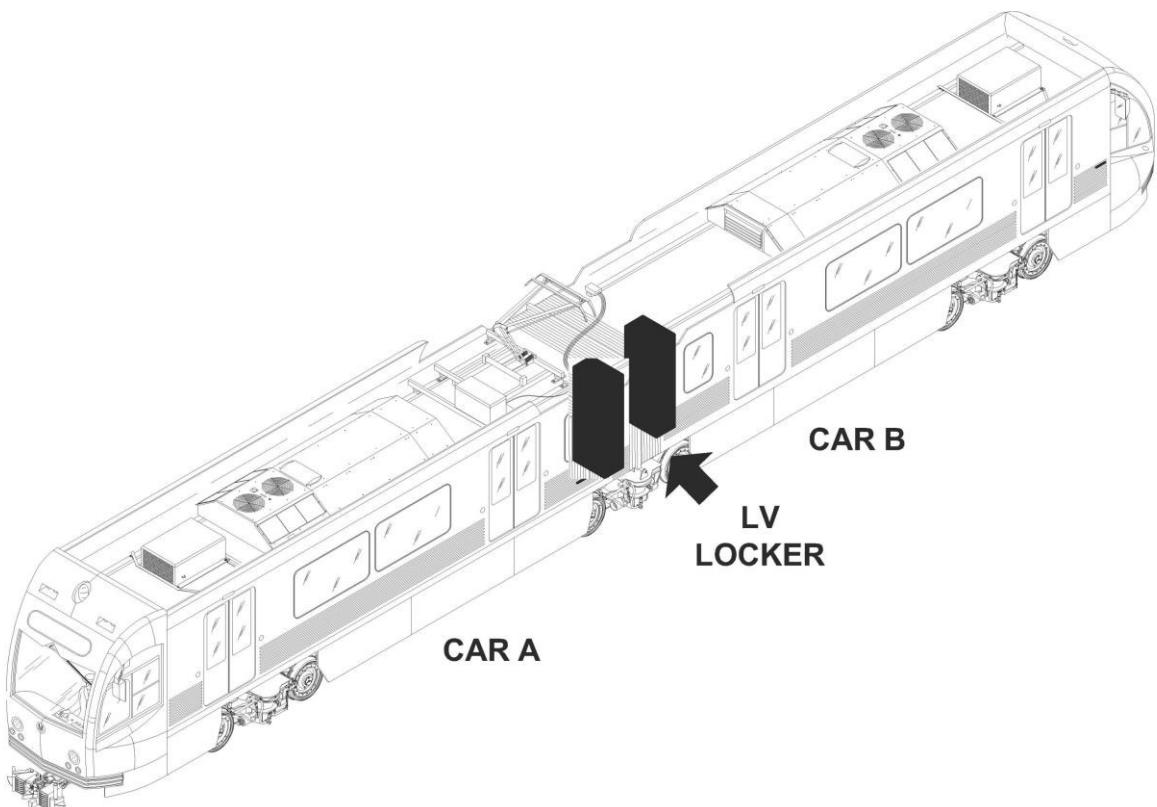
Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

LOCATION



P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-01

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION & SAFETY CIRCUITS

Unit:

Component:

RELAY

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)**APPLICABILITY:**

This Replacement procedure is applicable to the following Items:

TABLE 1 RELAY IDENTIFICATION & LOCATIONS

LABEL	DESCRIPTION	TYPE	P/N	CAR	LOCATION	FUNCTIONAL DIAGRAMS	
						SCHEMATICS	SHEET #
3K04	LVPS FAULT RELAY	2 CONTACTS	211VK01374B0802	B	LV LOCKER	LV	24
3K05\1	AUXILIARY NO MOCION RELAY	6 CONTACTS	211VK01374B0803	A - B	LV LOCKER	LV	27
3K05\2	AUXILIARY NO MOCION RELAY	6 CONTACTS	211VK01374B0803	A - B	LV LOCKER	LV	27
3K07\1	CAB ENABLE RELAY	6 CONTACTS	211VK01374B0803	A - B	LV LOCKER	LV	23
3K07\2	CAB ENABLE RELAY	6 CONTACTS	211VK01374B0803	A - B	LV LOCKER	LV	23
3K07\3	CAB ENABLE RELAY	6 CONTACTS	211VK01374B0803	A - B	LV LOCKER	LV	23
3K09	PROPELLION REQUEST RELAY	4 CONTACTS	211VK01374B0801	A	LV LOCKER	LV	32
3K10	PROPELLION FAULT RELAY	6 CONTACTS	211VK01374B0803	A - B	LV LOCKER	LV	27
3K13	CAB ENABLE RELAY (LOCAL)	6 CONTACTS	211VK01374B0803	A - B	LV LOCKER	LV	22
3K14	FORWARD DIRECTION RELAY	6 CONTACTS	211VK01374B0803	A - B	LV LOCKER	LV	32
3K15	BACKWARD DIRECTION RELAY	2 CONTACTS	211VK01374B0802	A - B	LV LOCKER	LV	32
3K16	CAB ENABLE INTERLOCK RELAY	2 CONTACTS	211VK01374B0802	A - B	LV LOCKER	LV	22
3K19	RELAY COMMAND CONTACTOR + TRAIN LINE	4 CONTACTS	211VK01374B0801	CA	LV LOCKER	LV	34
3K17	HSCB OPEN COMMAND RELAY	4 CONTACTS	211VK01374B0801	A	LV LOCKER	LV	27
3K18	APS FAULT RELAY	2 CONTACTS	211VK01374B0802	B	LV LOCKER	LV	24

P2550 CORRECTIVE MAINTENANCE SHEET							
							Card Code: R-C-10-00-00-00/R-01
System: LOW VOLTAGE DISTRIBUTION						Sheet: 3/8	
Subsystem/Assy: LOW VOLTAGE DISTRIBUTION & SAFETY CIRCUITS						Unit:	
Component: RELAY						Man Hours: 1.0	
Maintenance Task: REPLACEMENT (TYPICAL)							
APPLICABILITY:							
TABLE 1 RELAY IDENTIFICATION & LOCATIONS (cont'd)							
LABEL	DESCRIPTION	TYPE	P/N	CAR	LOCATION	FUNCTIONAL DIAGRAMS	
						SCHEMATICS	SHEET#
3K22	BY PASS RELAY	4 CONTACTS	211VK01374B0801	A	LV LOCKER	LV	26
3K23	POWER COMMAND RELAY	4 CONTACTS	211VK01374B0801	A	LV LOCKER	LV	32
3K24	35MPH SPEED LIMIT RELAY	2 CONTACTS	211VK01374B0802	A	LV LOCKER	LV	26
3K25	PROPULSION REQUEST RELAY	4 CONTACTS	211VK01374B0801	A	LV LOCKER	LV	26
3K26	NO-MOTION RELAY	4 CONTACTS	211VK01374B0801	A - B	LV LOCKER	LV	28
3K27	STOPPING BRAKE RELAY	4 CONTACTS	211VK01374B0801	A - B	LV LOCKER	LV	27
3K28	SCEB RELAY	6 CONTACTS	211VK01374B0803	A	LV LOCKER	LV	32
3K29	FSB RELAY	4 CONTACTS	211VK01374B0801	A	LV LOCKER	LV	32
6D04	6K01 RELAY TIMING UNIT	2 CONTACTS	211VD00903B04 211VU00783B16	A	LV LOCKER	LV	52
6D05	6K02 RELAY TIMING UNIT	2 CONTACTS	211VD00903B04 211VU00783B16	A	LV LOCKER	LV	52
6K01	D.M. OPERATIVE RELAY (SECURITY BRAKE COMM)	2 CONTACTS	211VK01374B0802	A	LV LOCKER	LV	52
6K02	D.M. OPERATIVE RELAY (SECURITY BRAKE COMM)	2 CONTACTS	211VK01374B0802	A	LV LOCKER	LV	52
6K11\1	SECURITY BRAKE LOOP RELAY	6 CONTACTS	211VK01374B0803	A - B	LV LOCKER	LV	53
6K11\2	SECURITY BRAKE LOOP RELAY	6 CONTACTS	211VK01374B0803	A - B	LV LOCKER	LV	53

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-01

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION & SAFETY CIRCUITS

Unit:

Component:

RELAY

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

SAFETY PRECAUTIONS:

LACMTA Maintenance Shop Safety Rules & Regulations

CAUTION: SWITCH OFF THE 3F01 CB (BATTERY BOX) BEFORE STARTING TO PERFORM THE
REPLACEMENT OF ANY RELAY LISTED IN THE PREVIOUS TABLE 1

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC 2000 Contact Cleaner

SPARE PARTS:

Refer to Table 1 Relay Identification & Locations

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-01

System: LOW VOLTAGE DISTRIBUTION	Sheet: 5/8
Subsystem/Assy: LOW VOLTAGE DISTRIBUTION & SAFETY CIRCUITS	Unit:
Component: RELAY	Man Hours: 1.0
Maintenance Task: REPLACEMENT (TYPICAL)	

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle in the Maintenance Shop.
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

CAUTION: SWITCH OFF THE 3F01 CB (BATTERY BOX) BEFORE STARTING TO PERFORM THE REPLACEMENT OF ANY RELAY LISTED IN THE PREVIOUS TABLE 1.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-01

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION & SAFETY CIRCUITS

Unit:

Component:

RELAY

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE (CONT'D):

To perform the Task proceed as follows:

REMOVAL

1. Gain access to the Relays Rack installed in the "A" & "B" LV Lockers, by opening the relevant LV Locker Door using the Maintenance Key.
2. Locate the Relay to be replaced.

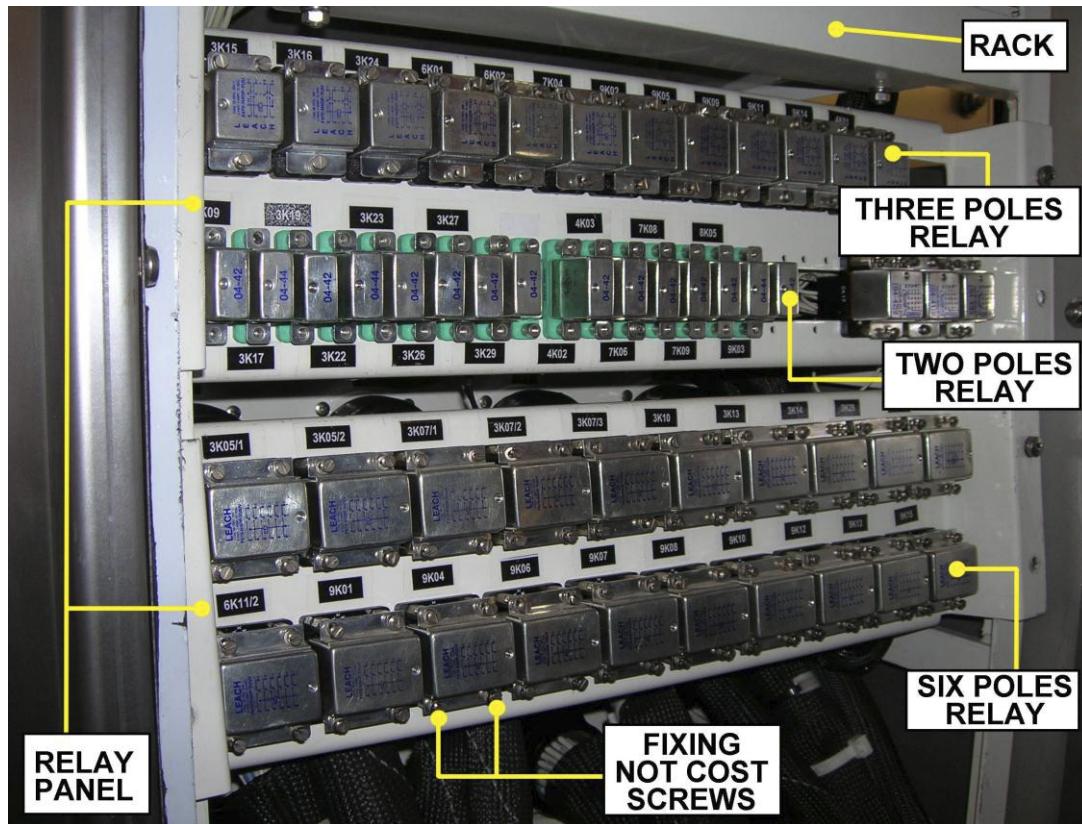


FIGURE 1 - LV LOCKER -RELAYS REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-01

System: LOW VOLTAGE DISTRIBUTION	Sheet: 7/8
Subsystem/Assy: LOW VOLTAGE DISTRIBUTION & SAFETY CIRCUITS	Unit:
Component: RELAY	Man Hours: 1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE:

REMOVAL (cont'd)

3. Loose and remove the Self Locking Nuts & Washers fixing the Relay to the Rack.
Retain them for later use.
4. Slide out the Relay in order to gain access to the relevant Wiring and Terminals connections.
5. Take note of Wiring Color Codes and relevant positions on Relay Terminals.
6. Disconnect the Wiring Cable from Relay Terminals.
7. Remove and discard the Relay.

INSTALLATION

1. Clean the Relay Seat using recommended Cleaner / Agent and lint-free rags.
2. Check Relay Plate for installation / missing / loose Hardware.
3. Torque, as per check result, to **15.2 ft-lb**.
4. Check Wires and Wire Terminals for signs of overheating.
Connect the Wiring to the Relay Terminals according to their position and Color Codes previously Noted.
Refer to the Functional Schematic Sheet listed in the previous Table 1 for complete Wiring Details
5. Torque the Wires Screw Terminals to **4 ft-*lb**.
6. Install the Relay in its position.
7. Install the Relay attaching Washers and Self Locking Nuts. Torque to **4 ft-*lb**
8. Leave the LV Locker.
9. Close and the LV locker Door using the Maintenance Key.
10. Restore Electrical Power.
11. Record Task results on the Defect Report Card for administrative and maintenance planning

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 “At every Task Completion.”

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-01

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/8

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION & SAFETY CIRCUITS

Unit:

Component:

RELAY

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE (CONT'D):**

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LEFT BLANK**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-02

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/6

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION

Unit:

Component:

MAIN CONTACTOR

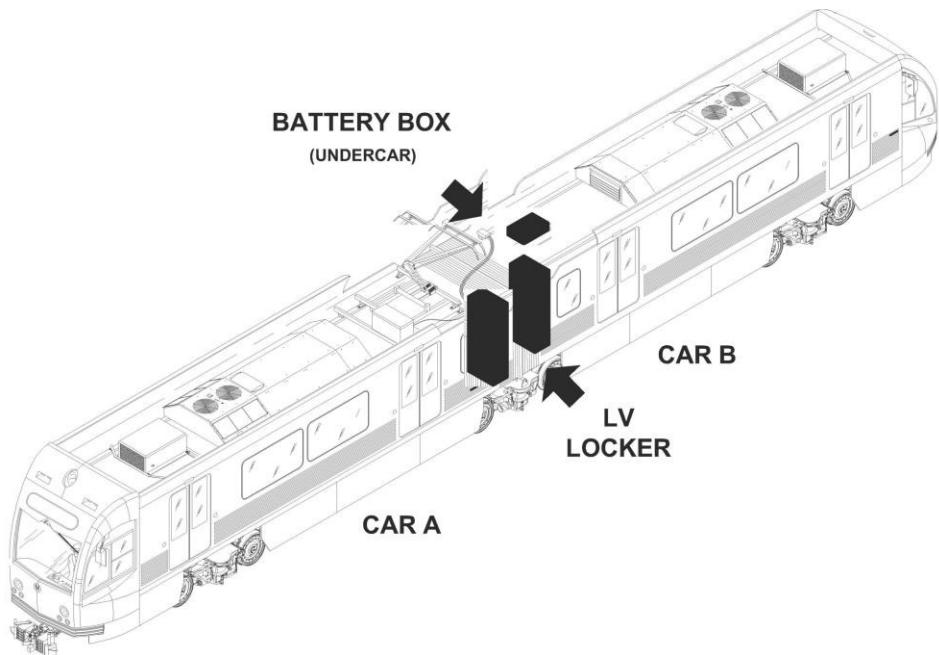
Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

LOCATION:



APPLICABILITY

This Replacement procedure is applicable to the following Items:

TABLE 1 CONTACTORS IDENTIFICATION & LOCATIONS

LABEL	DESCRIPTION	TYPE	P/N	CAR	LOCATION	FUNCTIONAL DIAGRAMS	
						SCHEMATICS	SHEET#
3K06	CAB ENABLE CONTACTOR	SINGLE POLE	211VK00779B	A - B	LV LOCKER	LV	23
3K20	CONTACTOR + TRAIN LINE	SINGLE POLE	211VK00732B04	B	BATTERY BOX	LV	21

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-02

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/6

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION

Unit:

Component:

MAIN CONTACTOR

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)**SAFETY PRECAUTIONS:**

LACMTA Maintenance Shop Safety Rules & Regulations

CAUTION: SWITCH OFF THE 3F01 CB (BATTERY BOX) BEFORE STARTING TO PERFORM THE REPLACEMENT OF ANY CONTACTOR LISTED IN THE PREVIOUS TABLE 1.**TOOLS:**

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC 2000 Contact Cleaner

SPARE PARTS:

Refer to Table 1 Contactors Identification & Locations

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-02

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

3/6

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION

Unit:

Component:

MAIN CONTACTOR

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle in the Maintenance Shop.
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

CAUTION: SWITCH OFF THE 3F01 CB (BATTERY BOX) BEFORE STARTING TO PERFORM THE REPLACEMENT OF ANY CONTACTOR LISTED IN THE PREVIOUS TABLE 1.

REMOVAL

To perform the Task proceed as follows (Refer to Figures 1 through 4):

1. Gain access to the Contactor to be replaced as follows.
 - **3K06** by opening the LV Locker Door
 - **3K20** by opening Battery Box Skirt and removing Battery Circuit Breakers Box Side Cover, disengaging the relevant Safety Latches

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-02

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/6

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION

Unit:

Component:

MAIN CONTACTOR

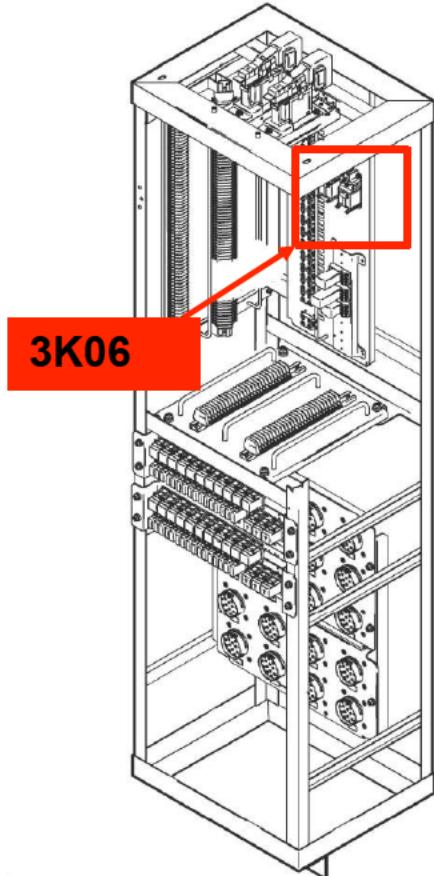
Man Hours:

1.0

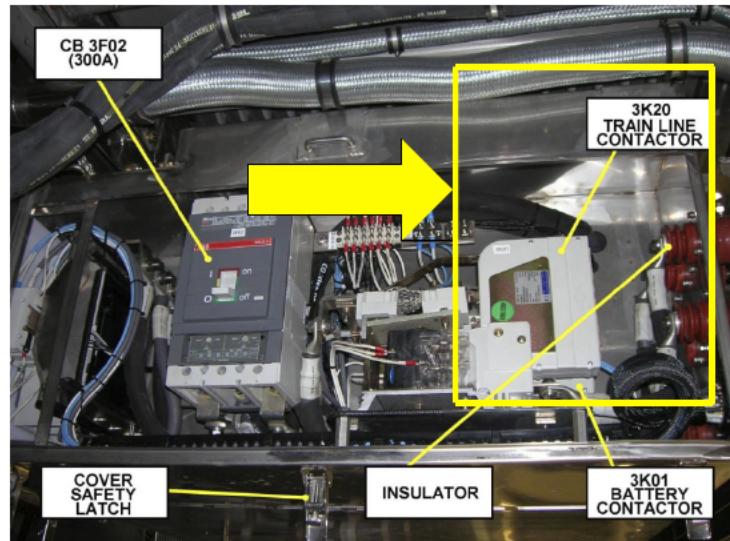
Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE (CONT'D):****REMOVAL**

2. Locate the Contactor to be replaced



**FIG 1 LV LOCKER
3K06 CONTACTOR LOCATION**



**FIG 2 BATTERY BOX -SIDE
3K20 CONTACTOR LOCATION**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-02

System:

Sheet:

LOW VOLTAGE DISTRIBUTION**5/6**

Subsystem/Assy:

Unit:

LOW VOLTAGE DISTRIBUTION

Component:

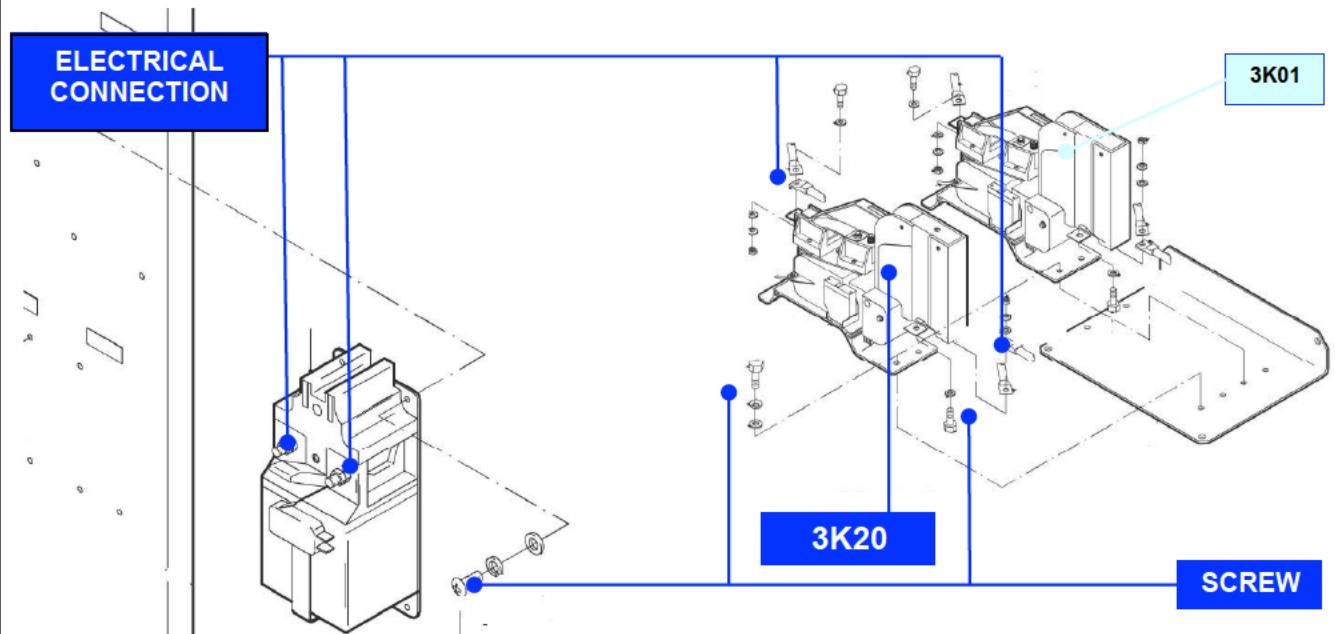
Man Hours:

MAIN CONTACTOR**1.0**

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE:**

3. Disconnect Electrical Connections from the Contactor. Note the Wiring Identification Labels.
4. Loose and remove the Contactor Fixing Self Locking Nuts & Washers.
Retain them for later use.

**FIG 3 3K06 CONTACTOR REPLACEMENT****FIG 4 3K20 CONTACTOR REPLACEMENT**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-02

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/6

Subsystem/Assy:

LOW VOLTAGE DISTRIBUTION

Unit:

Component:

MAIN CONTACTOR

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE (CONT'D):****INSTALLATION**

To perform the task proceed as follows (Refer to Figures 1 through 4):

1. Clean the Contactor Seat using recommended Cleaner / Agent and lint-free rags.
2. Check the Wires and the Wire Terminals for signs of overheating.
3. Connect the Wiring to the Contactor Terminals according to their Identification Labels previously Noted.
4. Refer to the Functional Schematic Sheet listed in the previous Table 1 for complete Wiring Details.
5. Torque the Wires Screw Terminals to **4 ft-*lb**.
6. Install the Contactor in its position.
7. Install the Contactor attaching Washers and Self Locking Nuts. Torque to **4 ft-*lb**.
8. Leave the Task area, respectively, as follows.
 - **3K06** by closing and locking the Lv Locker Door
 - **3K20** by installing the Battery Circuit Breakers Box Side Cover, engaging the relevant Safety Latches and closing & locking the opening Battery Box Skirt
9. Restore Electrical Power.
10. Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS**(para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-03

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/8

Subsystem/Assy:

LV DISTRIBUTION / SAFETY & CUT OUT CIRCUITRY

Unit:

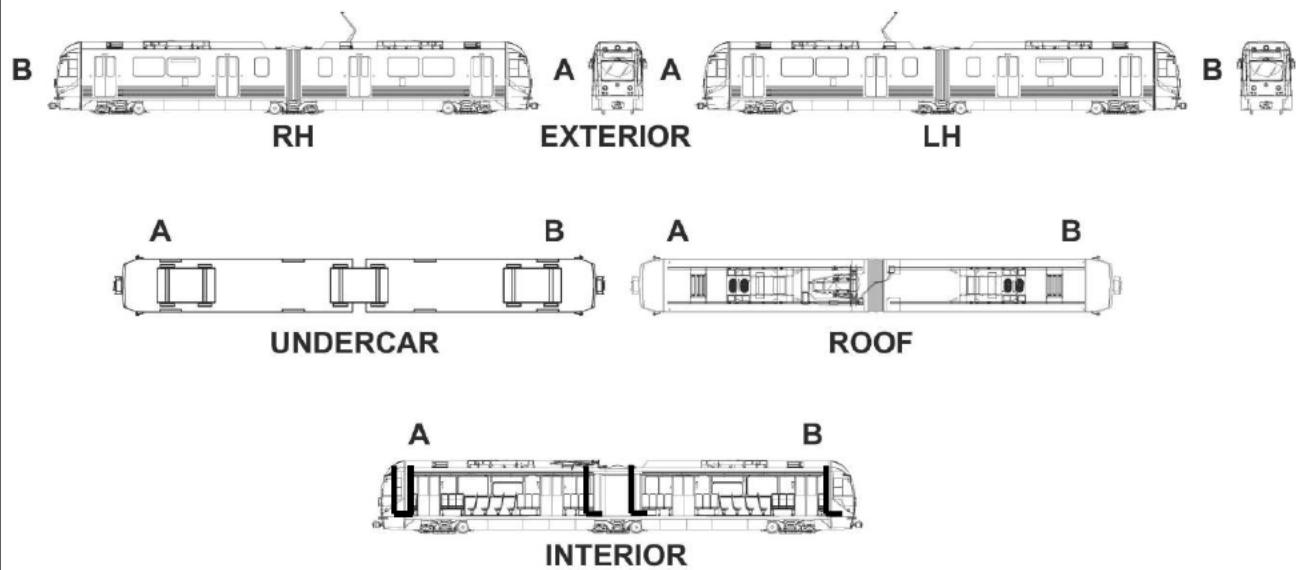
Component:

SWITCH / PUSHBUTTON

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)
LOCATION:

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-03

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

LV DISTRIBUTION / SAFETY & CUT OUT CIRCUITRY

Unit:

Component:

SWITCH / PUSHBUTTON

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)

APPLICABILITY

This Replacement procedure is applicable to the following Items:

TABLE 1 SWITCHES / PUSHBUTTONS IDENTIFICATION & LOCATIONS

LABEL	DESCRIPTION	TYPE	MFR P/N	CAR	LOCATION	FUNCTIONAL DIAGRAMS	
						SCHEMATICS	SHEET#
3S04	LAMP TEST PUSH BUTTON	Momentary Round Black PB	P9XPNNS	A - B	CAB CONSOLE	LV	15
3S06	PROPULSION RESET P.B.	Momentary Illuminated Blue Square PB w/Guard	P9SPLLGD	A - B		LV	43
5S01	PANTOGRAPH UP\DOWN SELECTOR	2 Momentary Knob Selector Switch	P9SSM23N	A - B		LV	49
3S03	TOWING MODE SWITCH	Momentary Illuminated Green Square PB w/Guard	P9SPLLGD	A - B	CAB - INDICATOR & SWITCH LH PANEL	LV	43
3S05	CARWASH MODE SWITCH	Momentary Illuminated Blue Square PB w/Guard	P9SPLLGD	A - B		LV	43
3S07	TCU / PROPULSION CUTOUT SWITCH	Cut Out Switch	211VQ00840B02	A - B		LV	26
3S08	NO MOTION BY PASS	Cut Out Switch	211VQ00840B03		CAB BY PASS PANEL	LV	
6S01	6A02 POWER SUPPLY BYPASS SWITCH	Cut Out Switch	211VQ00840B04	A		LV	53
3S02	APS/LVPS SELECTOR	3 Stable Position Rotary Switch	211VQ01397B02	B	ELE LOCKER DATA DOWNLOAD PANEL	LV	24

P2550 CORRECTIVE MAINTENANCE SHEET	
	Card Code: R-C-10-00-00-00/R-03
System: LOW VOLTAGE DISTRIBUTION	Sheet: 3/8
Subsystem/Assy: LV DISTRIBUTION / SAFETY & CUT OUT CIRCUITRY	Unit:
Component: SWITCH / PUSHBUTTON	Man Hours: 0.5
Maintenance Task: REPLACEMENT (TYPICAL)	
SAFETY PRECAUTIONS:	
LACMTA Maintenance Shop Safety Rules & Regulations	
CAUTION: SWITCH OFF THE 3F01 CB (BATTERY BOX) BEFORE STARTING TO PERFORM THE REPLACEMENT OF ANY SWITCH / PUSHBUTTON LISTED IN THE PREVIOUS TABLE 1.	
TOOLS:	
LACMTA Maintenance Shop Standard Tools Kit	
CONSUMABLES:	
CRC 2000 Contact Cleaner	
SPARE PARTS:	
"Propulsion Reset" Switch Lamp	Type/PN MB400-NFW28H-BP
Refer to previous Table 1 Switches / Pushbuttons Identification & Locations	

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-03

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

LV DISTRIBUTION / SAFETY & CUT OUT CIRCUITRY

Unit:

Component:

SWITCH / PUSHBUTTON

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE (CONT'D):

**FIG 1 CONSOLE****FIG 2 3S06 SWITCH****FIG 3 3S04 SWITCH****FIG 4 5S01 SWITCH**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-03

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/8

Subsystem/Assy:

LV DISTRIBUTION / SAFETY & CUT OUT CIRCUITRY

Unit:

Component:

SWITCH / PUSHBUTTON

Man Hours:

0.5

Maintenance Task:

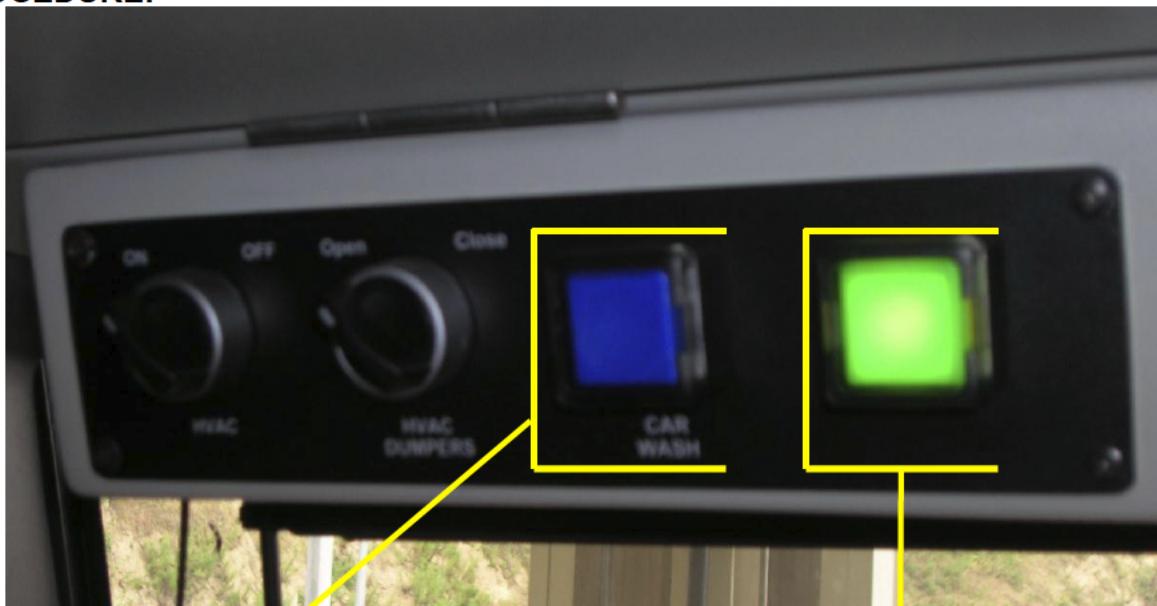
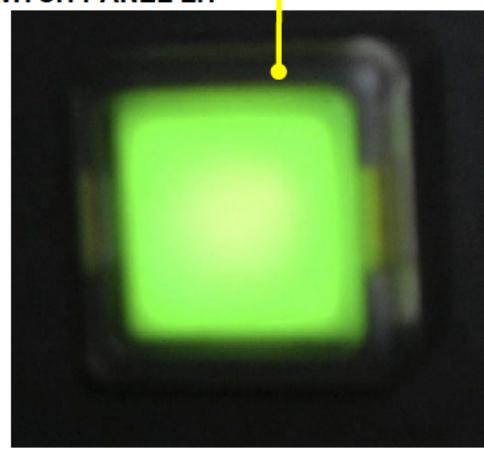
REPLACEMENT (TYPICAL)
PROCEDURE:

FIG 5 INDICATOR & SWITCH PANEL LH

FIG 6 3S05 CAR WASH MODE SWITCH

FIG 7 3S03 TOWING MODE SWITCH

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-03

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

LV DISTRIBUTION / SAFETY & CUT OUT CIRCUITRY

Unit:

Component:

SWITCH / PUSHBUTTON

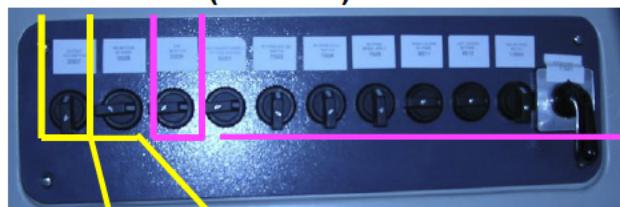
Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)

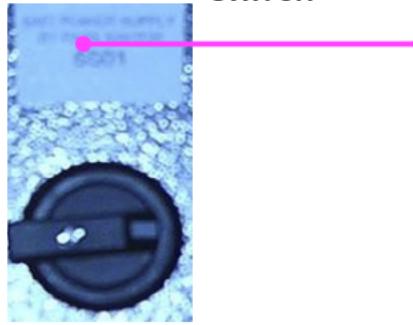
PROCEDURE (CONT'D):



CAB A

CAB B

FIG 8 BY PASS PANEL

FIG 9 3S07
TCU CUT OUT
SWITCHFIG 10 3S08
NO MOTION BY PASS
SWITCHFIG 11 3S07
PROPULSION CUT
OUT SWITCHFIG 12 3S08
NO MOTION BY PASS
SWITCH6S01 6A02 (DC/DC CONVERTER) POWER
SUPPLY BY PASS SWITCH

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-03

System:

Sheet:

LOW VOLTAGE DISTRIBUTION**7/8**

Subsystem/Assy:

Unit:

LV DISTRIBUTION / SAFETY & CUT OUT CIRCUITRY

Component:

Man Hours:

SWITCH / PUSHBUTTON**0.5**

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE:



FIG 14 ELE LOCKER DATA DOWN LOAD PANEL

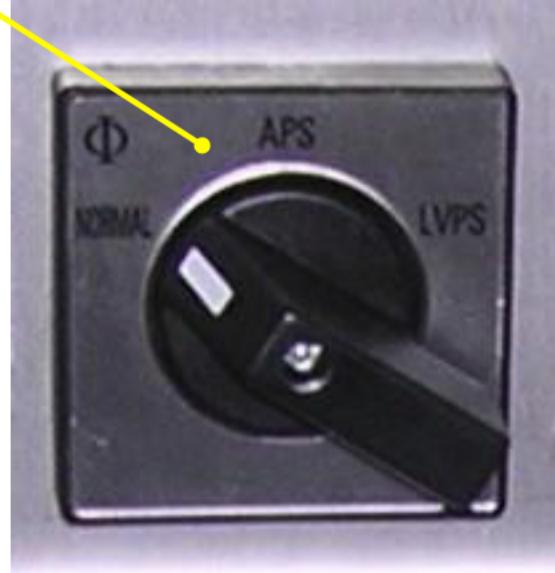


FIG 15 3S02 APS / LVPS SELECTOR

PRELIMINARY OPERATIONS

- Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

CAUTION: SWITCH OFF THE 3F01 CB (BATTERY BOX) BEFORE STARTING TO PERFORM THE REPLACEMENT OF ANY SWITCH / PUSHBUTTON LISTED IN THE PREVIOUS TABLE 1.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-03

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/8

Subsystem/Assy:

LV DISTRIBUTION / SAFETY & CUT OUT CIRCUITRY

Component:

SWITCH / PUSHBUTTON

Unit:

Man Hours:
0.5

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE (CONT'D):****REPLACEMENT**

To perform the Switch Replacement proceed as follows (Refer to Figures 1 through 15):

1. Removal

- Locate the Switch / Pushbutton to be replaced.
- Gain access to the rear of the Panel Assy where the relevant Switch / Pushbutton is installed on, by unscrewing and removing the relevant Panel Assy attaching hardware (Screws and Washers).
NOTE: It is advised to retain the attaching Hardware for later use.
- On the rear of the Panel Assy, locate the Switch / Pushbutton Body to be replaced and its Electrical Connections.
- Note the Switch / Pushbutton Body Wiring Identification Codes.
- Disconnect the Switch / Pushbutton Body electrical Connections.
- Disengage the Switch / Pushbutton Assy from its seat.
- Remove the Switch / Pushbutton Assy by pushing it from the rear toward the front of the Panel Assy.

2. Installation

- Install and engage on its seat the Switch / Pushbutton Assy to be installed.
- Connect the Switch / Pushbutton Body Electrical Connections according to the previously noted Wiring Identification Labels.
- Refer to the Functional Schematic Sheet listed in the previous Table 1 for complete Wiring Details.
- Position the Panel Assy on which the relevant "new" Switch / Pushbutton have been installed.
- Install and tighten the Panel Assy attaching Hardware.
- Key on the Vehicle and check that the "new" Switch / Pushbutton works properly.
- Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-05

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/6

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

INDICATOR LEDS BOARD

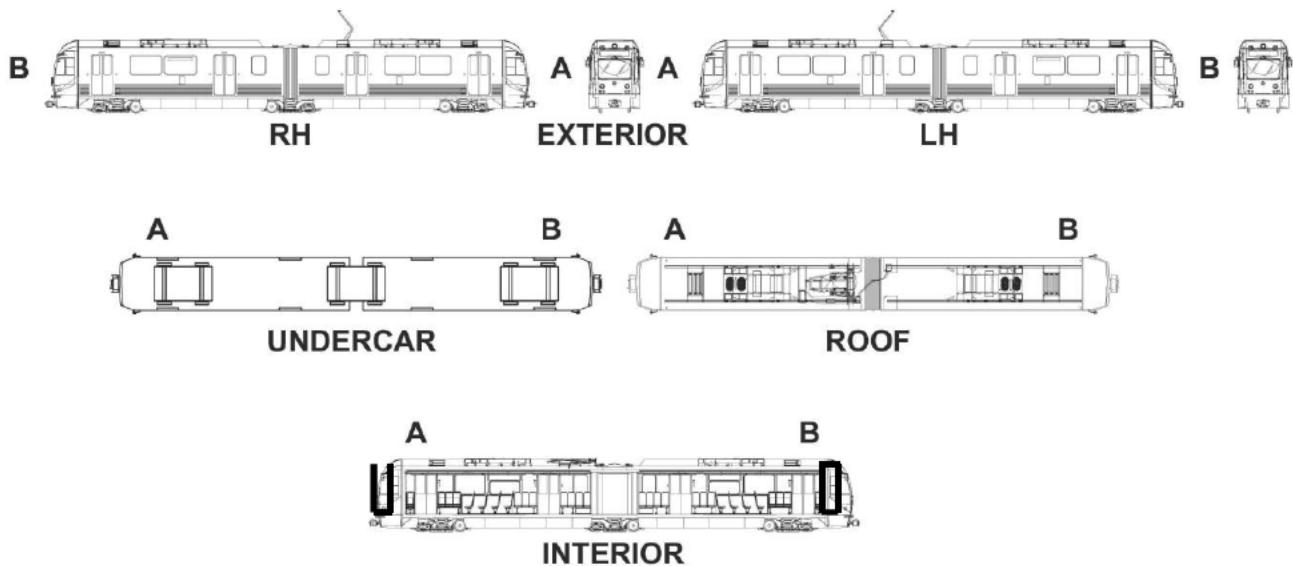
Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)

LOCATION:



APPLICABILITY

This Replacement procedure is applicable to the following Items:

TABLE 1 INDICATOR LED BOARDS IDENTIFICATION & LOCATIONS

DESCRIPTION	P/N	CAR	LOCATION
ELECTRONIC BOARD FOR "A" INDICATOR	AA04FTA	A - B	CAB INDICATOR PANEL A
ELECTRONIC BOARD FOR "B" INDICATOR	AA04FTJ	A - B	CAB INDICATOR PANEL B

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-05

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/6

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

INDICATOR LEDS BOARD

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)

SAFETY PRECAUTIONS:

LACMTA Maintenance Shop Safety Rules & Regulations

CAUTION: SWITCH OFF THE 3F01 CB (BATTERY BOX) BEFORE STARTING TO PERFORM THE REPLACEMENT OF ANY BOARD LISTED IN THE PREVIOUS TABLE 1.

CAUTION: A TECHNICIAN HANDLING ELECTRONIC ASSEMBLIES AND COMPONENTS SHOULD WEAR A CONDUCTIVE WRIST STRAP WITH A GROUND WIRE CONNECTED EITHER TO GROUND OR CHASSIS (VEHICLE) GROUND.

CAUTION: WHEN TRANSPORTING A PRINTED CIRCUIT BOARD OR COMPONENT, IT MUST BE PROTECTED FROM STATIC WHILE IN TRANSIT.

CAUTION: WHEN REMOVING THE PC BOARD FROM ITS RACK OR CRADLE, WEAR A WRIST STRAP WIRED TO THE VEHICLE OR GROUND.
NEVER TOUCH OR HANDLE THE PC BOARD BY ITS TRACES, CONNECTOR TEETH, OR COMPONENTS.
IMMEDIATELY PLACE THE PC BOARD INTO A CONDUCTIVE STATIC SHIELDING BAG.
CARRY THE PC BOARD TO A STATIC-FREE WORK STATION AND WEAR A GROUNDING STRAP WHEN REMOVING IT FROM THE STATIC BAG.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC Industrial - Precision Cleaner M3 PN 147535

Dry Compressed Air for Electronic Equipment (commercial)

SPARE PARTS:

Refer to previous Table 1 Indicator Led Boards Identification & Locations

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-05

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

3/6

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

INDICATOR LEDS BOARD

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE:****PRELIMINARY OPERATIONS**

- Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

CAUTION: SWITCH OFF THE 3F01 CB (BATTERY BOX) BEFORE STARTING TO PERFORM THE REPLACEMENT OF ANY BOARD LISTED IN THE PREVIOUS TABLE 1.

To perform the Task proceed as follows (Refer to Figures 1 through 7):

REPLACEMENT**Removal**

- Locate the Indicator Panel where the LEDs Board needs to be replaced.

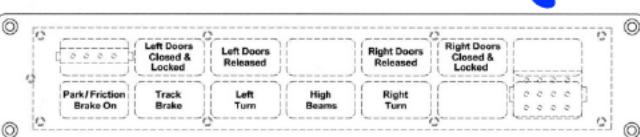
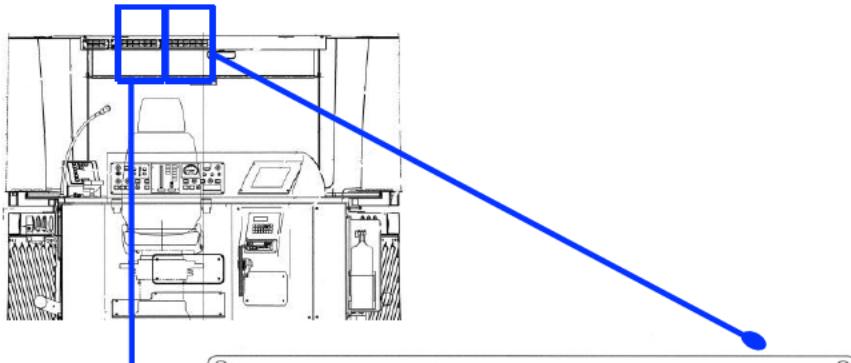


FIG 1 INDICATOR PANEL "A" LOCATION

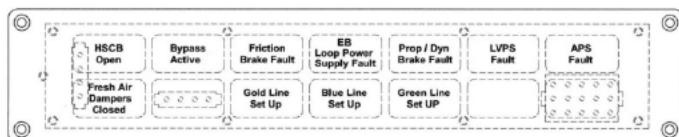


FIG 2 INDICATOR PANEL "B" LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-05

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/6

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

INDICATOR LEDS BOARD

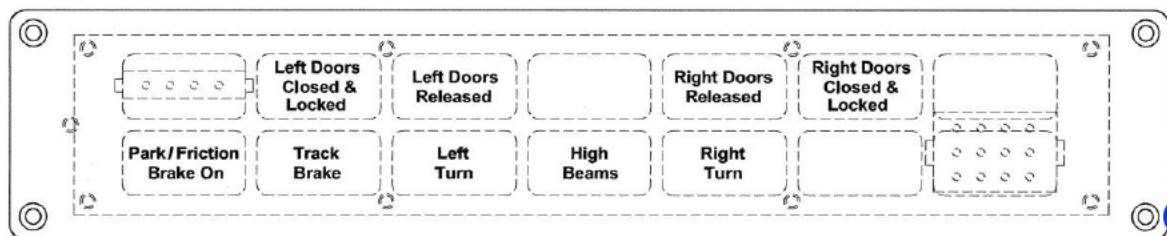
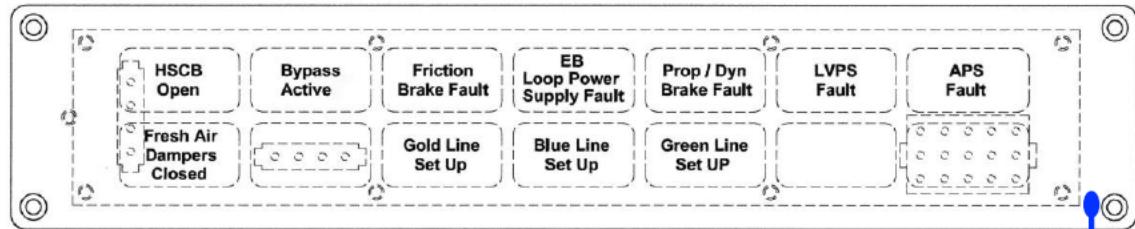
Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE (CONT'D):**

- 2) Gain access to the Board to be replaced by loosening the relevant Indicator ("A" / "B") Panel Front Plate Fixing Screws.

**FIG 3 INDICATOR PANEL A****FIG 4 INDICATOR PANEL B**
FRONT PLATE FIXING SCREW

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-05

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/6

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

INDICATOR LEDS BOARD

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE (CONT'D):

- 3) Supporting the Indicator Front Plate Assy, remove the Front Plate Fixing Screws.
Retain them for later use.
- 4) Pull out the Front Plate Assy.
- 5) Loosen and remove the Board Fixing Nuts. Retain them for later use.
- 6) Disconnect the Board Connectors.
- 7) Remove the Board.
- 8) Make available the Board for Repair.

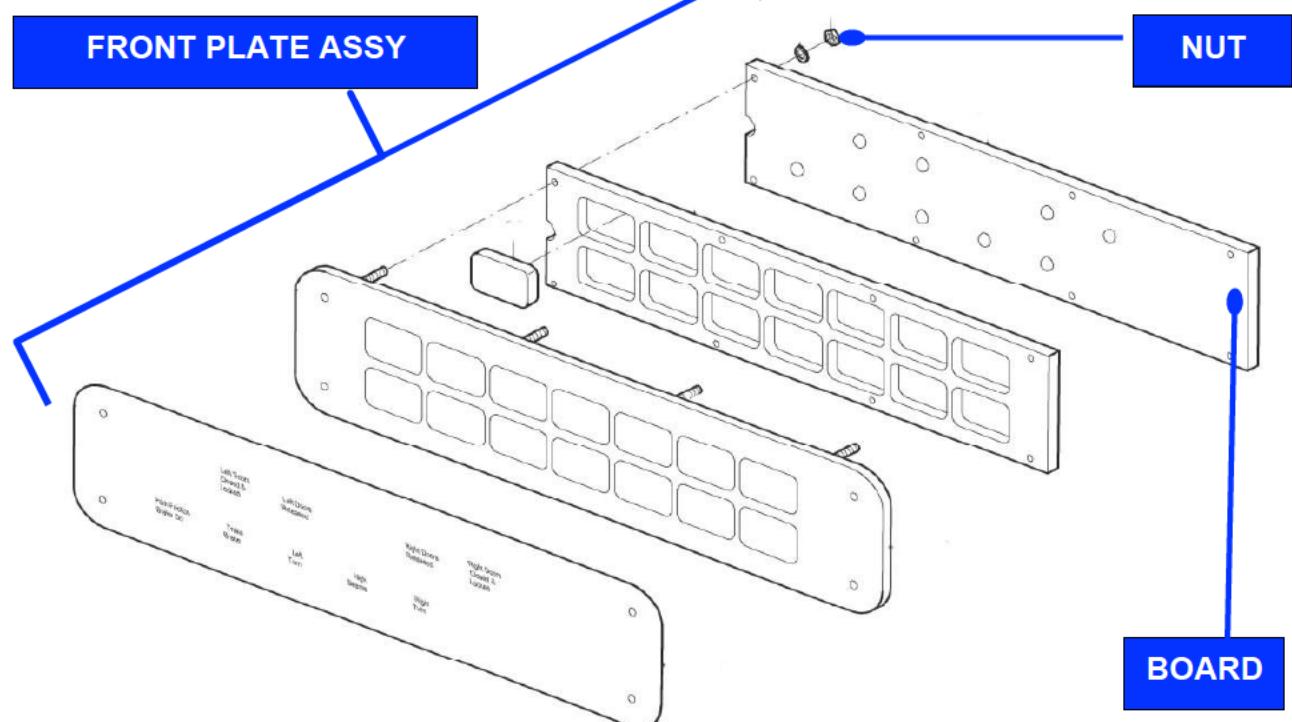


FIG 5 INDICATOR PANEL FRONT PLATE ASSY (A/ B)

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-05

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/6

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

INDICATOR LEDS BOARD

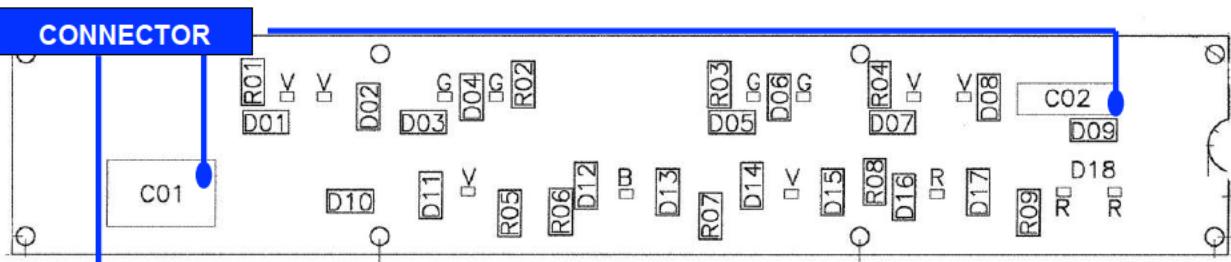
Man Hours:

0.5

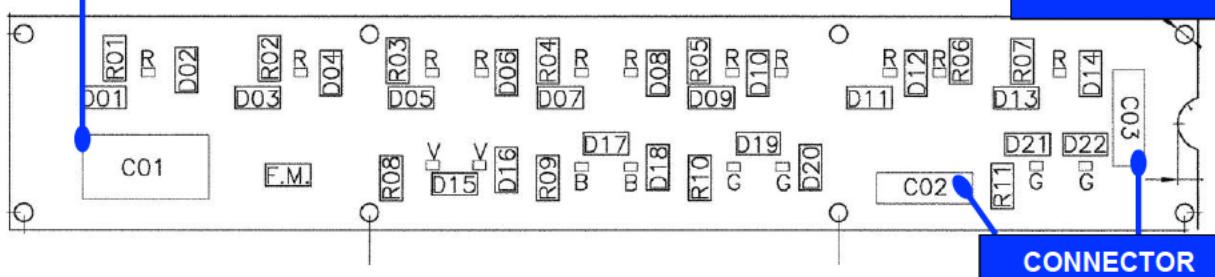
Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE (CONT'D):

**FIG 6 LEDS BOARD INDICATOR PANEL "A"**

**D=DIODE
R=RESISTOR**

**FIG 7 LEDS BOARD INDICATOR PANEL "B"**

CONNECTOR

Installation

- 1) Clean the Board Seat using recommended agent and lint-free rags
- 2) Check Wires and Connectors for damage and signs of overheating. Replace as per check results.
- 3) Install the Board onto its Seat.
- 4) Install the Board Fixing Nuts. Torque to 4 ft lb.
- 5) Install the Front Plate Assy in its position.
- 6) Install the Indicator ("A" / "B") Panel Front Plate Fixing Screws. Tighten as needed.
- 7) Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "At every Task Completion."

