

**MBB**

Transportation  
Technology Division

# DISNEYLAND MARK V MONORAIL

VOLUME 1

MAINTENANCE MANUAL BODY

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MARK V  
MONORAIL

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Technology Division

MAINTENANCE MANUAL

VOLUME 1

1988

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## VOLUME 1

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## INTRODUCTION

1. How to use the manualA. General

A list of the applicable Chapters is given on page 1 to this introduction, abbreviations used in the text of the maintenance manual (Volume 1) are given in full in the first instance of use in each chapter, followed by the abbreviation in parenthesis. A complete list of abbreviations used in the maintenance manual is given in to this introduction.

The maintenance manual is written to enable the customer to extract information for the purpose of training personnel in the maintenance practices necessary to keep the Mark V monorail in a good serviceable condition.

Each chapter has the following sections:

- Description and Operation
- Fault Isolation
- Maintenance Practices
- Servicing
- Removal/Installation
- Adjustment/Test
- Cleaning/Painting

If a particular chapter has a section that is not applicable (N/A) then that section is detailed as such.

(1) Description/Operation

A brief general description of the purpose of the system is followed by a description of each of the major assemblies or components in the system. After the description, an explanation of the operation and control of the system is given. A schematic illustration is included where necessary and this together with the electrical drawing set will aid in fault isolation.

(2) Fault Isolation

Trouble shooting or fault isolation procedures are given in each chapter to enable the mechanic to determine the cause of a fault



reported by the driver of the monorail. The fault isolation procedures are given in logical steps from the fault or symptom through stages to a system normal configuration. Any fault isolation procedure not given in the maintenance manual should be referred to the manufacturer.

(3) Maintenance Practices

A table of maintenance practices is given in each chapter to enable the workshop administration staff to plan the periodic inspections that are necessary for preventative maintenance.

(4) Servicing

A table of servicing schedules is given in each chapter to enable the workshop administration staff to plan for the lubrication or replacement of components.

(5) Removal/Installation

This section gives the mechanic clear and concise instructions on the removal and installation of major components or assemblies in the system based on a maintenance philosophy of exchanging the defective component or assembly to keep out of service time to a minimum. Any further work should be done in the mechanic's bay with reference to the Vendor's overhaul/component maintenance manual relative to the component or assembly that has been removed.

WARNINGS/CAUTIONS/NOTES relative to the safety of personnel or equipment are given as follows:

- WARNINGS, applicable to the safety and health of the mechanic.
- CAUTIONS, applicable to the safety of equipment
- NOTES, highlights a text part or a procedure.

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WARNING

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FAILURE TO OBSERVE A WARNING CAN  
CAUSE INJURY TO PERSONNEL.

---



---

**CAUTION**

---

FAILURE TO OBSERVE THE CAUTIONS CAN  
CAUSE DAMAGE TO EQUIPMENT.

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**NOTE**

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Notes are also given where necessary  
to aid personnel in the maintenance  
task.

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**(6) Adjustment/Test**

Each chapter contains instructions necessary to adjust and test a system. The instructions are applicable whenever a component or system has been disturbed or to determine that the system is still within the design specifications, tolerances and parameters.

**(7) Cleaning/Painting**

The instructions given in this section, details the necessary procedures to remove dirt and restore the high quality finish to the monorail's components. The cleaning procedures are necessary to maintain equipment in a good serviceable condition.

Enquiries should be addressed to the manufacturer's design office.

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## B. LIST OF ABBREVIATIONS

AC	Alternating current
Chap.	Chapter
DC	Direct current
Fig.	Figure
Ft	Feet
FM	Frequency modulation
FWD	Forward
GRP	Glass reinforced plastic
Hz	Hertz (cycles)
Instl.	Installation
in.	Inch
I.P.C	Illustrated Parts Catalog (Vol. 3)
lbs	Pounds
LH	Left hand
Mk	Mark
mm	Millimetre
m	Metre
N/A	Not applicable
PA	Public address
PCU	Programmable control unit
PUR	Polyurethane
RH	Right hand
RF	Reference
Sect.	Section
V	Volt
Vol.	Volume

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# CHAPTER 00-00 GENERAL

Jan. 88



## CHAPTER 00-00

## GENERAL

1. Description and OperationA. Description (Fig. 1)

## (1) General

The MK V Monorail train is an aerodynamic designed structure. It is 139.77ft (1677.25inches) long with a total unladen weight of 74.900lbs. It is designed to carry 132 passengers. The train has:

- a front cabin (drivers)
- passenger cars
- a rear cabin
- bellows

The data for the weight and dimensions of train is given in the text and on Figure 1. Four train units are planned with the following colors:

- Train 1 - purple
- Train 2 - orange
- Train 3 - blue
- Train 4 - red.

## (a) Front (drivers) Cabin

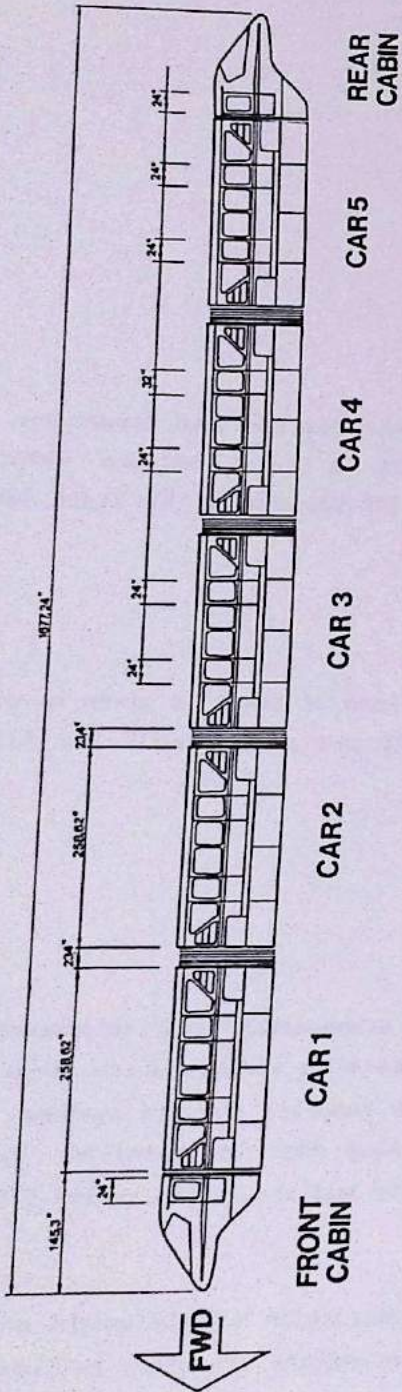
The front cabin has a seating arrangement for five passengers and a driver. The driver is seated at a console which gives him the control and indication of the monorail and its systems. A pneumatically operated 24 inch plug door is installed. The weight of the front cabin is 2.650 lbs and its length is 145.3 inches.

## (b) Passenger Cars

1 Cars 1 to 3 and 5

The cars are similar in construction but the weight of each car is different, therefore the weights are given in Figure 1. The cars are 258.62 inches long and have two pneumatically-operated 24 inch plug doors. Each car has a seating arrangement for 24 passengers. Two emergency exits are fitted in the roof of each car.





Passenger (Pax) Seating Arrangement

	Configuration 1	Configuration 2	Configuration 3
Front Cabin	1 driver + 5 pax	1 driver + 5 pax	1 driver + 5 pax
Car 1	24 pax	24 pax	24 pax
Car 2	24 pax	24 pax	24 pax
Car 3	24 pax	24 pax	24 pax
Car 4	24 pax	19 pax + 1 wheelchair	16 pax + 2 wheelchairs
Car 5	24 pax	24 pax	24 pax
Rear Cabin	7 pax	7 pax	7 pax
<b>Total</b>	<b>132 pax</b>	<b>127 pax + 1 wheelchair</b>	<b>124 pax + 2 wheelchair</b>

DATA.

Unladen weight excluding chassis.

	lbs (pounds)
Front cabin	2,650
Car 1	2,888
Car 2	2,866
Car 3	3,020
Car 4	2,932
Car 5	2,954
Rear Cabin	2,380
<b>Total</b>	<b>19,690</b>
<b>Unladen weight including chassis</b>	<b>74,900</b>
<b>Maximum laden weight</b>	<b>98,100</b>

Fig. 1 Mk.V Monorail - General Arrangement



2 Car 4

This car is fitted with a 24 inch pneumatically-operated plug door and a 32 inch pneumatically-operated plug door to allow the transportation of wheel chairs. The car has 24 passengers in normal seating arrangement or 19 passengers plus 1 wheelchair or 16 passengers plus room for two wheelchairs. Bench seats adjacent to the 32 inch plug door fold upright to make space for the wheelchair(s). The length of car four (4) is 258.62 inches. Two emergency exits are fitted in the roof of the car.