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-06

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/8

Subsystem/Assy:

APS-LVPS

Unit:

APS-LVPS CONTROL

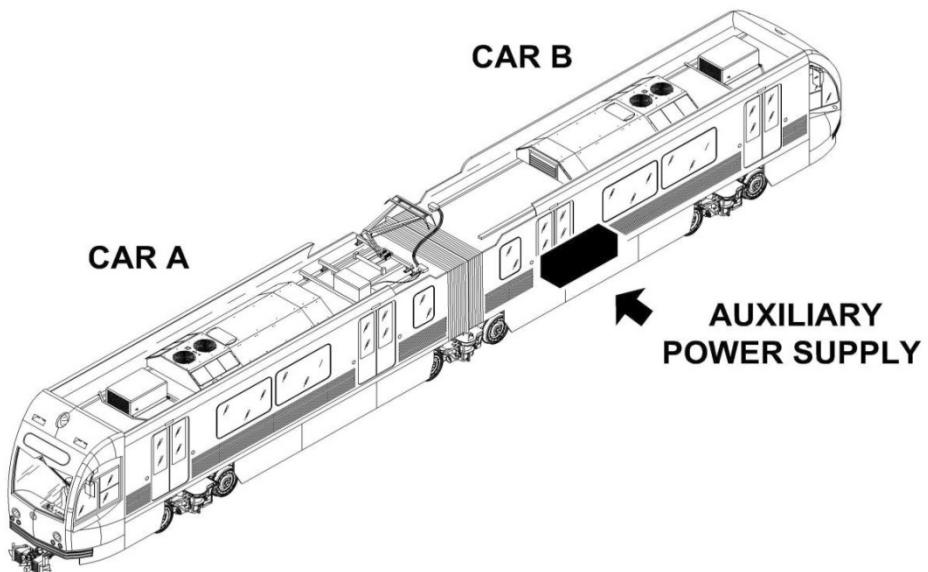
Component:

BOARD

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)
LOCATION:


APPLICABILITY

This Replacement Procedure is applicable to the following Items

- PSC-04 Board
- CIA-04 Board
- Power Supply Module

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-06

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

APS-LVPS

Unit:

APS-LVPS CONTROL

Component:

BOARD

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

SAFETY PRECAUTIONS:

LACMTA Maintenance Shop Safety Rules & Regulations

CAUTION: A TECHNICIAN HANDLING ELECTRONIC ASSEMBLIES AND COMPONENTS SHOULD WEAR A CONDUCTIVE WRIST STRAP WITH A GROUND WIRE CONNECTED EITHER TO GROUND OR CHASSIS (VEHICLE) GROUND.

CAUTION: WHEN TRANSPORTING A PRINTED CIRCUIT BOARD OR COMPONENT, IT MUST BE PROTECTED FROM STATIC WHILE IN TRANSIT.

CAUTION: WHEN REMOVING THE PC BOARD FROM ITS RACK OR CRADLE, WEAR A WRIST STRAP WIRED TO THE VEHICLE OR GROUND.
NEVER TOUCH OR HANDLE THE PC BOARD BY ITS TRACES, CONNECTOR TEETH, OR COMPONENTS.
IMMEDIATELY PLACE THE PC BOARD INTO A CONDUCTIVE STATIC SHIELDING BAG.
CARRY THE PC BOARD TO A STATIC-FREE WORK STATION AND WEAR A GROUNDING STRAP WHEN REMOVING IT FROM THE STATIC BAG.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC Industrial - Precision Cleaner M3 PN 147535

Dry Compressed Air for Electronic Equipment (commercial).

Cleaner / Degreaser Commercial

SPARE PARTS:

- | | | |
|-----------------------|-----|---------------|
| · PSC-04 Board | P/N | 231EE60430B |
| · CIA-04 Board | P/N | 231EE60435B |
| · Power Supply Module | P/N | 211EG23527B |
| · Front Cover O-ring | P/N | 211EX21730B03 |

P2550 CORRECTIVE MAINTENANCE SHEET	
Card Code:	
R-C-10-00-00-00/R-06	
System: LOW VOLTAGE DISTRIBUTION	Sheet: 3/8
Subsystem/Assy: APS-LVPS	Unit: APS-LVPS CONTROL
Component: BOARD	Man Hours: 1.0
Maintenance Task: REPLACEMENT (TYPICAL)	
<p>PROCEDURE:</p> <p>PRELIMINARY OPERATIONS</p> <p>Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:</p> <ol style="list-style-type: none"> 1. Place the Vehicle in the Maintenance Shop., over the Pit or on the Stand Up Rail. 2. Set the Master Controller Handle to FSB position. 3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON). 4. Remove Electrical Power from Vehicle by lowering the Pantograph. 5. Turn the Transfer Switch to OFF. 6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF. 7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures. <p>NOTE The tag must indicate the name of the person who removed Power. That person knows why the Power was removed and when it safe to restore it. Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.</p>	

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-06

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

APS-LVPS

Unit:

APS-LVPS CONTROL

Component:

BOARD

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE (CONT'D):

REMOVAL

To perform the Task proceed as follows (Refer to Figures 1 through 5):

- 1) Remove the Electrical Power from the Equipment by switching off respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)



FIG 1 3F01 CB LOCATION

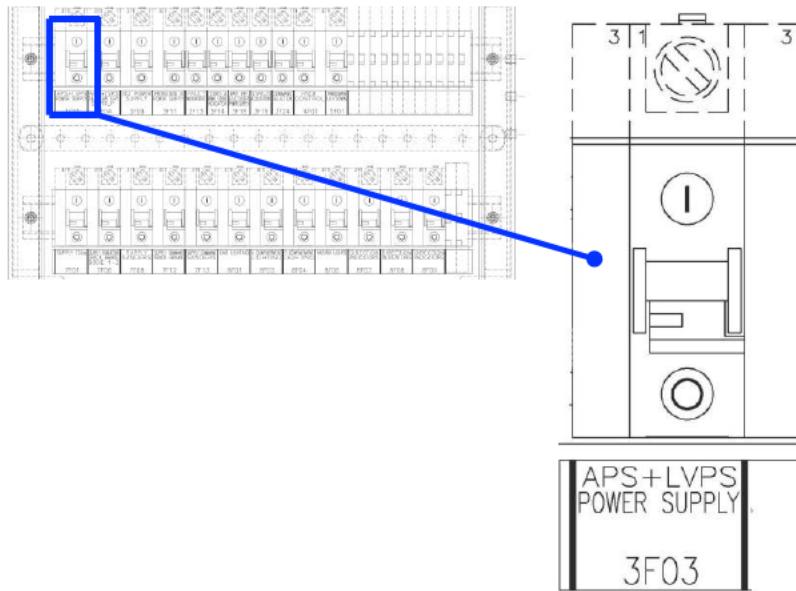


FIG 2 LV LOCKER B 3F03 CB LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-06

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/8

Subsystem/Assy:

APS-LVPS

Unit:

APS-LVPS CONTROL

Component:

BOARD

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE(CONT'D)

REMOVAL(cont'd)

NOTE: It is advisable to retain the removed attaching Hardware for later use.

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to
Sheet R-C -02-05-00-00 / R-00 2.

- 2) Gain access to APS / LVPS Control Unit Rack by removing the relevant APS /LVPS Front Panel as follows:
 - a) Disconnect the Front Panel Grounding Cable.
 - b) Loose the Front Panel Fixing Screws.
 - c) Supporting the Front Panel with suitable Device, remove the Front Panel Fixing Screws.
 - d) Remove the Front Panel and discard the relevant O-ring.

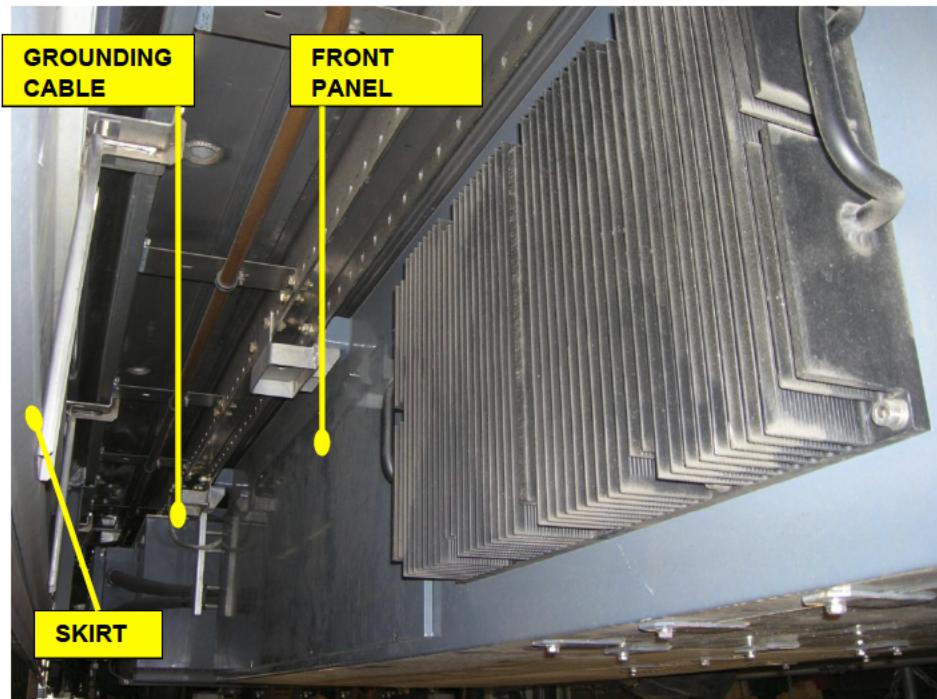


FIG 3 APS / LVPS LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-06

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

APS-LVPS

Unit:

APS-LVPS CONTROL

Component:

BOARD

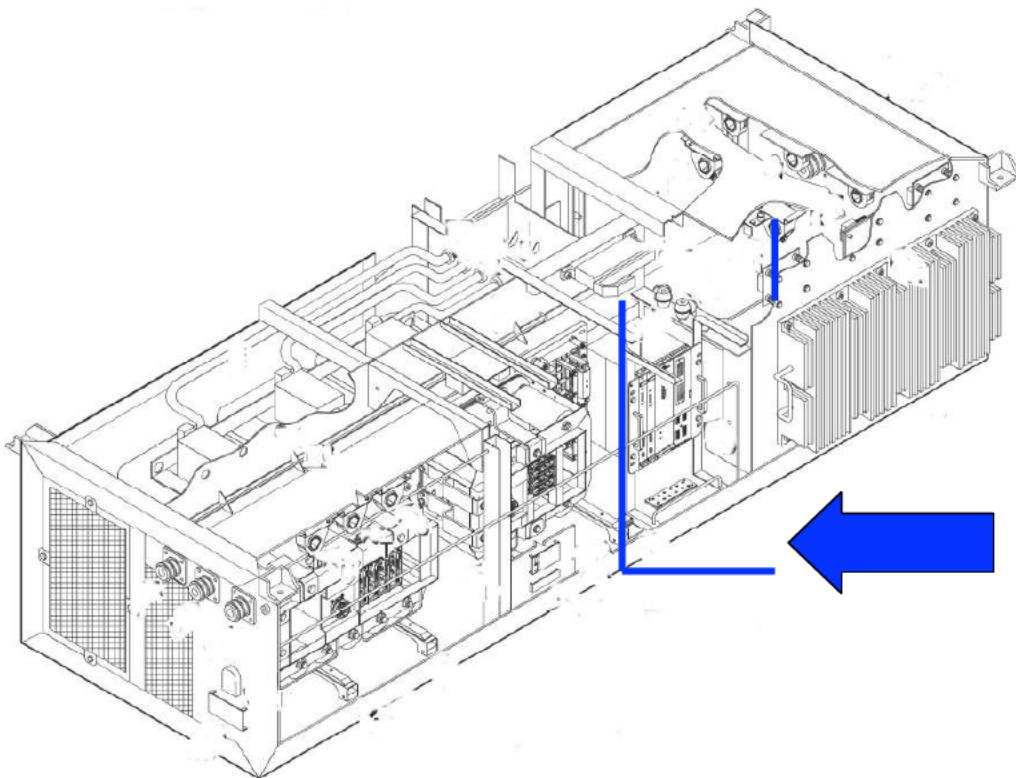
Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE:****REMOVAL(cont'd)**

- 3) Locate the
APS / LVPS
Control Unit
Rack

**FIG 4 APS / LVPS CONTROL UNIT RACK LOCATION**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-06

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

7/8

Subsystem/Assy:

APS-LVPS

Unit:

APS-LVPS CONTROL

Component:

BOARD

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE:

REMOVAL(cont'd)

- 4) Locate the Board / Module to be Replaced.
- 5) Disconnect the Board / Module Connectors from the relevant Board to be removed.
- 6) Loose the Board / Module Fixing Screws. Retain them for later use.
- 7) Carefully pull the Board / Module out from the Rack and slide it out from the relevant guide.

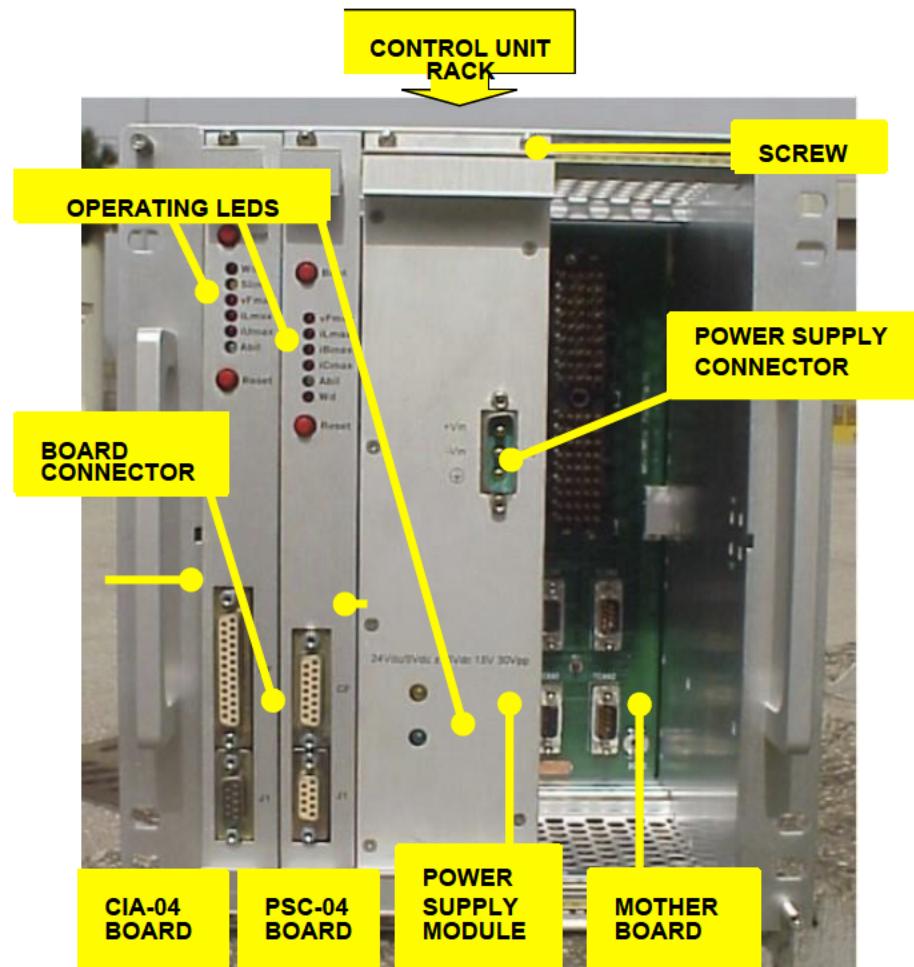


FIG 5 CONTROL UNIT RACK- BOARD REPLACEMENT

CAUTION: A TECHNICIAN HANDLING ELECTRONIC ASSEMBLIES AND COMPONENTS SHOULD WEAR A CONDUCTIVE WRIST STRAP WITH A GROUND WIRE CONNECTED EITHER TO EARTH OR CHASSIS (VEHICLE) GROUND.

CAUTION: NEVER TOUCH OR HANDLE THE PC BOARD BY ITS TRACES, CONNECTOR TEETH, OR COMPONENTS.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-06

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/8

Subsystem/Assy:

APS-LVPS

Unit:

APS-LVPS CONTROL

Component:

BOARD

Man Hours:

1.0

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE:****INSTALLATION**

To perform the Task proceed as follows: (Refer to Figures 1 through 5):

NOTE: It is assumed that the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.

1. Check the (removed) Board / Module receptacle for signs of overheating.
2. Slide the " new " Board / Module into its guide, assure proper alignment to the receptacle and push firmly to seat the Board into the receptacle.
3. Secure the Board / Module by tightening the relevant fixing Screws.
4. Reconnect the Board / Module Connectors.
5. Restore Electrical Power to APS / LVPS Control Unit by switching ON the 3F01 (Battery Box Front)
6. Check on the "new " installed Board / Module that the relevant Operating Leds are GREEN, indicating that the Board is working properly.
7. Check on the Control Unit that all the Operating Leds are GREEN, indicating that it works properly.

FINAL OPERATIONS

1. Clean the APS / LVPS Front Panel O-ring Seat using recommended agent and lint-free rags.
2. Position the "new" Front Panel O-ring on its Seat.
3. Position the Front Panel on its Seat using suitable Support Device.
4. Install the Front Panel Fixing Screws. Torque to **5 ft lb**.
5. Reconnect the Front Panel Grounding Cable. Torque to **4 ft lb**.
6. Restore Electrical Power to APS / LVPS Assy" by switching ON the 3F03 (LV Locker B Section).
7. Close and lock the LV Locker B Door and the Battery Box Front Cover.
8. Restore Electrical Power to Vehicle.
9. Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-07

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/10

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

DIODE

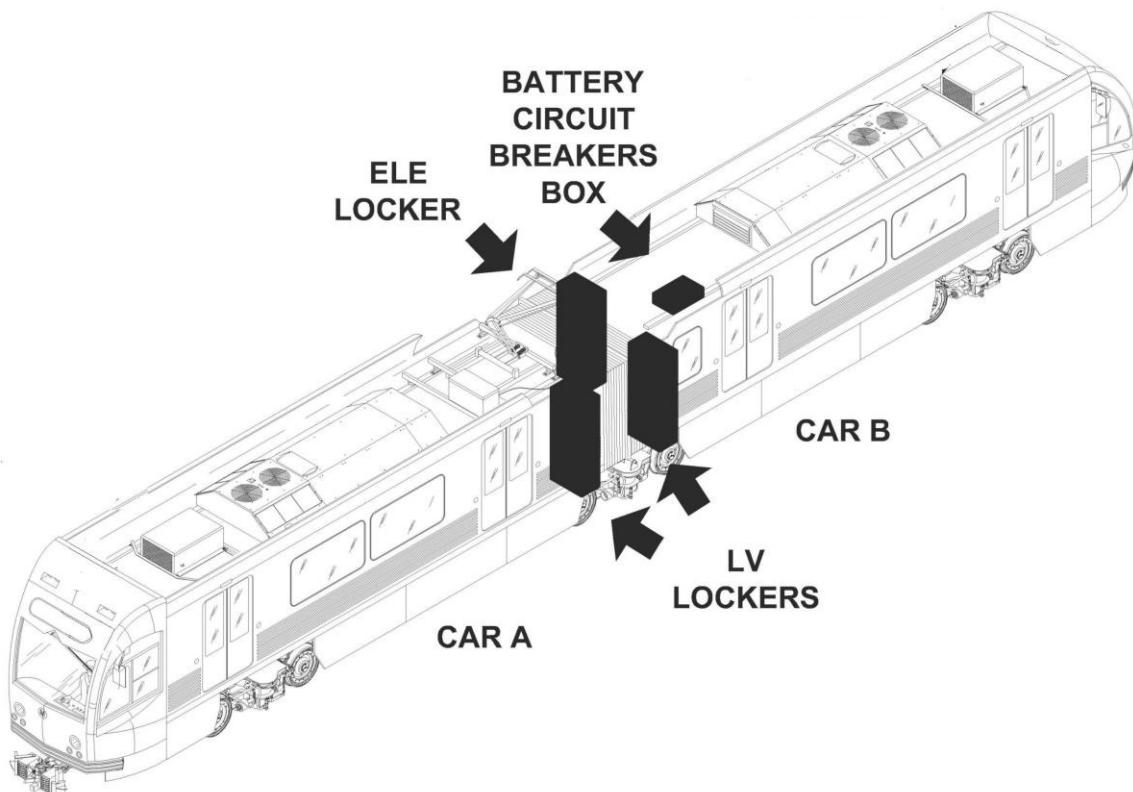
Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)

LOCATION



P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-07

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/10

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

DIODE

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE:****APPLICABILITY**

This Replacement procedure is applicable to the following Equipment:

TABLE 1 DIODE IDENTIFICATION & LOCATION

LABEL	POSITION	LOCATION	CAR	PROTECTION CB	FUNCTIONAL DIAGRAMS	
					SCHEMATICS	SHEET#
3V02 & 3V03	BATTERY CIRCUIT BREAKER BOX	BATTERY BOX	“B”	3F01	LV	21
3V05 & 3V06	DATA DOWNLOAD PANEL	ELE LOCKER	“B”	3F11	LV	25
3V01	DIODE PANEL	LV LOCKER	“A” - “B”	3F17	LV	21
3V04	DIODE PANEL		“A”	3F23	LV	26
3V07 through 3V10	DIODE PANEL		“A” - “B”	3F20	LV	32
3V11 through 3V13	DIODE PANEL		“A” - “B”	3F24	LV	43
3V24	DIODE PANEL		“A” - “B”	3F14	LV	18

P2550 CORRECTIVE MAINTENANCE SHEET	
Card Code: R-C-10-00-00-00/R-07	
System: LOW VOLTAGE DISTRIBUTION	Sheet: 2/10
Subsystem/Assy: LV DISTRIBUTION CIRCUITRY	Unit:
Component: DIODE	Man Hours: 0.5
Maintenance Task: REPLACEMENT (TYPICAL)	
SAFETY PRECAUTIONS: LACMTA Maintenance Shop Safety Rules & Regulations	
TOOLS: LACMTA Maintenance Shop Standard Tools Kit	
CONSUMABLES: CRC 2000 Contact Cleaner Dry Compressed Air for Electronic Equipment (commercial).	
SPARE PARTS: Epitaxial Diode P/N 211VV01044B	

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-07

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/10

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

DIODE

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE:****PRELIMINARY OPERATIONS**

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle in the Maintenance Shop.
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-07

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/10

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

DIODE

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE:

To perform the Task proceed as follows:

A) DIODES LOCATED IN THE BATTERY CIRCUIT BREAKER BOX

REMOVAL

1. Switch off the relevant "Diode Circuit" Protection CB as indicated in the previous Table 1.
2. Gain access to the Diodes to be replaced by opening Battery Box Skirt and removing Battery Circuit Breakers Box Side Cover, disengaging the relevant Safety Latches.
3. Locate the Diode to be Replaced.
4. Take note of Wiring Color Codes and relevant positions on Diode Terminals.
5. Disconnect the Wiring from Diode Terminals by loosening and removing the relevant Screws on the Diode Terminals. Retain them for later use.
6. Loosen and remove the Diode Locking Screws & Washers. Retain them for later use.
7. Remove the Diode and discard it.

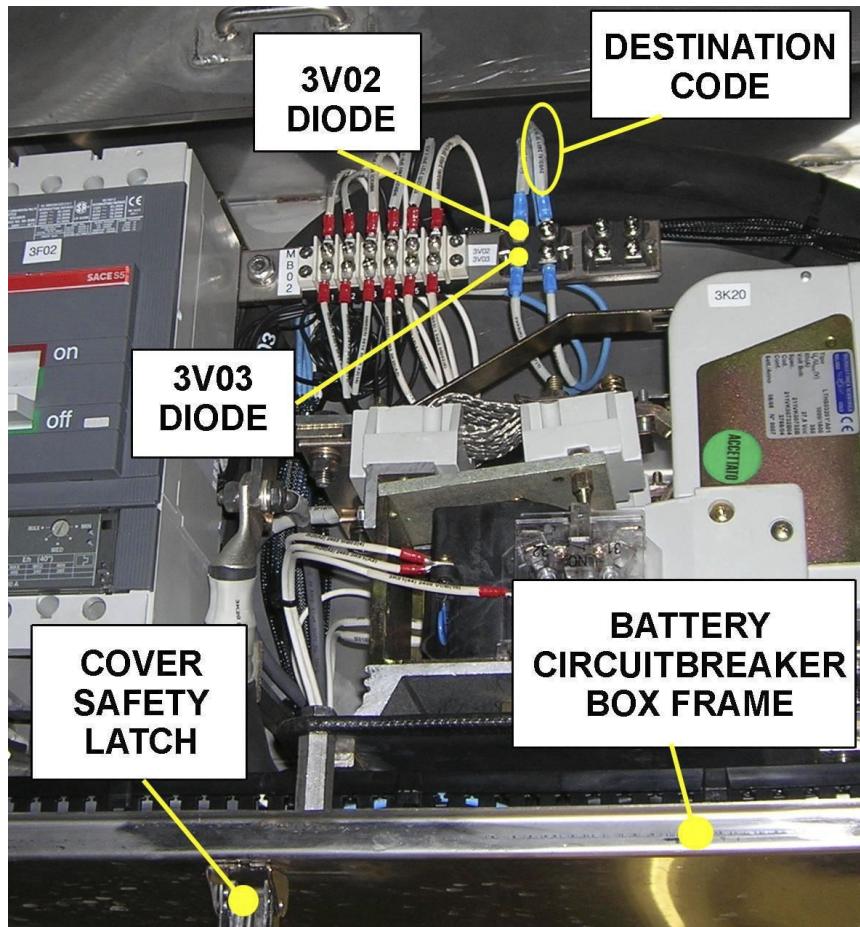


FIG 1
BATTERY CIRCUIT BREAKERS BOX DIODES REMOVAL

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-07

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/10

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

DIODE

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE (CONT'D)**

A) DIODES LOCATED IN THE BATTERY CIRCUIT BREAKER BOX (cont'd)

INSTALLATION

To perform the Task proceed as follows:

1. Clean the Diode Seat using recommended Cleaner / Agent and lint-free rags.
2. Check Wires and Wire Terminals for signs of overheating.
3. Install the "new" Diode in position.
4. Install Diode Locking Screws & Washers. Torque to **13 ft-*lb**.
5. Connect the Wiring to the Diode Terminals according to their position and Colour Codes previously noted Torque to **13 ft-*lb**.

Refer to the Functional Schematic Sheet listed in the previous Table 1 for complete Wiring Details.

6. Leave the Task area installing the Battery Circuit Breakers Box Side Cover, engaging the relevant Safety Latches and closing & locking the Battery Box Skirt.
7. Switch on the "Diode Circuit" Protection CB as indicated in the previous Table 1.
8. Restore Electrical Power to Vehicle.
9. Record Task results on the Defect Report Card for administrative and maintenance Planning.

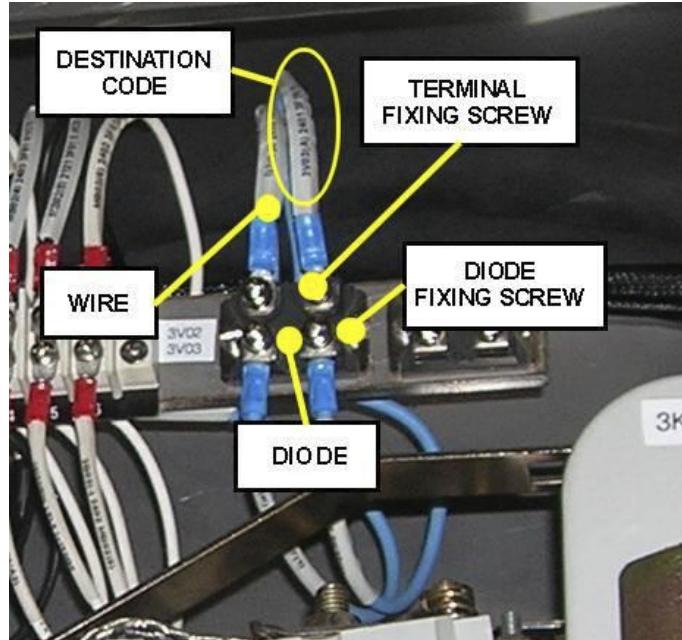


FIG 2
BATTERY CIRCUIT BREAKERS BOX
DIODES INSTALLATION

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS**(para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-07

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

7/10

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

DIODE

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE(CONT'D)

B) DIODES LOCATED IN THE " B " ELE LOCKER -DATA DOWNLOAD PANEL REMOVAL

1. Switch off the relevant " Diode Circuit" Protection CB as indicated in the previous Table 1.
2. Enter the " B " ELE Locker using the Maintenance Key.
3. Locate the Data Download Panel and remove it by loosening and removing the relevant Fixing Screws. Retain them for later use.
4. Locate the Diode to be replaced.
5. Take note of Wiring Color Codes and relevant positions on Diode Terminals.
6. Disconnect the Wiring from Diode Terminals by loosening and removing the relevant Screws on 4 Diode Terminals. Retain them for later use.
7. Loose and remove the Diode Locking Screws & Washers. Retain them for later use.
8. Remove the Diode and discard it.

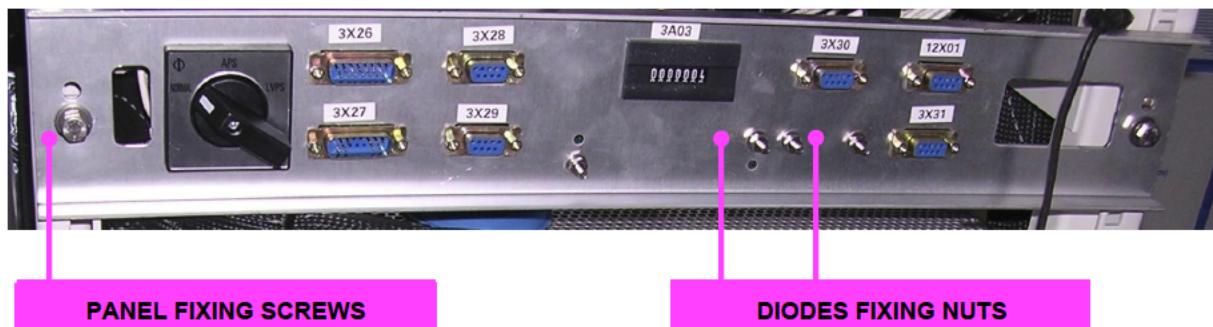


FIG 3 " B " ELE LOCKER DATA DOWN LOAD PANEL DIODES REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-07

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/10

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

DIODE

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE(CONT'D)**

B) DIODES LOCATED IN THE " B " ELE LOCKER -DATA DOWNLOAD PANEL (cont'd)

INSTALLATION

To perform the Task proceed as follows:

1. Clean the Diode Seat using recommended Cleaner / Agent and lint-free rags.
2. Check Wires and Wire Terminals for signs of overheating.
3. Install the "new" Diode in position.
4. Install Diode Locking Screws & Washers. Torque to **13 ft-*lb**.
5. Connect the Wiring to the Diode Terminals according to their position and Colour Codes previously noted Torque to **13 ft-*lb**.
Refer to the Functional Schematic Sheet listed in the previous Table 1 for complete Wiring Details.
6. Position the Data Download Panel onto the Rack and fix it by installing the relevant Fixing Hardware. Torque to **6.2 ft lb**.
7. Swicth on the " Diode Circuit " Protection CB as indicated in the previous Table 1.
8. Close and lock the ELE Locker Door using the Maintenance Key.
9. Restore Electrical Power to Vehicle.
10. Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS**(para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-07

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

9/10

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

DIODE

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE:****C) DIODES LOCATED IN THE LV LOCKER -DIODE SECTION****REMOVAL**

1. Switch off the relevant " Diode Circuit" Protection CB as indicated in the previous Table 1.
2. Gain access to the Diodes Section on the side of the Rack installed in the "A" & "B" LV Lockers, by opening the relevant LV Locker Door using the Maintenance Key.
3. Locate the Diode to be replaced.

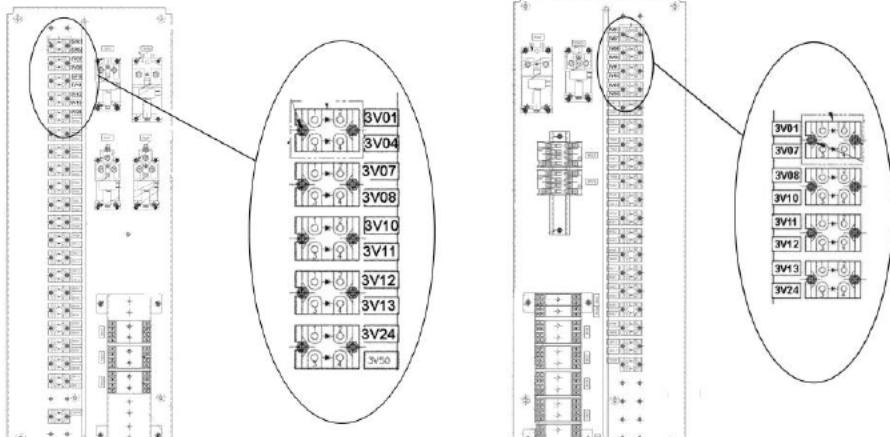
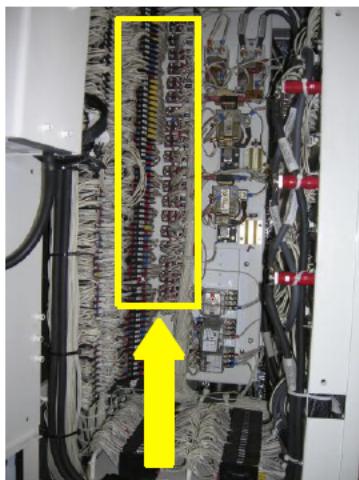


FIG 4 LV LOCKER DIODES SECTION LAYOUT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-00-00-00/R-07

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

10/10

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

Component:

DIODE

Man Hours:

0.5

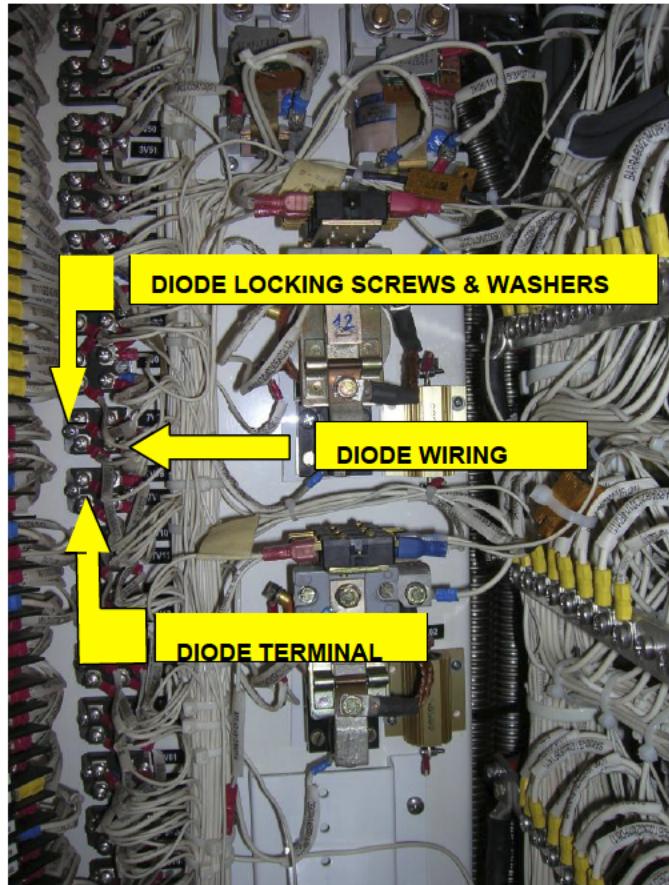
Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE(CONT'D)****REMOVAL(cont'd)**

4. Take note of Wiring Color Codes and relevant positions on Diode Terminals.
5. Disconnect the Wiring from Diode Terminals by loosening and removing the relevant Screws on the Diode Terminals. Retain them for later use.
6. Loose and remove the Diode Locking Screws & Washers. Retain them for later use.
7. Remove the Diode and discard it.

INSTALLATION

1. Install the Diode in position.
2. Install Diode Locking Screws & Washers. Torque to 13 ft lb.
3. Connect the Wiring to the Diode Terminals according to their position and Color Codes previously noted. Torque to 13 ft lb.
4. Leave the LV Locker and close the LV locker Door using the Maintenance Key.
5. Restore Electrical Power.
6. Record Task results on the Defect Report Card for administrative and maintenance planning.

**FIGURE 5 DIODE REPLACEMENT**

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "At every Task Completion."

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/10

Subsystem/Assy:

APS-LVPS

Unit:

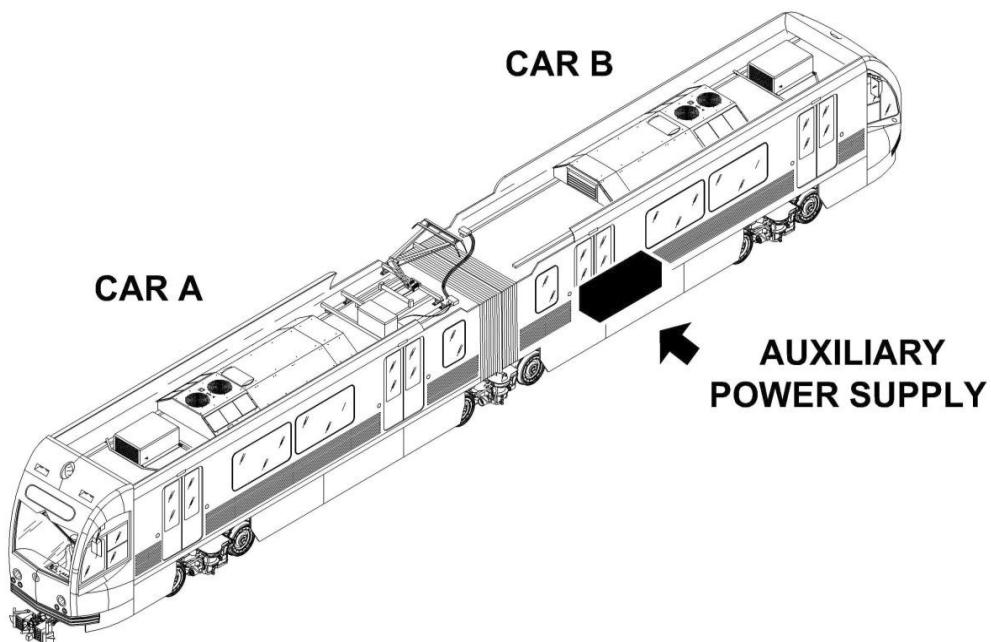
INVERTER (APS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT
LOCATION:


P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/10

Subsystem/Assy:

APS-LVPS

Unit:

INVERTER (APS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT**SAFETY PRECAUTIONS:**

WARNING: BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.

WARNING: ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.

WARNING: BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.

WARNING: HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS.
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.

WARNING: WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.

WARNING: HEAVY OBJECT - THE INVERTER (APS) MODULE WEIGHS 77 LB. SUPPORT INVERTER (APS) MODULE WITH SUITABLE LIFTING DEVICE. FAILURE TO COMPLY CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

CAUTION: DURING MODULE SHIFTING, PAY ATTENTION TO NOT DAMAGE THE HEAT SINK.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit
Module Support Hydraulic Device

CONSUMABLES:

Cleaner / Degreaser

SPARE PARTS:

Inverter Module P/N 231EE10574B O-ring, Front Panel P/N: 211EX21730B03

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

3/10

Subsystem/Assy:

APS-LVPS

Unit:

INVERTER (APS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/10

Subsystem/Assy:

APS-LVPS

Unit:

INVERTER (APS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE:

To perform the Task proceed as follows (Refer to Figures 1 through 6):

REMOVAL

- 1) Remove the Electrical Power from the Equipment by switching off respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)



FIG 1 3F01 CB LOCATION

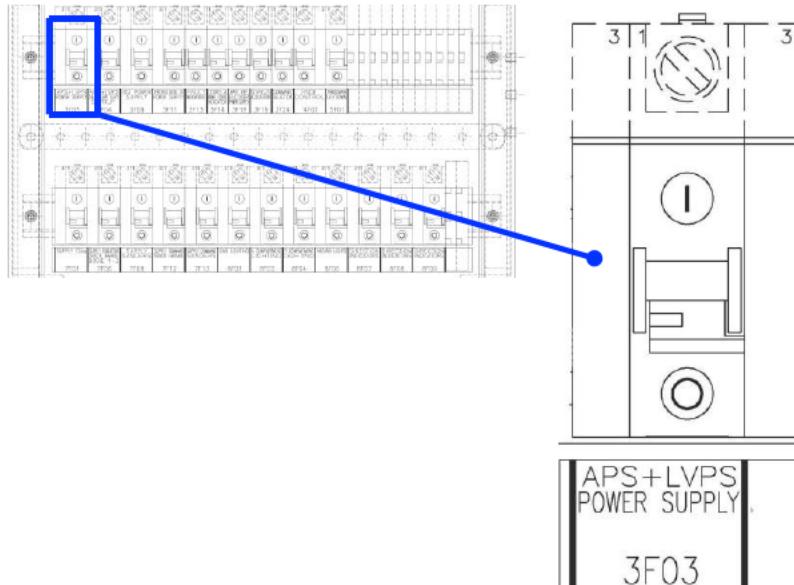


FIG 2 LV LOCKER B 3F03 CB LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/10

Subsystem/Assy:

APS-LVPS

Unit:

INVERTER (APS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd)

NOTE: It is advisable to retain the removed attaching Hardware for later use.

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to Sheet R-C -02-05-00-00 / R-00 2.

- 2) Gain access to Inverter (APS).
Module by removing the relevant APS /LVPS Front Panel as follows:
- 3) Disconnect the Front Panel Grounding Cable.
 - a) Loose the Front Panel Fixing Screws.
 - b) Supporting the Front Panel with suitable Device, remove the Front Panel Fixing Screws.
 - c) Remove the Front Panel and discard the relevant O-ring.

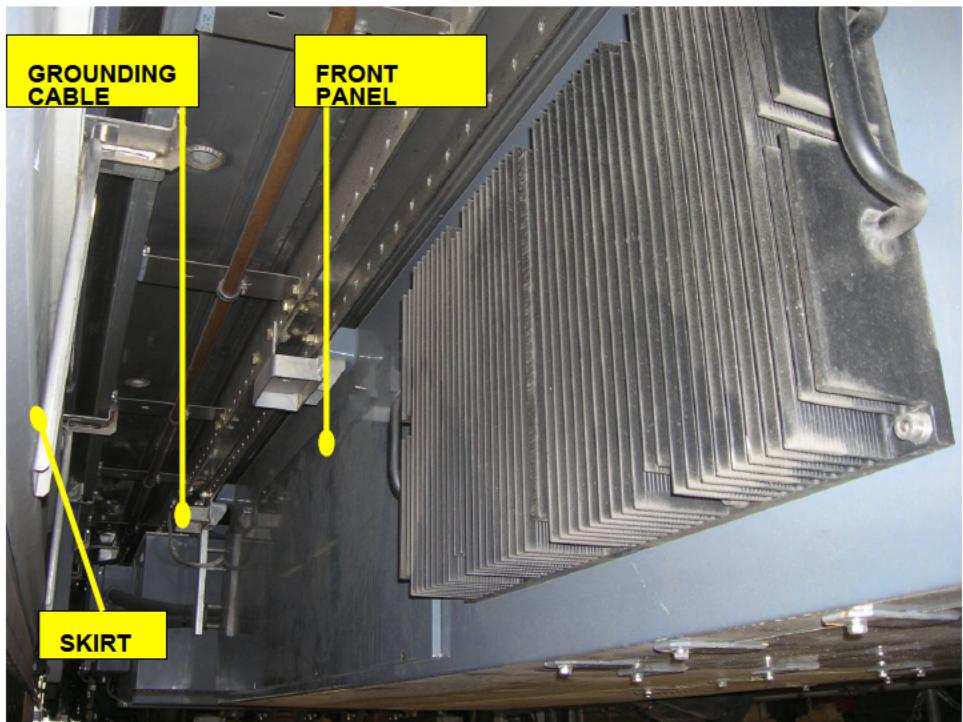


FIG 3 APS / LVPS LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/10

Subsystem/Assy:

APS-LVPS

Unit:

INVERTER (APS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL(cont'd)**

- 4) Locate the Inverter (APS) Module to be replaced

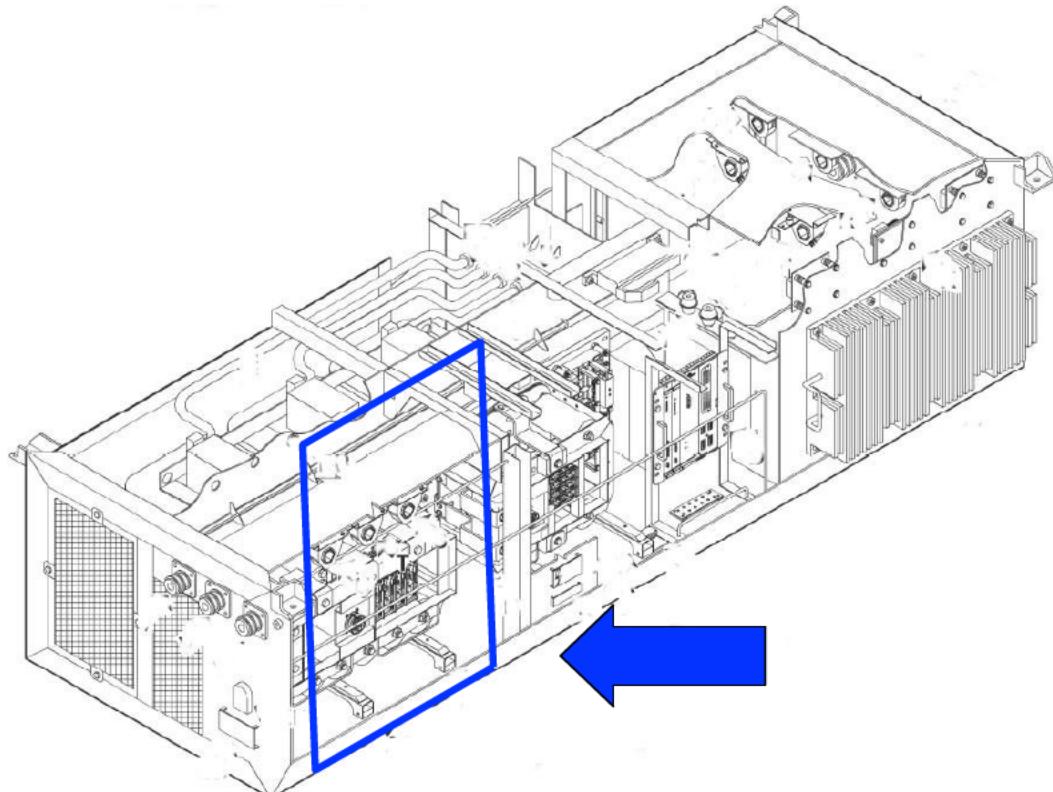


FIG 4 APS / LVPS INVERTER (APS)MODULE LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

7/10

Subsystem/Assy:

APS-LVPS

Unit:

INVERTER (APS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd)

- 5) Disconnect the Electrical Connections (Inputs & Outputs)
- 6) Disconnect the LV Connector

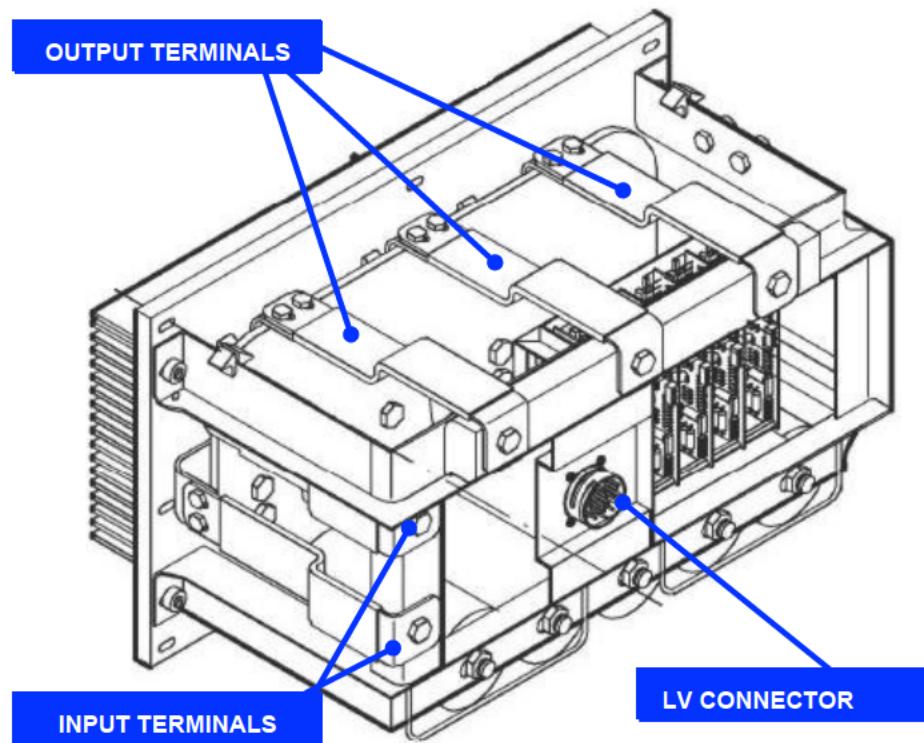


FIG 5 INVERTER (APS)MODULE ELECTRICAL CONNECTIONS

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/10

Subsystem/Assy:

APS-LVPS

Unit:

INVERTER (APS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL(cont'd)**

- 7)** Remove the Inverter (APS) Module Fixing Screws and Washers.

NOTE:

Now the Inverter (APS) Module is free to be shifted on the Sliding Strips.

- 8)** Shift carefully the Module with a first movement to disengage its Heat Sink from the Cooling Duct located in the rear side of the Module.

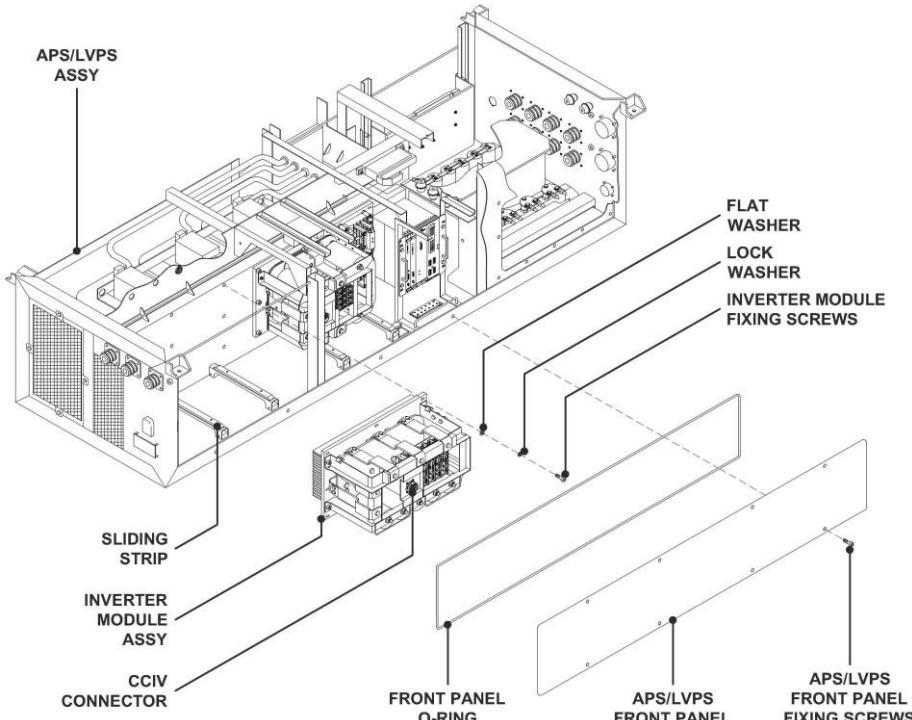


FIG 6 INVERTER (APS)MODULE REPLACEMENT

CAUTION: DURING MODULE SHIFTING PAY ATTENTION TO NOT DAMAGE THE HEAT SINK

- 9)** Once the Module is disengaged, support it with suitable Hydraulic Device first and then complete the removal by shifting it along the Sliding Strips.
- 10)** Remove and discard the Cooling Duct Gasket.
- 11)** Make available the Module for Repair.

WARNING: HEAVY OBJECT - THE INVERTER (APS) MODULE WEIGHS 77 LB.

SUPPORT INVERTER MODULE WITH SUITABLE SUPPORT DEVICE.

FAILURE TO COMPLY CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-01-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
9/10

Subsystem/Assy:

Unit:

APS-LVPS
INVERTER (APS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

INSTALLATION

To perform the task proceed as follows (Refer to Figures 1 through 6):

NOTE: It is assumed that:

1. the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.
2. the Inverter (APS) Module to be installed is placed on a suitable Hydraulic Device and is ready for on vehicle installation.

1. On Auxiliary Inverter:

- a) Clean the Inverter (APS) Module Compartment using recommended agent and cleaning rags.
- b) Install a "new" Cooling Duct Gasket.
- c) Check Electrical Connections Terminals and LV Connector for damage / signs of overheating. Replace as per check results.

2. Carefully raise the "new" Inverter (APS) Module using Support Hydraulic Device.

3. Stop the raising when the Inverter Module Brackets are about 1/3 inch higher than the Frame Sliding Strips in order to allow the Inverter Module a secure sliding into its position.

4. Carefully slide the Module and, at the same time, lower it in order to engage the Module Heat Sink with the Cooling Duct.

CAUTION: DURING MODULE SHIFTING PAY ATTENTION TO NOT DAMAGE THE HEAT SINK.

5. Lower the Module to allow the Frame Sliding Strips to completely support it.

NOTE: Now the Inverter (APS) Module is still free but it remain in position because it is supported by the Frame Sliding Strips.

6. Install the Inverter (APS) Module Fixing Hardware, Torque to **6.2 ft-lb**.

7. Remove Support Hydraulic Device.

8. Reconnect the Electrical Connections. Torque to **15.2 ft-lb**.

9. Reconnect the Low Voltage Connector.

10. Restore the Electrical Power to the Vehicle.

11. Restore the Electrical Power to the Equipment by switching on respectively:

- The 3F01 Battery CB (Battery Box -Front)
- The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

10/10

Subsystem/Assy:

APS-LVPS

Unit:

INVERTER (APS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****INSTALLATION(cont'd)**

**WARNING: ONCE RESTORED THE POWER, ELECTRICAL HAZARD IS PRESENT
THROUGHOUT THE AUXILIARY SYSTEM AND CAUTION MUST BE TAKEN
WHILE WORKING ON OR NEAR THE EQUIPMENT.
FAILURE TO COMPLY CAN CAUSE SERIOUS PERSONAL INJURY OR
DEATH.**

12. Check on the Control Unit that all the Operating Leds are GREEN, indicating that Equipment works Properly.
13. Once completed the previous Check remove Power from Vehicle and from the Equipment by switching off the relevant CBs and safely proceed with the Final Operations.

FINAL OPERATIONS

1. Clean the APS / LVPS Front Panel O-ring Seat using recommended agent and lint-free rags.
2. Position the "new" Front Panel O-ring on its Seat.
3. Position the Front Panel on its Seat using suitable Support Device.
4. Install the Front Panel Fixing Screws. Torque to **5 ft lb**.
5. Reconnect the Front Panel Grounding Cable. Torque to **4 ft lb**.
6. Restore the Electrical Power to the Equipment by switching on respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)
7. Restore the Electrical Power to the Vehicle.
8. Close and lock the LV Locker B Door and the Battery Box Front Cover.
9. Record task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.
 Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-02-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
1/10

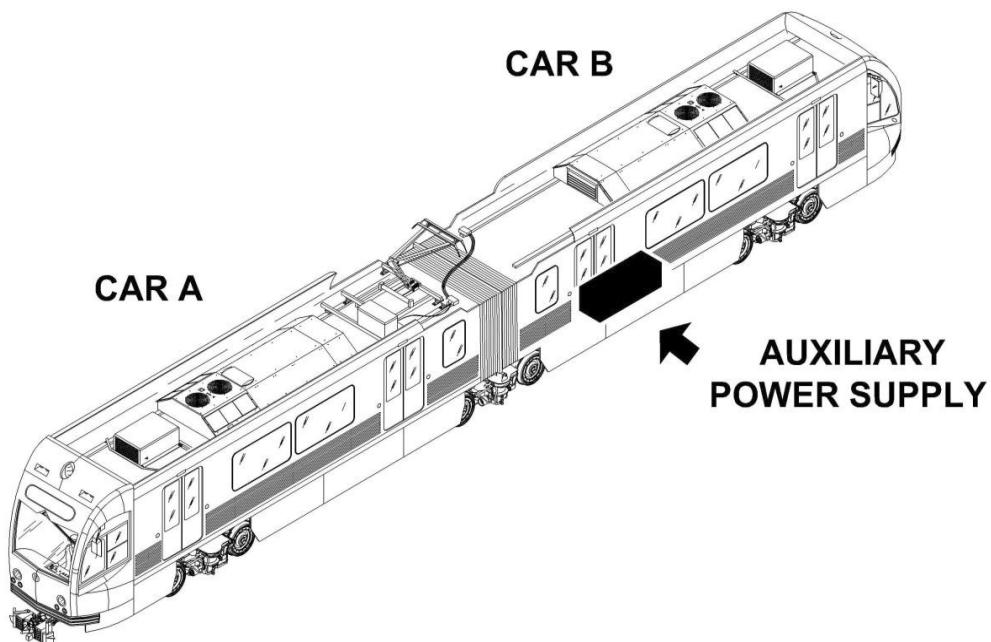
Subsystem/Assy:

 Unit:
CB (LVPS) MODULE

Component:

 Man Hours:
1.5

Maintenance Task:

REPLACEMENT
LOCATION:


P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-02-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/10

Subsystem/Assy:

APS-LVPS

Unit:

CB (LVPS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT**SAFETY PRECAUTIONS:**

WARNING: BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.

WARNING: ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.

WARNING: BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.

WARNING: HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.

WARNING: WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.

WARNING: HEAVY OBJECT - THE CB (LVPS) MODULE WEIGHS 77 LB. SUPPORT CB (LVPS) MODULE WITH SUITABLE DEVICE. FAILURE TO COMPLY SO CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

CAUTION: DURING MODULE SHIFTING, PAY ATTENTION TO NOT DAMAGE THE HEAT SINK.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit
Module Support Hydraulic Device

CONSUMABLES:

Cleaner / Degreaser

SPARE PARTS:

CB (LVPS) Module P/N 231EE10575B

O-ring, Front Panel

P/N: 211EX21730B03

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-02-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
3/10

Subsystem/Assy:

 Unit:
CB (LVPS) MODULE

Component:

 Man Hours:
1.5

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-02-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/10

Subsystem/Assy:

APS-LVPS

Unit:

CB (LVPS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT**PROCEDURE:**

To perform the Task proceed as follows (Refer to Figures 1 through 6):

REMOVAL

- 1) Remove the Electrical Power from the Equipment by switching off respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)



FIG 1 3F01 CB LOCATION

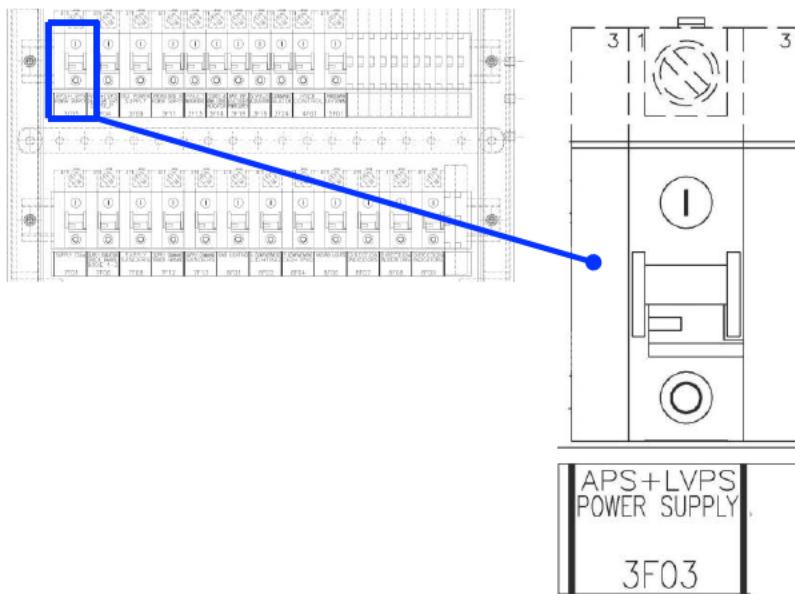


FIG 2 LV LOCKER B 3F03 CB LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-02-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/10

Subsystem/Assy:

APS-LVPS

Unit:

CB (LVPS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

NOTE: It is advisable to retain the removed attaching Hardware for later use

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to
Sheet R-C -02-05-00-00 / R-00 2

- 2) Gain access to CB (LVPS) Module by removing the relevant APS /LVPS Front Panel as follows:
 - a) Disconnect the Front Panel Grounding Cable.
 - b) Loose the Front Panel Fixing Screws.
 - c) Supporting the Front Panel with suitable Device, remove the Front Panel Fixing Screws.
 - d) Remove the Front Panel and discard the relevant O-ring.

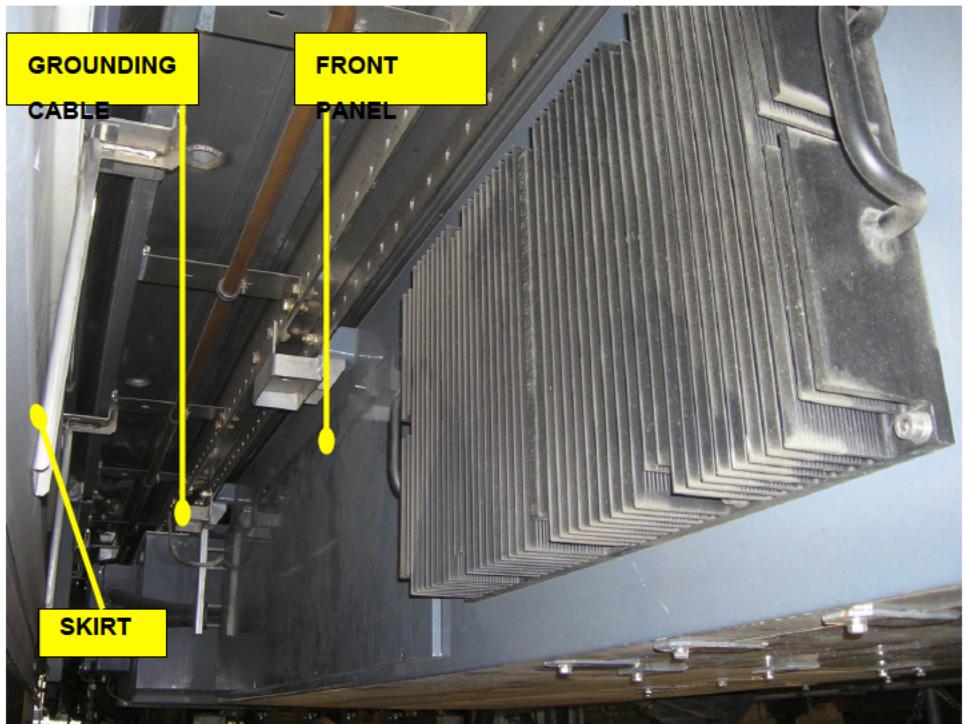


FIG 3 APS / LVPS LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-02-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/10

Subsystem/Assy:

APS-LVPS

Unit:

CB (LVPS) MODULE

Component:

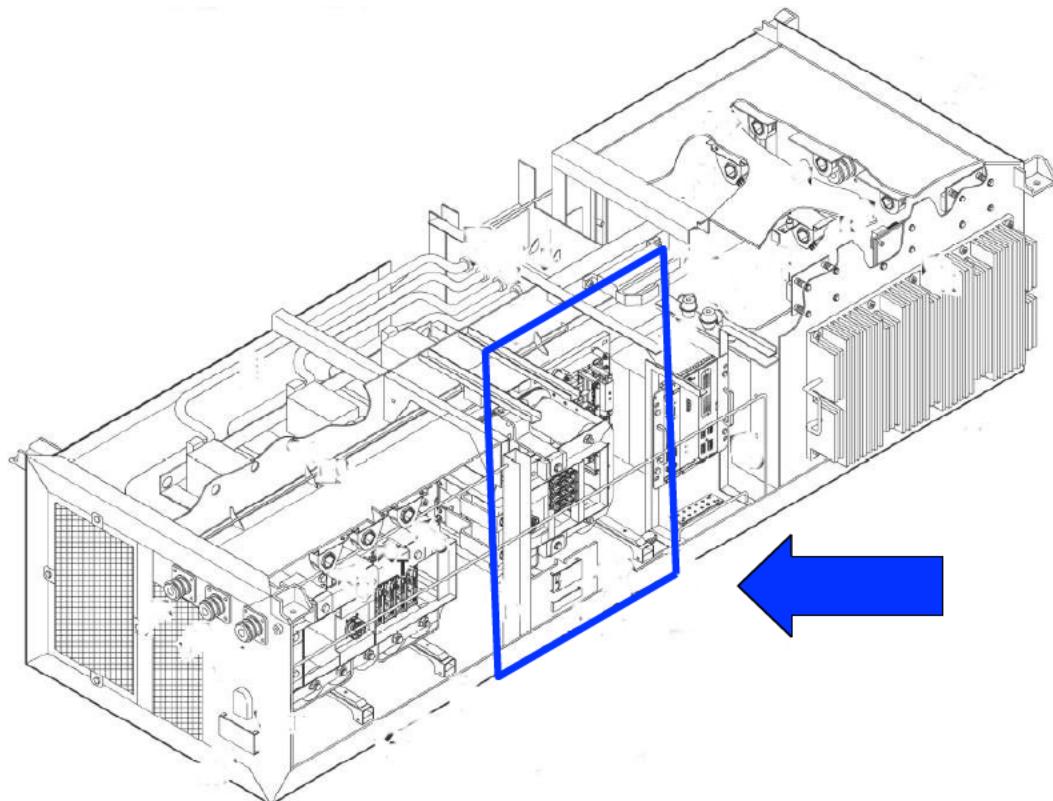
Man Hours:

1.5

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL(cont'd)**

- 3) Locate the CB (LVPS) Module to be replaced

**FIG 4 APS / LVPS CB (LVPS) MODULE LOCATION**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-02-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
7/10

Subsystem/Assy:

 Unit:
CB (LVPS) MODULE

Component:

 Man Hours:
1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd)

- 4) Disconnect the Electrical Connections (Inputs & Outputs)

- 5) Disconnect the LV Connector

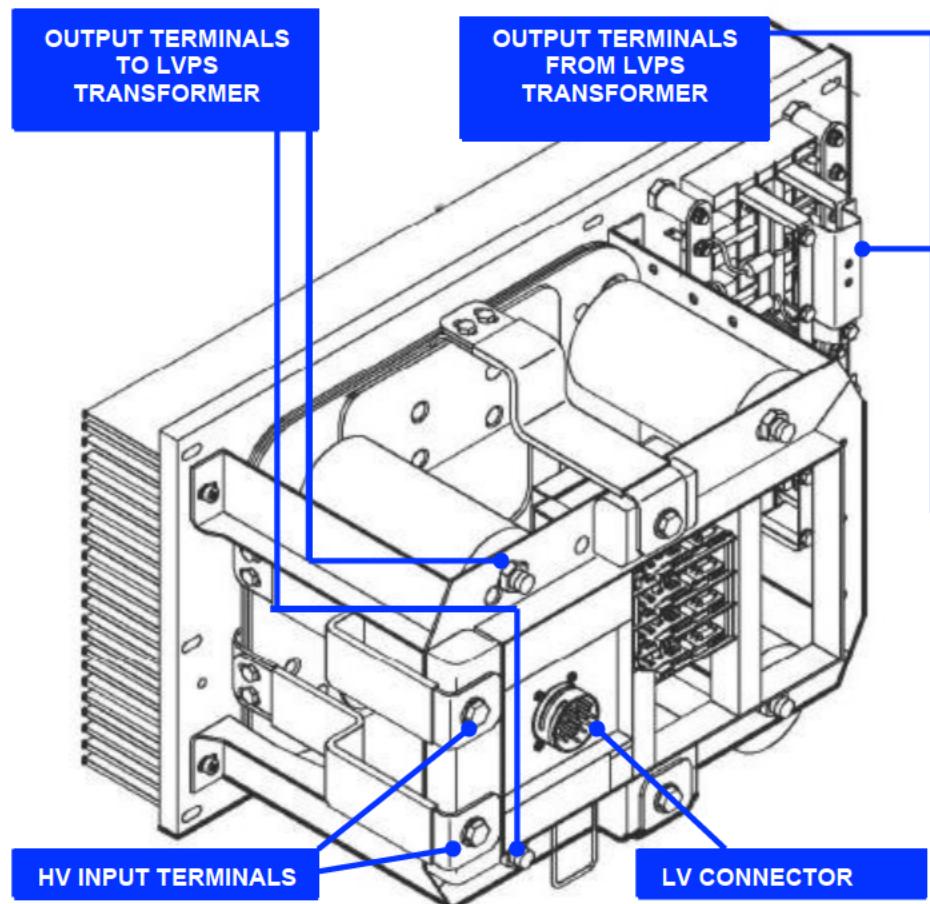


FIG 5 CB (LVPS)MODULE ELECTRICAL CONNECTIONS

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-02-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/10

Subsystem/Assy:

APS-LVPS

Unit:

CB (LVPS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL (cont'd)**

- 6)** Remove the CB(LVPS) Module Fixing Screws and Washers.

NOTE:

Now the CB(LVPS) Module is free to be shifted on the Sliding Strips.

- 7)** Shift carefully the Module with a first movement to disengage its Heat Sink from the Cooling Duct located in the rear side of the Module.

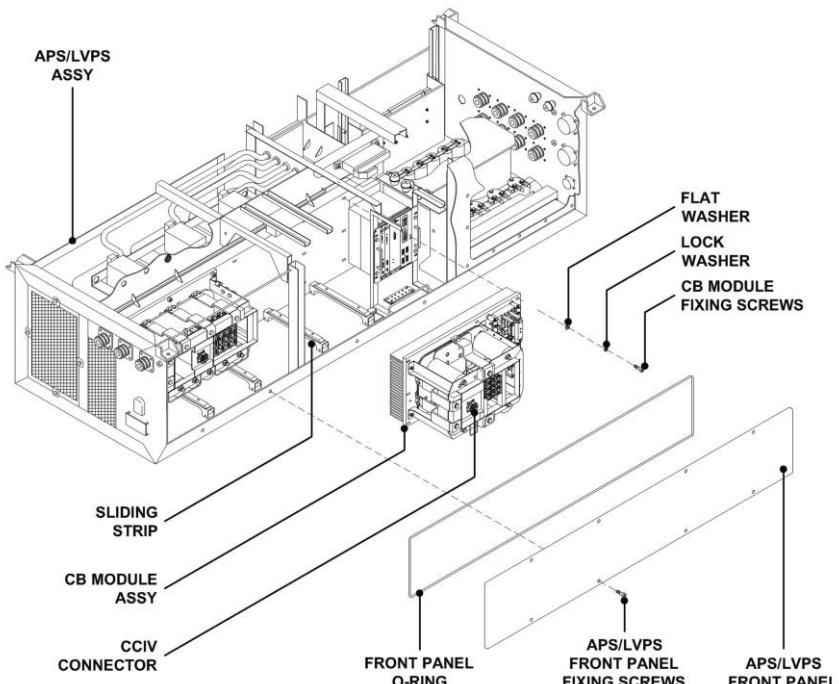


FIG 6 CB (LVPS)MODULE REPLACEMENT

CAUTION: DURING MODULE SHIFTING PAY ATTENTION TO NOT DAMAGE THE HEAT SINK

- 8)** Once the Module is disengaged, support it with suitable Hydraulic Device first and then complete the removal by shifting it along the Sliding Strips.
- 9)** Remove and discard the Cooling Duct Gasket.
- 10)** Make available the Module for Repair.

WARNING:HEAVY OBJECT - THE CB (LVPS) MODULE WEIGHS 77 LB.

SUPPORT INVERTER MODULE WITH SUITABLE DEVICE.

FAILURE TO COMPLY SO CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-02-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
9/10

Subsystem/Assy:

 Unit:
CB (LVPS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

INSTALLATION

To perform the task proceed as follows (Refer to Figures 1 through 6):

NOTE: It is assumed that:

1. The Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.
2. The CB(LVPS) Module to be installed is placed on a suitable Hydraulic Device and is ready for on-vehicle installation.

1. On Auxiliary Inverter:

- a) Clean the CB (LVPS) Module Compartment using recommended agent and cleaning rags.
- b) Install a "new" Cooling Duct Gasket.
- c) Check Electrical Connections Terminals and LV Connector for damage / signs of overheating. Replace as per check results.

2. Carefully raise the "new" CB (LVPS) Module using Support Hydraulic Device.

3. Stop the raising when the CB (LVPS) Module Brackets are about 1/3 inch higher than the Frame Sliding Strips in order to allow the CB Module a secure sliding into its position.

4. Carefully slide the Module and, at the same time, lower it in order to engage the Module Heat Sink with the Cooling Duct.

CAUTION: DURING MODULE SHIFTING PAY ATTENTION TO NOT DAMAGE THE HEAT SINK.

5. Lower the CB (LVPS) Module to allow the Frame Sliding Strips to completely support it.

NOTE: Now the CB Module is still free but it remain in position because it is supported by the Frame Sliding Strips.

6. Install the CB Module Fixing Hardware, Torque to **6.2 ft-lb**.

7. Remove Support Hydraulic Device.

8. Reconnect the Electrical Connections. Torque to **15.2 ft-lb**.

9. Reconnect the Low Voltage Connector.

10. Restore the Electrical Power to the Vehicle.

11. Restore the Electrical Power to the Equipment by switching on respectively:

- The 3F01 Battery CB (Battery Box -Front)
- The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-02-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

10/10

Subsystem/Assy:

APS-LVPS

Unit:

CB (LVPS) MODULE

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****INSTALLATION(cont'd)**

**WARNING: ONCE RESTORED THE POWER, ELECTRICAL HAZARD IS PRESENT
THROUGHOUT THE AUXILIARY SYSTEM AND CAUTION MUST BE TAKEN WHILE
WORKING ON OR NEAR THE EQUIPMENT.FAILURE TO COMPLY CAN CAUSE
SERIOUS PERSONAL INJURY OR DEATH.**

12. Check on the Control Unit that all the Operating Leds are GREEN, indicating that the Equipment works properly.
13. Once completed the previous Check remove Power from Vehicle and from the Equipment by switching off the relevant CBs and safely proceed with the Final Operations.

FINAL OPERATIONS

1. Clean the APS / LVPS Front Panel O-ring Seat using recommended agent and lint-free rags.
2. Position the "new" Front Panel O-ring on its Seat.
3. Position the Front Panel on its Seat using suitable Support Device.
4. Install the Front Panel Fixing Screws. Torque to **5 ft lb**.
5. Reconnect the Front Panel Grounding Cable. Torque to **4 ft lb**.
6. Restore the Electrical Power to the Equipment by switching on respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)
7. Restore the Electrical Power to the Vehicle.
8. Close and lock the LV Locker B Door and the Battery Box Front Cover.
9. Record task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-07-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/8

Subsystem/Assy:

APS-LVPS

Unit:

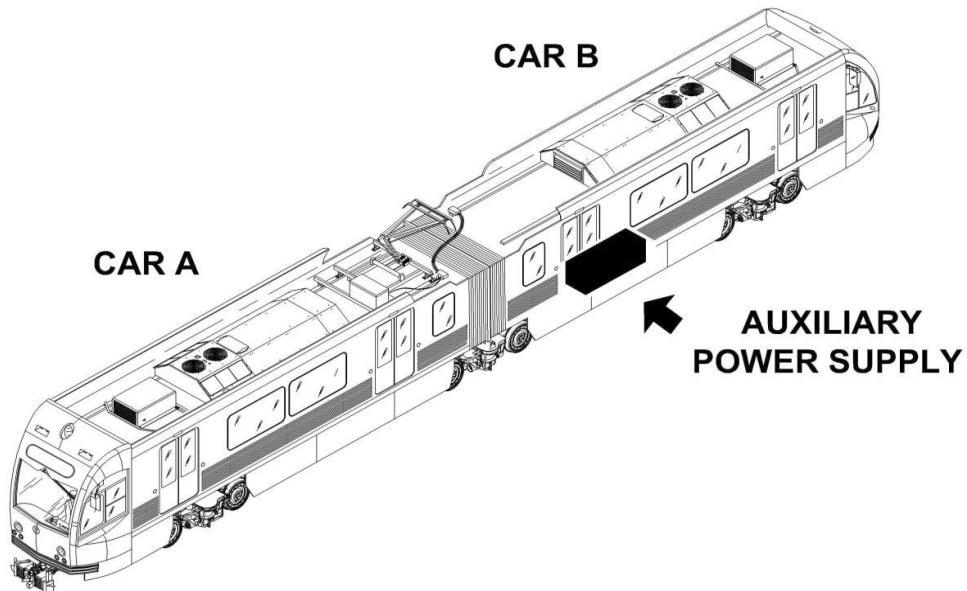
CARD

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT
LOCATION:


APPLICABILITY

This Replacement Procedure is applicable to the following Items:

- SK TV 01 Card
- SK TV 02 Card
- GOB Card

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-07-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

APS-LVPS

Unit:

CARD

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

SAFETY PRECAUTIONS:

WARNING: BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.

WARNING: ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.

WARNING: BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.

WARNING: HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS.
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.

WARNING: WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC 2000 Contact Cleaner

SPARE PARTS:

TV-01 Card P/N 231EE40295B

TV-02 Card P/N 231EE40296B

GOB Card P/N 231EE40331B

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-07-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

3/8

Subsystem/Assy:

APS-LVPS

Unit:

CARD

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-07-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

APS-LVPS

Unit:

CARD

Component:

Man Hours:

1.5

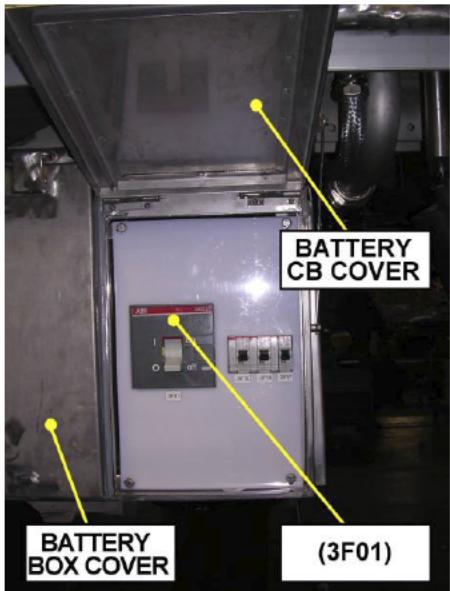
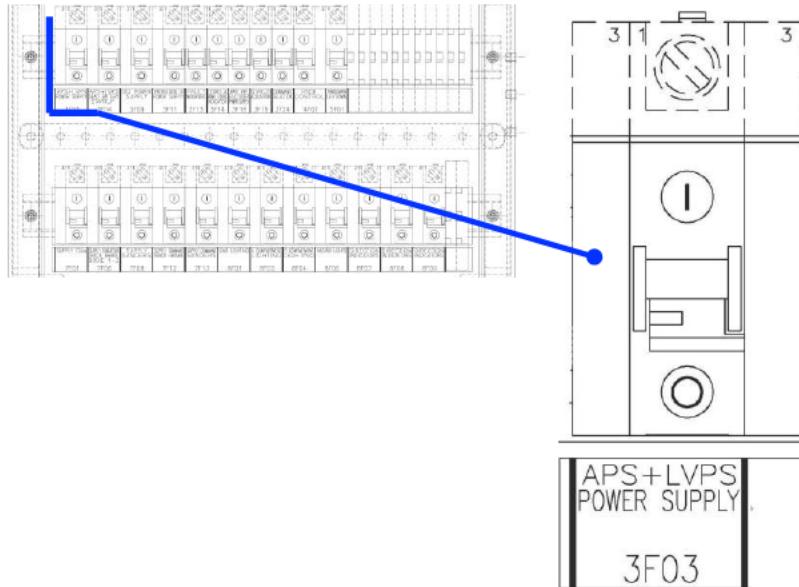
Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL**

To perform the Task proceed as follows (Refer to Figures 1through 4):

- 1)** Remove the Electrical Power from the Equipment by switching off respectively:

- The 3F01 Battery CB (Battery Box -Front)
- The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)

**FIG 1 3F01 CB LOCATION****FIG 2 LV LOCKER B 3F03 CB LOCATION**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-07-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/8

Subsystem/Assy:

APS-LVPS

Unit:

CARD

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT
PROCEDURE (CONT'D):
REMOVAL (cont'd):

- 2) Remove the Active Clamp Module according to Sheet R-C -10-01-22-00 / R-00.

- 3) Locate the Card to be Replaced.

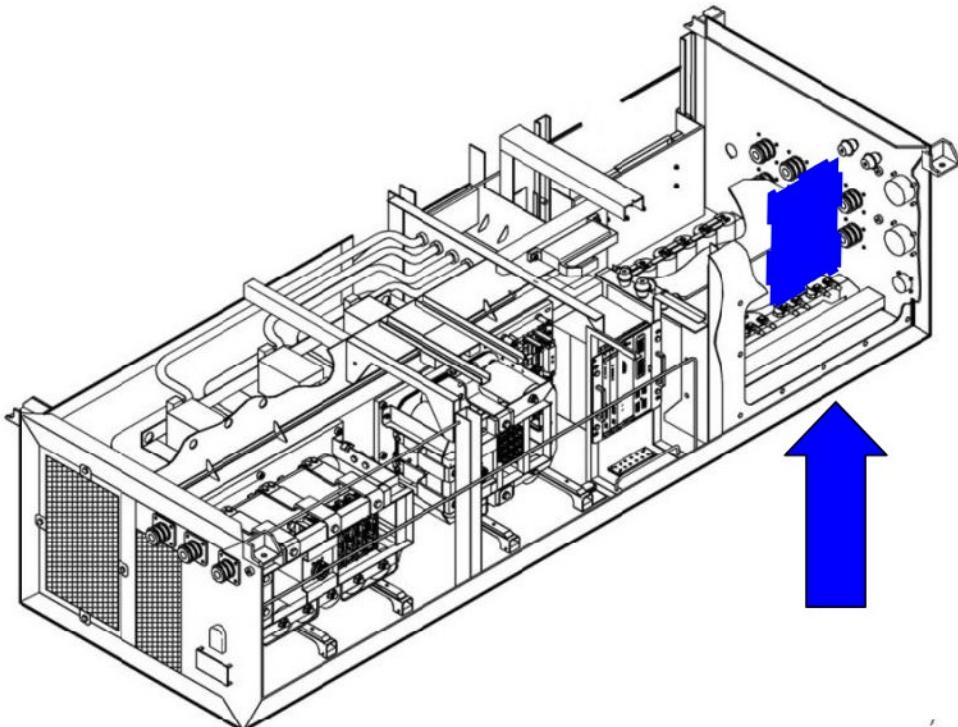


FIG 3 APS / LVPS SK TV & GOB CARDS LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-07-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

APS-LVPS

Unit:

CARD

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd)

- 4) Disconnect the Card Electrical Connections.
- 5) Supporting the Card, loose and remove the Card Assy Fixing Hardware.
- 6) Remove and discard the Card.

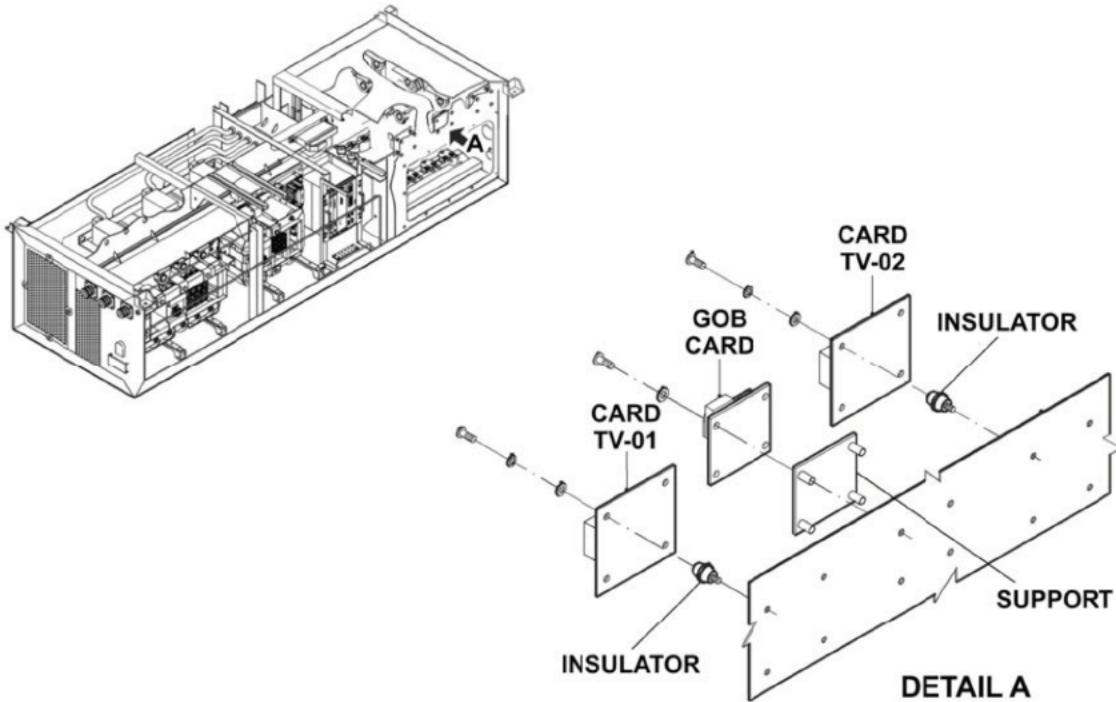


FIGURE 4 -SK TV & GOB CARD - REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-07-00/R-00

System: LOW VOLTAGE DISTRIBUTION	Sheet: 7/8
--	----------------------

Subsystem/Assy: APS-LVPS	Unit: CARD
------------------------------------	----------------------

Component:	Man Hours: 1.5
------------	--------------------------

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

INSTALLATION

To perform the Task proceed as follows (Refer to Figures 1through 4):

NOTE: It is assumed that the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.

1. Clean the Card Seat using recommended agent and lint-free rags.
2. Check the Card Electrical Connections and relevant Insulator for damage / signs of overheating.
3. Position the "new" Card onto its Seat.
4. Install the Card Fixing Hardware. Torque to **4ft lb**.
5. Reconnect the Card Electrical Connections. Tighten as needed.
6. Install the Active Clamp Module according to Sheet R-C -10-01-22-00 / R-00.

FINAL OPERATIONS

1. Restore the Electrical Power to the Equipment by switching on respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)
2. Restore the Electrical Power to the Vehicle
3. Close and lock the LV Locker B Door and the Battery Box Front Cover.
4. Record task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-07-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/8

Subsystem/Assy:

APS-LVPS

Unit:

CARD

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):**

**INTENTIONALLY
LEFT BLANK**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-09-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/8

Subsystem/Assy:

APS-LVPS

Unit:

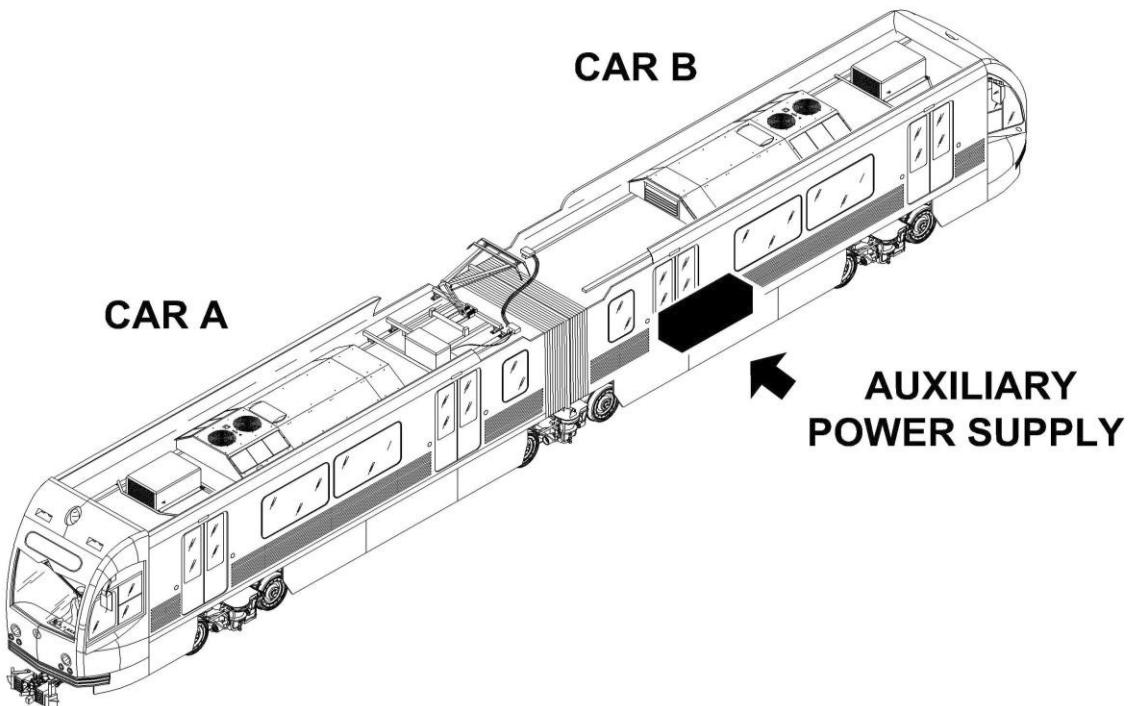
ELECTROLYTIC CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT
LOCATION:

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-09-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

APS-LVPS

Unit:

ELECTROLYTIC CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

SAFETY PRECAUTIONS:

WARNING: BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.

WARNING: ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.

WARNING: BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.

WARNING: HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS.
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.

WARNING: WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC 2000 Contact Cleaner

SPARE PARTS:

Electrolytic Capacitor (15mF 63 VDC)

P/N 211EC22317B

Support

P/N 212EE05136B

Tie-Wrap

P/N 111ES00460B13

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-09-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

3/8

Subsystem/Assy:

APS-LVPS

Unit:

ELECTROLYTIC CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-09-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

APS-LVPS

Unit:

ELECTROLYTIC CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT**PROCEDURE:**

To perform the Task proceed as follows (Refer to Figures 1 through 4):

REMOVAL

- 1) Remove the Electrical Power from the Equipment by switching off respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)



FIG 1 3F01 CB LOCATION

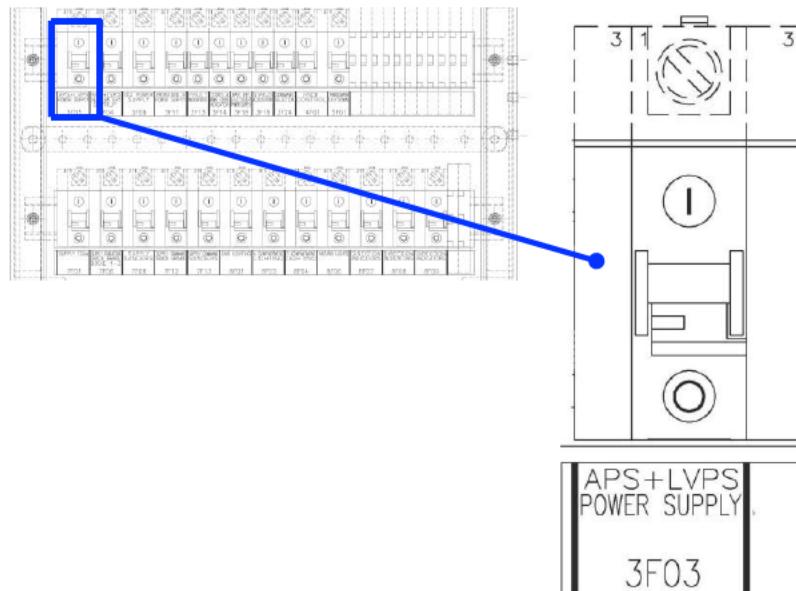


FIG 2 LV LOCKER B 3F03 CB LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-09-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/8

Subsystem/Assy:

APS-LVPS

Unit:

ELECTROLYTIC CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd)

NOTE: It is advisable to retain the removed attaching Hardware for later use.

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to
Sheet R-C -02-05-00-00 / R-00 2.

- 2) Gain access to the Electrolytic Capacitor by removing the relevant Electronic Components (EC) Panel (located on the opposite side of the Front Panel) as follows:
 - a) Disconnect the (EC) Panel Grounding Cable
 - b) Loose the (EC) Panel Fixing Screws
 - c) Supporting the (EC) Panel, remove the (EC) Panel Fixing Screws
 - d) Remove the (EC) Panel and discard the relevant O-ring
- 3) Locate the Electrolytic Capacitor to be replaced.

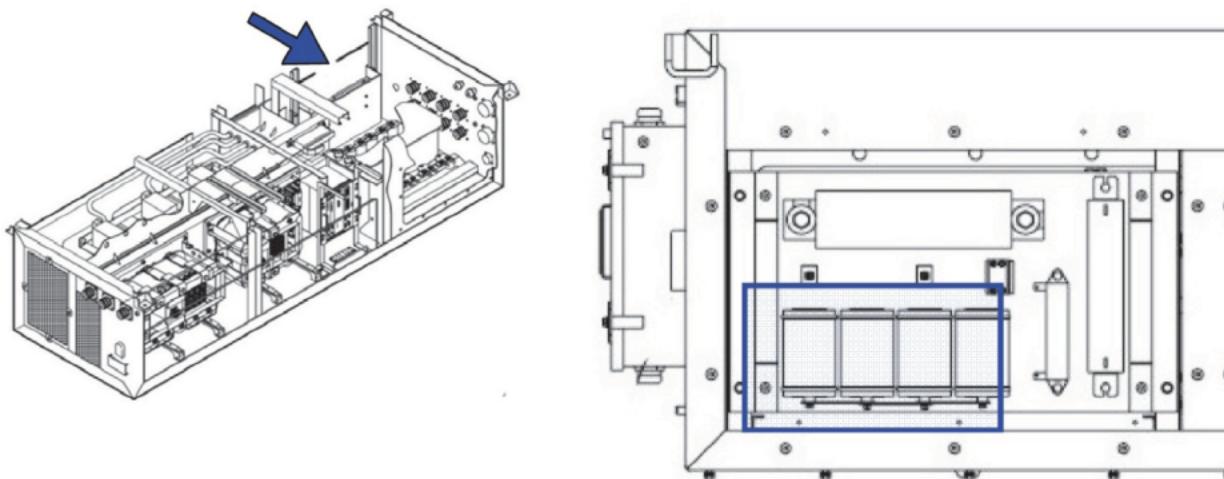


FIG 3 APS / LVPS ELECTROLYTIC CAPACITOR LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-09-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

APS-LVPS

Unit:

ELECTROLYTIC CAPACITOR

Component:

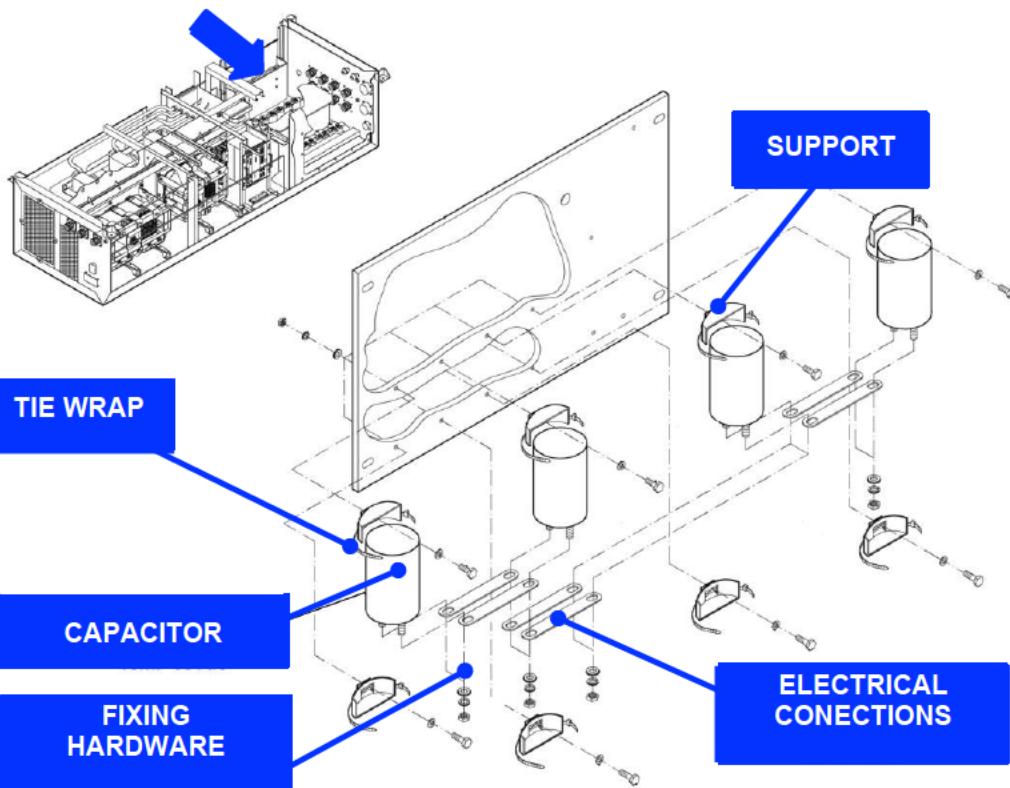
Man Hours:

1.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL(cont'd)**

- 4) Disconnect the Electrical Connections by loosening and removing the relevant Hardware.



- 5) Cut and discard the Tie-Wrap

- 6) Remove and discard the Electrolytic Capacitor

NOTE:
Leave in place the Capacitor Support

FIGURE 4 -ELECTROLYTIC CAPACITOR - REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-09-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
7/8

Subsystem/Assy:

Unit:

APS-LVPS
ELECTROLYTIC CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

INSTALLATION

To perform the Task proceed as follows: (Refer to Figures 1 through 4)

NOTE: It is assumed that the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.

1. Clean the Capacitor Support using recommended agent and lint-free rags.
2. Check Electrical Connections for damage / signs of overheating.
3. Position the Capacitor to be installed into its Support.
4. Secure Capacitor by means of the Tie-Wrap. Tighten as required.
5. Reconnect the Electrical Connections. Tighten as needed.

FINAL OPERATIONS

1. Clean the (EC) Panel O-ring Seat using recommended agent and lint-free rags.
2. Position the "new" (EC) Panel O-ring on its Seat.
3. Position the (EC) Panel on its Seat.
4. Install the (EC) Panel Fixing Screws. Torque to **5 ft lb**.
5. Reconnect the (EC) Panel Grounding Cable. Torque to **4 ft lb**.
6. Restore the Electrical Power to the Equipment by switching on respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)
7. Close and lock the LV Locker B Door and the Battery Box Front Cover.
8. Restore Power to Vehicle.
9. Record task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-09-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/8

Subsystem/Assy:

APS-LVPS

Unit:

ELECTROLYTIC CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT**INTENTIONALLY
LEFT BLANK**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-10-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/8

Subsystem/Assy:

APS-LVPS

Unit:

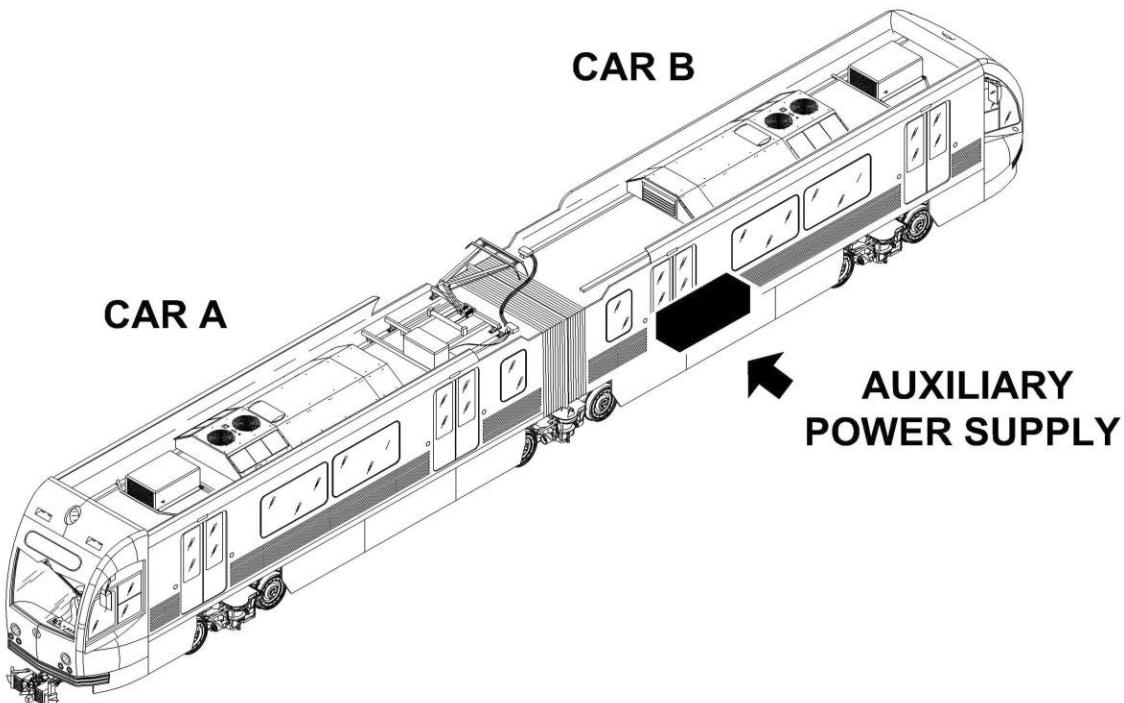
CA FILTER CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT
LOCATION:

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-10-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

APS-LVPS

Unit:

CA FILTER CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT**SAFETY PRECAUTIONS:**

- WARNING:** BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.
- WARNING:** ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.
- WARNING:** BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.
- WARNING:** HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.
- WARNING:** WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.
- WARNING:** HEAVY OBJECT - THE MAGNETIC GROUP & THE CA FILTER CAPACITORS WEIGHS TOGETHER ABOUT 170 LB.
SUPPORT THEM WITH SUITABLE DEVICE.
FAILURE TO COMPLY SO CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

Support Hydraulic Device

CONSUMABLES:

CRC 2000 Contact Cleaner

SPARE PARTS:

CA Filter Capacitor

P/N 211EC22642B

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-10-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

3/8

Subsystem/Assy:

APS-LVPS

Unit:

CA FILTER CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-10-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

APS-LVPS

Unit:

CA FILTER CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

To perform the Task proceed as follows (Refer to Figures 1 through 5):

REMOVAL

- 1) Remove the Electrical Power from the Equipment by switching off respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)



FIG 1 3F01 CB LOCATION

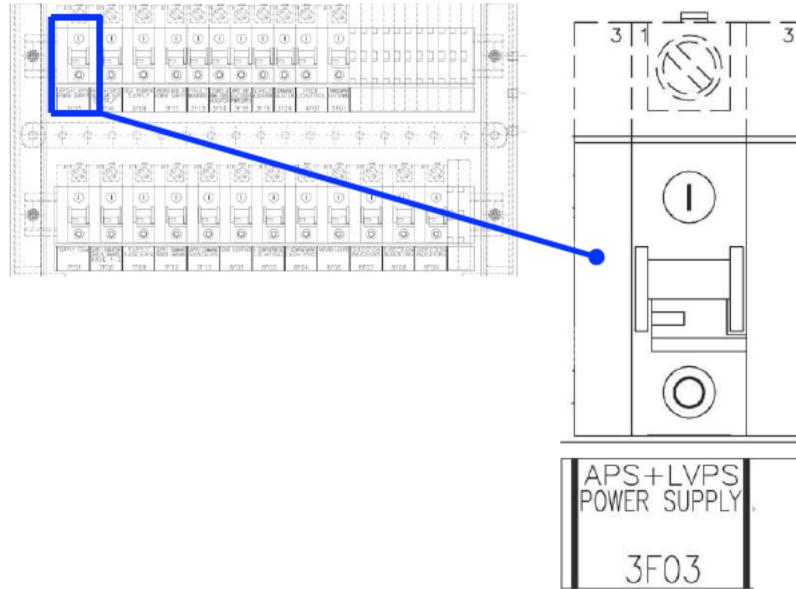


FIG 2 LV LOCKER B 3F03 CB LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-10-00/R-00

System:	Sheet:
LOW VOLTAGE DISTRIBUTION	5/8
Subsystem/Assy:	Unit:
APS-LVPS	CA FILTER CAPACITOR
Component:	Man Hours:
	1.0
Maintenance Task:	
REPLACEMENT	

PROCEDURE (CONT'D):

REMOVAL(cont'd)

NOTE: It is advisable to retain the removed attaching Hardware for later use

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to
Sheet R-C -02-05-00-00 / R-00 2

- 2) Gain access to the CA Filter Capacitor by removing the relevant TRCB Panel (Bottom Panel) as follows:
 - a) Disconnect the (Bottom Panel) Grounding Cable
 - b) Loose the (Bottom Panel) Fixing Screws
 - c) Supporting the (Bottom Panel), remove the (Bottom Panel) Fixing Screws
 - d) Remove the (Bottom Panel) and discard the relevant O-ring



FIG 3 APS BOTTOM PANEL LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-10-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

APS-LVPS

Unit:

CA FILTER CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd)

- 3) Locate the CA Filter Capacitor to be replaced

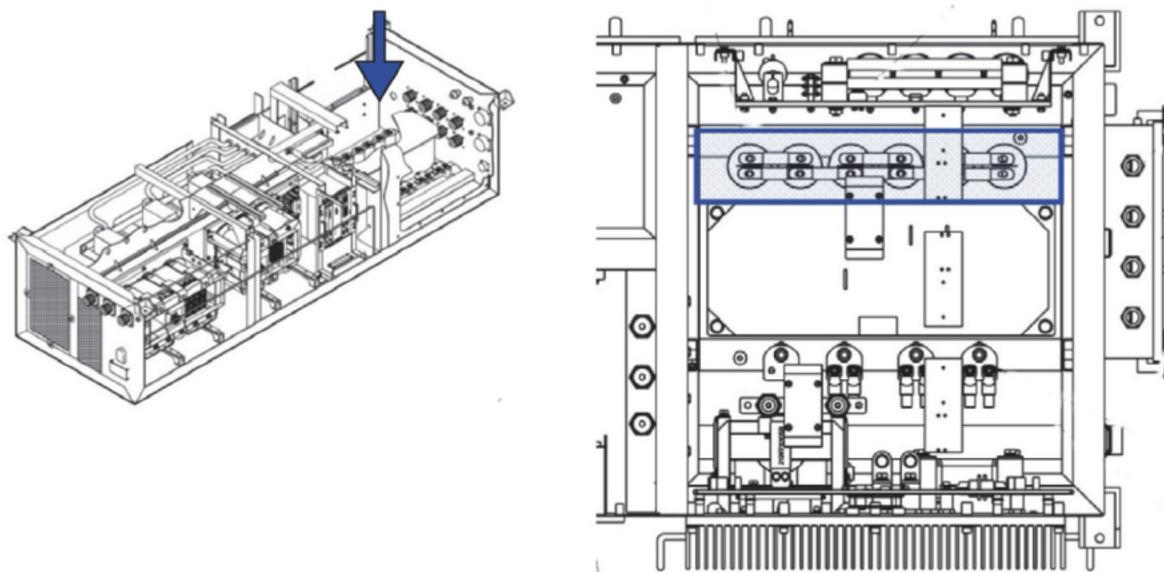


FIG 4 APS / LVPS CA FILTER CAPACITOR LOCATION

WARNING: HEAVY OBJECT - THE MAGNETIC GROUP & THE CA FILTER CAPACITORS WEIGHS ABOUT 170 LB. SUPPORT THEM WITH SUITABLE DEVICE. FAILURE TO COMPLY CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

- 4) Place a suitable Support Hydraulic Device under the CA Filter Capacitors & Magnetic Group Support Frame.
- 5) Raise the Hydraulic Device until its Head Plate is against the Support Frame in order to safely supporting the load of the Equipment installed on
- 6) Loose and remove the Support Frame Fixing Hardware
- 7) Lower carefully the Hydraulic Device with a first step to gain access to the Equipment Electrical Connections with the System.
- 8) Disconnect the "Equipment Electrical Connections with the System" to make available the Equipment for complete lowering.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-10-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
7/8

Subsystem/Assy:

Unit:

APS-LVPS
CA FILTER CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL (cont'd)

- 9) Complete the Hydraulic Device lowering until the CA Filter Capacitors are accessible for removal
CAUTION: MAKE SURE THAT THE " REMOVED " SUPPORT FRAME, WITH THE EQUIPMENT INSTALLED ON, IS SECURED TO THE HYDRAULIC DEVICE TO SAFELY PROCEED WITH THE TASK

- 10) Disconnect the CA Filter Capacitor Electrical Connections
- 11) Supporting the CA Filter Capacitor, loose and remove its attaching Hardware
- 12) Remove and discard the CA Filter Capacitor

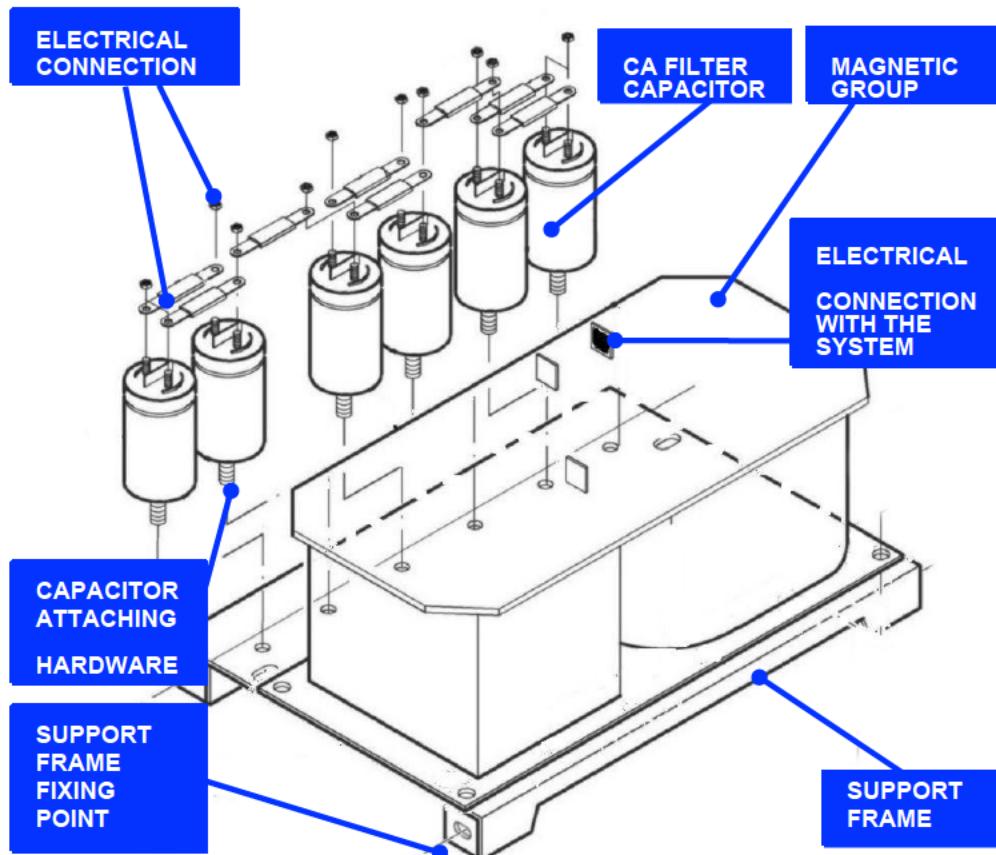


FIGURE 5 - CA FILTER CAPACITOR - REPLACEMENT

INSTALLATION

To perform the Task proceed as follows (Refer to Figures 1 through 5):

NOTE: It is assumed that the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-10-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/8

Subsystem/Assy:

APS-LVPS

Unit:

CA FILTER CAPACITOR

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****INSTALLATION**

1. On Auxiliary Power Supply:
 - a) Clean the CA Filter & Magnetic Group Compartment using recommended agent and cleaning rags.
 - b) Make sure that the "Electrical Connections with the System" inside the Compartment are properly positioned to make easier the raising of the Support Frame with the Equipment installed on.
2. Install the "new" CA Filter Capacitor on the Support Frame.
Torque the relevant attaching Harware to **5 ft lb**.
3. Reconnect the CA Filter Capacitor Electrical Connections.
Torque the relevant attaching Harware to **5 ft lb**.
4. Position the Hydraulic Device under the CA Filter & Magnetic Group Compartment to have the Support Frame with the Equipment installed on ready for on Vehicle installation.
5. Carefully raise the Hydraulic Device paying attention to not damage the Equipment installed on the Support Frame and those inside CA Filter & Magnetic Group Compartment.
6. Stop the raising to have the access for the reconnection of the "Equipment Electrical Connections with the System."
7. Reconnect the Equipment Electrical Connections with the System. Torque to **15.2 ft lb**.
8. Carefully complete the raising to match the Support Frame Fixing Points with the relevant Installation points on the APS Box Structure.
7. Install the Support Frame Fixing Hardware. Torque to **6.2 ft lb**.
8. Lower and remove the Support Hydraulic Device.

FINAL OPERATIONS

1. Clean the (Bottom Panel) O-ring Seat using recommended agent and lint-free rags.
2. Position the "new" (Bottom Panel) O-ring on its Seat
3. Position the (Bottom Panel) on its Seat using suitable Support Device.
4. Install the (Bottom Panel)Fixing Screws. Torque to **5 ft lb**.
5. Reconnect the (Bottom Panel) Grounding Cable. Torque to **4 ft lb**.
6. Restore the Electrical Power to the Equipment by switching on respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)
7. Restore Power to Vehicle.
8. Close and lock the LV Locker B Door and the Battery Box Front Cover.
9. Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-11-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
1/8

Subsystem/Assy:

Unit:

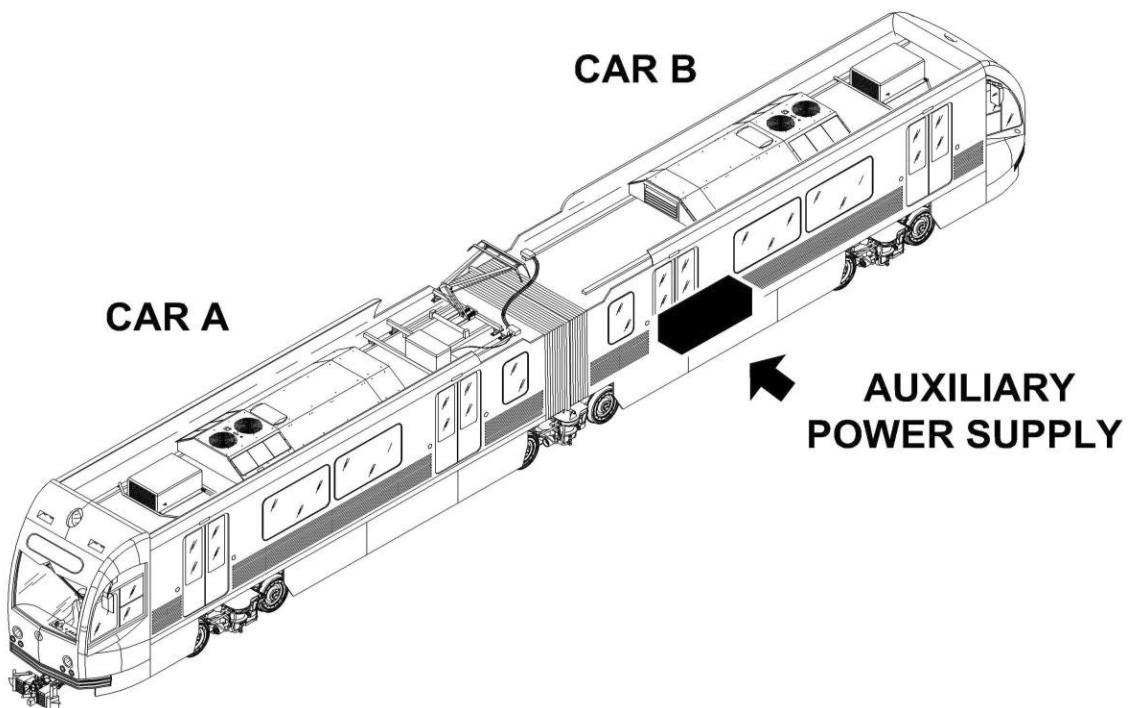
APS-LVPS
SK START UP CARD

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT
LOCATION:

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-11-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

APS-LVPS

Unit:

SK START UP CARD

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

SAFETY PRECAUTIONS:

WARNING: BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.

WARNING: ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.

WARNING: BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.

WARNING: HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.

WARNING: WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC 2000 Contact Cleaner

SPARE PARTS:

SK START-UP Card P/N 211EG23869B

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-11-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

3/8

Subsystem/Assy:

APS-LVPS

Unit:

SK START UP CARD

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-11-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

APS-LVPS

Unit:

SK START UP CARD

Component:

Man Hours:

1.0

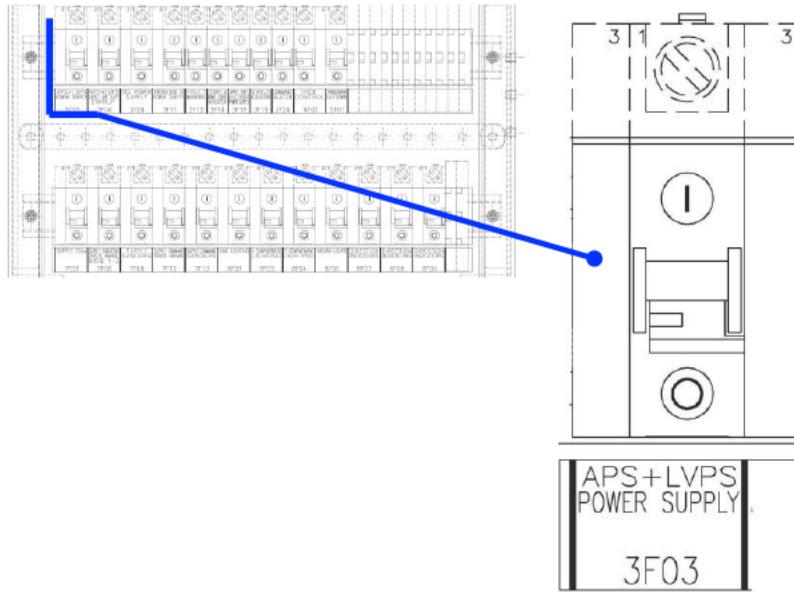
Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL**

To perform the Task proceed as follows (Refer to Figures 1through 5):

- 1)** Remove the Electrical Power from the Equipment by switching off respectively:

- The 3F01 Battery CB (Battery Box -Front)
- The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)

**FIG 1 3F01 CB LOCATION****FIG 2 LV LOCKER B 3F03 CB LOCATION**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-11-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/8

Subsystem/Assy:

APS-LVPS

Unit:

SK START UP CARD

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd):

NOTE: It is advisable to retain the removed attaching Hardware for later use.

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to

Sheet R-C -02-05-00-00 / R-00 2.

- 2) Gain access to APS / LVPS Control Unit Rack by removing the relevant APS / LVPS Front Panel as follows:
 - a) Disconnect the Front Panel Grounding Cable.
 - b) Loose the Front Panel Fixing Screws.
 - c) Supporting the Front Panel with suitable Device, remove the Front Panel Fixing Screws.
 - d) Remove the Front Panel and discard the relevant O-ring.

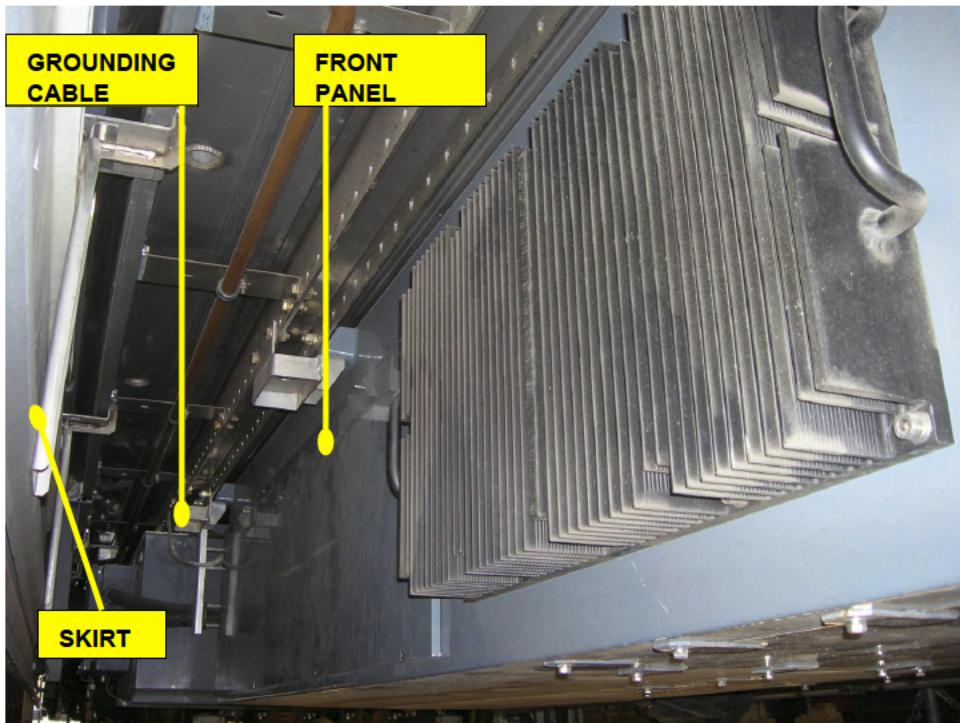


FIG 3 APS / LVPS LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-11-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

APS-LVPS

Unit:

SK START UP CARD

Component:

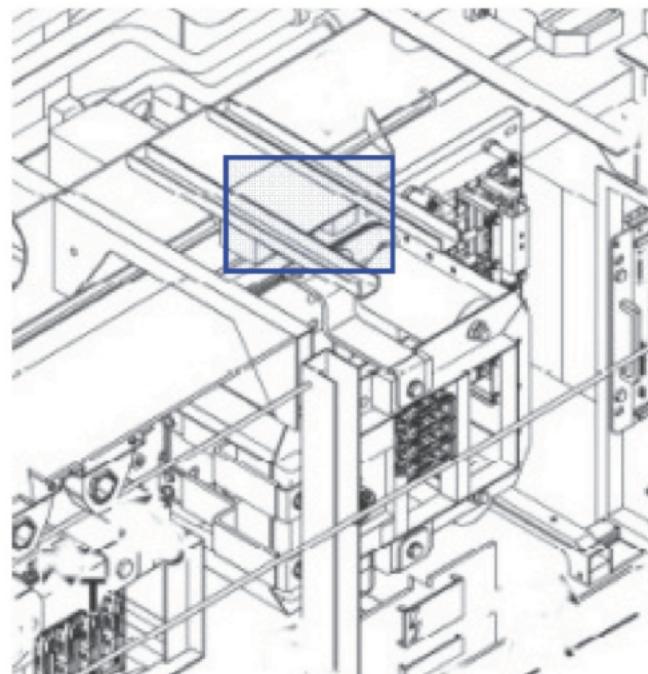
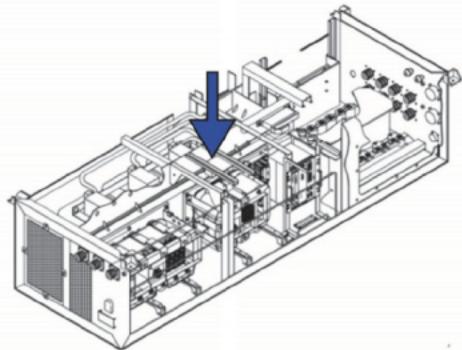
Man Hours:

1.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):**

- 3) Locate the Card to be replaced.

**FIG 4 APS / LVPS SK START UP CARD LOCATION**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-11-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

7/8

Subsystem/Assy:

APS-LVPS

Unit:

SK START UP CARD

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL(cont'd)**

- 4) Disconnect the Card Electrical Connections
- 5) Supporting the Card, loose and remove the Card Assy Fixing Hardware.
- 6) Remove the Card from its Support together with the Panel from Insulator.
- 7) Discard the Card.

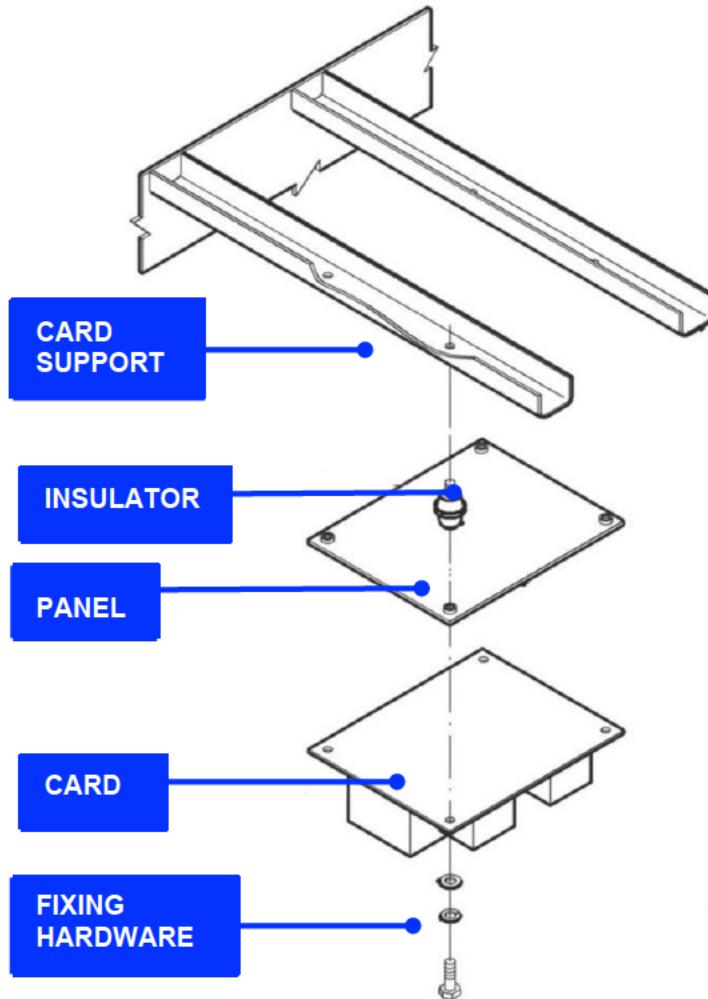


FIG 5 SK START UP CARD LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-11-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/8

Subsystem/Assy:

APS-LVPS

Unit:

SK START UP CARD

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****INSTALLATION**

To perform the Task proceed as follows (Refer to Figures 1through 5):

NOTE: It is assumed that the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.

1. Clean the Card Seat using recommended agent and lint-free rags
2. Check the Card Electrical Connections and relevant Insulator for damage / signs of overheating.
3. Reassembly the Card with the Panel
4. Position the Insulator and the "new" Card Assy.
5. Install the Card Assy Fixing Hardware. Torque to **4ft lb.**
6. Reconnect the Card Electrical Connections. Tighten as needed.

FINAL OPERATIONS

1. Clean the APS / LVPS Front Panel O-ring Seat using recommended agent and lint-free rags.
2. Position the "new" Front Panel O-ring on its Seat.
3. Position the Front Panel on its Seat using suitable Support Device.
4. Install the Front Panel Fixing Screws. Torque to **5 ft lb.**
5. Reconnect the Front Panel Grounding Cable. Torque to **4 ft lb.**
6. Restore the Electrical Power to the Equipment by switching on respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)
7. Close and lock the LV Locker B Door and the Battery Box Front Cover.
8. Restore Power to Vehicle.
9. Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-12-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/8

Subsystem/Assy:

APS-LVPS

Unit:

END CONNECTOR (9 PINS)

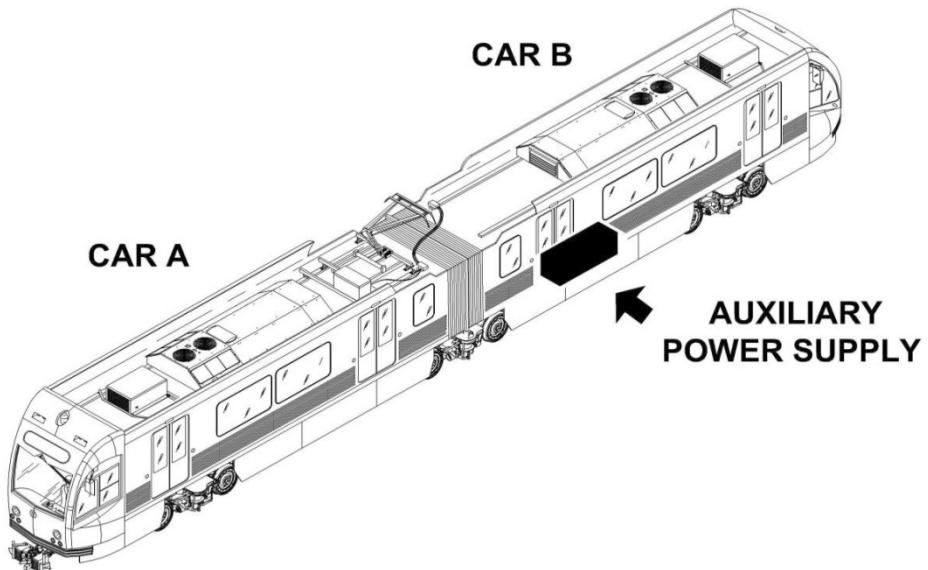
Component:

RESISTOR 1W

Man Hours:

1.0

Maintenance Task:

REPLACEMENT
LOCATION:


P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-12-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

APS-LVPS

Unit:

END CONNECTOR (9 PINS)

Component:

RESISTOR 1W

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

SAFETY PRECAUTIONS:

LACMTA Maintenance Shop Safety Rules & Regulations

CAUTION: A TECHNICIAN HANDLING ELECTRONIC ASSEMBLIES AND COMPONENTS SHOULD WEAR A CONDUCTIVE WRIST STRAP WITH A GROUND WIRE CONNECTED EITHER TO GROUND OR CHASSIS (VEHICLE) GROUND.

CAUTION: WHEN TRANSPORTING A PRINTED CIRCUIT BOARD OR COMPONENT, IT MUST BE PROTECTED FROM STATIC WHILE IN TRANSIT.

CAUTION: WHEN REMOVING THE PC BOARD FROM ITS RACK OR CRADLE, WEAR A WRIST STRAP WIRED TO THE VEHICLE OR GROUND.
NEVER TOUCH OR HANDLE THE PC BOARD BY ITS TRACES, CONNECTOR TEETH, OR COMPONENTS.
IMMEDIATELY PLACE THE PC BOARD INTO A CONDUCTIVE STATIC SHIELDING BAG.
CARRY THE PC BOARD TO A STATIC-FREE WORK STATION AND WEAR A GROUNDING STRAP WHEN REMOVING IT FROM THE STATIC BAG.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC Industrial - Precision Cleaner M3 PN 147535

Dry Compressed Air for Electronic Equipment (commercial).

SPARE PARTS:

End Connector (with Built -in Resistor 120 Ohm -1W)

P/N 211ER20552B

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-12-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

3/8

Subsystem/Assy:

APS-LVPS

Unit:

END CONNECTOR (9 PINS)

Component:

RESISTOR 1W

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle in the Maintenance Shop., over the Pit or on the Stand Up Rail.
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-12-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

APS-LVPS

Unit:

END CONNECTOR (9 PINS)

Component:

RESISTOR 1W

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL

To replace the End Connector installed on the Mother Board (Control Unit Rack) proceed as follows
 (Refer to Figures 1through 5):

1) Remove the Electrical Power from the Equipment by switching off respectively:

- The 3F01 Battery CB (Battery Box -Front)
- The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)



FIG 1 3F01 CB LOCATION

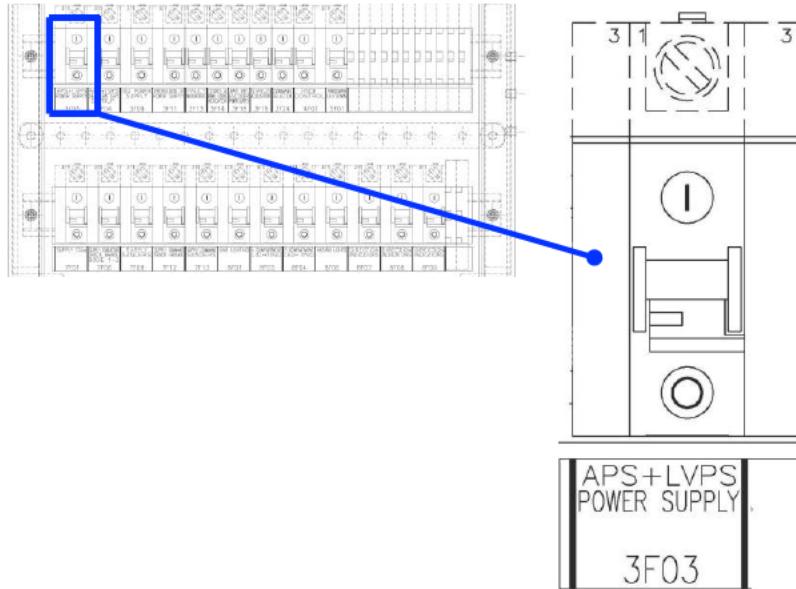


FIG 2 LV LOCKER B 3F03 CB LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-12-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/8

Subsystem/Assy:

APS-LVPS

Unit:

END CONNECTOR (9 PINS)

Component:

RESISTOR 1W

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE(CONT'D)

REMOVAL(cont'd)

NOTE: It is advisable to retain the removed attaching Hardware for later use.

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to Sheet R-C -02-05-00-00 / R-00 2.

- 2) Gain access to APS / LVPS Control Unit Rack by removing the relevant APS /LVPS Front Panel as follows:
 - a) Disconnect the Front Panel Grounding Cable
 - b) Loose the Front Panel Fixing Screws
 - c) Supporting the Front Panel with suitable Device, remove the Front Panel Fixing Screws
 - d) Remove the Front Panel and discard the relevant O-ring.

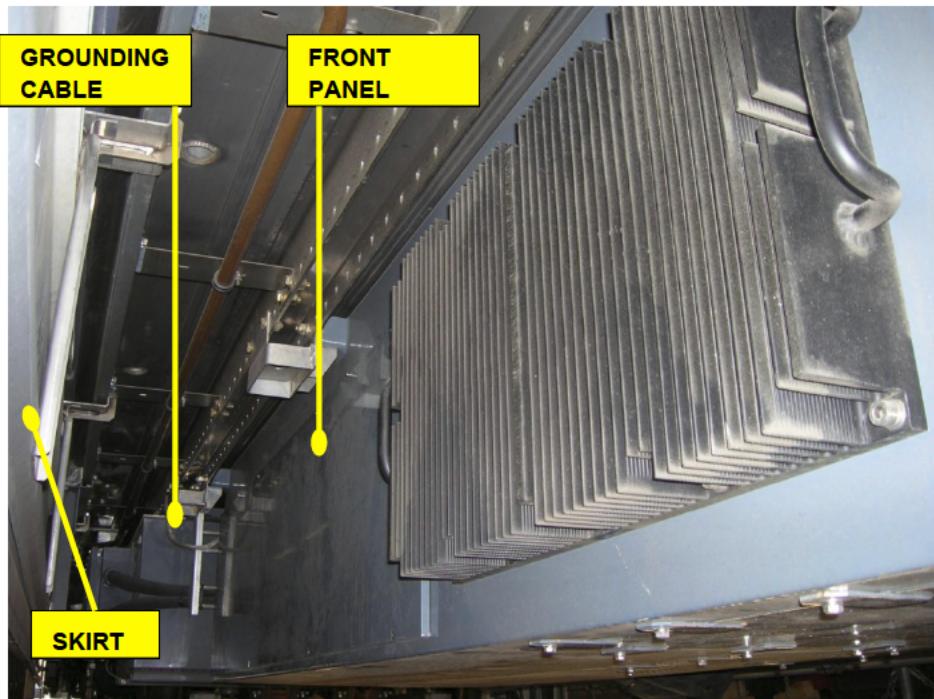


FIG 3 APS / LVPS LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-12-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

APS-LVPS

Unit:

END CONNECTOR (9 PINS)

Component:

RESISTOR 1W

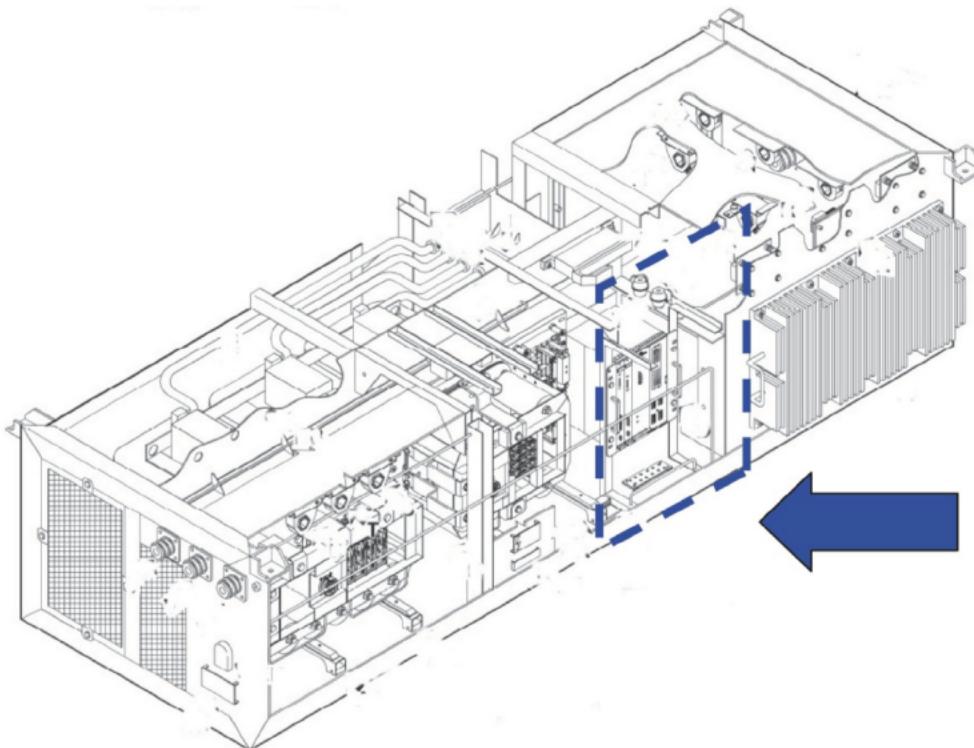
Man Hours:

1.0

Maintenance Task:

REPLACEMENT**PROCEDURE:****REMOVAL(cont'd)**

- 3) Locate the
APS / LVPS
Control Unit
Rack

**FIG 4 APS / LVPS CONTROL UNIT RACK LOCATION**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-12-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

7/8

Subsystem/Assy:

APS-LVPS

Unit:

END CONNECTOR (9 PINS)

Component:

RESISTOR 1W

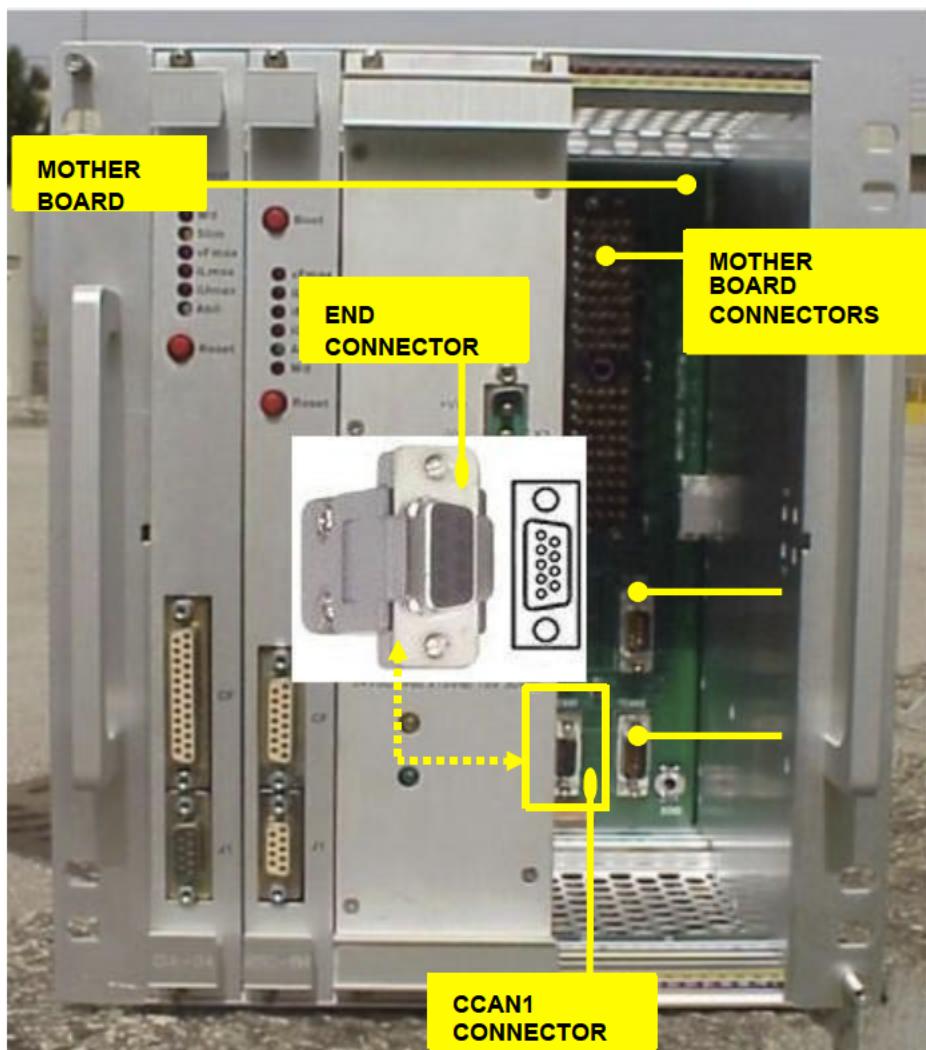
Man Hours:

1.0

Maintenance Task:

REPLACEMENT**PROCEDURE:****REMOVAL(cont'd)**

- 4) Locate the Mother Board
- 5) Disconnect the Connectors from the Mother Board by loosening the relevant Screws.
- 6) Locate, inside the Rack the CCAN1 Connector where is installed on the End Connector to be replaced
- 7) Disconnect the End Connector by loosening the relevant Screws
- 8) Discard the End Connector


FIG 5 END CONNECTOR REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-12-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/8

Subsystem/Assy:

APS-LVPS

Unit:

END CONNECTOR (9 PINS)

Component:

RESISTOR 1W

Man Hours:

1.0

Maintenance Task:

REPLACEMENT**PROCEDURE:****INSTALLATION**

To perform the Task proceed as follows: (Refer to Figures 1 through 5):

NOTE: It is assumed that the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.

1. Check the Mother Board Connectors for damaged Pins / signs of overheating.
2. Install the "new" End Connector.
3. Secure the End Connector by tightening the relevant fixing Screws.
4. Install and secure the Connectors previously removed from Mother Board.
5. Restore Electrical Power to APS / LVPS Control Unit by switching ON the 3F01 (Battery Box Front).
6. Check on the Control Unit that all the Operating Leds are GREEN, indicating that it works properly.

FINAL OPERATIONS

1. Clean the APS / LVPS Front Panel O-ring Seat using recommended agent and lint-free rags.
2. Position the "new" Front Panel O-ring on its Seat.
3. Position the Front Panel on its Seat using suitable Support Device.
4. Install the Front Panel Fixing Screws. Torque to **5 ft lb**.
5. Reconnect the Front Panel Grounding Cable. Torque to **4 ft lb**.
6. Restore Electrical Power to APS / LVPS Assy " by switching ON the 3F03 (LV Locker B Section).
7. Close and lock the LV Locker B Door and the Battery Box Front Cover.
8. Restore Electrical Power to Vehicle.
9. Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-13-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/10

Subsystem/Assy:

APS-LVPS

Unit:

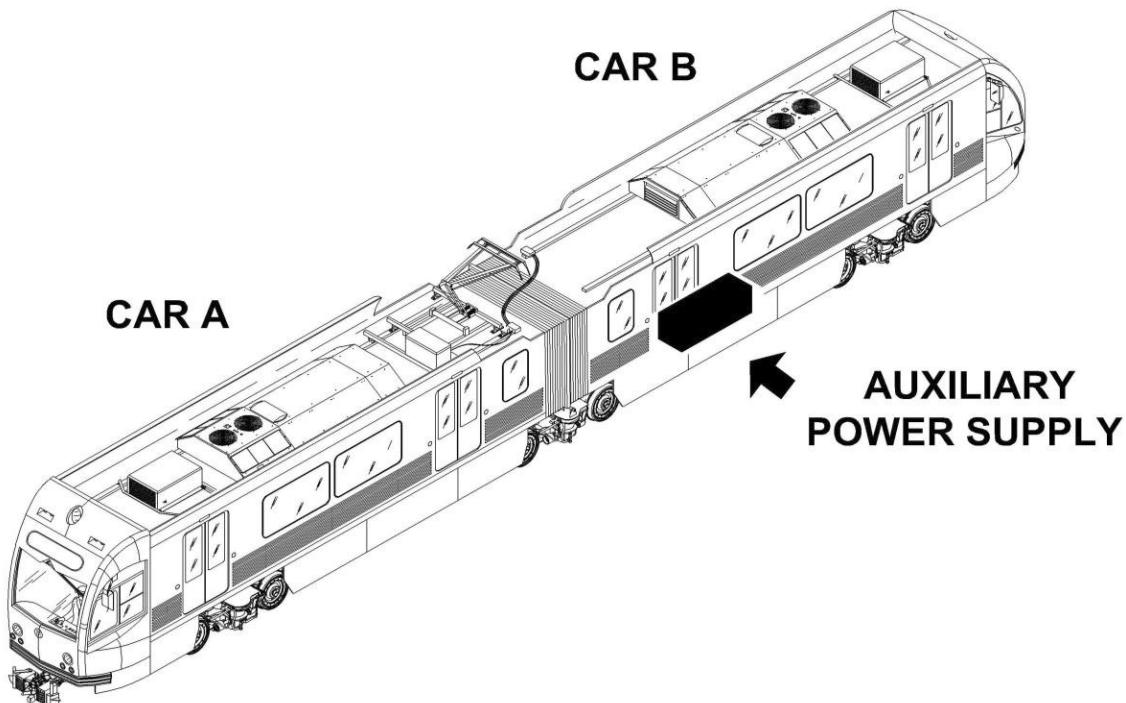
TRANSDUCER LT305-S/SP6

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT
LOCATION:

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-13-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/10

Subsystem/Assy:

APS-LVPS

Unit:

TRANSDUCER LT305-S/SP6

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

SAFETY PRECAUTIONS:

- WARNING:** BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.
- WARNING:** ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.
- WARNING:** BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.
- WARNING:** HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS.
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.
- WARNING:** WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC 2000 Contact Cleaner

SPARE PARTS:

Transducer LT305-S/SP6 P/N 211ET22467B

O-ring, Front Panel

P/N: 211EX21730B03

Transducer Gasket P/N 212EE10644B

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-13-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

3/10

Subsystem/Assy:

APS-LVPS

Unit:

TRANSDUCER LT305-S/SP6

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-13-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/10

Subsystem/Assy:

APS-LVPS

Unit:

TRANSDUCER LT305-S/SP6

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL

To perform the Task proceed as follows (Refer to Figures 1through 7):

- 1)** Remove the Electrical Power from the Equipment by switching off respectively:

- The 3F01 Battery CB (Battery Box -Front)
- The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)

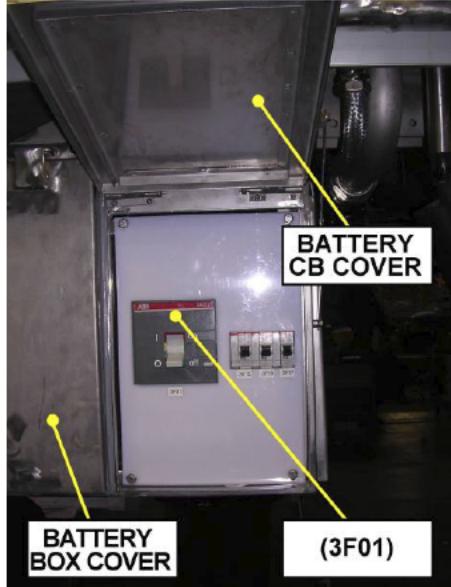


FIG 1 3F01 CB LOCATION

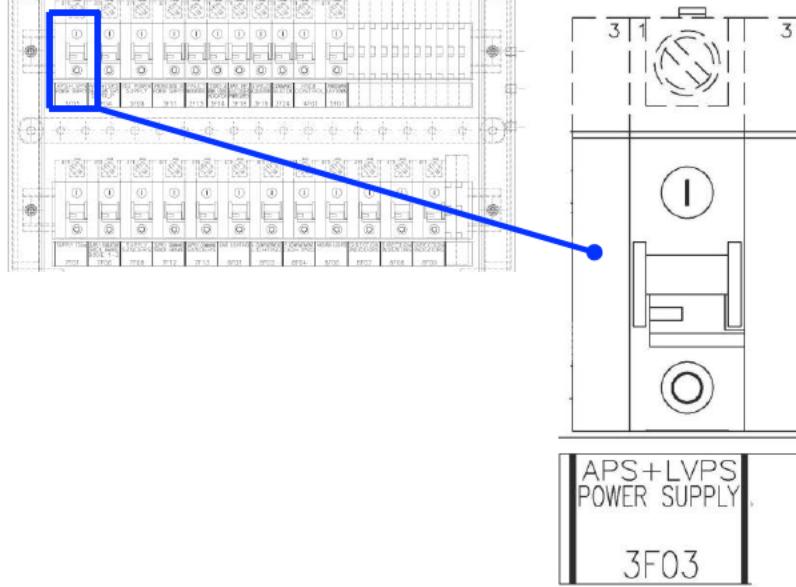


FIG 2 LV LOCKER B 3F03 CB LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-13-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
5/10

Subsystem/Assy:

APS-LVPS

Unit:

TRANSDUCER LT305-S/SP6

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

A TRANSDUCERS LOCATED IN THE INVERTER (APS) MODULE COMPARTMENT(cont'd)

REMOVAL(cont'd):

NOTE: It is advisable to retain the removed attaching Hardware for later use.

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to
Sheet R-C -02-05-00-00 / R-00 2.

- 2) Gain access to
APS / LVPS Control
Unit Rack by
removing the
relevant APS
/LVPS Front Panel
as follows:
 a) Disconnect the
Front Panel
Grounding Cable.
 b) Loose the Front
Panel Fixing
Screws.
 c) Supporting the
Front Panel with
suitable Device,
remove the Front
Panel Fixing
Screws.
 d) Remove the
Front Panel and
discard the
relevant O-ring.

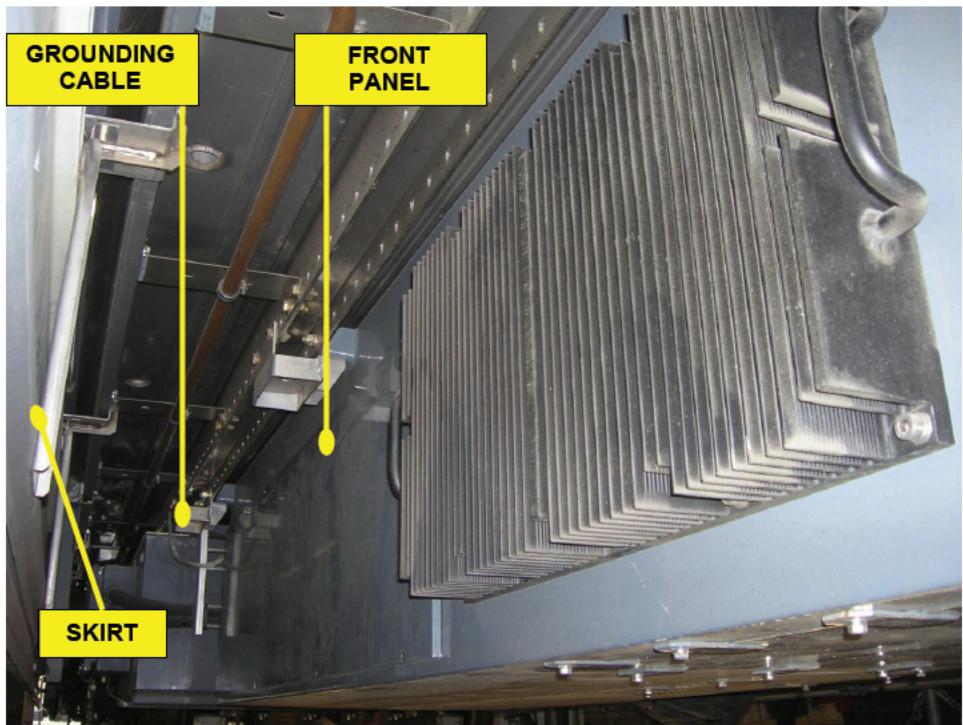


FIG 3 APS / LVPS LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-13-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/10

Subsystem/Assy:

APS-LVPS

Unit:

TRANSDUCER LT305-S/SP6

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****A TRANSDUCERS LOCATED IN THE INVERTER (APS) MODULE COMPARTMENT(cont'd):****REMOVAL(cont'd):**

- 3) Locate the Transducer to be replaced.

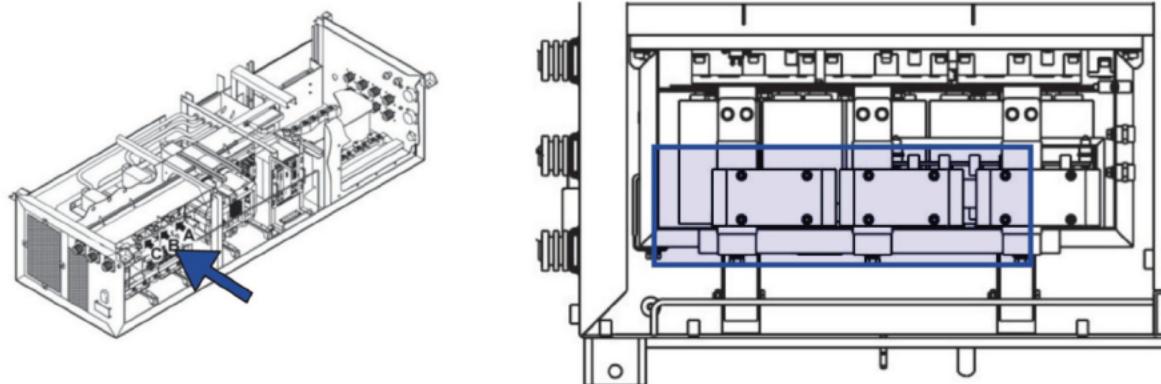


FIG 4 APS MODULE COMPARTMENT-TRANSDUCERS LOCATION

- 4) Disconnect the Transducer Electrical Connections.
 - 5) Supporting the Transducer, loose and remove the Transducer Assy Fixing Hardware.
 - 6) Remove the Transducer from its Support.
- NOTE.** Remove the Transducer (Fig 5 Detail B & C) together with the Gasket.
- 7) Discard the Transducer. (and the Gasket).

INSTALLATION

To perform the Task proceed as follows (Refer to Figures 1through 5):

7. Clean the Transducer Seat using recommended agent and lint-free rags.
8. Check the Transducer Electrical Connections for damage / signs of overheating.
9. Position the "new" Transducer.

NOTE. Install the "new" Transducer (Fig 5 Detail B & C) together with the "new" Gasket.

10. Install the Transducer Fixing Hardware. Torque to 4ft lb.
11. Reconnect the Transducer Electrical Connections. Tighten as needed.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-13-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION**7/10**

Subsystem/Assy:

Unit:
TRANSDUCER LT305-S/SP6

Component:

Man Hours:
1.5

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****A TRANSDUCERS LOCATED IN THE INVERTER (APS) MODULE COMPARTMENT(cont'd)**
INSTALLATION(cont'd)

1. Clean the APS / LVPS Front Panel O-ring Seat using recommended agent and lint-free rags.
2. Position the "new" Front Panel O-ring on its Seat.
3. Position the Front Panel on its Seat using suitable Support Device.
4. Install the Front Panel Fixing Screws. Torque to 5 ft lb.
5. Reconnect the Front Panel Grounding Cable. Torque to 4 ft lb.

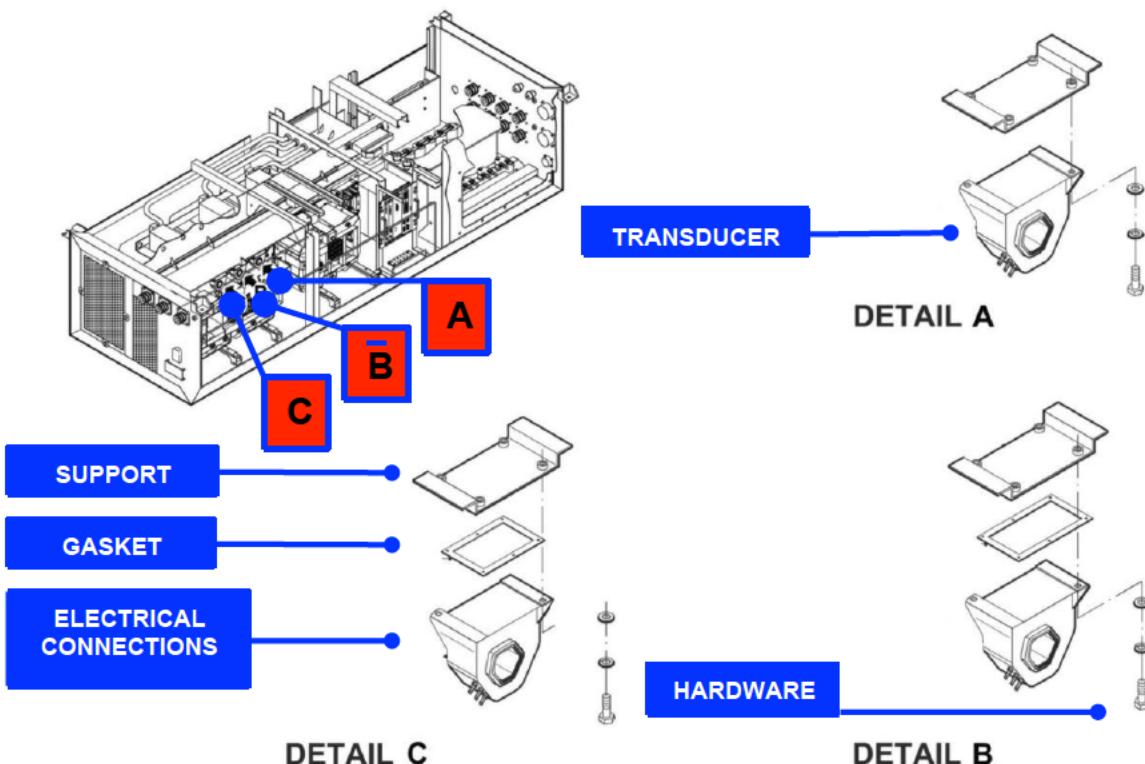


FIGURE 5 - APS MODULE COMPARTMENT TRANSDUCER LT305-S/SP6 REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-13-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/10

Subsystem/Assy:

APS-LVPS

Unit:

TRANSDUCER LT305-S/SP6

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

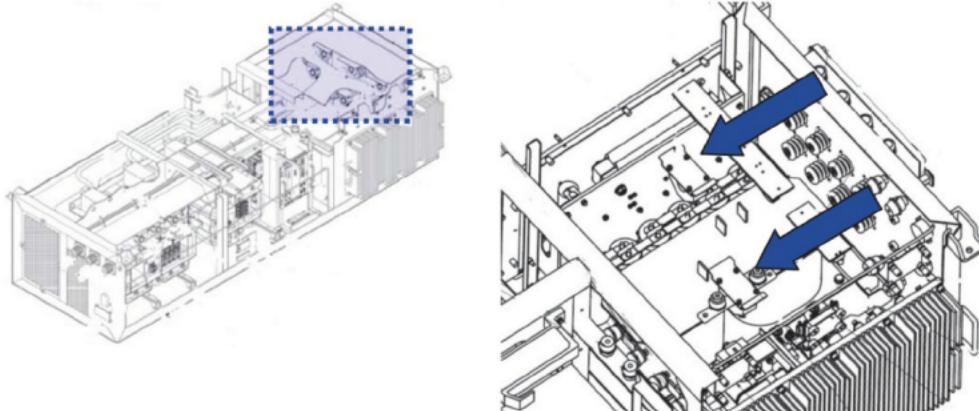
PROCEDURE (CONT'D):

B TRANSDUCERS LOCATED IN THE ELECTRONIC COMPONENT COMPARTMENT

REMOVAL

- 1) Remove the Active Clamp Module according to Sheet R-C -10-01-22-00 / R-00.

- 2) Locate the Transducer to be replaced.



**FIG 6 APS / LVPS
ELECTRONIC COMPONENT COMPARTMENT TRANSDUCERS LOCATION**

- 3) Disconnect the Transducer Electrical Connections.
- 4) Supporting the Transducer, loose and remove the Transducer Assy Fixing Hardware.
- 5) Remove the Transducer from its Support.
- 6) Discard the Transducer.

INSTALLATION

To perform the Task proceed as follows (Refer to Figures 1 through 7):

1. Clean the Transducer Seat using recommended agent and lint-free rags.
2. Check the Transducer Electrical Connections for damage / signs of overheating.
3. Position the "new" Transducer.
4. Install the Transducer Fixing Hardware. Torque to 4ft lb.
5. Reconnect the Transducer Electrical Connections. Tighten as needed.
6. Install the Active Clamp Module according to Sheet R-C -10-01-22-00 / R-00.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-13-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION**9/10**

Subsystem/Assy:

Unit:

APS-LVPS**TRANSDUCER LT305-S/SP6**

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

B TRANSDUCERS LOCATED IN THE ELECTRONIC COMPONENT COMPARTMENT (cont'd)

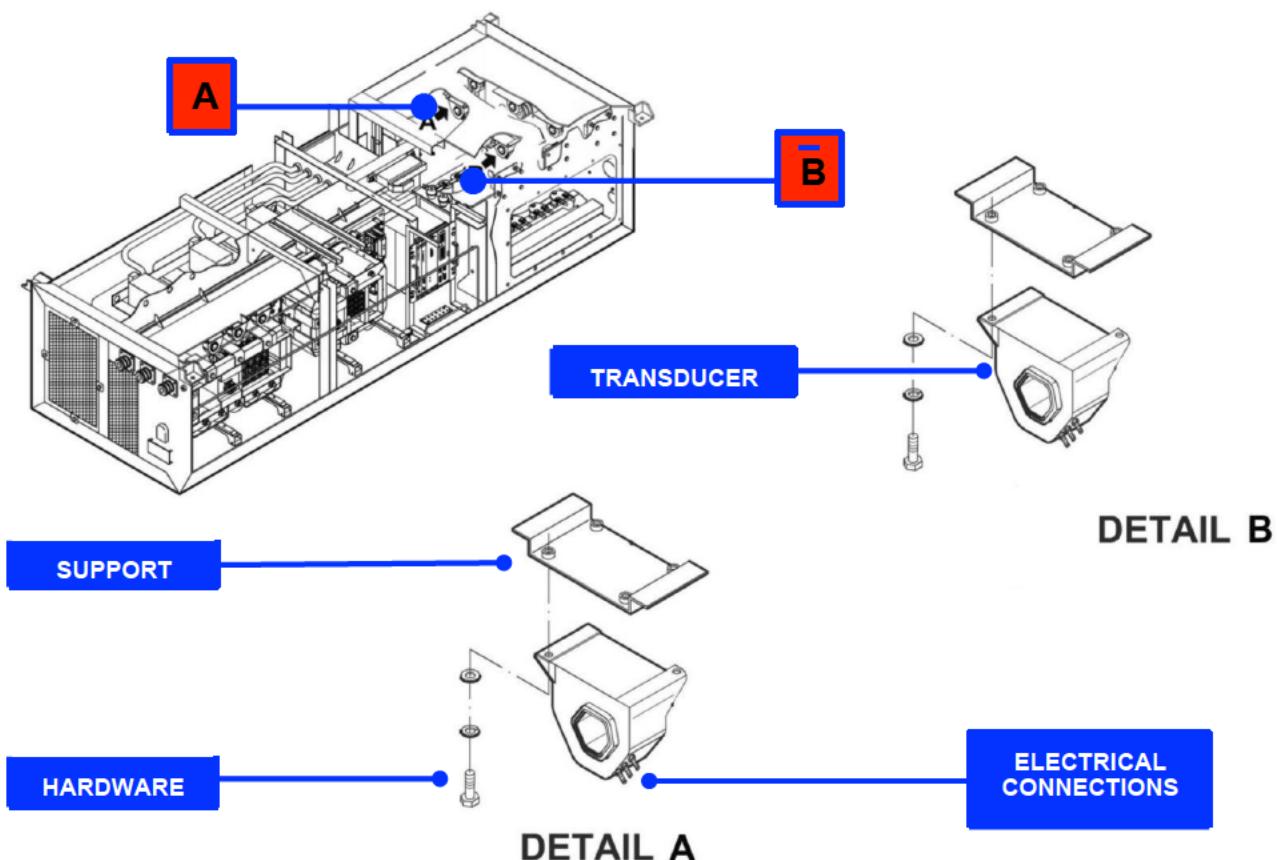


FIGURE 7 -
ELECTRONIC COMPONENT COMPARTMENT
TRANSDUCER LT305-S/SP6 REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-13-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

10/10

Subsystem/Assy:

APS-LVPS

Unit:

TRANSDUCER LT305-S/SP6

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

FINAL OPERATIONS

1. Restore the Electrical Power to the Equipment by switching on respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)
2. Close and lock the LV Locker B Door and the Battery Box Front Cover.
3. Restore Power to Vehicle.
4. Record task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

.Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 “**At every Task Completion.**”

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/14

Subsystem/Assy:

APS-LVPS

Unit:

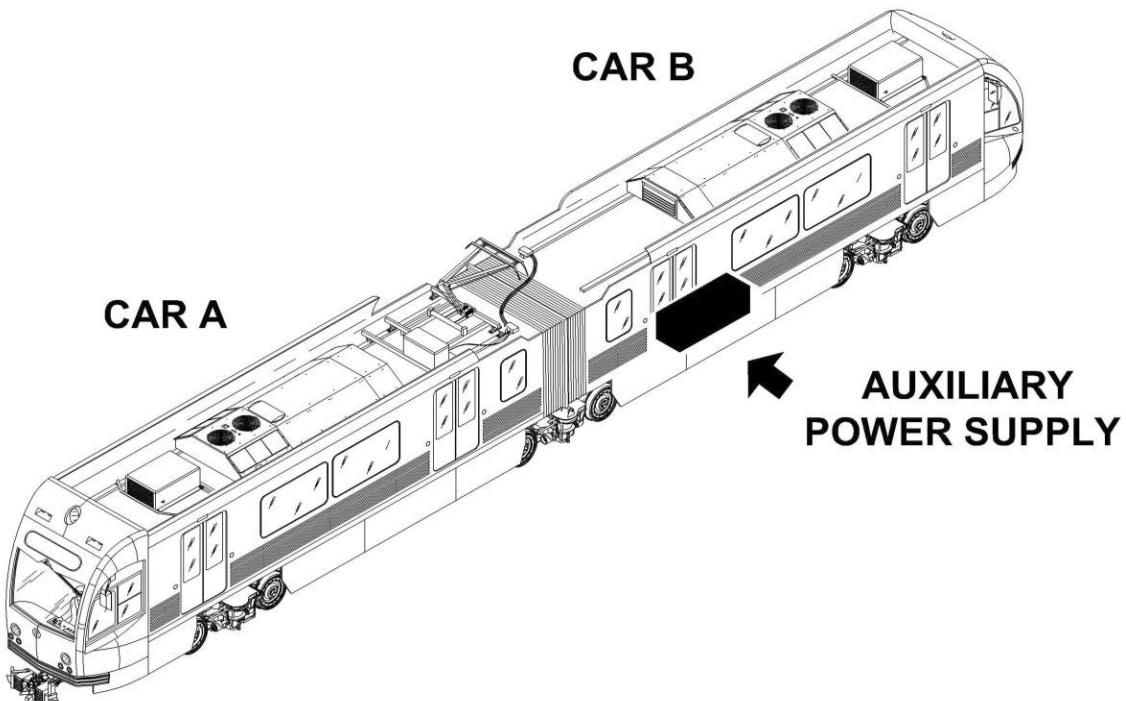
TRANSFORMER APS

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT
LOCATION:

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/14

Subsystem/Assy:

APS-LVPS

Unit:

TRANSFORMER APS

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT**SAFETY PRECAUTIONS:**

WARNING: BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.

WARNING: ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.

WARNING: BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.

WARNING: HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS.
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.

WARNING: WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.

WARNING: HEAVY OBJECT - THE TRANSFORMER APS WEIGHS 660 LB. SUPPORT TRANSFORMER APS WITH SUITABLE LIFTING DEVICE. FAILURE TO COMPLY CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit
Module Support Hydraulic Device

CONSUMABLES:

Cleaner / Degreaser

SPARE PARTS:

Transformer APS P/N 211ET23732B

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:	Sheet:
LOW VOLTAGE DISTRIBUTION	3/14
Subsystem/Assy:	Unit:
APS-LVPS	TRANSFORMER APS

Component:	Man Hours:
	2.0

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Stand Up Rail.
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.
 That person knows why the Power was removed and when it safe to restore it.
 Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

INTRODUCTORY NOTE

The Transformer APS Replacement Procedure is provided in two Parts as follows:

- A) **APS / LVPS ASSY REMOVAL / INSTALLATION FROM / ON THE VEHICLE.**
- B) **TRANSFORMER APS REPLACEMENT WITH THE APS / LVPS ASSY REMOVED FROM THE VEHICLE.**

This arrangement of the Procedure is due to the following main reasons:

- Transformer:APS Weight (660 lb)
- Transformer:APS Overall Dimensions
- Transformer:APS Location in the APS / LVPS Assy Box
- Location of the APS / LVPS Assy Box on board the Vehicle
- APS / LVPS Assy Box Overall Dimensions and relevant clearances available to safely shift / lift the Transformer APS with respect to adjacent Equipment installed

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/14

Subsystem/Assy:

APS-LVPS

Unit:

TRANSFORMER APS

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

A) APS / LVPS ASSY REMOVAL / INSTALLATION FROM / ON THE VEHICLE

REMOVAL

To perform the Task proceed as follows (Refer to Figures 1 through 6):

- 1) Remove the Electrical Power from the Equipment by switching off respectively:
 - The 3F01 Battery CB (Battery Box -Front).
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section).

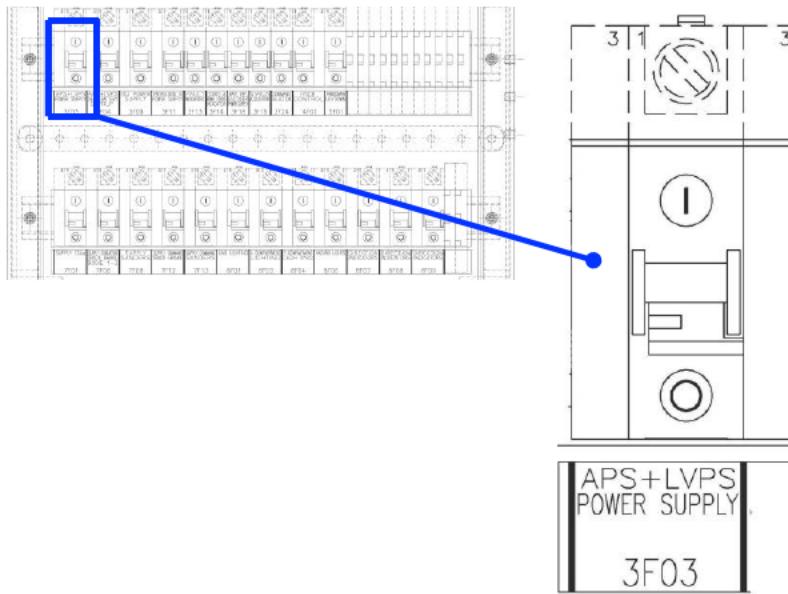


FIG 1 3F01 CB LOCATION

FIG 2 LV LOCKER B 3F03 CB LOCATION

- 2) Remove the relevant APS / LVPS Skirt according to Sheet R-C -02-05-00-00 / R-00 2.
- 3) Raise the Vehicle according to LACMTA Rules & Regulations.

NOTE: It is advisable to retain the removed attaching Hardware for later use.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
5/14

Subsystem/Assy:

 Unit:
TRANSFORMER APS

Component:

 Man Hours:
2.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

- A) **APS / LVPS ASSY REMOVAL / INSTALLATION FROM / ON THE VEHICLE REMOVAL(cont'd).**
- 4) Disconnect the APS / LVPS Assy Input /Output Connectors from relevant Terminals.

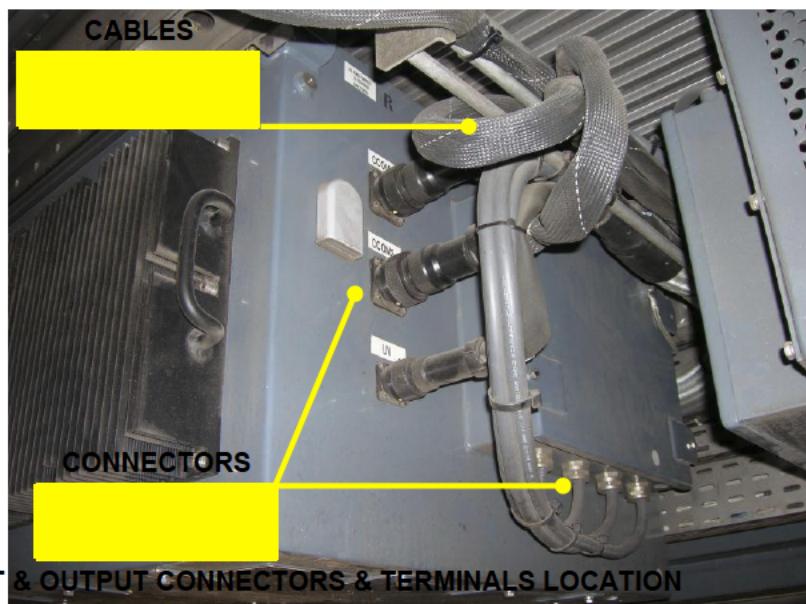
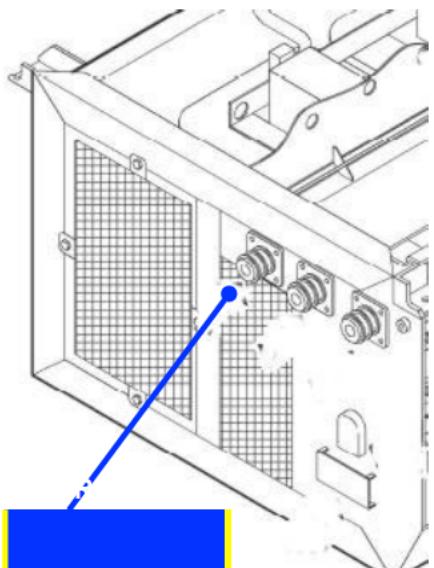


FIG 3 APS / LVPS INPUT & OUTPUT CONNECTORS & TERMINALS LOCATION

- 5) Secure and protect the Cables and relevant Connectors using suitable Clamps and Protection Caps.
 6) Protect the Terminals on the APS / LVPS assy Box using suitable Protection Caps.
 7) Place the Lifting / Support Device(s)(Total Capacity 1,700 Lb) under the APS / LVPS Assy Box.

WARNING: HEAVY OBJECT - THE APS / LVPS ASSY BOX WEIGHS 1,653 LB. SUPPORT APS / LVPS ASSY BOX WITH SUITABLE LIFTING DEVICE. FAILURE TO COMPLY CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/14

Subsystem/Assy:

APS-LVPS

Unit:

TRANSFORMER APS

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

CAUTION: IT IS STRONGLY ADVISED TO PLACE THE LIFTING / SUPPORT DEVICE(S) AS SHOWN IN FIG 4

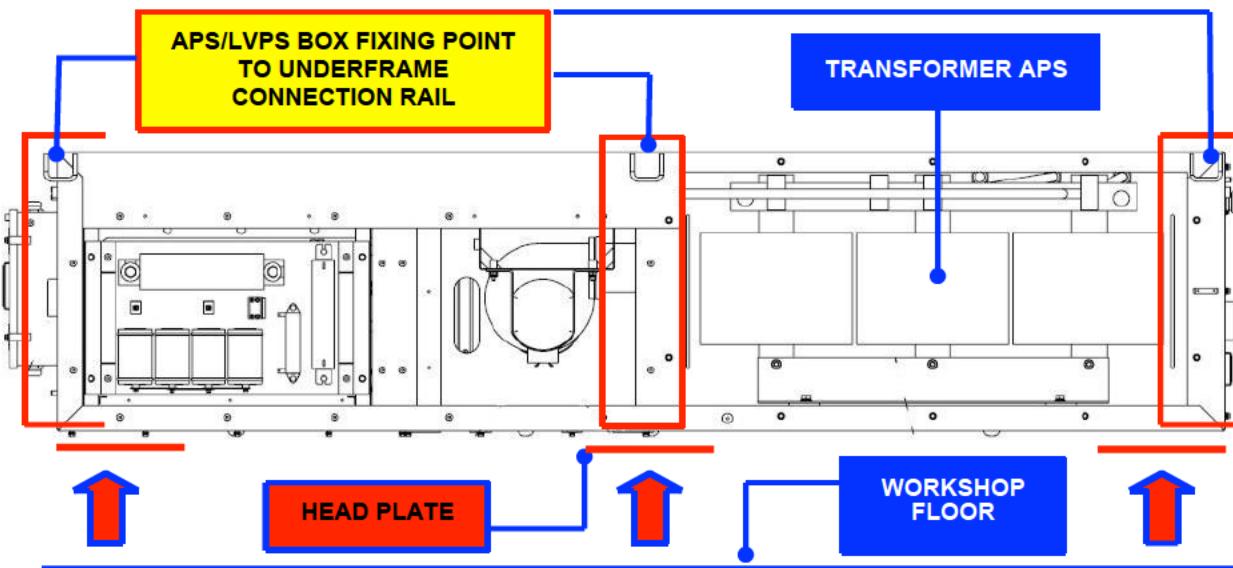


FIG 4 APS / LVPS LIFTING / SUPPORT POINTS LOCATION

- 8) Raise the Lifting / Support Device(s) until the Head Plate(s) is (are) against the APS / LVPS Assy Box. areas surrounding the Lifting Points in order to safely supporting and sharing the load.
- 9) Loose and remove the APS / LVPS Assy Box Frame Fixing Hardware from the Underframe Connection Rails.
- 10) Lower carefully the Lifting / Support Device (s).

CAUTION: PAY ATTENTION TO KEEP THE APS /LVPS BOX PARALLEL TO THE WORKSHOP FLOOR.

- 11) Once completed the lowering, make available the removed APS / LVPS Assy Box for Transformer APS safely removal.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
7/14

Subsystem/Assy:

Unit:

APS-LVPS
TRANSFORMER APS

Component:

Man Hours:

2.0

Maintenance Task:

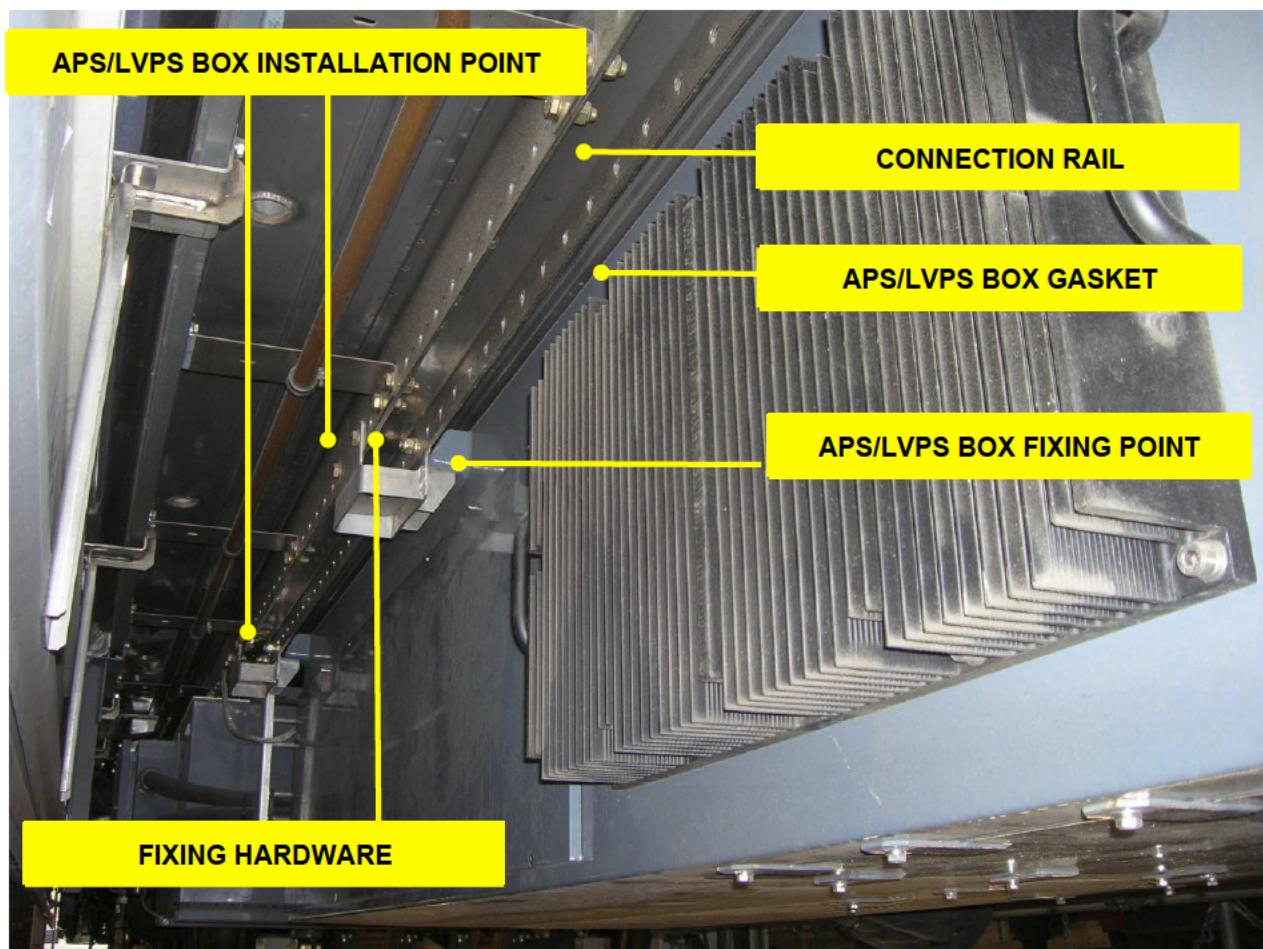
REPLACEMENT
PROCEDURE (CONT'D):


FIG 5 APS / LVPS ASSY BOX REMOVAL / INSTALLATION -FRONT VIEW

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/14

Subsystem/Assy:

APS-LVPS

Unit:

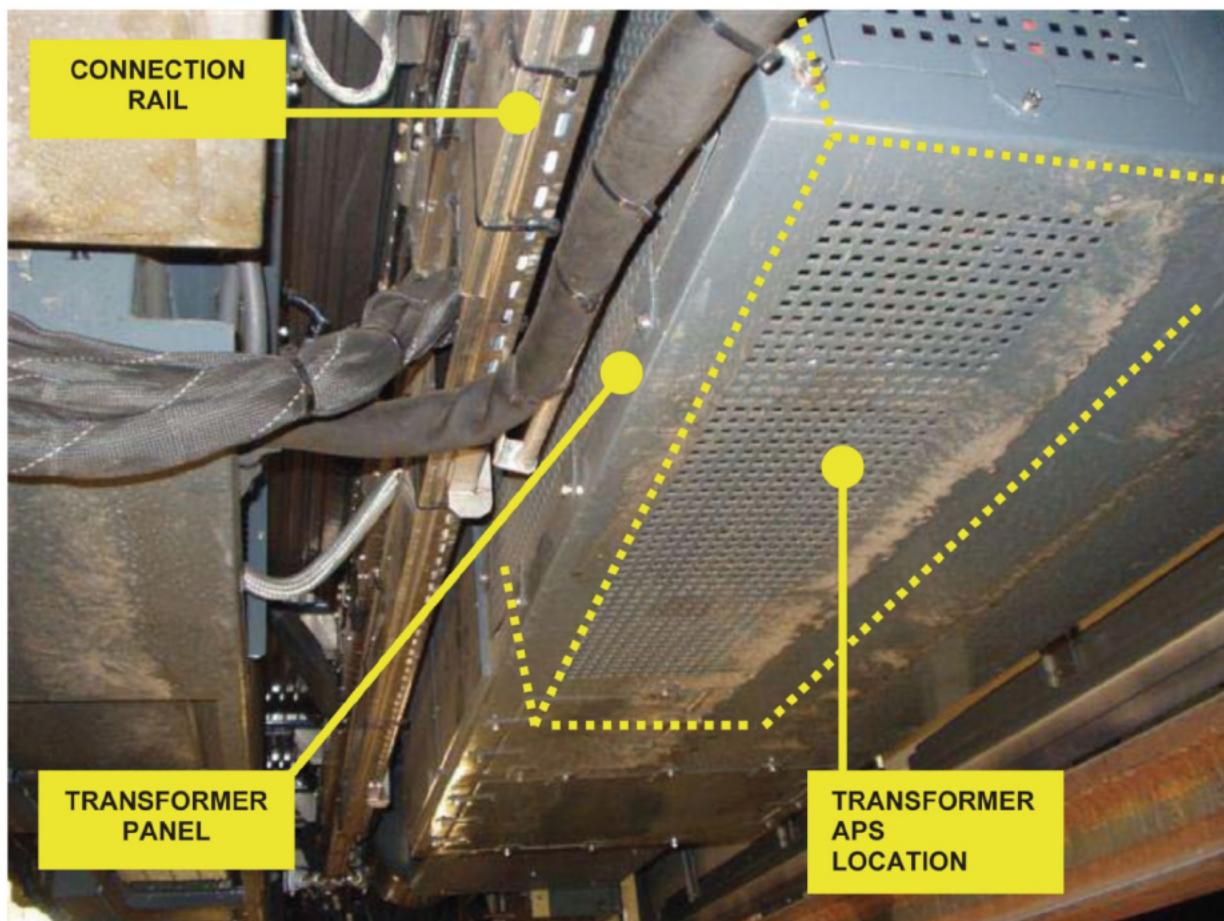
TRANSFORMER APS

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****FIG 6 APS / LVPS ASSY BOX REMOVAL / INSTALLATION -REAR VIEW**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System: LOW VOLTAGE DISTRIBUTION	Sheet: 9/14
Subsystem/Assy: APS-LVPS	Unit: TRANSFORMER APS
Component:	Man Hours: 2.0

 Maintenance Task:
REPLACEMENT
PROCEDURE (CONT'D):
A) APS / LVPS ASSY REMOVAL / INSTALLATION FROM / ON THE VEHICLE (cont'd)
INSTALLATION

To perform the Task proceed as follows: (Refer to Figures 1 through 6)

NOTE: It is assumed that:

- The Vehicle is on the Stand Up Rail and raised according to LACMTA Rules & Regulations
- The APS / LVPS Assy Box is safely positioned under the Vehicle, onto the Lifting / Support Device(s), as shown in Fig 4 and ready for on Vehicle installation

1. Check the Gasket of APS/LVPS Assy Box for damage /deformation and that it can properly work. Replace as per check result.
2. Carefully raise the Lifting / Support Device (s) paying attention to not damage the APS / LVPS Assy Box.

CAUTION: PAY ATTENTION TO KEEP THE APS /LVPS BOX PARALLEL TO THE WORKSHOP FLOOR.

3. Carefully complete the raising to match the APS / LVPS Assy Box Fixing Points with the relevant Installation Points on the Underframe Connection Rails.
4. Install the APS / LVPS Assy Box Fixing Hardware. Torque to **30 ft lb**.
5. Lower and remove the Lifting / Support Device (s).
6. Remove (on Vehicle) the Clamps and Protection Caps installed, during Removal, on the APS / LVPS Assy Input /Output Cables and Connectors.
7. Remove (on APS / LVPS Assy Box) the Protection Caps installed, during Removal, on the Terminals.
8. Reconnect the Input /Output Connectors to the relevant APS / LVPS Assy Box Terminals.
9. Lower the Vehicle according to LACMTA Rules & Regulations.
10. Install the relevant APS / LVPS Skirt according to Sheet R-C -02-05-00-00 / R-00 2.

11. Restore the Electrical Power to the Equipment by switching on respectively:

- The 3F01 Battery CB (Battery Box -Front)
- The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)

12. Close and lock the LV Locker B Door and the Battery Box Front Cover.

13. Restore Power to Vehicle.

14. Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "At every Task Completion."

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

10/14

Subsystem/Assy:

APS-LVPS

Unit:

TRANSFORMER APS

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

- B) TRANSFORMER APS REPLACEMENT WITH THE APS / LVPS ASSY
REMOVED FROM THE VEHICLE**

REMOVAL

To perform the Task, proceed as follows (Refer to Figures 7 through 9).

NOTE: It is assumed that the APS / LVPS Assy Box is properly positioned to make easier the safely remove the Transformer APS.

- 1) Locate the Transformer APS to be replaced.

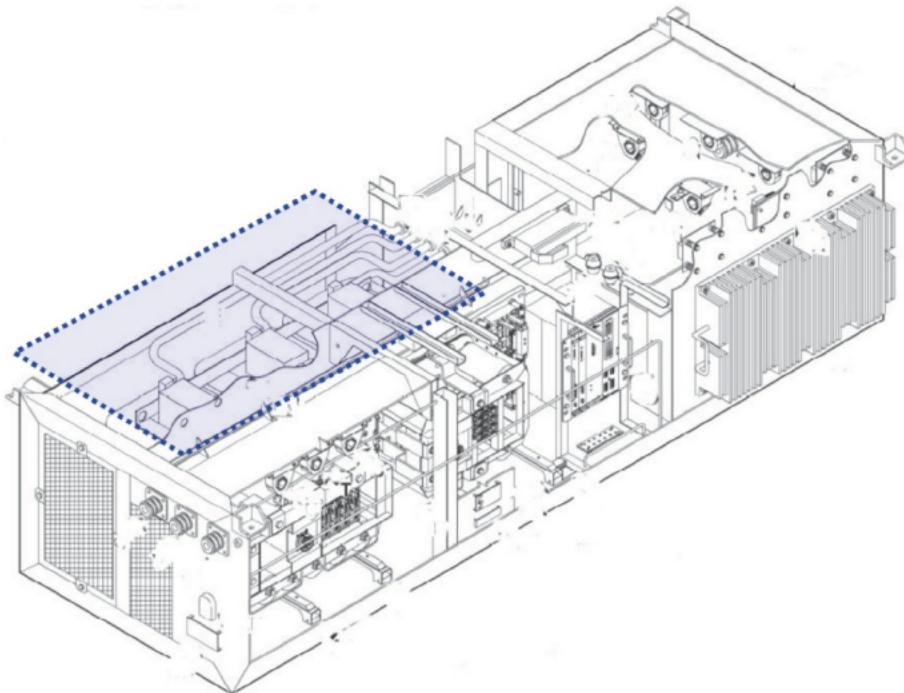


FIG 7 TRANSFORMER APS LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
11/14

Subsystem/Assy:

APS-LVPS

Unit:

TRANSFORMER APS

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

- B) TRANSFORMER APS REPLACEMENT WITH THE APS / LVPS ASSY
REMOVED FROM THE VEHICLE(cont'd).

REMOVAL (cont'd)

- 2) Gain access to the Transformer APS by removing the relevant Transformer Panel (TP) (located on the opposite side of the Front Panel) as follows:
 - a) Loose the (TP) Panel Fixing Screws.
 - b) Supporting the (TP) Panel, remove the (TP) Panel Fixing Screws.
 - c) Remove the (TP) Panel and discard the relevant O-ring.
- 3) Disconnect the Electrical Connections (Inputs & Outputs).

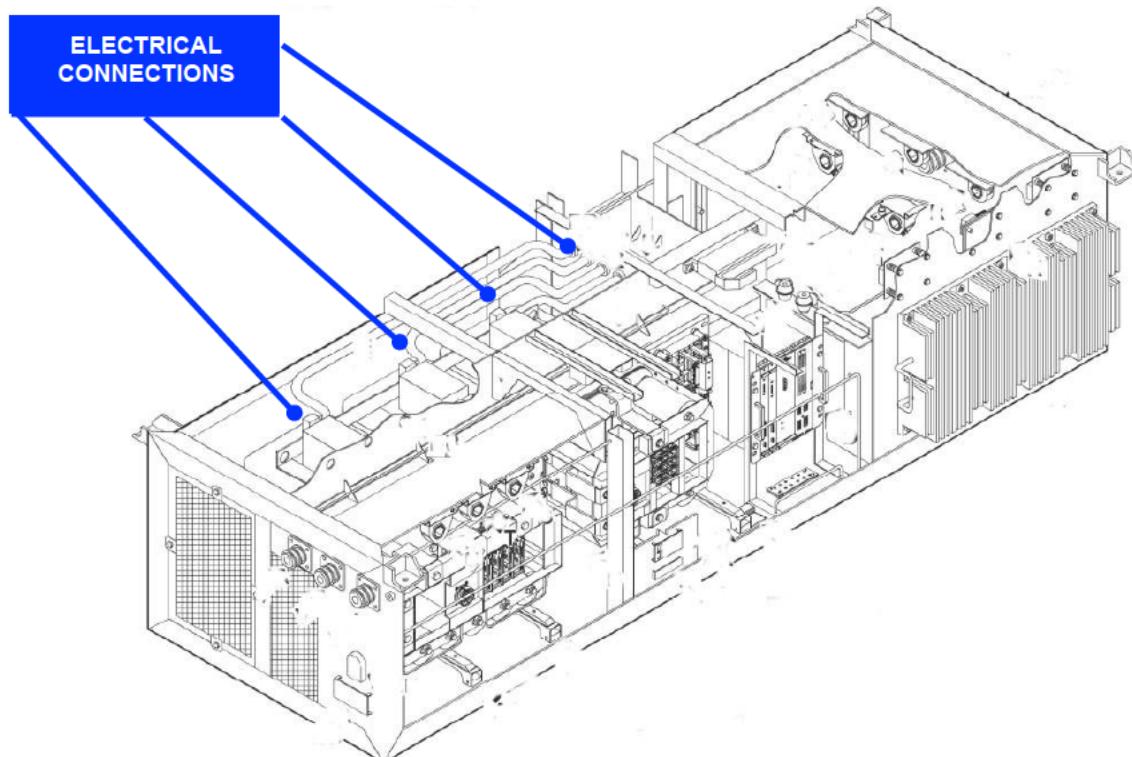


FIG 8 TRANSFORMER APS ELECTRICAL CONNECTIONS

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

12/14

Subsystem/Assy:

APS-LVPS

Unit:

TRANSFORMER APS

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):**

- B) TRANSFORMER APS REPLACEMENT WITH THE APS / LVPS ASSY
REMOVED FROM THE VEHICLE(cont'd).**

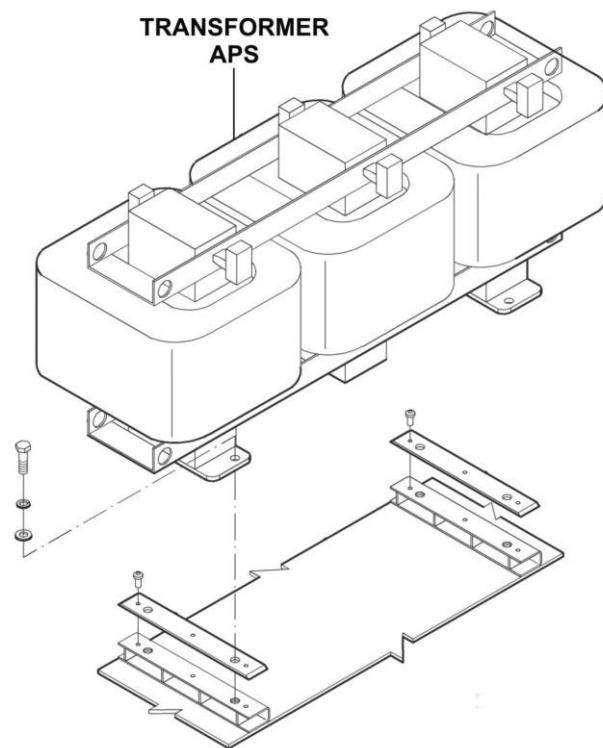
REMOVAL (cont'd)

- 4) Remove the Transformer APS Fixing Hardware.

NOTE: Now the Transformer APS is free to be safely shifted from its compartment.

WARNING: HEAVY OBJECT - THE TRANSFORMER APS WEIGHS 660 LB. SUPPORT TRANSFORMER APS WITH SUITABLE LIFTING DEVICE. FAILURE TO COMPLY CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

- 5) Remove the Transformer APS using suitable Fork Lift Equipment (660 lb capacity).



- 6) Make available the removed Transformer APS for Repair.

FIG 9 TRANSFORMER APS REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
13/14

Subsystem/Assy:

Unit:

APS-LVPS
TRANSFORMER APS

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

- B) TRANSFORMER APS REPLACEMENT WITH THE APS / LVPS ASSY
REMOVED FROM THE VEHICLE(cont'd).**

INSTALLATION

To perform the Task proceed as follows (Refer to Figures 7 through 9)

NOTE: It is assumed that the APS / LVPS Assy Box is properly positioned to make easier the safely installation of the Transformer APS.

**WARNING: HEAVY OBJECT - THE TRANSFORMER APS WEIGHS 660 LB.
SUPPORT TRANSFORMER APS WITH SUITABLE LIFTING DEVICE.
FAILURE TO COMPLY CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.**

1. Clean the Transformer APS Compartment in the APS /LVPS Assy Box using recommended agent and cleaning rags.
2. Carefully position the Transformer APS into its Compartment using suitable Fork Lift Equipment (660 lb capacity).
3. Carefully complete the positioning to match the Transformer Fixing Points with its relevant Installation Points on the Compartment Frame Brackets.

NOTE: Now the Transformer APS is still free but it remain in position because it is supported by the Box Frame Brackets.

4. Remove the Fork Lift Equipment.
5. Install the Transformer APS Fixing Hardware. Torque to **30 ft-lb**.
6. Reconnect the Electrical Connections.. Torque to **30 ft-lb**.
7. Clean the (TC) Panel O-ring Seat using recommended agent and lint-free rags.
8. Position the "new" (TC) Panel O-ring on its Seat.
9. Position the (TC) Panel on its Seat.
10. Install the (TC) Panel Fixing Screws. Torque to **5 ft lb**.
11. Record task results on the Defect Report Card for administrative and maintenance planning.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-14-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

14/14

Subsystem/Assy:

APS-LVPS

Unit:

TRANSFORMER APS

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT**INTENTIONALLY****LEFT BLANK**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-15-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/10

Subsystem/Assy:

APS-LVPS

Unit:

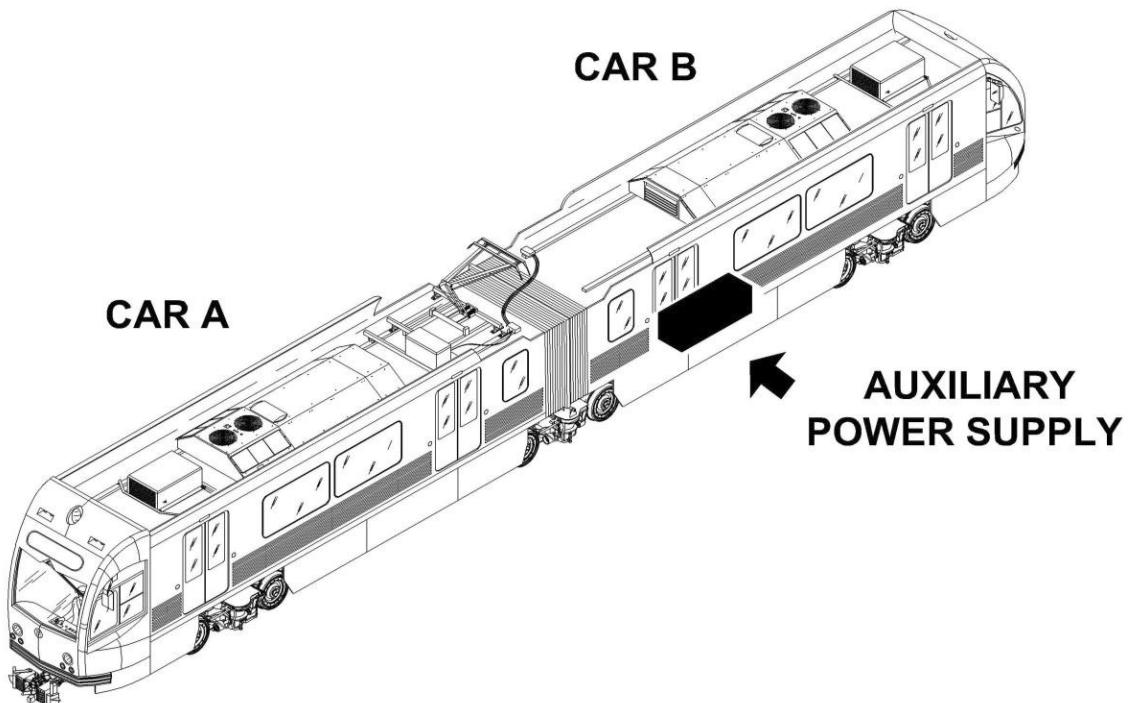
MAGNETIC GROUP

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT
LOCATION:

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-15-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/10

Subsystem/Assy:

APS-LVPS

Unit:

MAGNETIC GROUP

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT**SAFETY PRECAUTIONS:**

- WARNING:** BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.
- WARNING:** ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.
- WARNING:** BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.
- WARNING:** HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.
- WARNING:** WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.
- WARNING:** HEAVY OBJECT - THE MAGNETIC GROUP & THE CA FILTER CAPACITORS WEIGHS TOGETHER ABOUT 170 LB.
SUPPORT THEM WITH SUITABLE DEVICE.
FAILURE TO COMPLY CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit
Support Hydraulic Device

CONSUMABLES:

Cleaner / Degreaser

SPARE PARTS:

Magnetic Group

P/N 211ET23734B

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-15-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
3/10

Subsystem/Assy:

Unit:

APS-LVPS
MAGNETIC GROUP

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-15-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/10

Subsystem/Assy:

APS-LVPS

Unit:

MAGNETIC GROUP

Component:

Man Hours:

2.0

Maintenance Task:

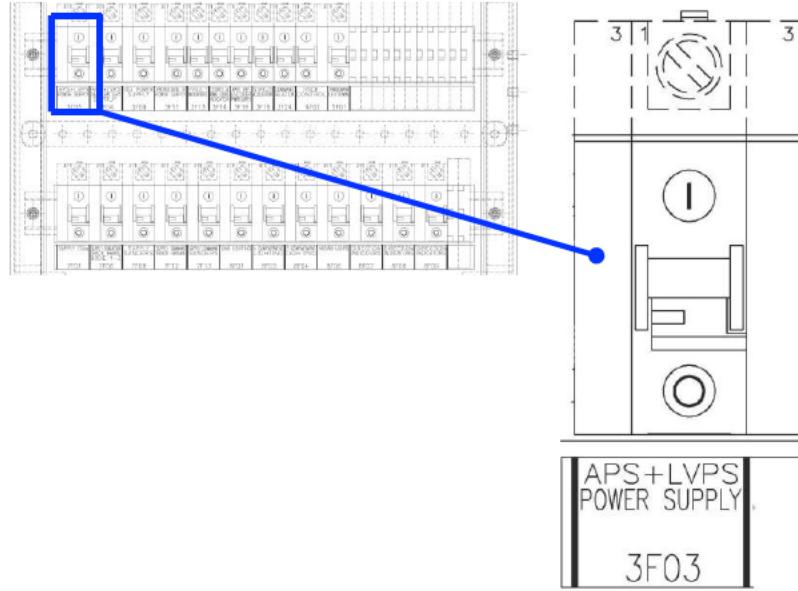
REPLACEMENT**PROCEDURE (CONT'D):**

To perform the Task proceed as follows (Refer to Figures 1 through 5):

REMOVAL

- 1)** Remove the Electrical Power from the Equipment by switching off respectively:

- The 3F01 Battery CB (Battery Box -Front)
- The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)

**FIG 1 3F01 CB LOCATION****FIG 2 LV LOCKER B 3F03 CB LOCATION**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-15-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
5/10

Subsystem/Assy:

APS-LVPS

Unit:

MAGNETIC GROUP

Component:

CA FILTER CAPACITOR

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd)

NOTE: It is advisable to retain the removed attaching Hardware for later use.

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to
Sheet R-C -02-05-00-00 / R-00 2.

- 2) Gain access to the Magnetic Group by removing the relevant TRCB Panel (Bottom Panel) as follows:
 - a) Disconnect the (Bottom Panel) Grounding Cable
 - b) Loose the (Bottom Panel) Fixing Screws.
 - c) Supporting the (Bottom Panel), remove the (Bottom Panel) Fixing Screws
 - d) Remove the (Bottom Panel) and discard the relevant O-ring.

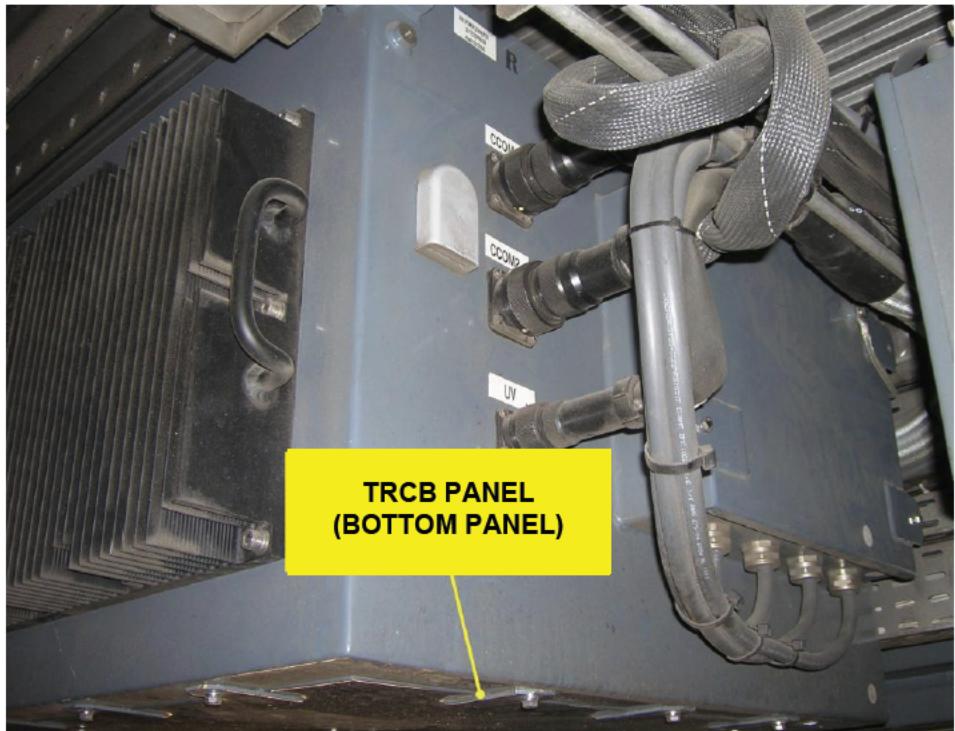


FIG 3 APS BOTTOM PANEL LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-15-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/10

Subsystem/Assy:

APS-LVPS

Unit:

MAGNETIC GROUP

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL(cont'd)**

- 3) Locate the Magnetic Group to be replaced

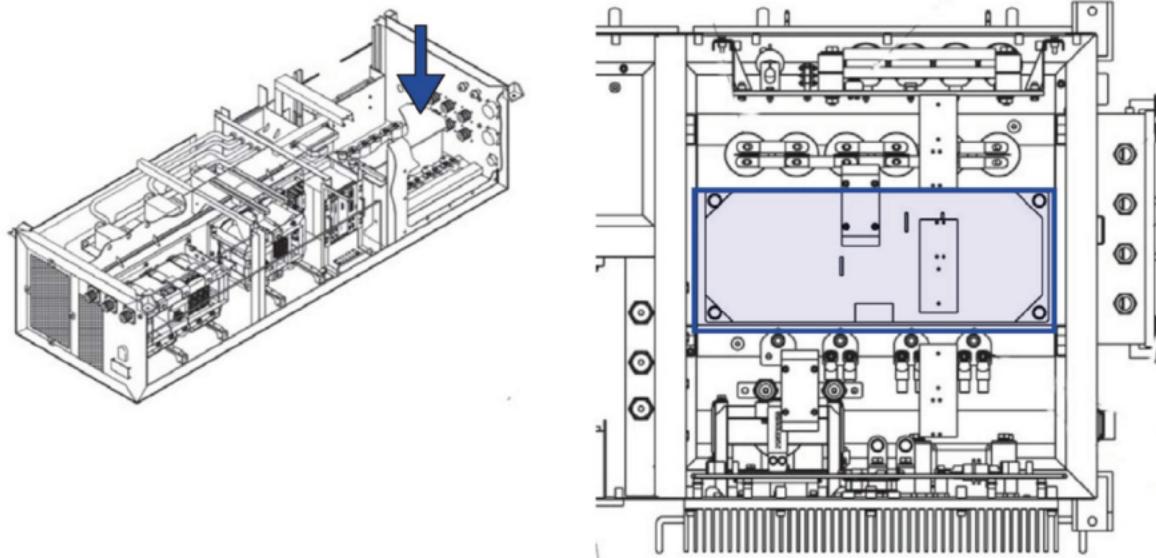


FIG 4 APS / LVPS MAGNETIC GROUP LOCATION

WARNING: HEAVY OBJECT - THE MAGNETIC GROUP & THE CA FILTER CAPACITORS WEIGHS TOGETHER ABOUT 170 LB. SUPPORT THEM WITH SUITABLE DEVICE. FAILURE TO COMPLY CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

- 4) Place a suitable Support Hydraulic Device under the CA Filter Capacitors & Magnetic Group Support Frame.
- 5) Raise the Hydraulic Device until its Head Plate is against the Support Frame in order to safely supporting the load of the Equipment installed on.
- 6) Loose and remove the Support Frame Fixing Hardware.
- 7) Lower carefully the Hydraulic Device with a first step to gain access to the Equipment Electrical Connections with the System.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-15-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
7/10

Subsystem/Assy:

Unit:

APS-LVPS
MAGNETIC GROUP

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

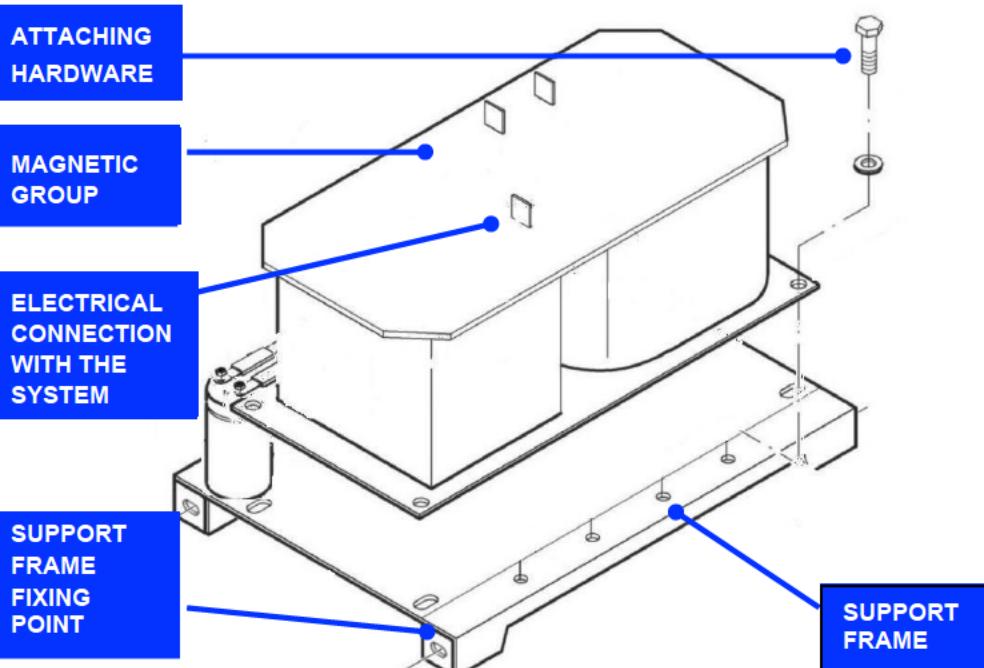
PROCEDURE (CONT'D):

REMOVAL(cont'd)

- 8) Disconnect the " Equipment Electrical Connections with the System " to make available the Equipment for complete lowering.
- 9) Complete the Hydraulic Device lowering until the Magnetic Group is accessible for removal

CAUTION: MAKE SURE THAT THE " REMOVED " SUPPORT FRAME WITH THE EQUIPMENT INSTALLED ON IS SECURED TO THE HYDRAULIC DEVICE TO SAFELY PROCEED WITH THE TASK

- 10) Loose and remove the Magnetic Group attaching Hardware



- 11) Using suitable Lifting Device, remove the Magnetic Group.

- 12) Make the removed Item available for Repair

FIGURE 5 - MAGNETIC GROUP - REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-15-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/10

Subsystem/Assy:

APS-LVPS

Unit:

MAGNETIC GROUP

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****INSTALLATION**

To perform the task proceed as follows (Refer to Figures 1 through 5):

NOTE: It is assumed that the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.

1. On Auxiliary Power Supply:
 - a) Clean the CA Filter & Magnetic Group Compartment using recommended agent and cleaning rags.
 - b) Make sure that the "Electrical Connections with the System" inside the Compartment are properly positioned to make easier the raising of the Support Frame with the Equipment installed on.
2. Install the "new" Magnetic Group on the Support Frame using suitable Lifting Device. Torque the relevant attaching Harware to **30 ft lb**.
3. Position the Hydraulic Device under the CA Filter & Magnetic Group Compartment to have the Support Frame with the Equipment installed on ready for on Vehicle installation.
4. Carefully raise the Hydraulic Device paying attention to not damage the Equipment installed on the Support Frame and those inside CA Filter & Magnetic Group Compartment.
5. Stop the raising to have the access for the reconnection of the "Equipment Electrical Connections with the System."
7. Reconnect the Equipment Electrical Connections with the System. Torque to **15.2 ft lb**.
8. Carefully complete the raising to match the Support Frame Fixing Points with the relevant Installation points on the APS Box Structure.
9. Install the Support Frame Fixing Hardware. Torque to **.6.2 ft lb**.
10. Lower and remove the Support Hydraulic Device.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-15-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

9/10

Subsystem/Assy:

APS-LVPS

Unit:

MAGNETIC GROUP

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****INSTALLATION(cont'd):****FINAL OPERATIONS**

1. Clean the (Bottom Panel) O-ring Seat using recommended agent and lint-free rags.
2. Position the “new” (Bottom Panel) O-ring on its Seat.
3. Position the (Bottom Panel) on its Seat using suitable Support Device.
4. Install the (Bottom Panel)Fixing Screws. Torque to **5 ft lb**.
5. Reconnect the (Bottom Panel) Grounding Cable. Torque to **4 ft lb**.
6. Restore the Electrical Power to the Equipment by switching on respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)
7. Close and lock the LV Locker B Door and the Battery Box Front Cover.
8. Restore Power to Vehicle.
9. Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of
 - the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and
 follow the prescriptions provided at Step 3 “**At every Task Completion.**”

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-15-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

10/10

Subsystem/Assy:

APS-LVPS

Unit:

MAGNETIC GROUP

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT**INTENTIONALLY LEFT
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P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-16-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/10

Subsystem/Assy:

APS-LVPS

Unit:

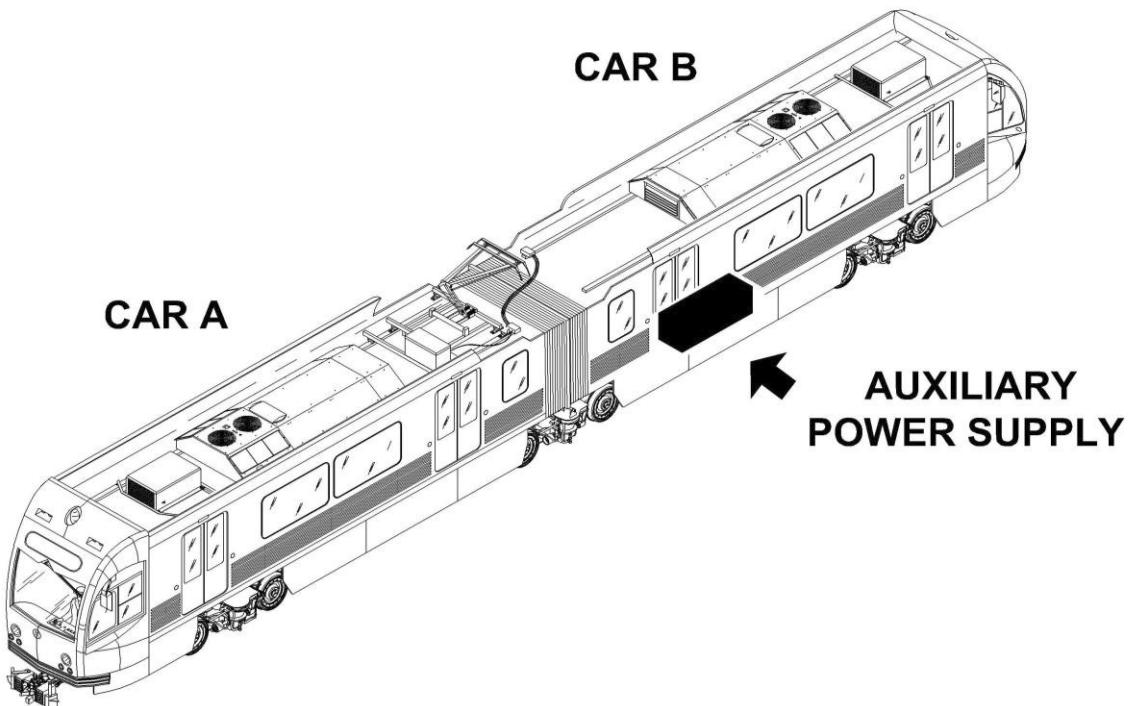
MOTOR FAN

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT
LOCATION:


P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-16-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/10

Subsystem/Assy:

APS-LVPS

Unit:

MOTOR FAN

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

SAFETY PRECAUTIONS:

WARNING: BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.

WARNING: ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.

WARNING: BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.

WARNING: HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS.
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.

WARNING: WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit
Support Hydraulic Device

CONSUMABLES:

Cleaner / Degreaser

SPARE PARTS:

Motor Fan	P/N 211EZ23776B
Outlet Gasket	P/N 212EE10934B
Inlet Gasket	P/N 212EE10018B

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-16-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

3/10

Subsystem/Assy:

APS-LVPS

Unit:

MOTOR FAN

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-16-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/10

Subsystem/Assy:

APS-LVPS

Unit:

MOTOR FAN

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE:

To perform the Task proceed as follows (Refer to Figures 1 through 5):

REMOVAL

1. Remove the Electrical Power from the Equipment by switching off the 2 F12 Motor Fan Auxiliary M.V. CB (LV Locker B Section-MV CB Panel).

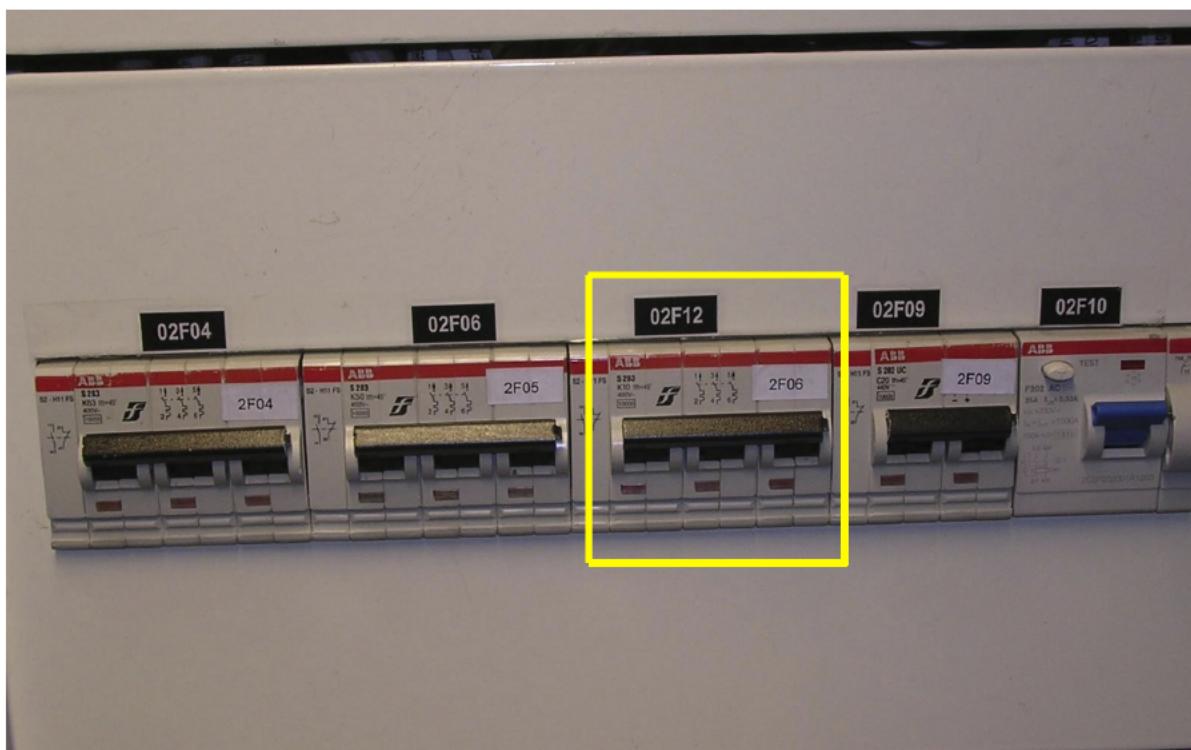


FIG 1

2F12 MOTOR FAN AUXILIARY M.V. CB

LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-16-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION**5/10**

Subsystem/Assy:

Unit:

APS-LVPS**MOTOR FAN**

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd)

NOTE: It is advisable to retain the removed attaching Hardware for later use.

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to Sheet R-C -02-05-00-00 / R-00 2.

2. Gain access to the Motor Fan Unit by removing the relevant:

- Fan Inspection Panel (FIP) (located on the opposite side of the Front Panel)
- Fan Bottom Panel (FBP) located on the bottom of the Motor Fan Compartment)

as follows:

- a) Disconnect the (FIP) / (FBP) Panel Grounding Cable.
- b) Loose the (FIP) Panel / (FBP) Fixing Screws.
- c) Supporting the (FIP) / (FBP) Panel, remove the (FIP) / (FBP) Panel Fixing Screws.
- d) Remove the (FIP) / (FBP) Panel and discard the relevant O-ring.

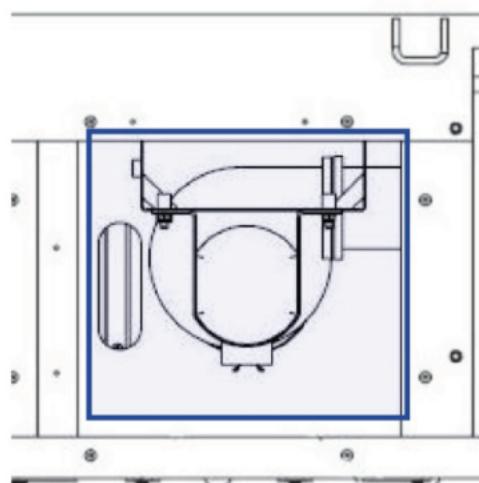
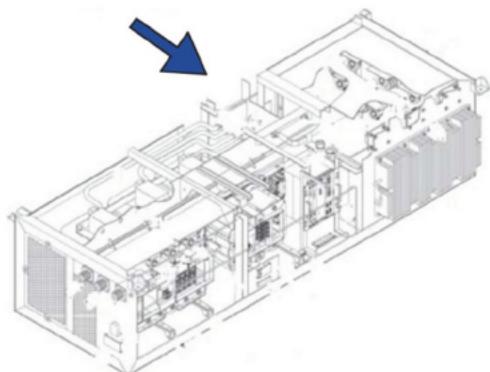


FIG 2 APS / LVPS MOTOR FAN UNIT LOCATION-

VIEW WITH (FIP) REMOVED

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-16-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION**6/10**

Subsystem/Assy:

APS-LVPS

Unit:

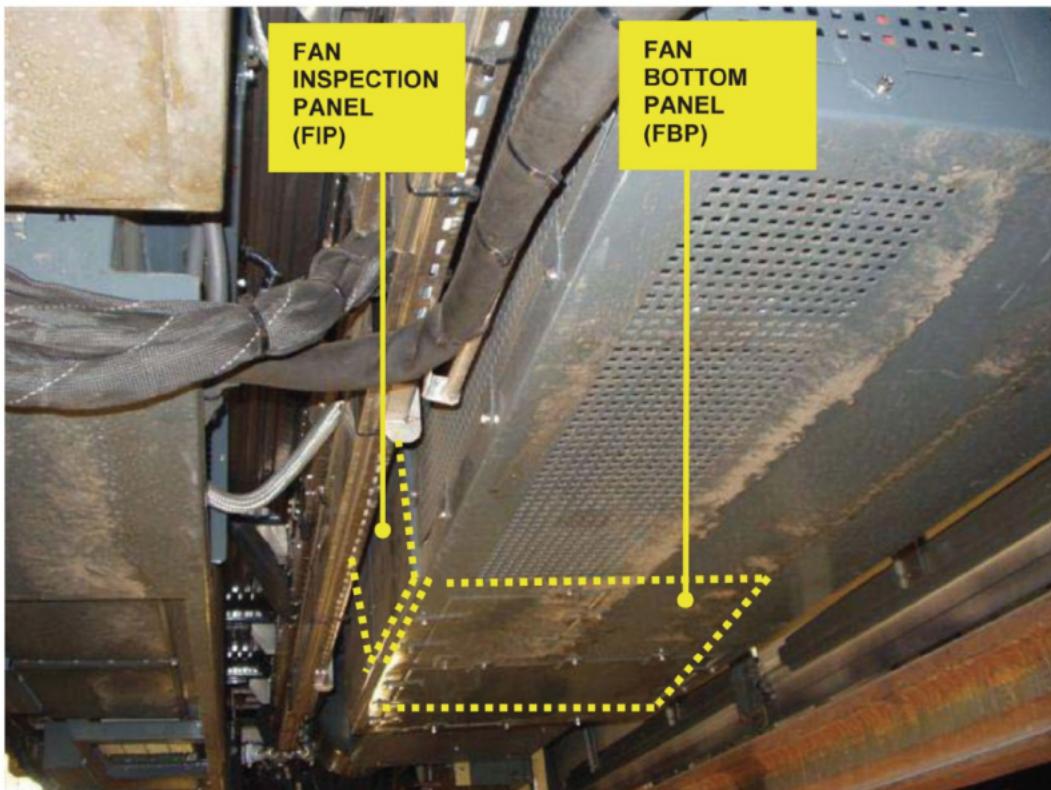
MOTOR FAN

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL(cont'd)****FIG 3 APS / LVPS MOTOR FAN UNIT & FAN PANELS LOCATION-**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-16-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
7/10

Subsystem/Assy:

APS-LVPS

Unit:

MOTOR FAN

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd)

3. Disconnect the Motor Grounding Wire by loosening relevant hardware. Protect Terminals by suitable Protection Caps.
4. Remove the Motor Power Supply Terminal Board Cover by loosening relevant hardware. Retain hardware and Cover for later use
5. Loosen the Cable Bushing and remove the Motor Power Supply Cable. by disconnecting the relevant Terminals.
6. Secure the Motor Power Supply Cable by relevant Clamp and protect Cable Terminals using suitable Protection Caps.
7. Position under the Motor a suitable Support Device provided with wood edges shaped so that they should safely support the Unit.
8. Raise the Support Device to support the Unit.
9. Loose and remove the Hardware fixing the Motor to the Support.

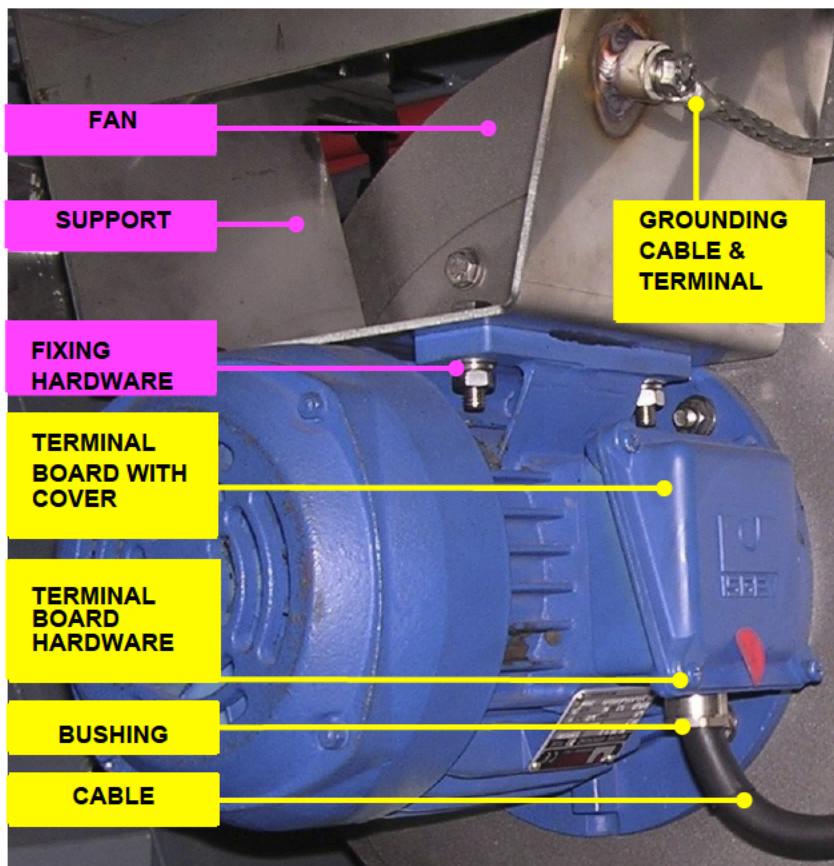


FIG 4 APS / LVPS MOTOR FAN CONNECTIONS

NOTE: Now the Motor Fan Unit is free. It remains in position because supported by the Support Device.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-16-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/10

Subsystem/Assy:

APS-LVPS

Unit:

MOTOR FAN

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL(cont'd)**

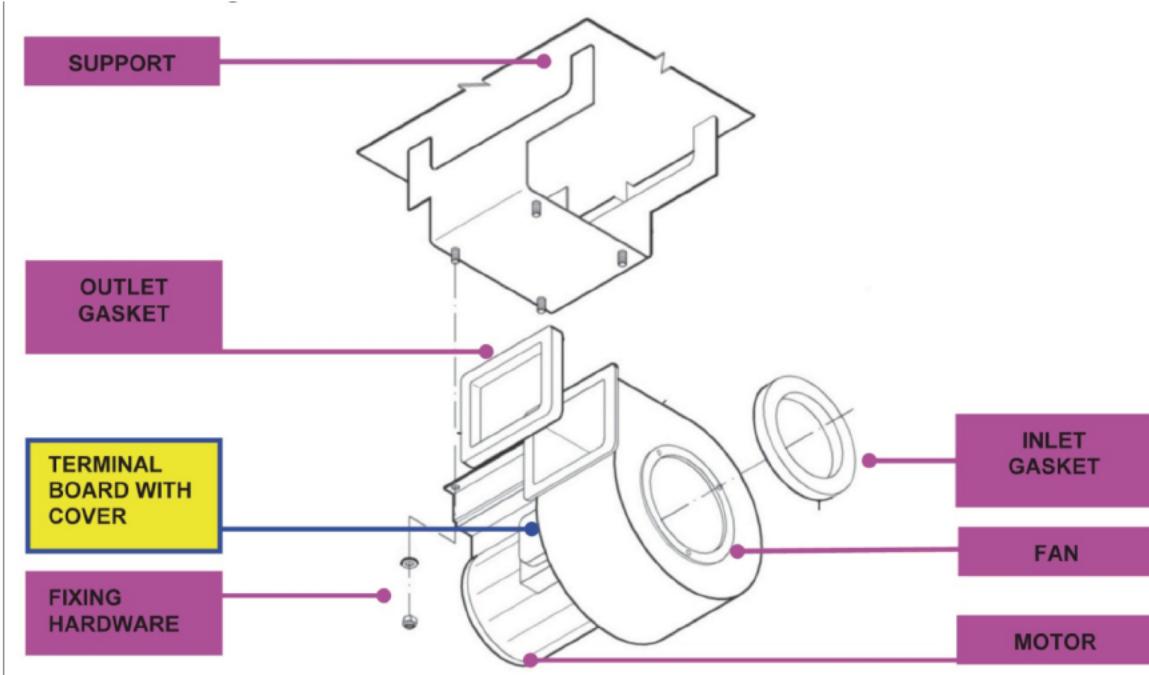
10. Remove the Motor Fan Unit by carefully lowering the Support Device.

NOTE: To remove the Unit a first movement (shifting / pulling) is needed to allow the mismatching of the Fan Inlet & Outlet Gaskets.

11. Remove and discard both the Gaskets.

12. Make available the removed Motor Fan Assy for Repair.

NOTE: Do not forget to collect the Motor Terminal Board Cover, relevant Hardware and Cable Bushing in a suitable box.

**FIGURE 5 - APS / LVPS****MOTOR FAN CONNECTIONS - REPLACEMENT**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-16-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

9/10

Subsystem/Assy:

APS-LVPS

Unit:

MOTOR FAN

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

INSTALLATION

To perform the Task proceed as follows: (Refer to Figures 1 through 5):

NOTE: It is assumed that:

- The Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations
- The Motor Fan Assy. to be installed is placed onto a suitable Support Device provided with wood edges shaped so that they should safely support it

1. Clean the Motor Fan Unit Compartment using recommended agent and cleaning rags.
2. Make sure that the Motor Power Supply Cable, inside the Compartment, is properly positioned to make easier the Motor Fan Unit installation.
3. Make free the Motor Cable Terminals and Cable from Protection Caps and Clamp.
4. Check the Cable Terminals for damage / signs of overheating. Replace as per check results.
5. Install both the "new" (Inlet & Outlet) Gaskets into their Seats.
6. Carefully raise the Support Device to position the Motor Fan Unit., paying attention to not damage the "new" Gaskets.
7. Complete the Motor Fan Assy. proper positioning by means of little (pushing / shifting) movements to match:
 - The Motor Fixing Holes with the relevant Installation Holes on the Motor Support (APS Box Structure)
 - Both the Fan Inlet & Outlet with the relevant Inlet & Outlet Ducts on the APS Box Structure

NOTE: Now the Motor Fan is still free. It remain in position because supported by the Support Device.

8. Install the Hardware (Selflocking Nuts) fixing the Motor to the Support. Tighten as needed.
9. Connect the Motor Power Supply Cable Terminals and tighten the Cable Bushing.
10. Install the Motor Power Supply Terminal Board Cover and relevant Hardware. Tighten as needed.
11. Remove the Protection Cap from the Grounding Wire Terminal and install it by tightening the relevant Hardware.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-16-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

10/10

Subsystem/Assy:

APS-LVPS

Unit:

MOTOR FAN

Component:

Man Hours:

2.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

INSTALLATION (cont'd)

FINAL OPERATIONS

1. Clean the (FIP) / (FBP) Panel O-ring Seat using recommended agent and lint-free rags.
2. Position the “new” (FIP) / (FBP) Panel O-ring on its Seat.
3. Position the (FIP) / (FBP) Panel on its Seat.
4. Install the (FIP) / (FBP) Panel Fixing Screws. Torque to **5 ft lb**.
5. Reconnect the (FIP) / (FBP) Panel Grounding Cable. Torque to **4 ft lb**.
6. Restore the Electrical Power to the Equipment by switching on the 2 F12 Motor Fan Auxiliary M.V. CB (LV Locker B Section-MV CB Panel).
7. Close and lock the LV Locker B Door.
8. Restore Power to Vehicle.
9. Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 “**At every Task Completion.**”

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-17-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/8

Subsystem/Assy:

APS-LVPS

Unit:

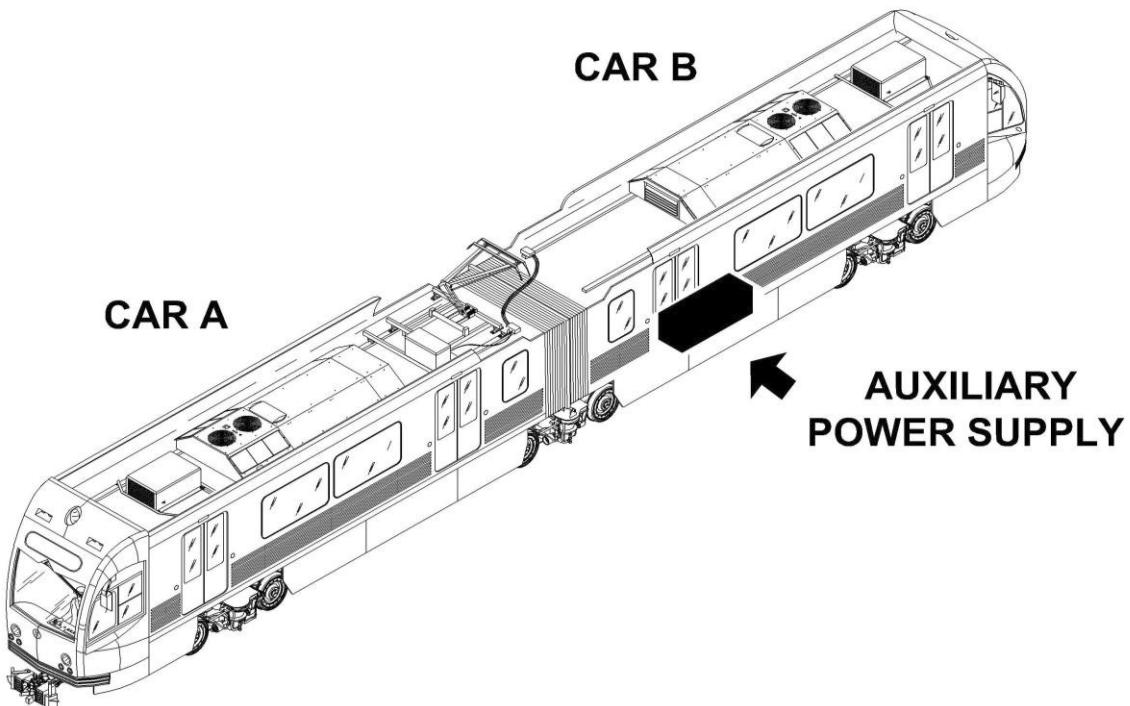
RESISTORS

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT
LOCATION:

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-17-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

APS-LVPS

Unit:

RESISTORS

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

SAFETY PRECAUTIONS:

WARNING: BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.

WARNING: ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.

WARNING: BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.

WARNING: HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS.
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.

WARNING: WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC 2000 Contact Cleaner

SPARE PARTS:

Resistor 68W 110 ohm 5%	P/N 211NR50043B120501	Support	P/N 211NR50064B0702
Resistor 3.3 / 300 W	P/N 211NR50046B06021	Support	P/N 211NR50064B0105
Resistor 1.5 / 250 W 1 KJ	P/N 211ER23590B	Block	P/N 212EE10102B

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-17-00/R-00

System:	LOW VOLTAGE DISTRIBUTION	Sheet:
Subsystem/Assy:	APS-LVPS	Unit: RESISTORS
Component:		Man Hours: 1.0

Maintenance Task:	REPLACEMENT
-------------------	--------------------

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-17-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

APS-LVPS

Unit:

RESISTORS

Component:

Man Hours:

1.0

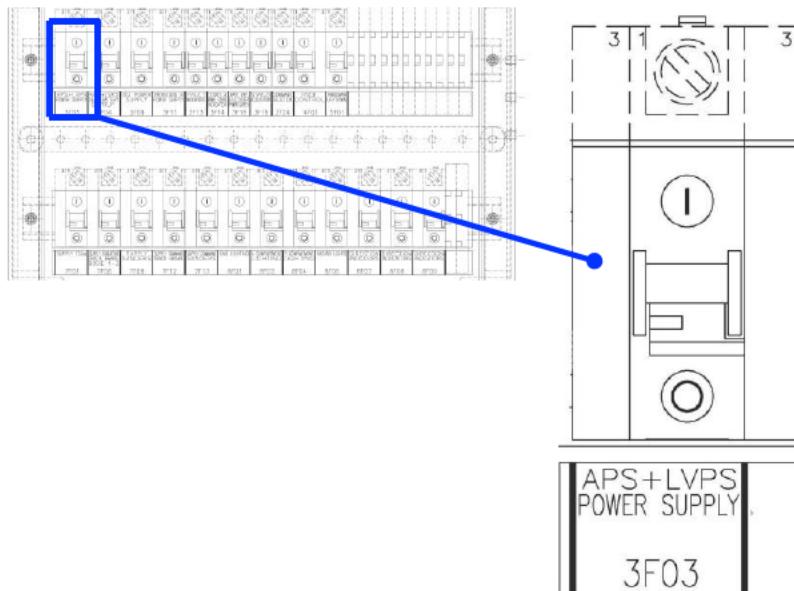
Maintenance Task:

REPLACEMENT**PROCEDURE:**

To perform the Task proceed as follows (Refer to Figures 1 through 4):

REMOVAL

- 1) Remove the Electrical Power from the Equipment by switching off respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)

**FIG 1 3F01 CB LOCATION****FIG 2 LV LOCKER B 3F03 CB LOCATION**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-17-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/8

Subsystem/Assy:

APS-LVPS

Unit:

RESISTORS

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd)

NOTE: It is advisable to retain the removed attaching Hardware for later use

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to
Sheet R-C -02-05-00-00 / R-00 2

- 2) Gain access to the Resistors by removing the relevant Electronic Components (EC) Panel (located on the opposite side of the Front Panel) as follows:
 - a) Disconnect the (EC) Panel Grounding Cable.
 - b) Loose the (EC) Panel Fixing Screws.
 - c) Supporting the (EC) Panel, remove the (EC) Panel Fixing Screws.
 - d) Remove the (EC) Panel and discard the relevant O-ring.
- 3) Locate the Resistor to be replaced.

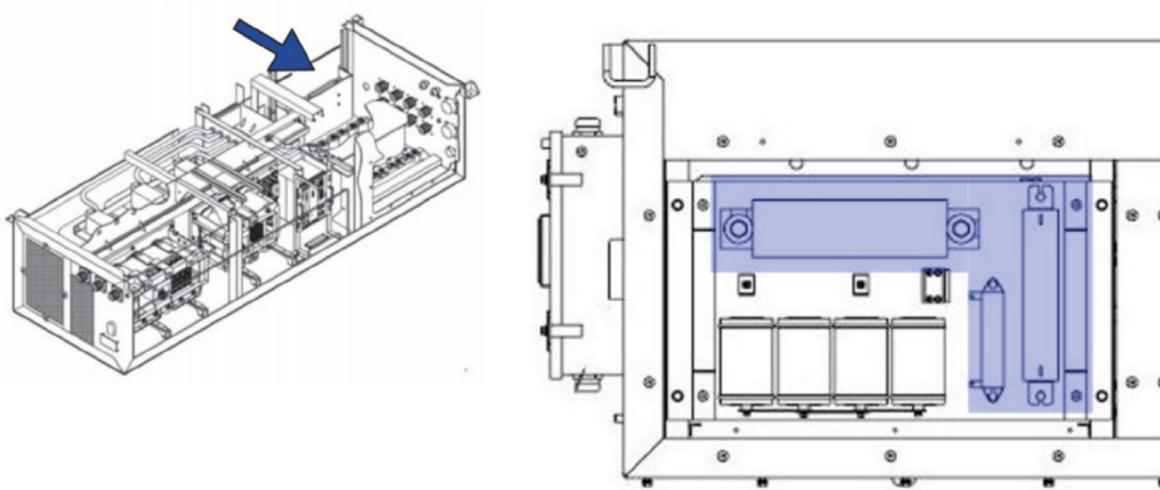


FIG 3 APS / LVPS RESISTORS LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-17-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

APS-LVPS

Unit:

RESISTORS

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd)

- 4) Disconnect the Electrical Connections by loosening and removing the relevant Hardware.

- 5) Remove the Resistor to be replaced together with the relevant Support / Block

- 6) Discard the Resistor

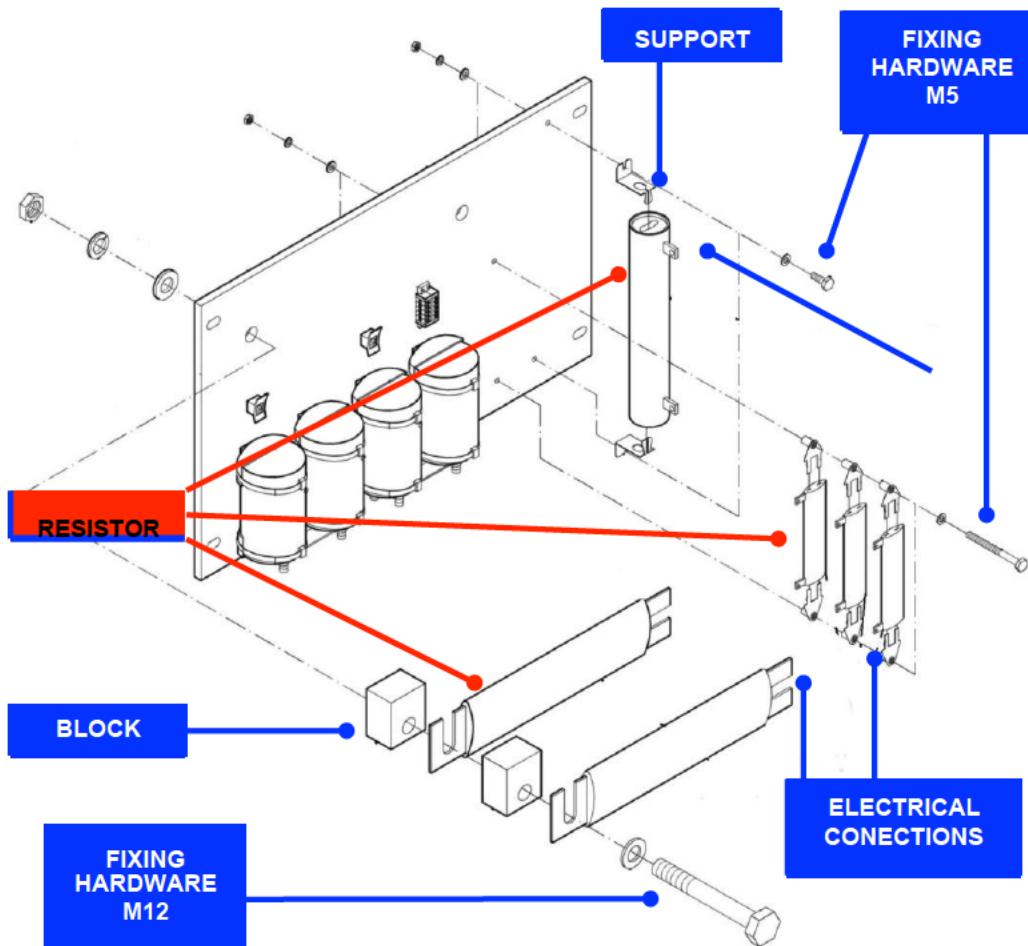


FIGURE 4 -RESISTORS - REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-17-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

7/8

Subsystem/Assy:

APS-LVPS

Unit:

RESISTORS

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

INSTALLATION

To perform the Task proceed as follows:(Refer to Figures 1 through 4)

NOTE: It is assumed that the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.

1. Clean the Resistor Support / Block using recommended agent and lint-free rags
2. Check Electrical Connections for damage / signs of overheating
3. Position the Resistor to be installed together with its Support Block.
4. Secure the Resistor Assy. by means of the relevant Fixing Hardware.

Torque according to the following Torque Values:

SCREW	M5	M12
TORQUE	5 ft-lb	15 ft-lb

5. Reconnect the Electrical Connections. Tighten as needed.

FINAL OPERATIONS

1. Clean the (EC) Panel O-ring Seat using recommended agent and lint-free rags.
2. Position the "new" (EC) Panel O-ring on its Seat.
3. Position the (EC) Panel on its Seat.
4. Install the (EC) Panel Fixing Screws. Torque to **5 ft lb**.
5. Reconnect the (EC) Panel Grounding Cable. Torque to **4 ft lb**
6. Restore the Electrical Power to the Equipment by switching on respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)
7. Close and lock the LV Locker B Door and the Battery Box Front Cover.
8. Restore Power to Vehicle.
9. Record task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-17-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/8

Subsystem/Assy:

APS-LVPS

Unit:

RESISTORS

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT**INTENTIONALLY
LEFT BLANK**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-19-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/8

Subsystem/Assy:

APS-LVPS

Unit:

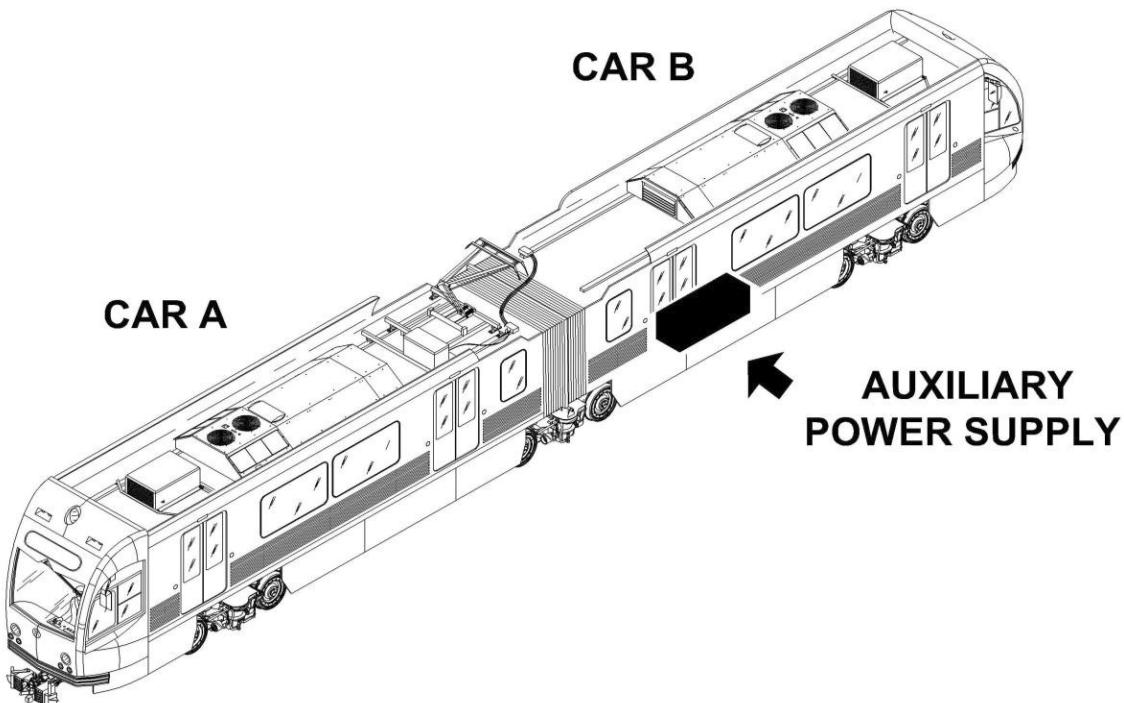
CURRENT TRANSDUCER

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT
LOCATION:

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-19-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

APS-LVPS

Unit:

CURRENT TRANSDUCER

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

SAFETY PRECAUTIONS:

WARNING: BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.

WARNING: ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.

WARNING: BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.

WARNING: HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS.
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.

WARNING: WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC 2000 Contact Cleaner

SPARE PARTS:

Current Transducer
Terminal Board

P/N 211ST60130B
P/N 211EU20633B07

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-13-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

3/8

Subsystem/Assy:

APS-LVPS

Unit:

CURRENT TRANSDUCER

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-19-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

APS-LVPS

Unit:

CURRENT TRANSDUCER

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL

To perform the Task proceed as follows (Refer to Figures 1 through 4):

- 1)** Remove the Electrical Power from the Equipment by switching off respectively:

- The 3F01 Battery CB (Battery Box -Front)
- The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)



FIG 1 3F01 CB LOCATION

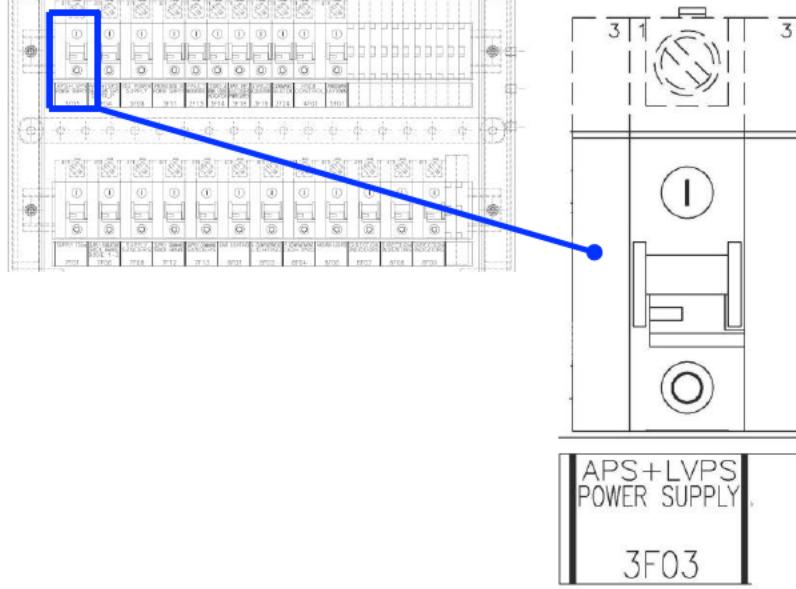


FIG 2 LV LOCKER B 3F03 CB LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-19-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/8

Subsystem/Assy:

APS-LVPS

Unit:

CURRENT TRANSDUCER

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL

- 2) Remove the Active Clamp Module according to Sheet R-C -10-01-22-00 / R-00.
- 3) Locate the Current Transducer to be replaced.

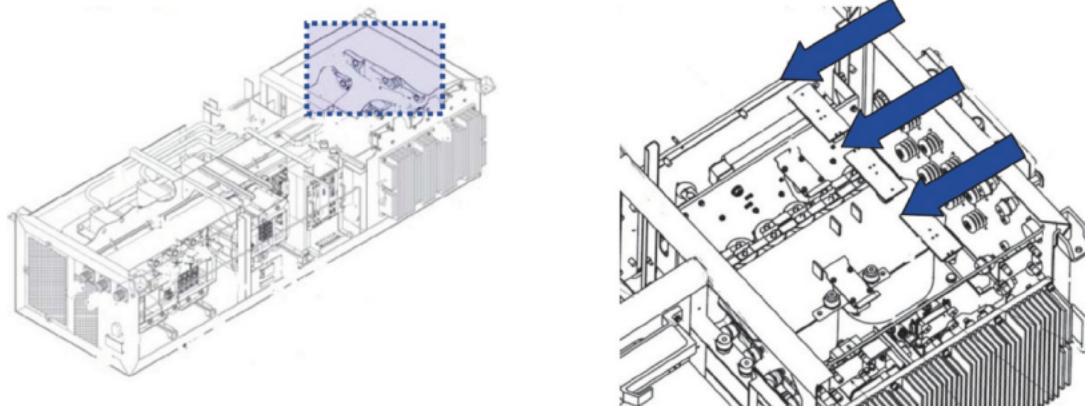


FIG 3 APS / LVPS CURRENT TRANSDUCERS LOCATION

- 4) Disconnect the Transducer Electrical Connections.
- 5) Supporting the Transducer, loose and remove the Transducer Assy. Fixing Hardware.
- 6) Remove the Transducer together with the relevant Terminal Board from its Support.
- 7) Discard the Transducer.

INSTALLATION

To perform the Task proceed as follows (Refer to Figures 1 through 4):

- 1) Clean the Transducer Seat using recommended agent and lint-free rags.
- 2) Check the Transducer and the relevant Terminal Board Electrical Connections for damage / signs of overheating.
- 3) Position the "new" Transducer together with the relevant Terminal Board on its Support.
- 4) Install the Transducer Fixing Hardware. Torque to 4ft lb.
- 5) Reconnect the Transducer Electrical Connections. Tighten as needed.
- 6) Install the Active Clamp Module according to Sheet R-C -10-01-22-00 / R-00.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-19-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

APS-LVPS

Unit:

CURRENT TRANSDUCER

Component:

Man Hours:

1.5

Maintenance Task:

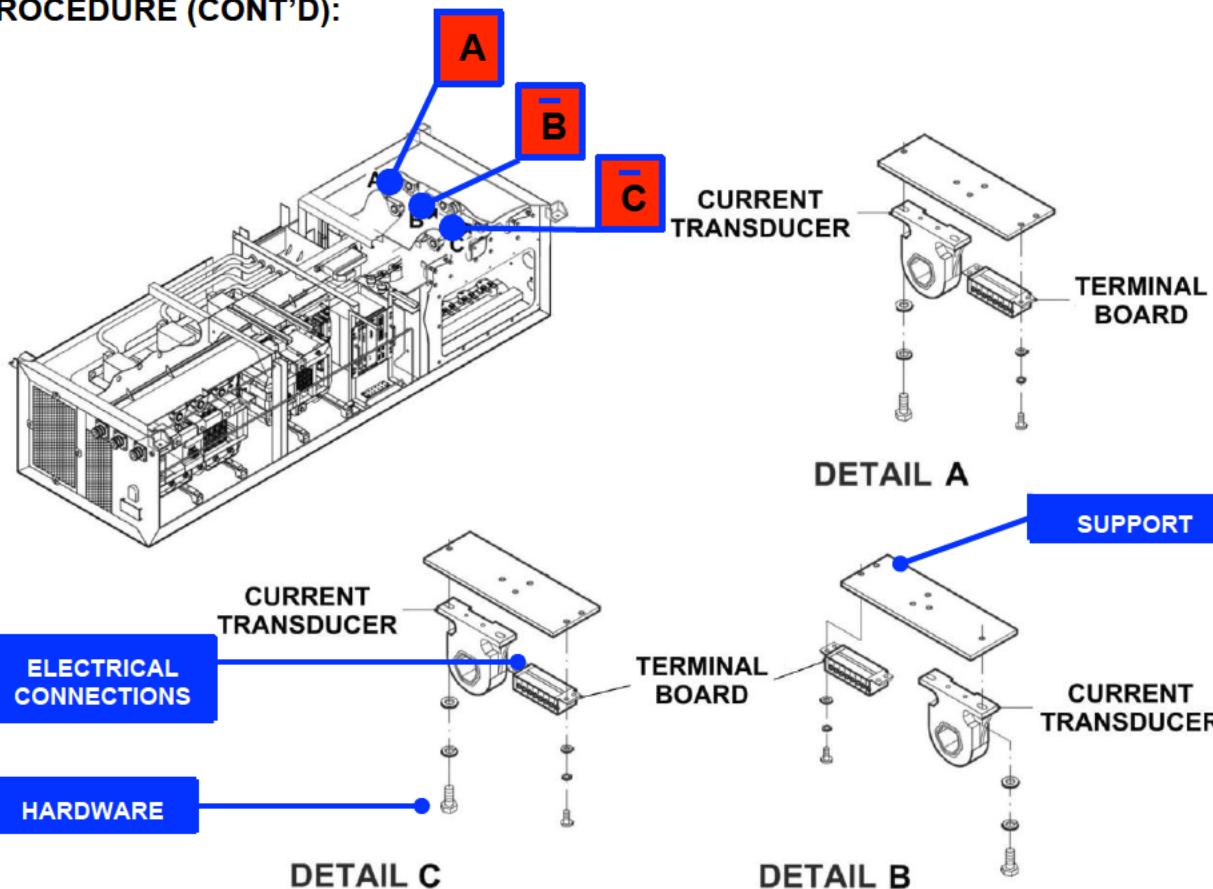
REPLACEMENT**PROCEDURE (CONT'D):**

FIGURE 4 - CURRENT TRANSDUCER REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-19-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

7/8

Subsystem/Assy:

APS-LVPS

Unit:

CURRENT TRANSDUCER

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT
PROCEDURE (CONT'D):

FINAL OPERATIONS

1. Restore the Electrical Power to the Equipment by switching on respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)
2. Close and lock the LV Locker B Door and the Battery Box Front Cover.
3. Restore Power to Vehicle.
4. Record task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 “**At every Task Completion.**”

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-19-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/8

Subsystem/Assy:

APS-LVPS

Unit:

CURRENT TRANSDUCER

Component:

Man Hours:

1.5

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****INTENTIONALLY****LEFT BLANK**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-21-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/8

Subsystem/Assy:

APS-LVPS

Unit:

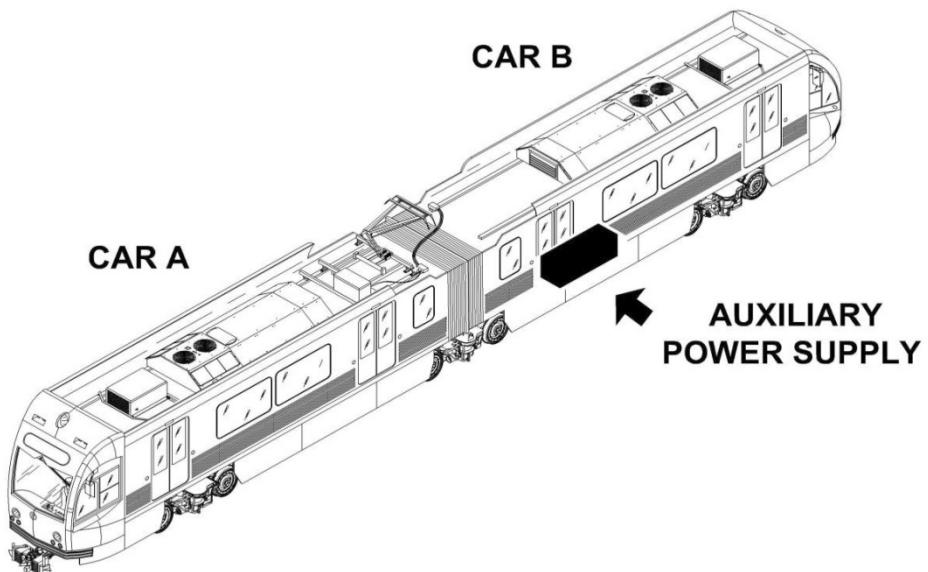
FUSE (63A)

Component:

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)
LOCATION:


P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-21-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

APS-LVPS

Unit:

FUSE (63A)

Component:

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)**SAFETY PRECAUTIONS:**

LACMTA Maintenance Shop Safety Rules & regulations

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC 2000 Contact Cleaner
 Dry Compressed Air for Electronic Equipment (commercial).

SPARE PARTS:

- | | |
|----------------------|------------------------|
| · Fuse 63A | P/N 211VF00021B04 0023 |
| · Fuse Holder | P/N 211VQ00023B03 0023 |
| · Front Cover O-ring | P/N 211EX21730B03 |

P2550 CORRECTIVE MAINTENANCE SHEET	
Card Code:	
R-C-10-01-21-00/R-00	
System: LOW VOLTAGE DISTRIBUTION	Sheet: 3/8
Subsystem/Assy: APS-LVPS	Unit: FUSE (63A)
Component:	Man Hours: 0.5
Maintenance Task: REPLACEMENT (TYPICAL)	
<p>PROCEDURE:</p> <p>PRELIMINARY OPERATIONS</p> <p>Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:</p> <ol style="list-style-type: none"> 1. Place the Vehicle in the Maintenance Shop over the Pit or on the Stand Up Rail. 2. Set the Master Controller Handle to FSB position. 3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON). 4. Remove Electrical Power from Vehicle by lowering the Pantograph. 5. Turn the Transfer Switch to OFF. 6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF. 7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures. <p>NOTE The tag must indicate the name of the person who removed Power. That person knows why the Power was removed and when it safe to restore it. Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.</p>	

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-21-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

APS-LVPS

Unit:

FUSE (63A)

Component:

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE (CONT'D):

REMOVAL

To perform the Task proceed as follows (Refer to Figures 1 through 5):

- 1) Remove the Electrical Power from the Equipment by switching off respectively:**

- The 3F01 Battery CB (Battery Box -Front)
- The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)



FIG 1 3F01 CB LOCATION

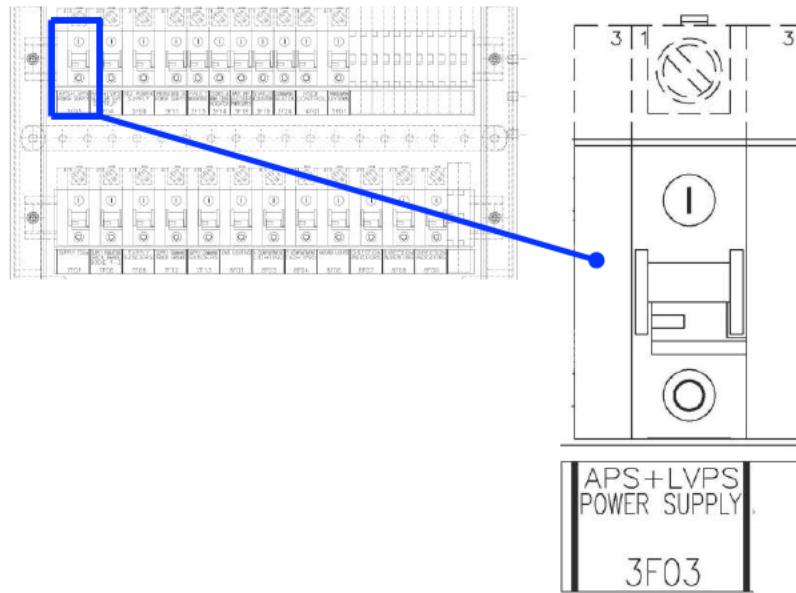


FIG 2 LV LOCKER B 3F03 CB LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-21-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
5/8

Subsystem/Assy:

Unit:

APS-LVPS
FUSE (63A)

Component:

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)

PROCEDURE(CONT'D)

REMOVAL(cont'd)

NOTE: It is advisable to retain the removed attaching Hardware for later use.

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to Sheet R-C -02-05-00-00 / R-00 2.

- 2) Gain access to Fuse Holder by removing the relevant APS /LVPS Front Panel as follows:
 - a) Disconnect the Front Panel Grounding Cable.
 - b) Loose the Front Panel Fixing Screws.
 - c) Supporting the Front Panel with suitable Device, remove the Front Panel Fixing Screws.
 - d) Remove the Front Panel and discard the relevant O-ring.

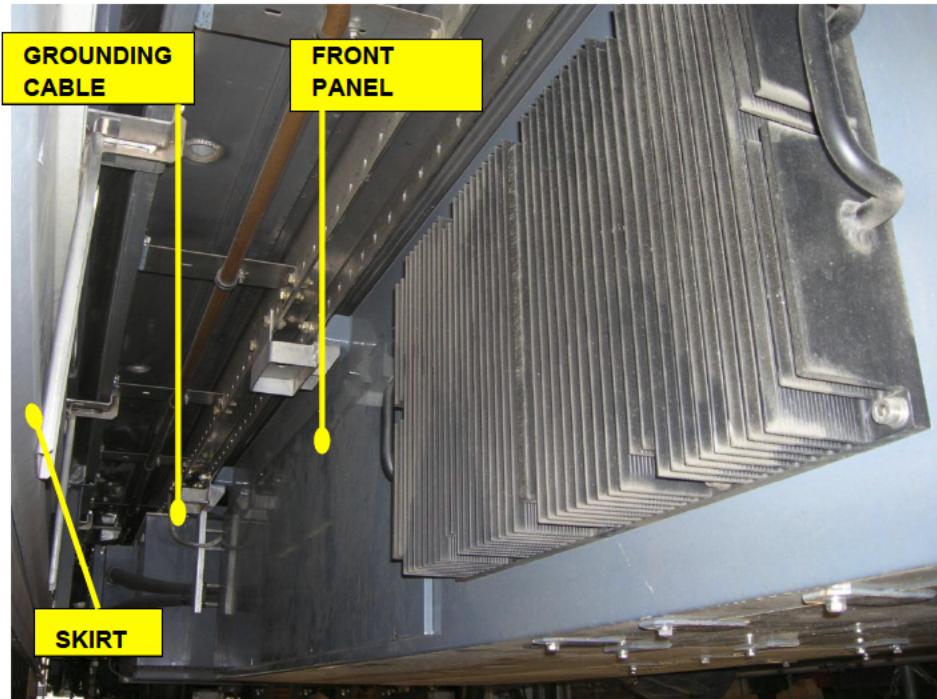


FIG 3 APS / LVPS LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-21-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

APS-LVPS

Unit:

FUSE (63A)

Component:

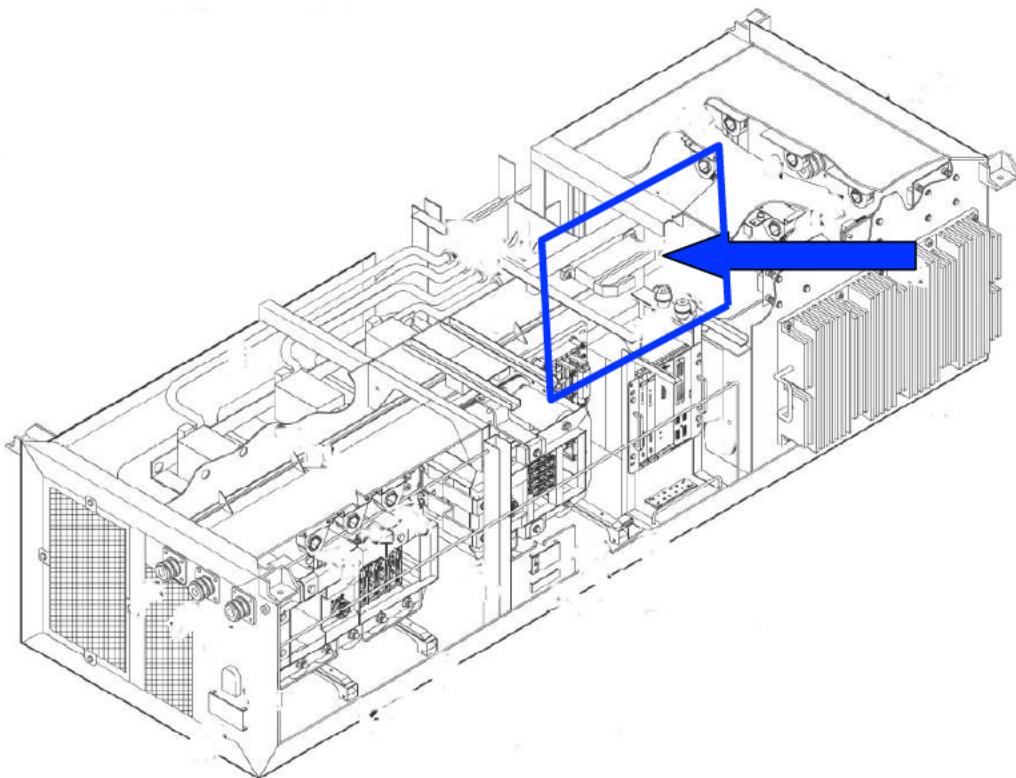
Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE:****REMOVAL(cont'd)**

- 3) Locate the
Fuse Holder

**FIG 4 APS / LVPS FUSE HOLDER LOCATION**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-21-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
7/8

Subsystem/Assy:

Unit:

APS-LVPS
FUSE (63A)

Component:

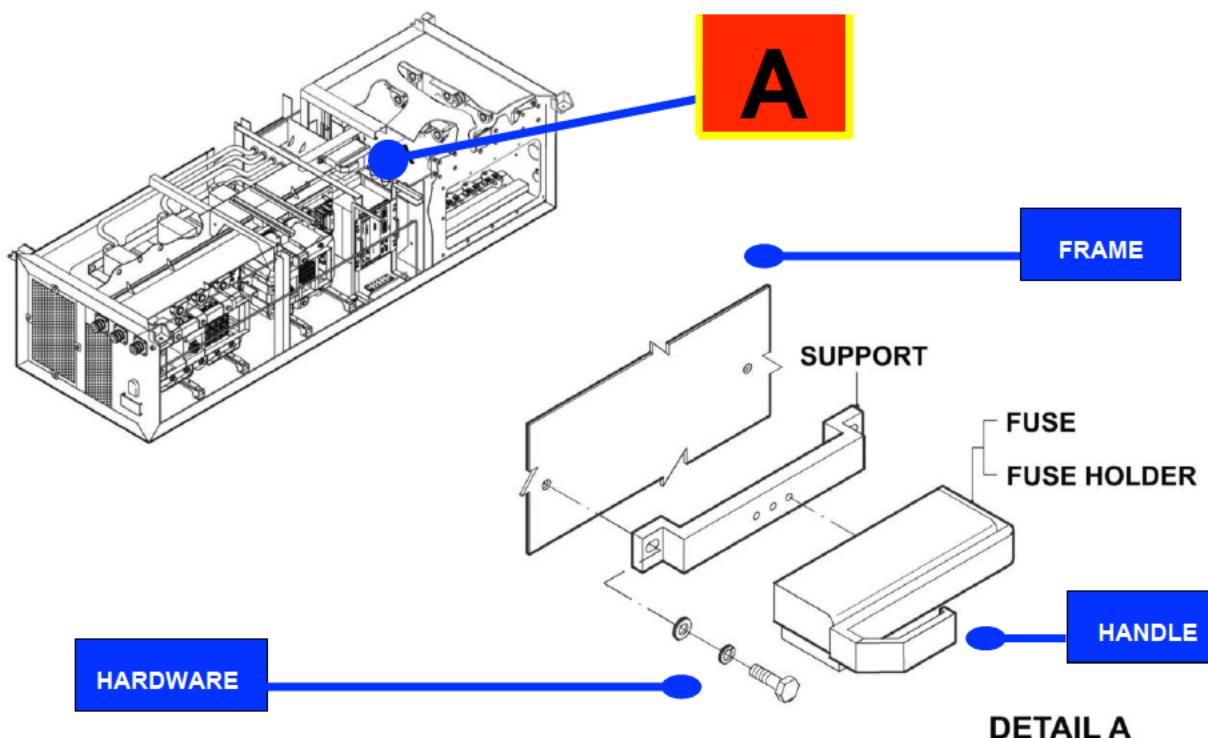
Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)
PROCEDURE:
REMOVAL(cont'd)

- 4) Open the Fuse Holder by pulling the relevant Handle.
- 5) Remove the Fuse.
- 6) Check the Fuse Holder for damage / signs of overheating. Replace as per check results by removing the relevant Fuse Holder Fixing Hardware.


FIG 5 FUSE (63A) REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-21-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/8

Subsystem/Assy:

APS-LVPS

Unit:

FUSE (63A)

Component:

Man Hours:

0.5

Maintenance Task:

REPLACEMENT (TYPICAL)**PROCEDURE:****INSTALLATION**

To perform the Task proceed as follows: (Refer to Figures 1 through 5):

NOTE: It is assumed that the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.

1. Install the "new" Fuse into the Fuse Holder.
2. Close the Fuse Holder by pushing the relevant Handle.
3. Restore Electrical Power to APS / LVPS Control Unit by switching ON the 3F01 (Battery Box Front).
4. Check on the Control Unit that all the Operating Leds are GREEN, indicating that it works properly.

FINAL OPERATIONS

1. Clean the APS / LVPS Front Panel O-ring Seat using recommended agent and lint-free rags.
2. Position the "new" Front Panel O-ring on its Seat.
3. Position the Front Panel on its Seat using suitable Support Device.
4. Install the Front Panel Fixing Screws. Torque to **5 ft lb**.
5. Reconnect the Front Panel Grounding Cable. Torque to **4 ft lb**.
6. Restore Electrical Power to APS / LVPS Assy " by switching ON the 3F03 (LV Locker B Section).
7. Close and lock the LV Locker B Door and the Battery Box Front Cover.
8. Restore Electrical Power to Vehicle.
9. Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-22-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/8

Subsystem/Assy:

APS-LVPS

Unit:

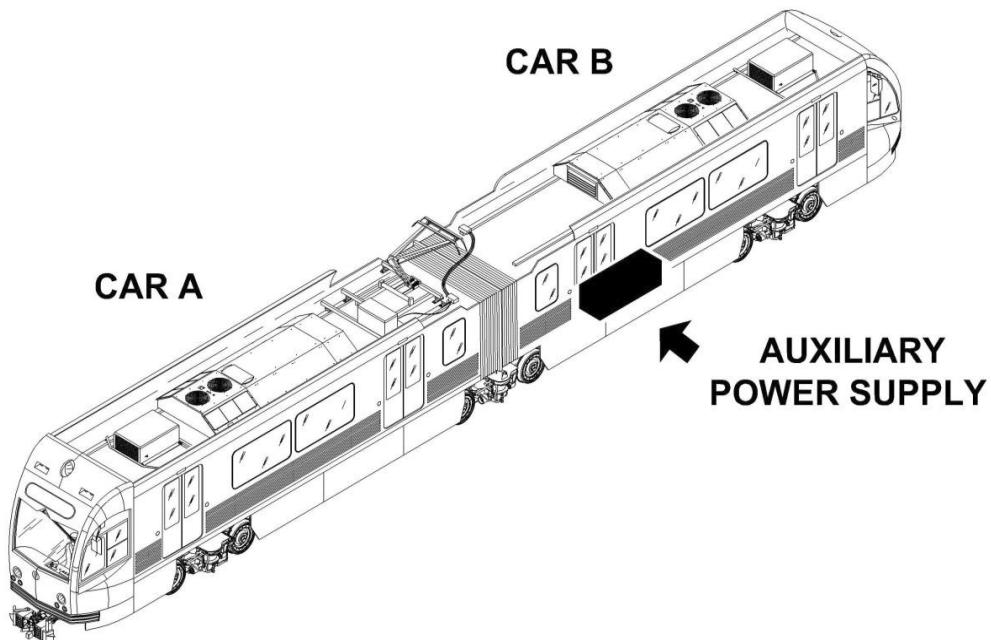
ACTIVE CLAMP MODULE

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT
LOCATION:


P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-22-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

APS-LVPS

Unit:

ACTIVE CLAMP MODULE

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

SAFETY PRECAUTIONS:

WARNING: BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.

WARNING: ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.

WARNING: BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.

WARNING: HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS.
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.

WARNING: WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

Cleaner / Degreaser

SPARE PARTS:

Active Clamp Module
Active Clamp Gasket

P/N 231EE09938B
P/N: 211EX21730B03

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-22-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

3/8

Subsystem/Assy:

APS-LVPS

Unit:

ACTIVE CLAMP MODULE

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-22-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

APS-LVPS

Unit:

ACTIVE CLAMP MODULE

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT

PROCEDURE:

To perform the Task proceed as follows (Refer to Figures 1 through 5):

REMOVAL

- 1) Remove the Electrical Power from the Equipment by switching off respectively:
 - The 3F01 Battery CB (Battery Box -Front)
 - The 3F03 APS / LVPS Power Supply CB (LV Locker B Section)



FIG 1 3F01 CB LOCATION

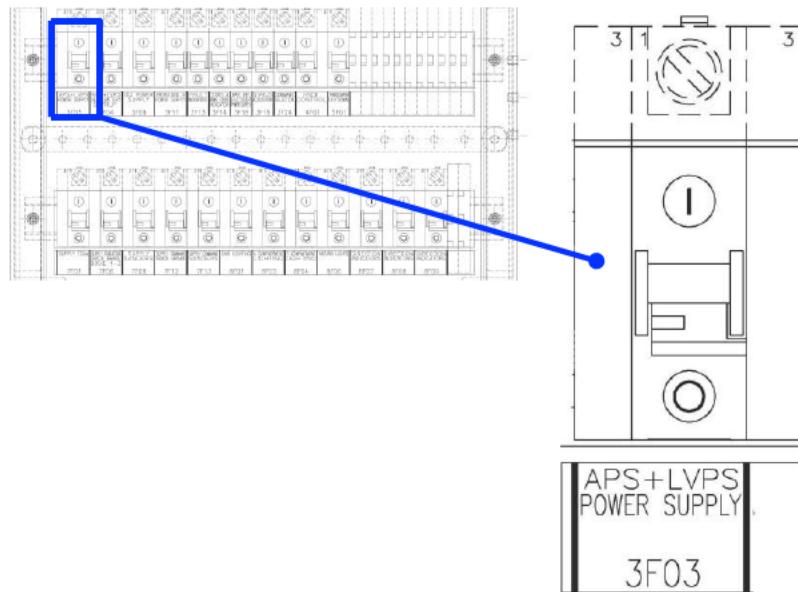


FIG 2 LV LOCKER B 3F03 CB LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-22-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
5/8

Subsystem/Assy:

Unit:

APS-LVPS
ACTIVE CLAMP MODULE

Component:

Man Hours:

1.0

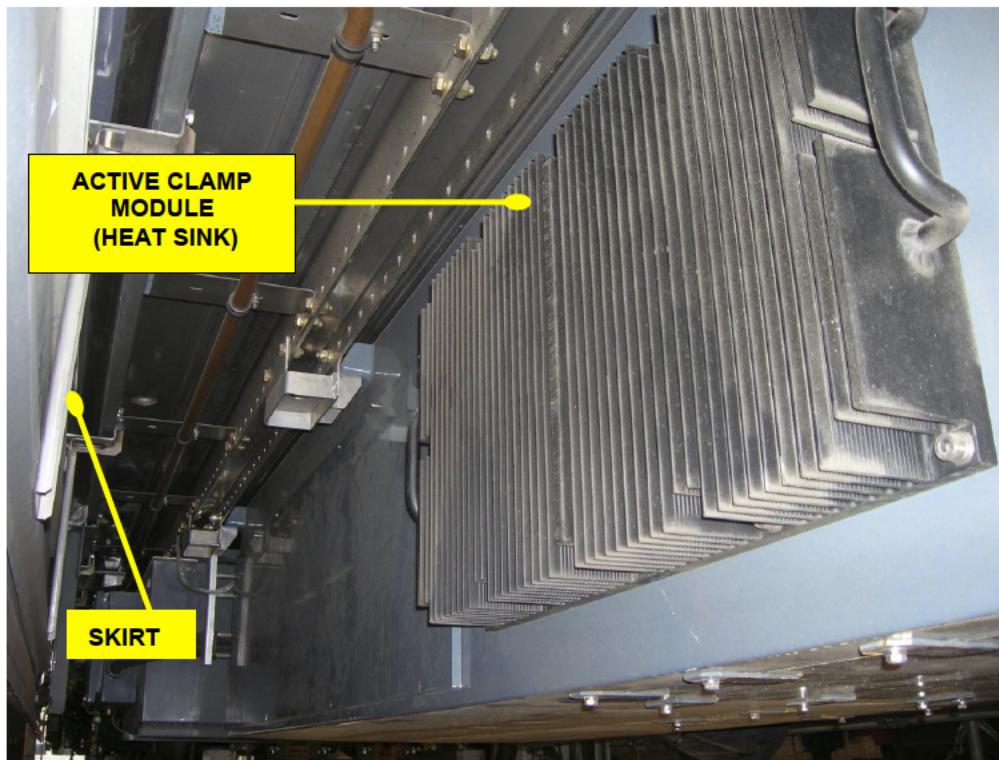
Maintenance Task:

REPLACEMENT
PROCEDURE (CONT'D):
REMOVAL (cont'd)

NOTE: It is advisable to retain the removed attaching Hardware for later use.

NOTE: It is advisable to remove the relevant APS / LVPS Skirt according to Sheet R-C -02-05-00-00 / R-00 2.

- 2) Locate the Active Clamp Module to be replaced.


FIG 3 APS / LVPS ACTIVE CLAMP MODULE (HEAT SINK) LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-22-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

APS-LVPS

Unit:

ACTIVE CLAMP MODULE

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL (cont'd)**

- 3) Remove the Active Clamp Module Fixing Hardware.

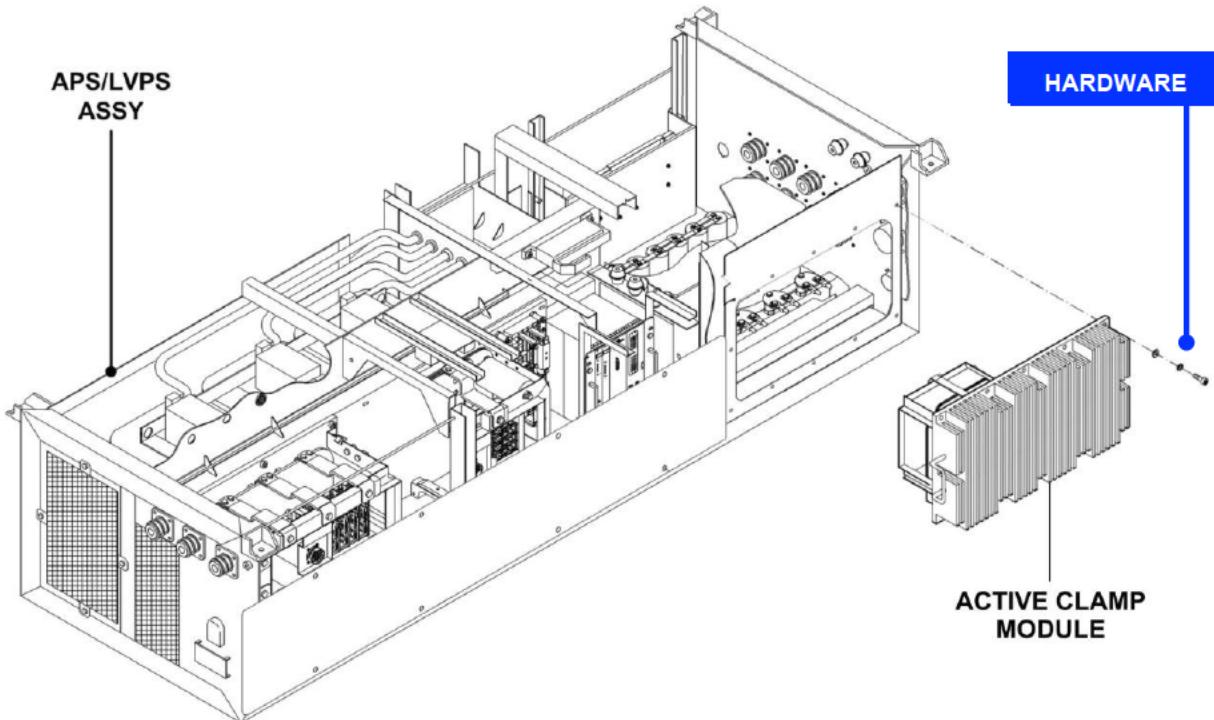


FIG 4 ACTIVE CLAMP MODULE REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-22-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION**7/8**

Subsystem/Assy:

APS-LVPS

Unit:

ACTIVE CLAMP MODULE

Component:

Man Hours:

1.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REMOVAL(cont'd)****VIEW TILTED 180° FOR CLARITY**

- 4) Supporting the Module by the Handles, pull it carefully with a first movement to gain access to the Electrical Connections.

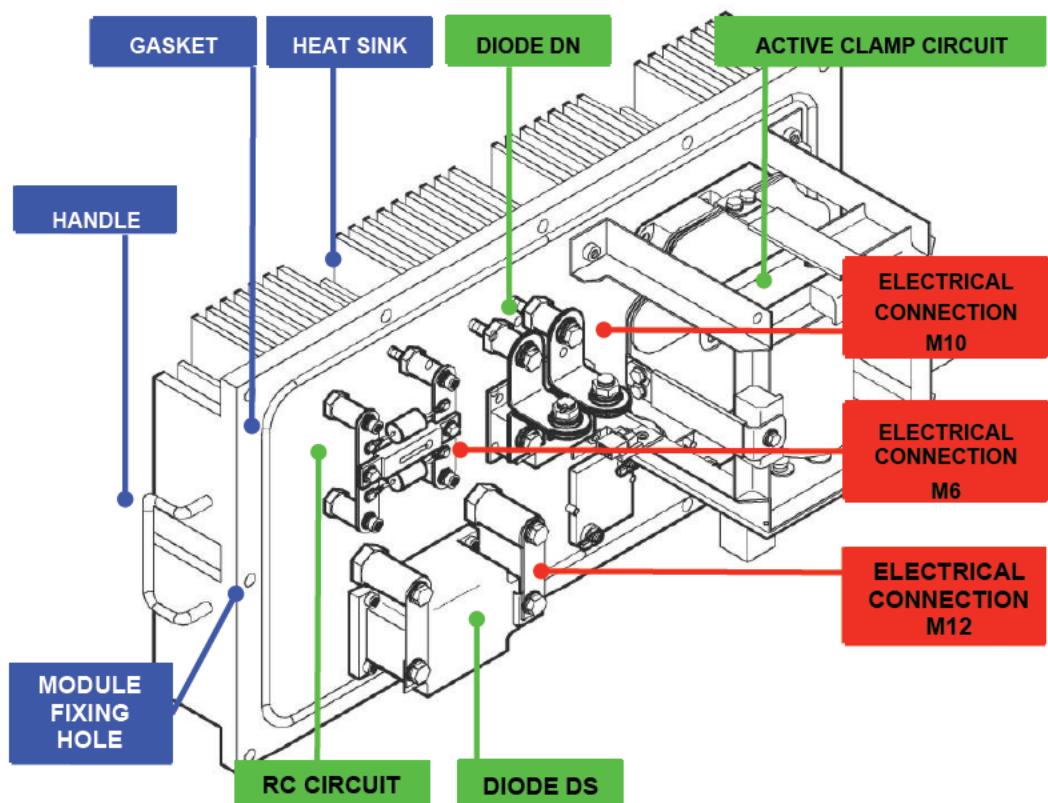


FIG 5 ACTIVE CLAMP MODULE COMPONENTS

- 6) Supporting the Module by the Handles, complete the Module removal by pulling it from its Seat.
- 7) Remove and discard the Module Gasket.
- 8) Make available the Module for Repair.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-22-00/R-00

System: LOW VOLTAGE DISTRIBUTION	Sheet: 8/8
Subsystem/Assy: APS-LVPS	Unit: ACTIVE CLAMP MODULE
Component:	Man Hours: 1.0

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****INSTALLATION**

To perform the Task proceed as follows (Refer to Figures 1 through 5):

NOTE: It is assumed that the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.

1. Clean the Active Clamp Module Compartment using recommended agent and lint-free rags.
2. Make sure that the Electrical Connections inside the Compartment are properly positioned to make easier the Active Clamp Module installation.
3. Check the Electrical Connections Terminals for damage / signs of overheating. Replace as per check results.
4. Install a “new” Gasket into its Seat on the “new” Active Clamp Module.
5. Supporting the Module by the Handles, position it to have the access for the reconnection of the Electrical Connections.
6. Supporting the Module, reconnect the Electrical Connections.

Torque according to the following Torque Values:

SCREW	M6	M10	M12
TORQUE	5 ft-*lb	8 ft lb	15 ft-lb

7. Supporting the Module by the Handles, carefully complete its installation to match the Module Fixing Holes with the relevant Installation Holes on the APS Box Structure.
8. Install the Module Fixing Hardware, Torque to **15.2 ft-lb**.
9. Restore the Electrical Power to the Equipment by switching on respectively:
 - a. the 3F01 Battery CB (Battery Box -Front)
 - b. the 3F03 APS / LVPS Power Supply CB (LV Locker B Section)
10. Restore the Electrical Power to the Vehicle.
11. Close and lock the LV Locker B Door and the Battery Box Front Cover.
12. Record task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.
 Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 “**At every Task Completion.**”

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-23-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
1/6

Subsystem/Assy:

Unit:

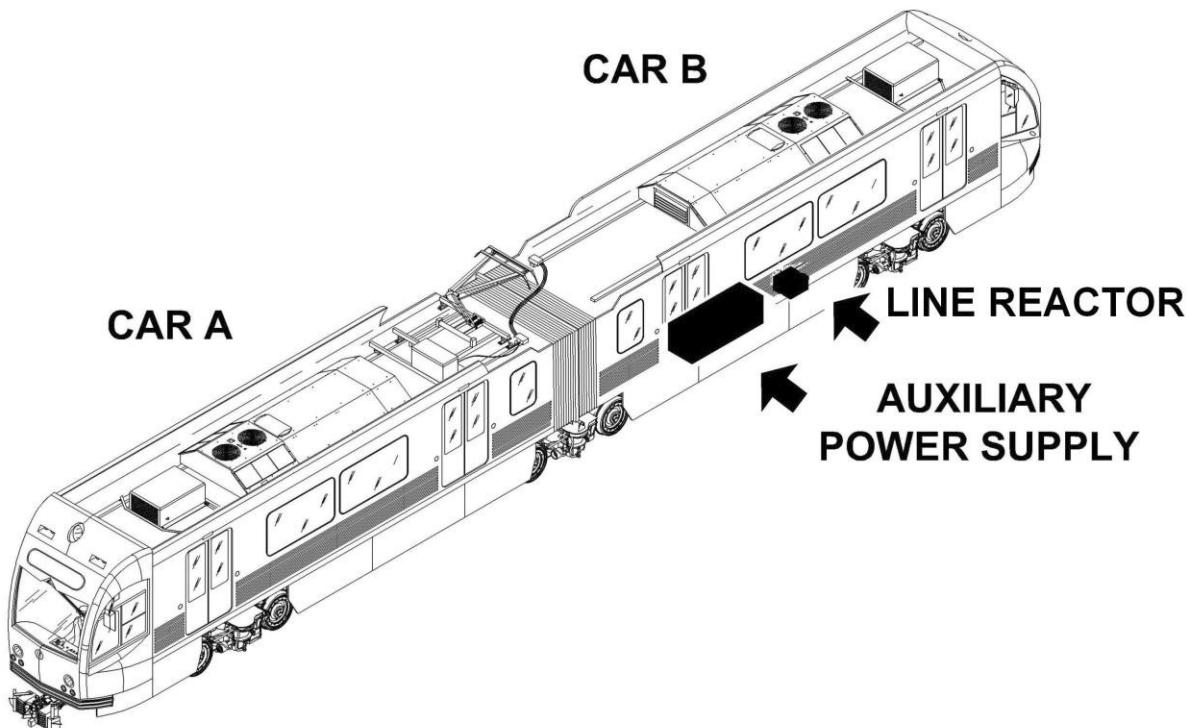
APS-LVPS
LINE REACTOR

Component:

Man Hours:

3.00

Maintenance Task:

REPLACEMENT
LOCATION:


P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-23-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

APS-LVPS

Unit:

LINE REACTOR

Component:

Man Hours:

3.0

Maintenance Task:

REPLACEMENT

SAFETY PRECAUTIONS:

- WARNING:** BLUE FLAG THE VEHICLE IN ACCORDANCE WITH ALL LACMTA BLUE FLAG POLICIES, RULES, & PROCEDURES IN ORDER TO WARN THAT MAINTENANCE PERSONNEL ARE WORKING ON, UNDER, OR NEAR ROLLING EQUIPMENT.
- WARNING:** ELECTRICAL HAZARD IS PRESENT THROUGHOUT THE PROPULSION SYSTEM AND CAUTION MUST BE TAKEN WHILE WORKING ON OR NEAR THE EQUIPMENT.
REMOVE ALL ELECTRICAL POWER BEFORE PERFORMING MAINTENANCE TO THE SYSTEM.
- WARNING:** BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.
- WARNING:** HIGH VOLTAGE IS PRESENT ON THE AUXILIARY INVERTER GROUP. AFTER REMOVING ALL POWER FROM THE VEHICLE, WAIT A MINIMUM OF 1 MINUTE PRIOR TO REMOVING OR OPENING AUXILIARY INVERTER GROUP, SINCE THE CAPACITORS DISCHARGE TIME IS 10 SECONDS.
FAILURE TO COMPLY WITH SAFETY REGULATIONS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH IF NOT FOLLOWED.
- WARNING:** WORKING AREAS MUST BE WELL VENTILATED, LIGHTED, AND CLEAR OF DEBRIS FOR OBVIOUS SAFETY REASONS.
- WARNING:** HEAVY OBJECT - THE AUXILIARY LINE REACTOR WEIGHS 595 LB. SUPPORT THE AUXILIARY LINE REACTOR WITH SUITABLE LIFTING DEVICE. FAILURE TO COMPLY CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit
Support Hydraulic Device

CONSUMABLES:

Cleaner / Degreaser (commercial)

SPARE PARTS:

Auxiliary Line Reactor	P/N AA03F8R (211EL23733B02)
Junction Box Cover Gasket	P/N

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-23-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
3/8

Subsystem/Assy:

Unit:

APS-LVPS
LINE REACTOR

Component:

Man Hours:

3.00

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle over the Pit (or Stand Up Rail).
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.
 That person knows why the Power was removed and when it safe to restore it.
 Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

To perform the Task proceed as follows (Refer to Figures 1 & 2):

NOTE: It is advisable to retain the removed attaching Hardware for later use.

NOTE: It is advisable to remove the relevant Auxiliary Line Reactor Skirt according to Sheet R-C -02-05-00-00 / R-00 2.

WARNING: HEAVY OBJECT - THE AUXILIARY LINE REACTOR WEIGHS 595LB.

SUPPORT THE AUXILIARY LINE REACTOR WITH SUITABLE LIFTING DEVICE.FAILED TO COMPLY CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-23-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

APS-LVPS

Unit:

LINE REACTOR

Component:

Man Hours:

3.00

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL

1. Locate the APS / LVPS Line Reactor to be replaced.

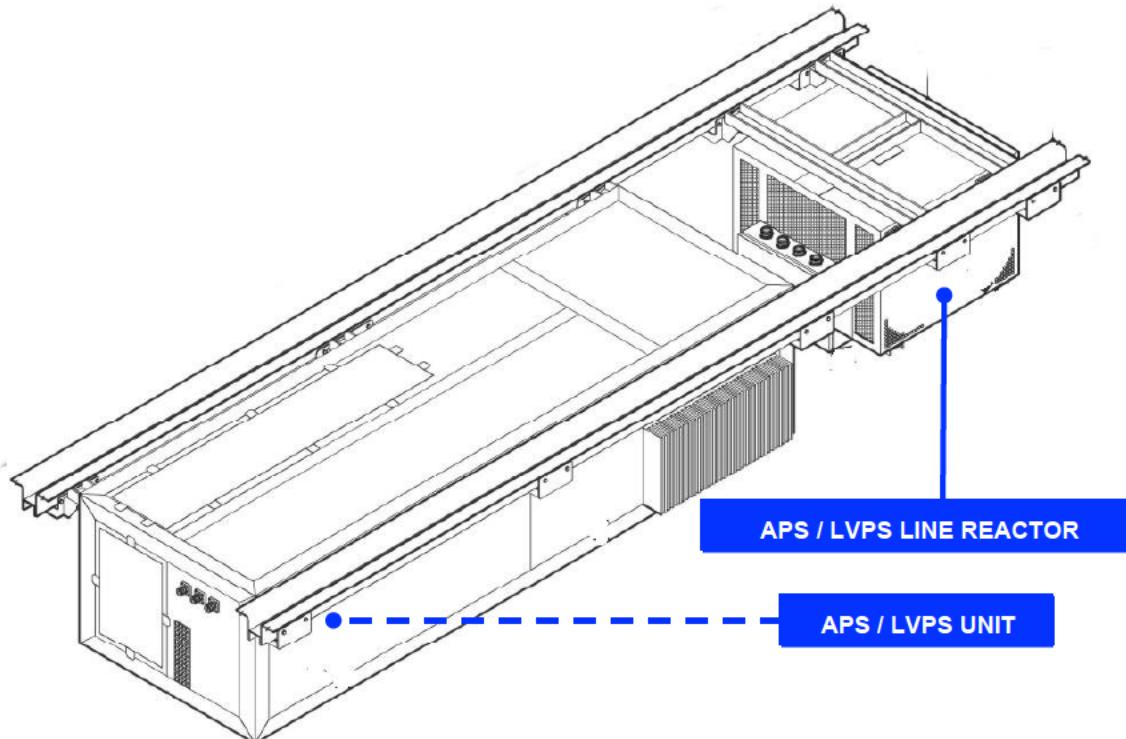


FIGURE 1 - AUXILIARY LINE REACTOR LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET	
	Card Code: R-C-10-01-23-00/R-00
System: LOW VOLTAGE DISTRIBUTION	Sheet: 5/8
Subsystem/Assy: APS-LVPS	Unit: LINE REACTOR
Component:	Man Hours: 3.00
Maintenance Task: REPLACEMENT	
PROCEDURE (CONT'D):	
REMOVAL(cont'd)	
<ol style="list-style-type: none"> 2. Disconnect the Junction Box Grounding Cable by loosening relevant hardware. Protect Terminals by suitable Protection Caps. 3. Remove the Junction Box Cover by loosening the relevant Hardware. Retain Hardware and Cover for later use. 4. Remove and discard the Junction Box Cover Gasket. 5. Loose the Cable Bushings and remove the Cables by disconnecting the relevant Terminals. 6. Secure the Cables by relevant Clamps and protect Cable Terminals using suitable Protection Caps. 7. Position under the Auxiliary Line Reactor Unit onto a suitable Support Device to safely support the Unit. 8. Raise the Support Device to safely support the Unit. 9. Loose and remove the Hardware fixing the Auxiliary Line Reactor Unit to the Underframe Supports. 	
<p>NOTE: Now the Auxiliary Line Reactor Unit is free. It remain in position because supported by the Support Device.</p>	
<ol style="list-style-type: none"> 10. Remove the Auxiliary Line Reactor Unit by carefully lowering the Support Device. 	
<p>NOTE: To remove the Unit a first movement (shifting) is needed to allow the disengagement of the Unit Brackets from the Underframe Supports.</p>	
<ol style="list-style-type: none"> 11. Make available the removed Auxiliary Line Reactor for Repair. 	
<p>NOTE: Do not forget to collect the Junction Box Cover, relevant Hardware and Cable Bushings in a suitable box.</p>	

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-23-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

APS-LVPS

Unit:

LINE REACTOR

Component:

Man Hours:

3.00

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd)

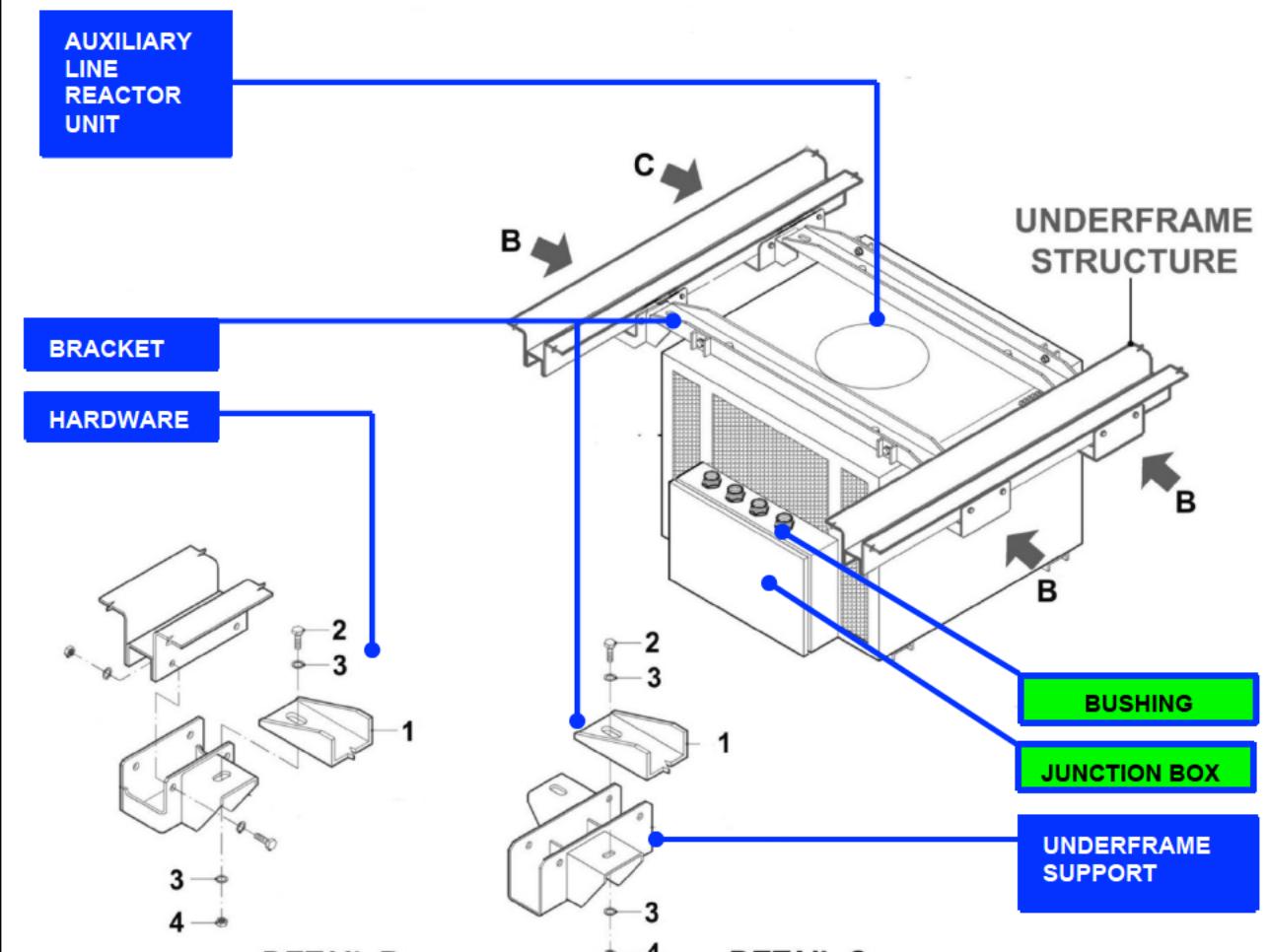


FIGURE 1 - AUXILIARY LINE REACTOR REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET	
Card Code:	
R-C-10-01-23-00/R-00	
System:	Sheet:
LOW VOLTAGE DISTRIBUTION	
Subsystem/Assy:	Unit:
APS-LVPS	LINE REACTOR
Component:	Man Hours:
	3.00
Maintenance Task:	
REPLACEMENT	
PROCEDURE (CONT'D):	
<p>INSTALLATION</p> <p>To perform the Task proceed as follows (Refer to Figures 1 & 2):</p> <p>NOTE: It is assumed that the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.</p> <ol style="list-style-type: none"> 1. Clean the Auxiliary Line Reactor Unit using recommended agent and cleaning rags. 2. Make sure that the Auxiliary Line Reactor Cables, on Vehicle, are properly positioned to make easier the Unit installation. 3. Make free, on Vehicle, the Cable Terminals and Cables from Protection Caps and Clamp. 4. Check the Cable Terminals for damage / signs of overheating. Replace as per check results. 5. Carefully raise the Support Device to position the Auxiliary Line Reactor Unit. 6. Stop the raising when the Unit Brackets are about 1/3 inch higher than the Underframe Supports in order to allow the Unit a secure sliding to its position 7. Lowering the Support Device, complete the Unit proper positioning by means of little (pushing / shifting) movements to match the (Unit) Brackets Fixing Holes with the relevant (Unit) Installation Holes on the Underframe Structure Supports. <p>NOTE: Now the Unit is still free. It remain in position because supported by the Underframe Supports.</p> <ol style="list-style-type: none"> 8. Install the Hardware fixing the Unit to the Underframe Supports. Torque to 52 ft lb. 9. Remove the Support Device. 10. Connect the Cable Terminals and tighten the Cable Bushings. 11. Install a "new" Junction Box Cover Gasket into its Seat. 12. Position the Junction Box Cover and install the relevant Fixing Hardware. Tighten as needed. 13. Remove the Protection Cap from the Grounding Wire Terminal and install it by tightening the relevant Hardware. 14. Restore the Electrical Power to the Vehicle. 15. Record Task results on the Defect Report Card for administrative and maintenance planning. <p>NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.</p> <p>Refer to HOW TO USE THE R-CM SHEETS (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "At every Task Completion."</p>	

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-01-23-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

8/8

Subsystem/Assy:

APS-LVPS

Unit:

LINE REACTOR

Component:

Man Hours:

3.00

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****INTENTIONALLY
LEFT BLANK**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00
LOW VOLTAGE DISTRIBUTION

Sheet:

1/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

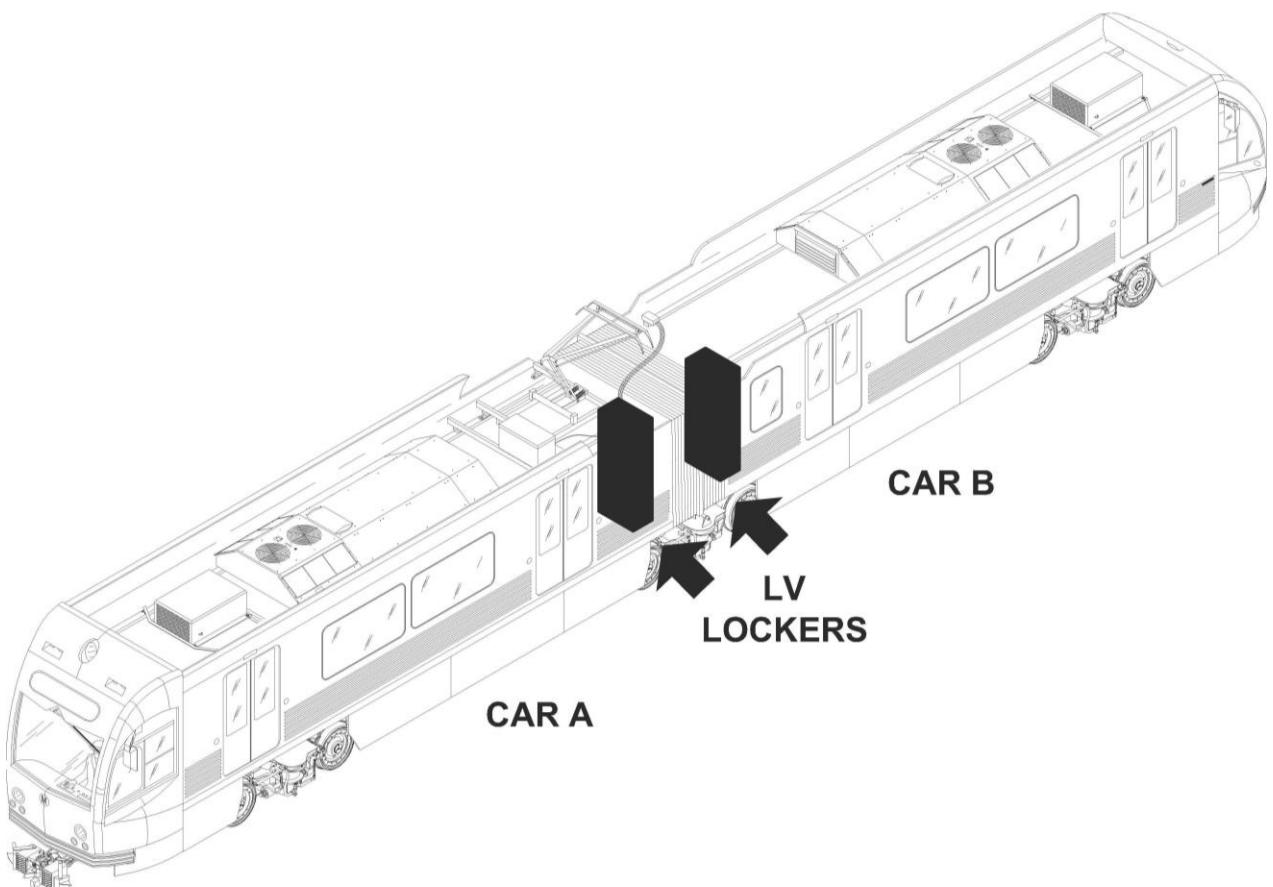
Man Hours:

1

Maintenance Task:

REPLACEMENT

LOCATION:



P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00**LOW VOLTAGE DISTRIBUTION**

Sheet:

2/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT**SAFETY PRECAUTIONS:**

LACMTA Maintenance Shop Safety Rules & regulations

WARNING: BEFORE PERFORMING MAINTENANCE PROCEDURES AND TOUCHING ANY COMPONENT, USE A RELIABLE HIGH VOLTAGE TEST PROBE TO VERIFY THAT NO VOLTAGE IS PRESENT.

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit.

Vacuum Cleaner

CONSUMABLES:

CRC Industrial - Precision Cleaner M3 PN 147535.

Dry Compressed Air for Electronic Equipment (commercial).

SPARE PARTS:

Main Circuit Breaker (3F07) Type S3N150 P/N AA03V6P (211VK01375B-05010003)

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00

LOW VOLTAGE DISTRIBUTION

Sheet:

3/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

1. Place the Vehicle in the Maintenance Shop.
2. Set the Master Controller Handle to FSB position.
3. Make sure that all Parking Brakes are applied (by checking on the IDU "Parking Brake A and B Not Released" and on Indicator Panel "A" "Park / Friction Brake" ON).
4. Remove Electrical Power from Vehicle by lowering the Pantograph.
5. Turn the Transfer Switch to OFF.
6. Set the Pantograph Control Motor Switch (5F02 CB LV Locker "A" Section) to OFF.
7. Lock out and tag out the Switch in accordance with all LACMTA Safety Rules, Regulations, Policies, and Procedures.

NOTE The tag must indicate the name of the person who removed Power.

That person knows why the Power was removed and when it safe to restore it.

Only the individual whose name appears on the tag or a person with his approval should remove the tag and restore Power.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00

LOW VOLTAGE DISTRIBUTION

Sheet:

4/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL

To perform the Task proceed as follows:

A) CB ASSY REMOVAL (Refer to Figures 1 through 4).

NOTE: It is advisable to retain the removed Hardware for later use.

1. Open the Battery Box Side Skirt, using the Maintenance Key, to gain access to the Battery Circuit Breakers Box.
2. Gain access to the Battery Circuit Breakers Box by disengaging Box Front Cover Safety Latches and by removing the Cover.
3. Switch the Battery Protection Circuit Breaker (3F01) to "OFF" position.

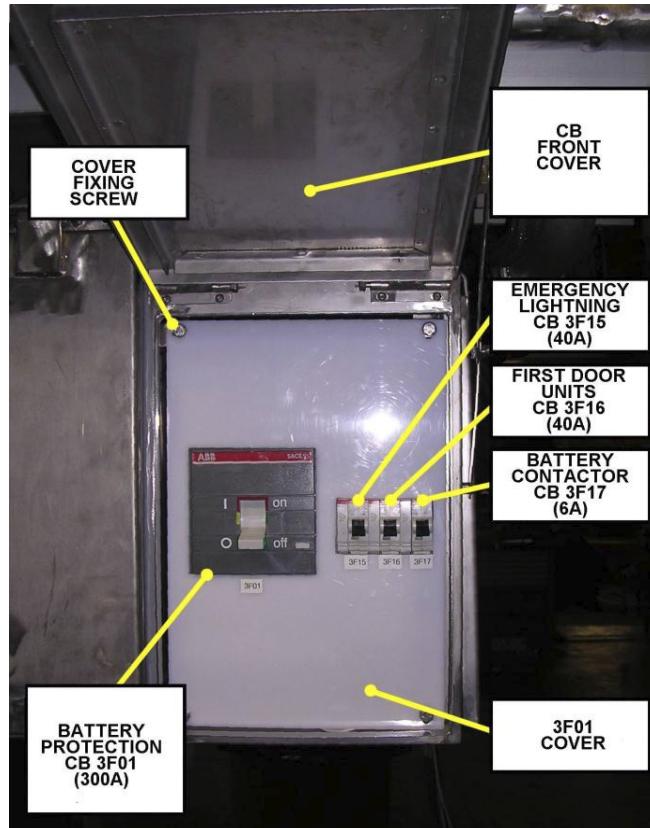


FIGURE 1 - BATTERY CIRCUIT BREAKERS BOX - FRONT SIDE

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00

LOW VOLTAGE DISTRIBUTION

Sheet:

5/14

Subsystem/Assy: LV DISTRIBUTION CIRCUITRY	Unit: MAIN CIRCUIT BREAKER (3F07)
---	---

Component:	Man Hours: 1
------------	------------------------

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

A) CB ASSY REMOVAL (cont'd)

4. Open the LV Locker Door using the Maintenance Key.
5. Locate the 3F07 Circuit Breaker.

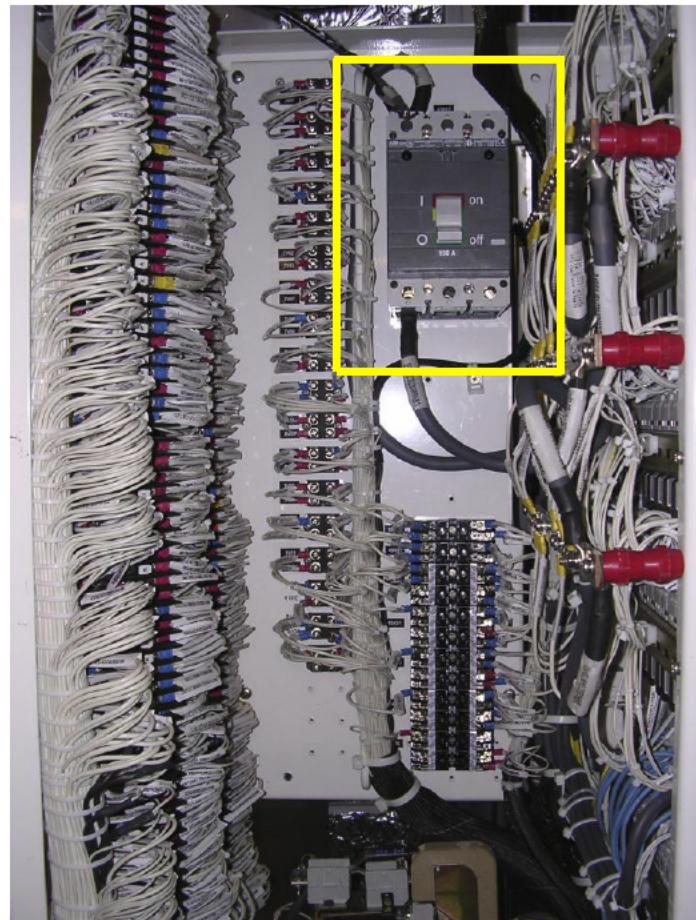


FIGURE 2 -- LV LOCKER - 3F07 CIRCUIT BREAKERS 150 A- LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00

LOW VOLTAGE DISTRIBUTION

Sheet:

6/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

A) CB ASSY REMOVAL (cont'd)

6. Supporting the CB, loose and remove the CB Bracket Fixing Screws.
7. Remove the CB with relevant Bracket Support.
8. Supporting the CB with relevant Bracket Support, disassemble the CB Assy. from Bracket support by loosening and removing the CB Assy. Fixing Screws.
9. Disconnect Electrical Connections as indicated in the next Step B.
10. Make Available the removed CB for Repair.

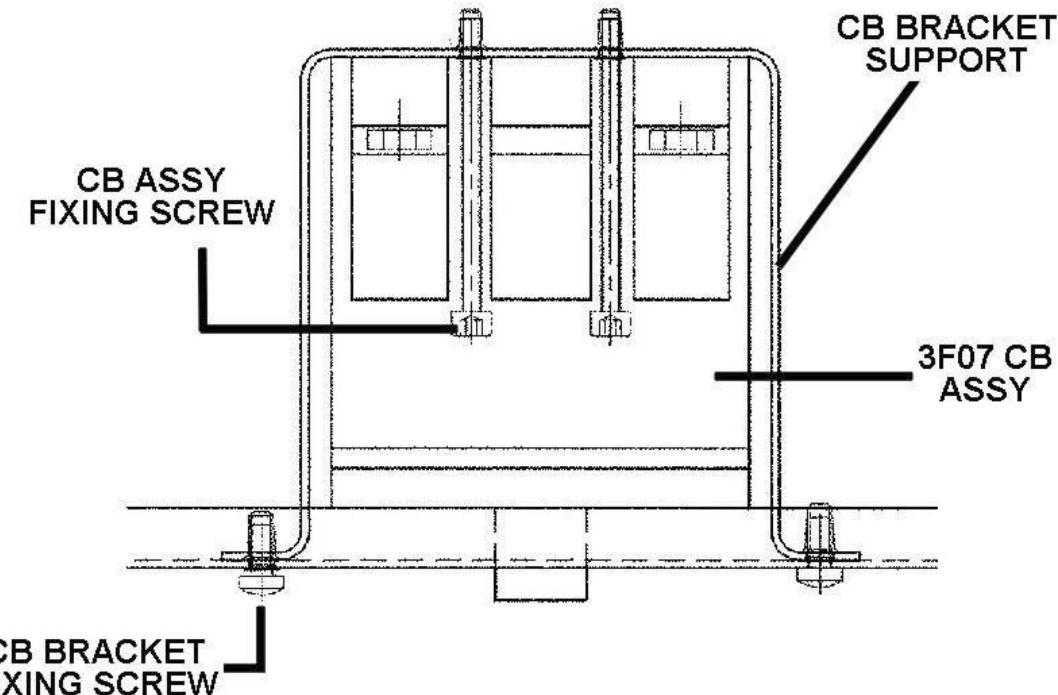


FIGURE 3 - 3F07 BIPOLAR CIRCUIT BREAKER ASSY - MOUNTING

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00

LOW VOLTAGE DISTRIBUTION

Sheet:

7/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

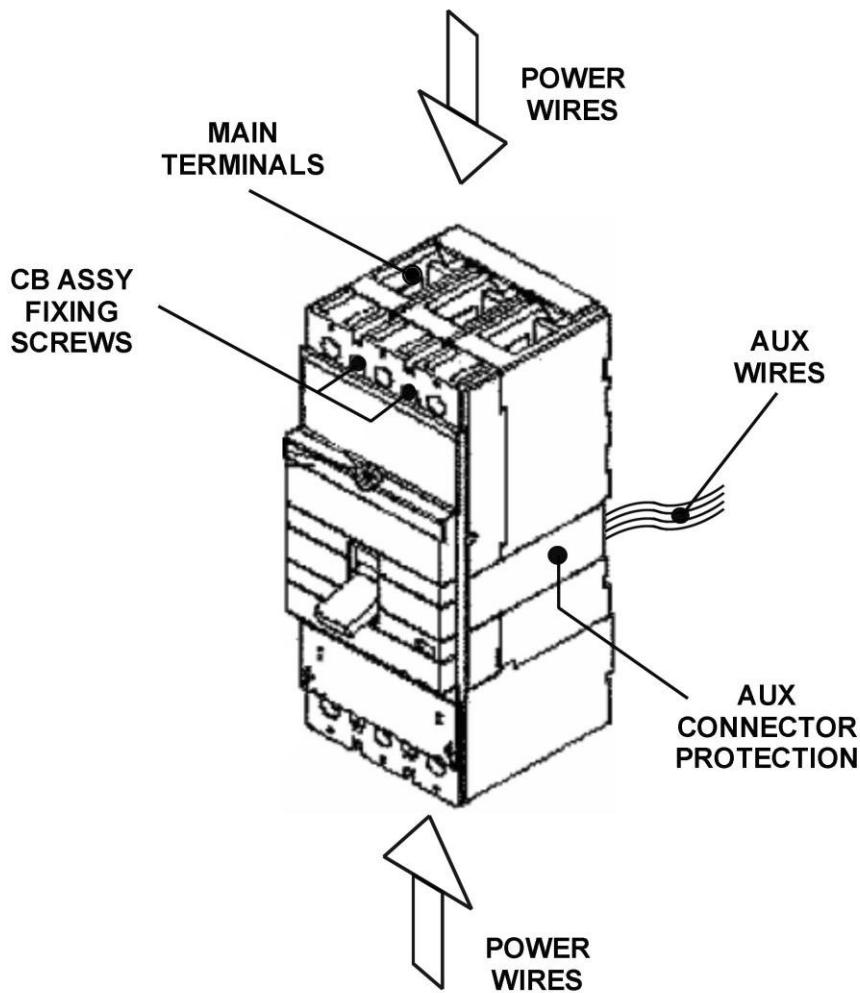


Figure 4 - 3F07 BIPOLAR CIRCUIT BREAKER ASSY 150 A

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00

LOW VOLTAGE DISTRIBUTION

Sheet:

8/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

Man Hours:

1

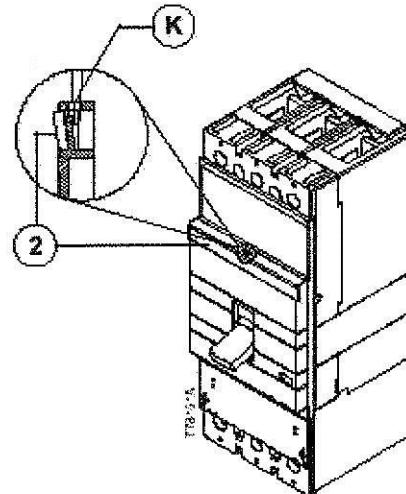
Maintenance Task:

REPLACEMENT

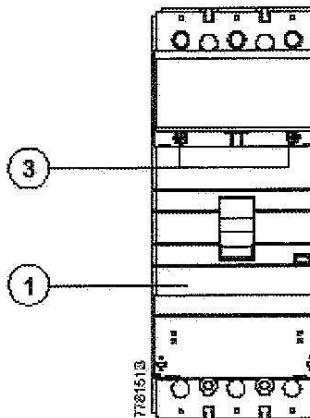
PROCEDURE (CONT'D):

B) CB WIRES REMOVAL (Refer to Figures 4 through 9)

- 1 Place in the rabbet "K" a suitable screwdriver and pull to remove the Label (2).

**Figure 5**

- 2 Loose the Screws (3) to remove the Front Cover (1).

**Figure 6**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00

LOW VOLTAGE DISTRIBUTION

Sheet:

9/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

- 3** Loose the Screws (4) to remove the Interior Cover (5).

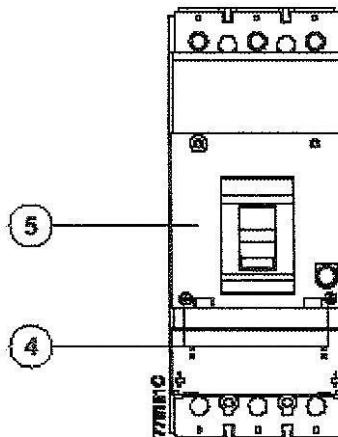


Figure 7

- 4** Remove the Aux Connectors Protection (6).

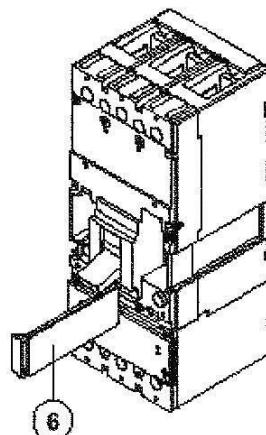


Figure 8

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00

LOW VOLTAGE DISTRIBUTION

Sheet:

10/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

- 5** Remove the Male Aux Connector (7) and, at the same time, the Aux Contacts Assy. (8).
- 6** Disconnect the Aux Wires by disengaging the Female Aux Connector (9)
- 7** Disconnect the Power Wires (2104 and 2302) by loosening the relevant Terminal Fixing Screws.

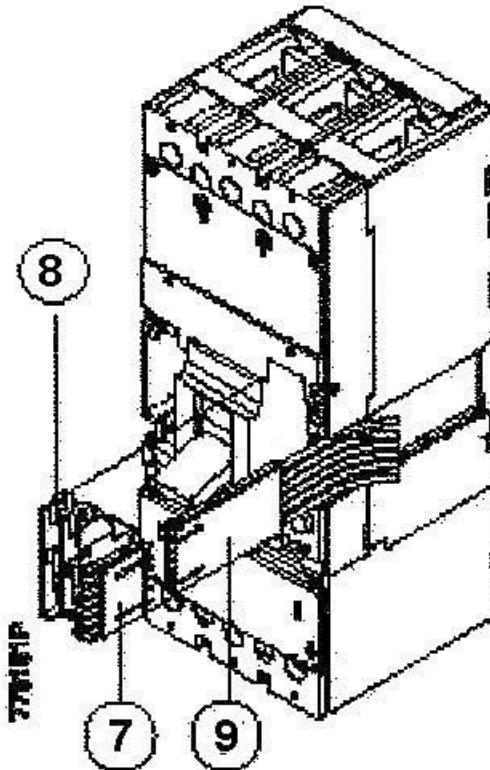


Figure 9

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00**LOW VOLTAGE DISTRIBUTION**

Sheet:

11/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

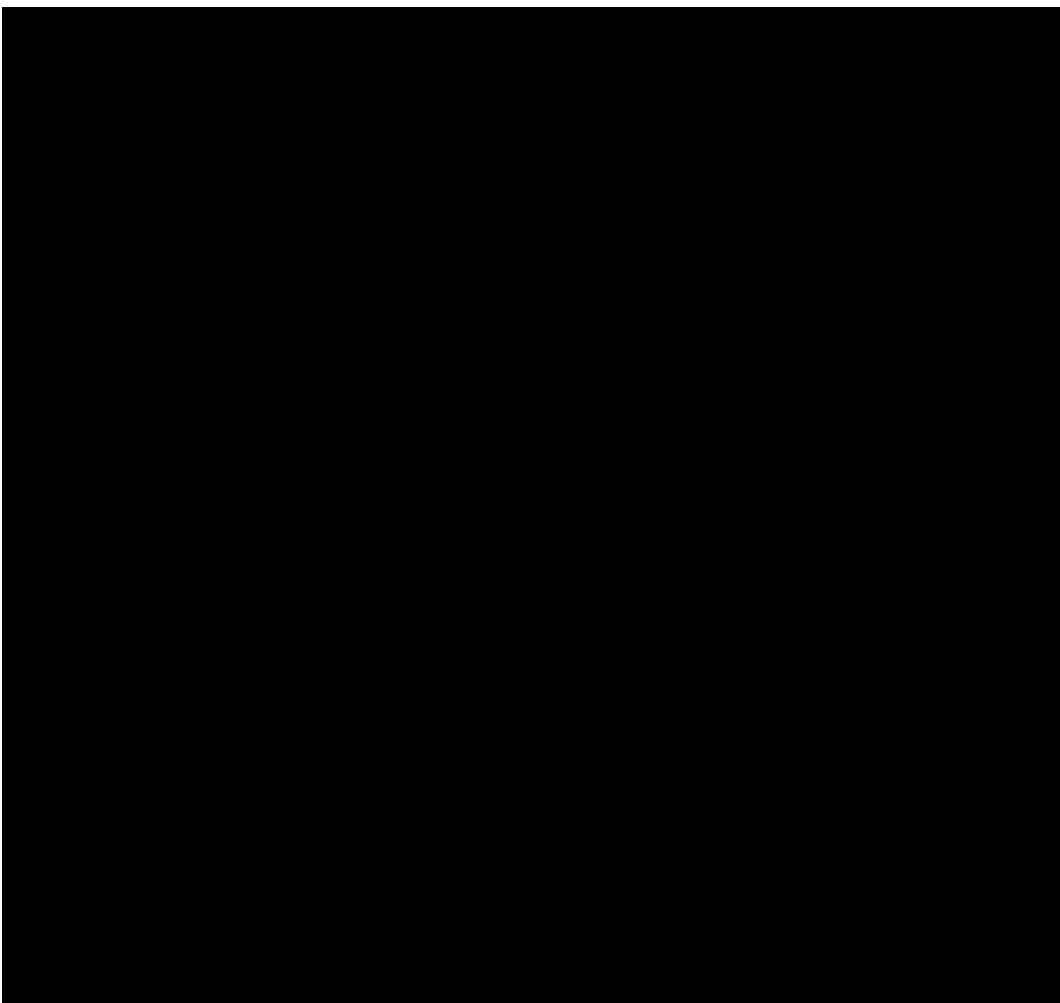
Man Hours:

1

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):**

8. Take note of Wiring Labels and relevant positions on CB Terminals.



P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00

LOW VOLTAGE DISTRIBUTION

Sheet:

12/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

INSTALLATION

To perform the Task proceed as follows:

A) CB ASSY INSTALLATION (Refer to Figures 1 through 4)

1. Clean the Circuit Breaker Seat using recommended Cleaner / Agent and lint-free rags.
2. Check the Power Wires and relevant Terminals for signs of overheating. Replace as per check Results.
3. Check the Male and Female Aux Connectors for Pins damaged / burns or missing. Replace as per check result.
4. Reassemble the CB with the relevant Bracket Support by installing the relevant CB Assy Fixing Screws. Torque to **14.8 ft lb**.
5. Reconnect Electrical Connections as indicated in the next Step **B**.
6. Fix the 3F07 Circuit Breaker as follows:
 - a) Install the CB Assy Fixing Screws (Fig 3). Torque to **14.8 lb ft**.
 - b) Check that the Circuit Breaker Moving Parts can be moved freely and are easy to operate.
7. Switch the Battery Protection Circuit Breaker (3F01) to “ON” position.
8. Reinstall Battery Circuit Breakers Box Front Covers and lock it engaging the relevant Safety Latches.
9. Close Vehicle Skirt and lock it using the Maintenance Key.
10. Restore Electrical Power to Vehicle.
11. On IDU "A" access to the Maintenance Menu first and then to “Fault” Screen by selecting, in sequence, the relevant Icons.
12. Check, through the List of the Current Active Faults shown in the “Fault” Screen, that the following Fault Code **is not listed**.

5821 A - Console Circuit Breaker Open

5825 B - Console Circuit Breaker Open

13. Record Task result on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 **“At every Task Completion.”**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00

LOW VOLTAGE DISTRIBUTION

Sheet:

13/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

B) CB WIRES INSTALLATION (Refer to Figures 5 trough 10)

1. Connect the Power Wires (2104 and 2302) to the relevant Terminals according to their positions and Labels previously noted. (Refer to Fig 10 for Wiring Scheme) Tighten as required.
2. Connect the Aux Wires by engaging the Female Aux Connector (9) as follows:
 - a) Insert the Female Aux Connector (9) into the rabbet pushing till to engage it.
 - b) Insert the Aux Contact Assy (8) into the 3F02 Circuit Breaker Assy pushing till to engage it.
 - c) At the same time insert the Male Aux Connector (7) pushing till to connect its.
3. Install the Aux Connectors Protection (6).
4. Install the Interior Cover (5) and fix it by the relevant Fixing Screws (4). Tighten as needed.
5. Install the Front Cover (1) fix it by the relevant Fixing Screws (3). Tighten as needed.
6. Install the Label (2) pushing till to engage it.

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-06-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

14/14

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

MAIN CIRCUIT BREAKER (3F07)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT**INTENTIONALLY LEFT
BLANK**

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-55-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION**1/6**

Subsystem/Assy:

Unit:

LV DISTRIBUTION CIRCUITRY**DOUBLE GAUGE LAMP (3P04-H1)**

Component:

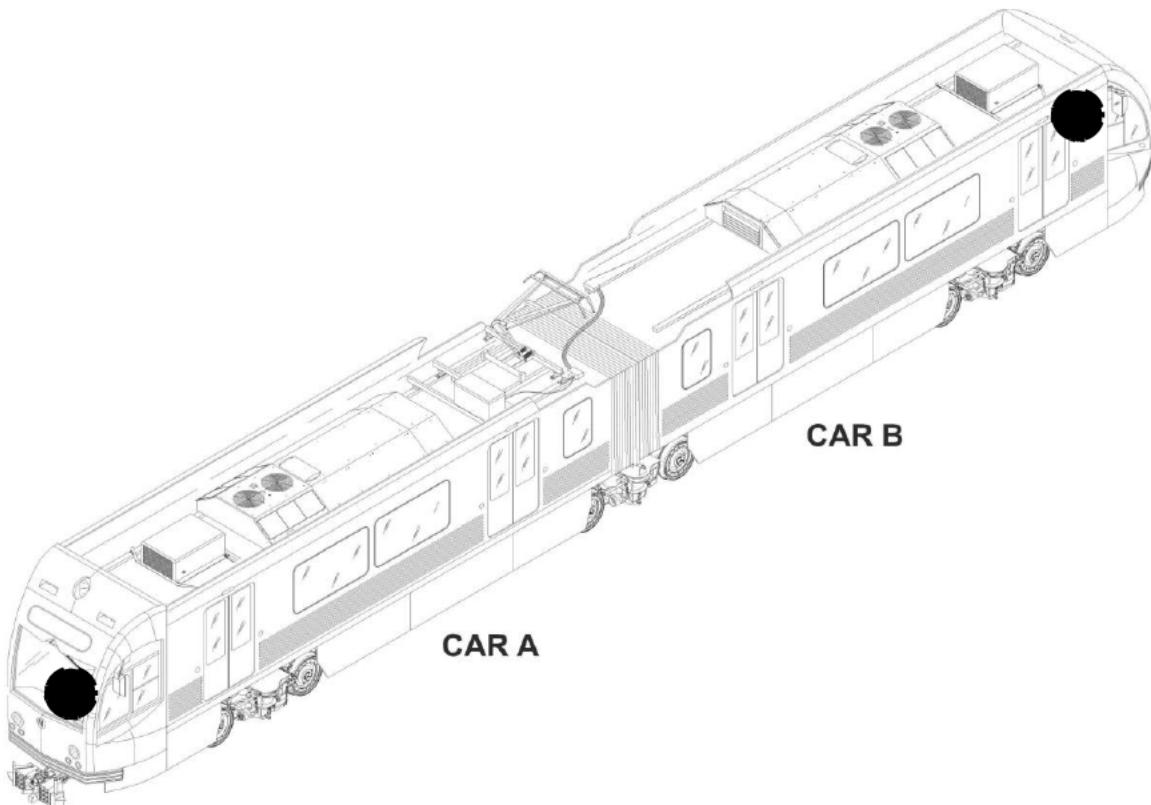
Man Hours:

0.15

Maintenance Task:

REPLACEMENT

LOCATION:



P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-55-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/6

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

DOUBLE GAUGE LAMP (3P04-H1)

Component:

Man Hours:

0.15

Maintenance Task:

REPLACEMENT**SAFETY PRECAUTIONS:**

LACMTA Maintenance Shop Safety Rules & Regulations

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

CRC 2000 Contact Cleaner

SPARE PARTS:

Double Gauge Lamp (3P04-H1) Light Bulb 28V, 0.04A P/N : U13756
 Lamp Dimmer (3R01)

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-55-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION
3/6

Subsystem/Assy:

Unit:

LV DISTRIBUTION CIRCUITRY
DOUBLE GAUGE LAMP (3P04-H1)

Component:

Man Hours:

0.15

Maintenance Task:

REPLACEMENT

PROCEDURE:

PRELIMINARY OPERATIONS

- Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

REPLACEMENT

To perform the Task proceed as follows:

- Switch off the 3F24 Command Select Circuit Breaker (located in the LV Locker).

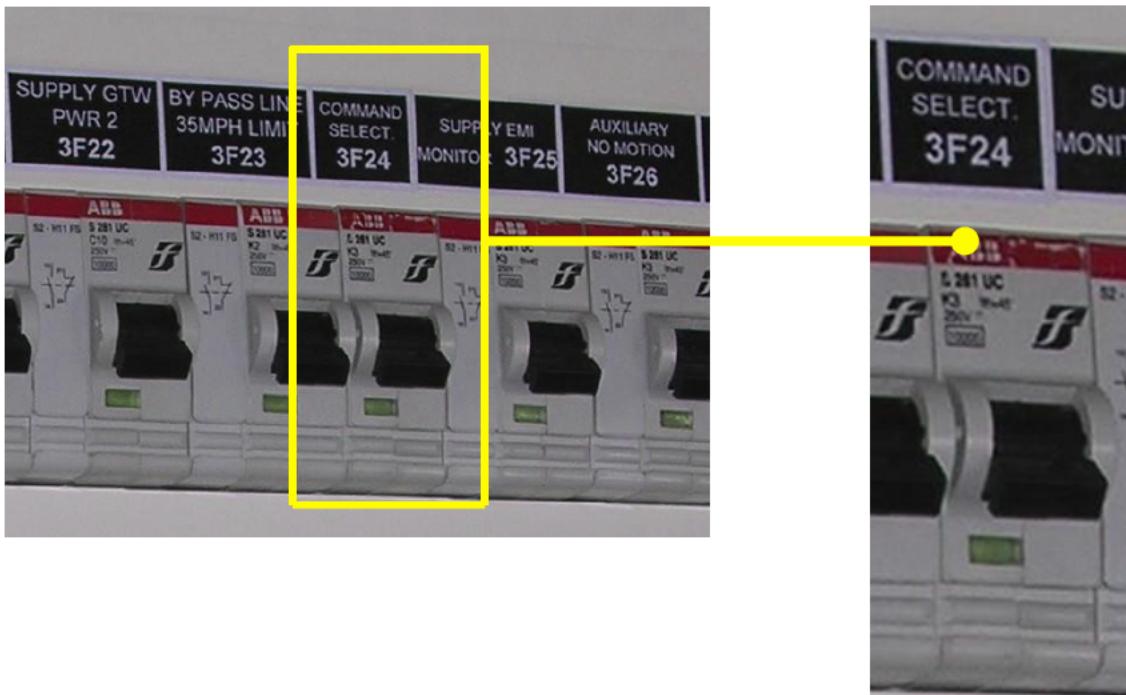


FIG 1 LV LOCKER CB PANEL 3F24 COMMAND SELECT LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-55-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/6

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

DOUBLE GAUGE LAMP (3P04-H1)

Component:

Man Hours:

0.15

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****REPLACEMENT (cont'd)**

2. On Cab Console, locate the Double Gauge, the Lamp Dimmer and the Lamp Test Pushbutton



FIG 2 CAB CONSOLE DOUBLE GAUGE, LAMP DIMMER & LAMP TEST PB LOCATION



FIG 3 DOUBLE GAUGE



FIG 4 LAMP DIMMER& LAMP TEST

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-55-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/6

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

DOUBLE GAUGE LAMP (3P04-H1)

Component:

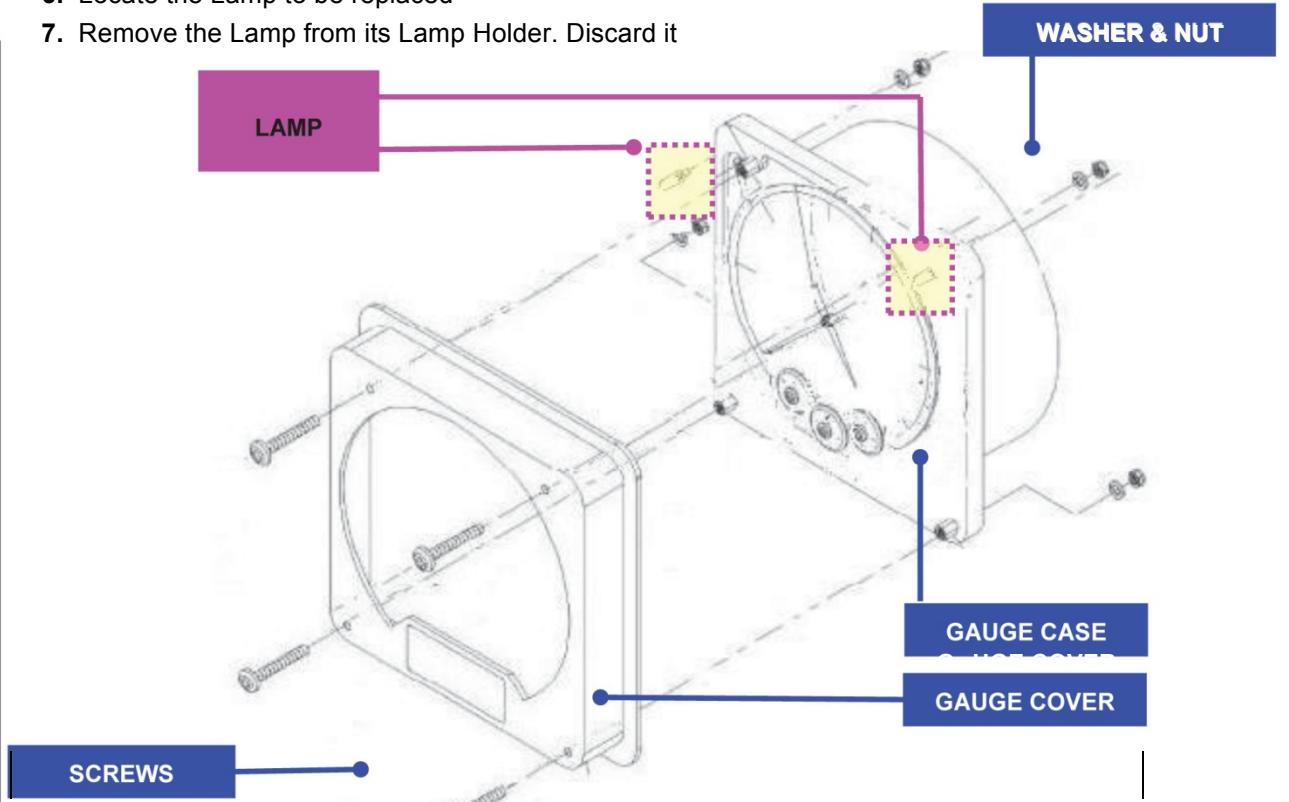
Man Hours:

0.15

Maintenance Task:

REPLACEMENT**PROCEDURE:****REPLACEMENT (cont'd)**

3. Carefully slide the Double Gauge out of its Seat just to gain access to the Washers and Nuts on the rear of the Cover
4. Loose and remove the Double Gauge Cover Fixing Hardware. Retain it for later use
5. Remove the Double Gauge Cover
6. Locate the Lamp to be replaced
7. Remove the Lamp from its Lamp Holder. Discard it


FIG 5 DOUBLE GAUGE LAMP BULB REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-03-55-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/6

Subsystem/Assy:

LV DISTRIBUTION CIRCUITRY

Unit:

DOUBLE GAUGE LAMP (3P04-H1)

Component:

Man Hours:

0.15

Maintenance Task:

REPLACEMENT**PROCEDURE:****REPLACEMENT (cont'd)**

8. Check the Lamp Holder for damage / signs of overheating. Replace as per check results.
9. Install a "new" Lamp into the relevant Lamp Holder.
10. Switch on the 3 F 24 Command Select CB (LV Locker).
11. Close and lock the LV Locker Door.
12. Operate the 3S04 Lamp Test Pushbutton and the 3R01 Console Dimmer to check that the "new" Lamp lights properly.
13. Position the Double Gauge Cover onto the Double Gauge Case Assy.
14. Install the Double Gauge Cover Fixing Harware. Tighten as needed.
15. Position the Double Gauge into the Console Seat.
16. Record Task result on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.

Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "**At every Task Completion.**"

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-04-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

1/8

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

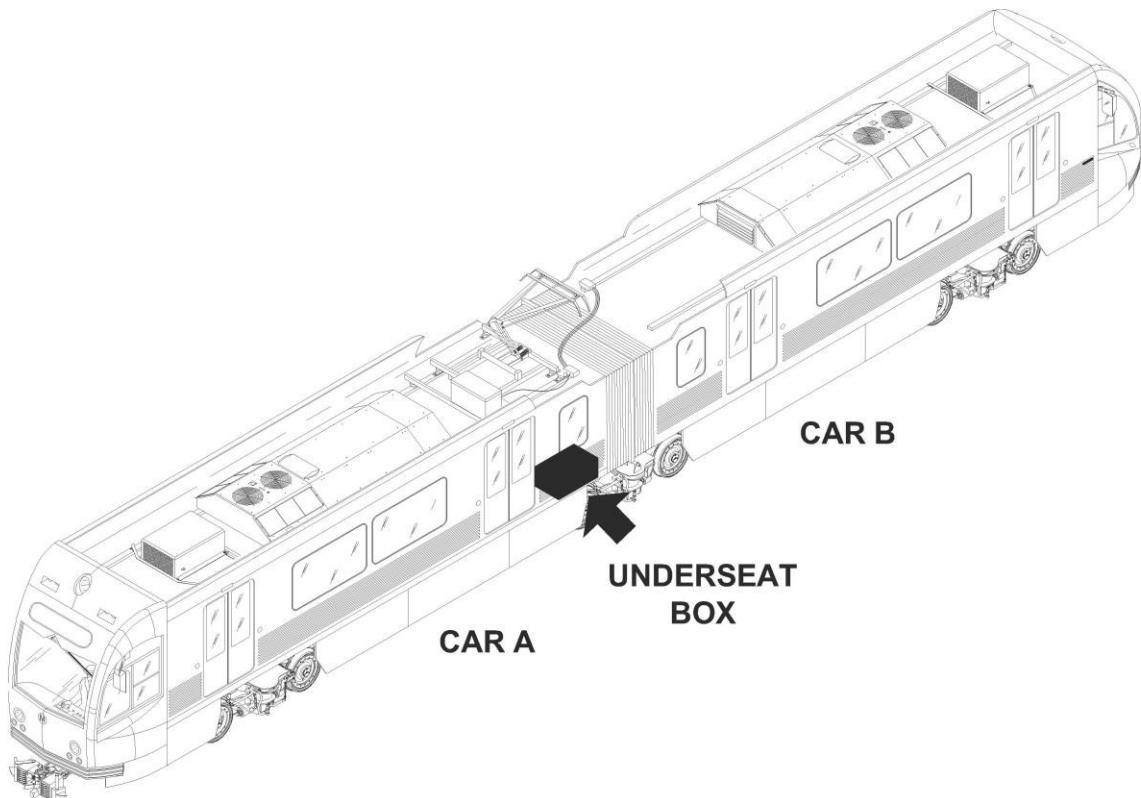
SAFETY LOOP DC \ DC CONVERTER (6A02)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT
LOCATION:

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-04-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

2/8

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

SAFETY LOOP DC \ DC CONVERTER (6A02)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT

SAFETY PRECAUTIONS:

LACMTA Maintenance Shop Safety Rules & regulations

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit.

Vacuum Cleaner

CONSUMABLES:

CRC Industrial - Precision Cleaner M3 PN 147535.

Dry Compressed Air for Electronic Equipment (commercial).

SPARE PARTS:

(6A02) DC / DC Converter

P/N AA0464J (211EG23870B)

Lock Washer

P/N AA00Z78

Gasket (Under Seat Box)

P/N AA03H7D

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-04-01-00/R-00

System:

Sheet:

LOW VOLTAGE DISTRIBUTION

3/8

Subsystem/Assy:

Unit:

SAFETY CIRCUITS
SAFETY LOOP DC \ DC CONVERTER (6A02)

Component:

Man Hours:

1

PROCEDURE:

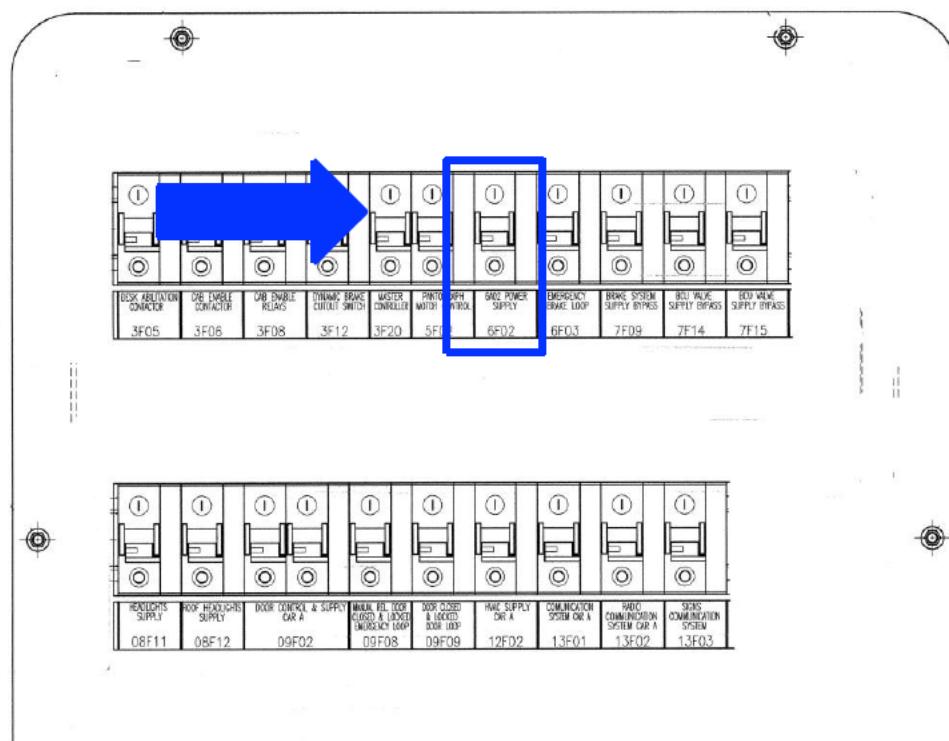
PRELIMINARY OPERATIONS

- 1 Set the Vehicle in safety conditions in accordance with LACMTA Maintenance Shop Regulations:

REMOVAL

To perform the Task proceed as follows: (Refer to Figures 1 through 6)

1. Switch off the 6F02 (DC/DC Converter Power Supply) CB located in the "A" Cab. LV CB Panel.


FIG 1 " A " CAB LV CB PANEL
6F02 LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-04-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

4/8

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

6A02 SAFETY LOOP DC \ DC CONVERTER

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd):

2. Locate the Under Seat Box in the " A " Passenger Compartment.
3. Gain access to the DC/DC Converter by opening the relevant Under Seat Box Cover using the Maintenance Key.
4. Locate the DC/DC Converter to be replaced.

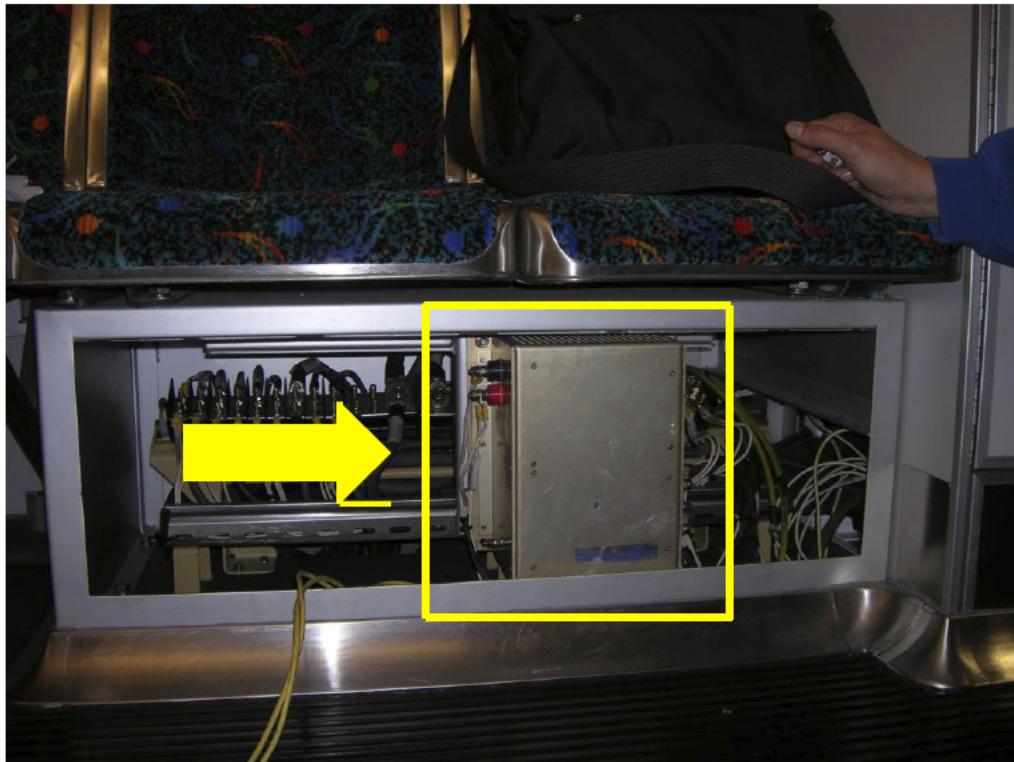


FIGURE 2 - UNDERSEAT BOX - DC/DC CONVERTER LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-04-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

5/8

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

SAFETY LOOP DC \ DC CONVERTER (6A02)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

REMOVAL(cont'd):

5. Disconnect the:
 - a. Auxiliary Wires
 - b. Input Power & Output Wires
 - c. Grounding Braid
 by loosening the relevant Terminals Fixing Hardware. Retain it for later use
6. Take note of Wirings Identifications & Color Codes and relevant positions on the Unit
7. Protect the Terminals on the Unit and of the Wires by suitable Protection Caps.
8. Loose and remove the Unit Fixing Hardware. Retain it for later use and discard Lock Washer
9. Remove the Unit. and make it available for Repair

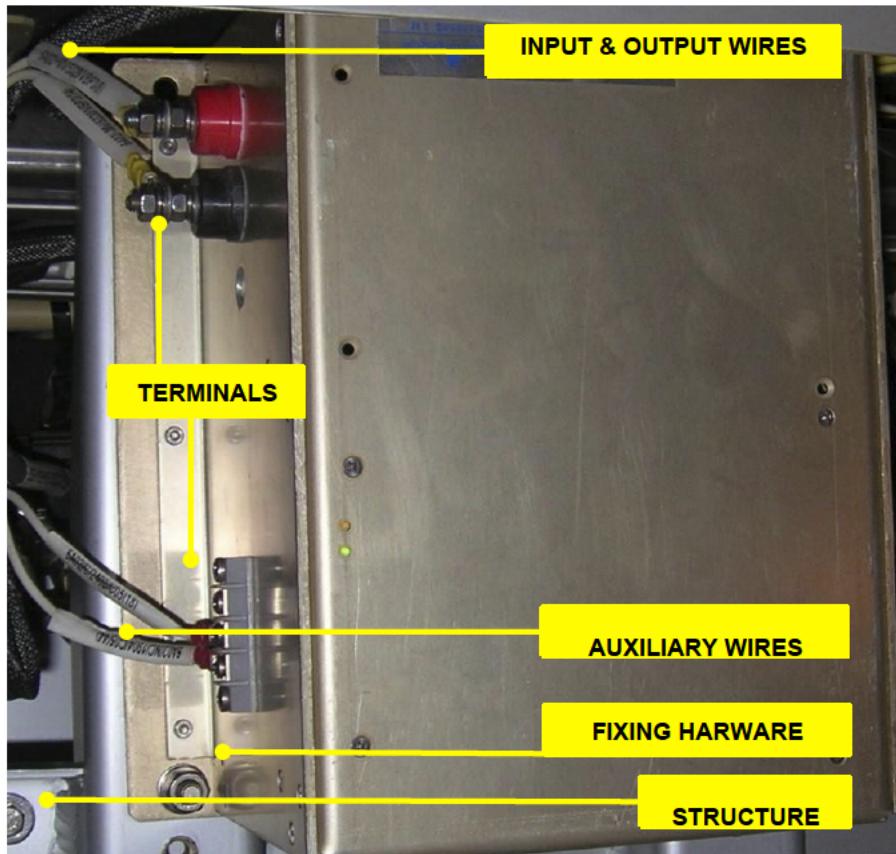


FIGURE 3 -DC/DC CONVERTER REPLACEMENT

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-04-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

6/8

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

SAFETY LOOP DC \ DC CONVERTER (6A02)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****INSTALLATION**

To perform the Task proceed as follows (Refer to Figures 1 through 6):

NOTE: It is assumed that the Vehicle is in Safety Conditions in accordance with LACMTA Maintenance Shop Regulations.

1. Vacuum clean the Under Seat Box Compartment. Use recommended agent and lint-free rags.as needed.
2. Make sure that the Wires inside the Under Seat Box Compartment are properly positioned to make easier the DC/DC Converter installation.
3. Check the Wires & Wires Terminals for damage / signs of overheating. Replace as per check results.
4. Position the "new" DC/DC Converter on its Seat.
5. Provide "new" Lock Washers and install the DC/DC Converter Fixing Hardware to fix the Unit to the Structure. Torque to 5 ft lb.
6. Remove the Protection Caps from the Terminals on the Unit and on the Wires.

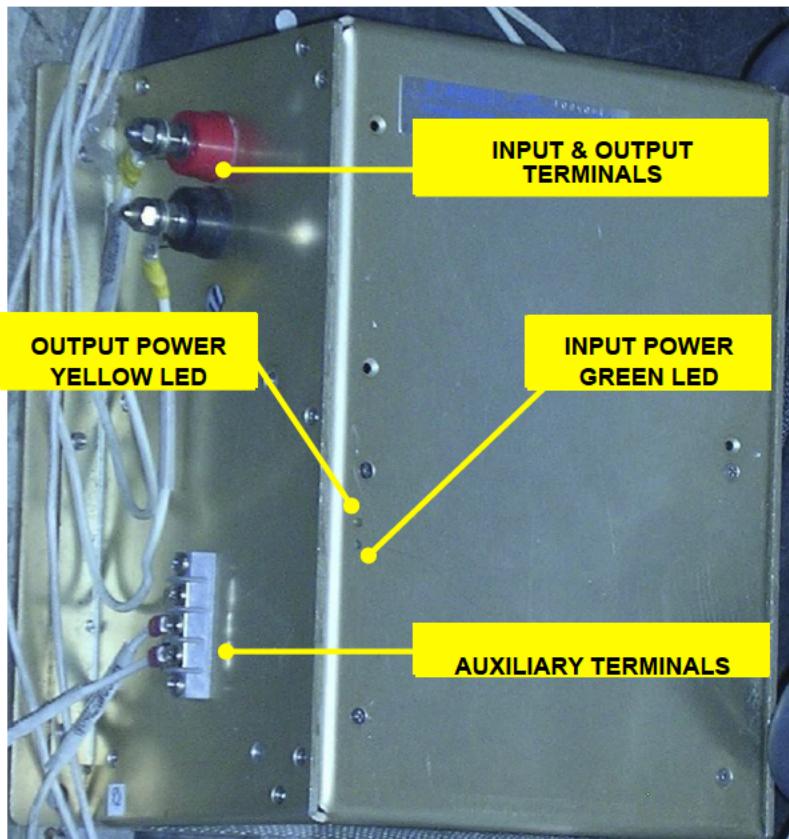


FIGURE 4 -DC/DC CONVERTER DETAILS

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-04-01-00/R-00

System:

LOW VOLTAGE DISTRIBUTION

Sheet:

7/8

Subsystem/Assy:

SAFETY CIRCUITS

Unit:

SAFETY LOOP DC \ DC CONVERTER (6A02)

Component:

Man Hours:

1

Maintenance Task:

REPLACEMENT

PROCEDURE (CONT'D):

INSTALLATION (cont'd)

7. Connect the Wires to the relevant DC/DC Converter Terminals according to their positions, Identification & Color Codes previously noted.

Refer to Fig 5 for Wiring Scheme or to the Functional Schematic Sheet 53 for complete Wiring Details.

FIGURE 5 -DC/DC CONVERTER WIRING

8. Torque the Electrical Connections according to the following Torque Values:

	INPUT & OUTPUT TERMINALS	AUX TERMINALS
SCREW	M5	M3
TORQUE	5 ft-*lb	4 ft lb

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code:

R-C-10-04-01-00/R-00

System:	LOW VOLTAGE DISTRIBUTION	Sheet:
Subsystem/Assy:	SAFETY CIRCUITS	SAFETY LOOP DC \ DC CONVERTER (6A02)
Component:		Man Hours: 1

Maintenance Task:

REPLACEMENT**PROCEDURE (CONT'D):****INSTALLATION (cont'd)**

9. Restore the Electrical Power to the DC/DC Converter by switching on the 6F02 (DC/DC Converter Power Supply CB) located in the "A" Cab. LV CB Panel
10. Check on the "new" installed DC/DC Converter that the relevant Operating Leds are lit, indicating that the Unit is working properly as follows:
 - GREEN, (Input Power)
 - YELLOW (Output Power)

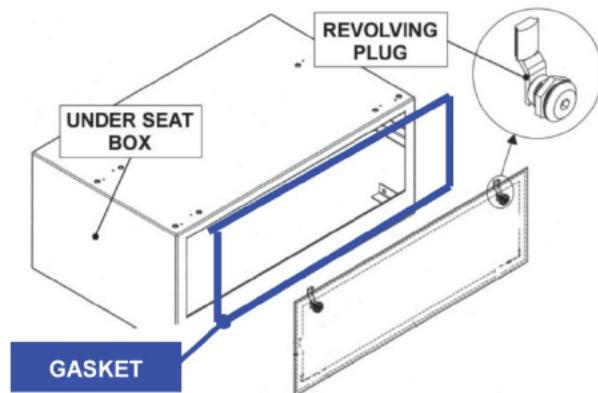


FIGURE 6 - UNDER SEAT BOX COVER DETAILS

11. Check the Gasket of the Under Seat Box Cover for damage / deformation. Replace as per check results.
12. Install the Under Seat Box Cover and lock it using the Maintenance Key

2153 - BRAKES_A The analog converter voltages were not as expected

15. Record Task results on the Defect Report Card for administrative and maintenance planning.

NOTE: At Task Completion it is recommended to check the correct operation and/or functions of the Subsystem to which the replaced Equipment pertains.
Refer to **HOW TO USE THE R-CM SHEETS** (para 10-III-04-01-02 of this Section) and follow the prescriptions provided at Step 3 "At every Task Completion"

10-III-05 CONSUMABLE MATERIALS LIST (R-CML)

The Consumable Materials needed to accomplish the LVDS Running Maintenance are listed, sequenced in alphabetical order, by SUBSYSTEM /ASSY -UNIT / COMPONENT, in the following Table 10-III-05.1

Table 10-III-05.1 Running Maintenance Consumable Materials List (R-CML)

SYSTEM 10		LOW VOLTAGE DISTRIBUTION	
SUBSYSTEM /ASSY - UNIT / COMPONENT	AGENT	PN	MTA PN
AUXILIARY POWER SUPPLY COMPONENTS	CRC 2000 Contact Cleaner		
	Cleaner / Degreaser	(commercial)	
LOW VOLTAGE DISTRIBUTION CIRCUITRY	CRC Industrial - Precision Cleaner	M3 PN 147535	
	Dry Compressed Air for Electronic Equipment	(commercial)	

10-III-06 TEST EQUIPMENT & SPECIAL TOOLS LIST (R-TESTL)

The Tools and Test Equipment needed to accomplish the LVDS Running Maintenance are listed, sequenced in alphabetical order, by SUBSYSTEM /ASSY -UNIT / COMPONENT, in the following Table 10-III-06.1.

Refer to "Tools and Test Equipment Manual" for Special Tools / Test Equipment Description and Maintenance.

Table 10-III-06.1 Running -Test Equipment & Special Tools List (R-TESTL)

SYSTEM 10		LOW VOLTAGE DISTRIBUTION		
SUBSYSTEM /ASSY - UNIT / COMPONENT	LACMTA STANDARD TOOLS KIT	LACMTA WORKSHOP DEVICES	SPECIAL TOOL / TEST EQUIPMENT	PN
AUXILIARY POWER SUPPLY COMPONENTS	X	Module Support Hydraulic Device		
APS LINE REACTOR	X	Module Support Hydraulic Device		
LOW VOLTAGE DISTRIBUTION CIRCUITRY	X	Vacuum Cleaner	Cable Certifier (Type LT 8600)	
LOW VOLTAGE DISTRIBUTION SYSTEM	X		Portable Test Unit (Ptu) (Dell-)	

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