3 Rear Cabin

The rear cabin is 145.3 inches long with a seating arrangement for 7 passengers. A 24 inch pneumatically-operated plug door is installed. The rear cabin has an emergency exit fitted in the roof of the cabin.

## (c) Bellows

There are concertina bellows-type diaphragms fitted between each of the passenger car-to-car ends. The length of each bellows is 23.4 inches.

## (2) Technical Description

## (a) General

The MK V monorail uses the overhauled chassis of the Mk III monorail. The vehicle dimensions ensure unrestricted operation on all existing tracks and with all existing equipment at Disneyland in Anaheim/California.

The Mk V monorail bodies are installed on the chassis and are connected by shock absorbers and transverse control arms.

## (b) Body Structure

The car bodies are built of fiber composite construction. This sandwich construction consists of reinforced glass fiber external skins and a hard foam core.

Individual sub-components, such as window frames and door frames, are prefabricated in fixtures that correspond to the external geometry, and are subsequently laminated to the major structure.

The supporting structure of the front and rear cabins is glass reinforced plastic (GRP) with sheets of hard foam in areas for added rigidity.

## (c) Interior Lining

The interior trim panels are preformed GRP linings in the front



and rear cabin and thermo formed polycarbonate, car 1 to 5. The seat shells are GRP with the seat cushions made of simulated leather type material with a foam backing.

(d) Door system

The platform side of each car is fitted with two electro-pneumatically operated plug doors. The front and rear cabin each have one plug door. The doors close flush with the train's external skin.

The doors are operated individually by push-button switches located adjacent to the doors and collectively by push-buttons on the exterior of the front cabin, rear cabin and center car. Each door has an externally-operated emergency opening system. The doors are fitted with a pressure sensing system that automatically initiates a retraction of the door if an obstruction is sensed. The clear passage width of a door is 24 inches.

The rear door of the fourth car has a clear passage width of 32 inches for the transportation of passengers in wheel chairs.

(e) Windows

Each car is fitted with four sliding windows on the non-station side, and two sliding windows on the station side. These windows are locked and only operated by the attendant personnel.

The fixed windows in the doors and the fixed windows at the ends of the cars are bonded to the car body. The front and rear cabins have only fixed windows.

(f) Emergency Exits

Two emergency exit hatches are installed in the roof at each end of the cars. The rear cabin has a single emergency exit hatch. The front cabin door can be opened from the inside and therefore the front cabin has no emergency hatch.

The passengers reach the emergency exit hatch via the seats and a step on each end-of-car diagonal wall.

A roof rail with handholds runs the full length of each car and the roof surface is coated with anti-slip paint. Transition along the roof to the individual cars is possible.

(g) Additional equipment

Each car is fitted with two ventilator units with a flow of approx. 820 m<sup>3</sup> per hour. The fans are controlled by a thermostat installed in Car 1. A special power supply ensures operation of all fans for at least one hour if the main power supply fails.



The front and rear cabin are each equipped with an air-conditioning unit controlled by a thermostat in the front cabin.

All cars and cabins are equipped with loudspeakers for the transmitting of information to the passengers.

A radio system in the front cabin provides the driver with communications to the stations and the maintenance facility.

#### B. Operation

The operation of the MK V Monorail is controlled by the driver. When the speed control power lever on the driver's console is moved to the speed position, power is supplied to the monorails generators which motivate the trains driving wheels and tires. The driving wheels and tires are seated on a center concrete beam. Side mounted wheels and tires stabilize the train by pressing against the sides of the concrete beam. Two contact rails on the non platform side of the beam transmits the electrical current through the monorail system to pick-off points for the trains generators.



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# CHAPTER 01-00 MOUNTING EQUIPMENTS

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## CHAPTER 01

## MOUNTING EQUIPMENTS

1. Description and OperationA. Description (Fig. 1)

## (1) General

The Mk.5 car monorail has two cabins and five cars attached to each car and cabin chassis with tie-rods and lateral mountings. Between the front cabin and car one and the rear cabin and car five are adjustable tie-bars. Note that the lateral mountings installed on cars one to five are similar, therefore only car one is described. The front cabin and rear cabin endwalls have similar mounting installations, therefore only the front cabin is described. The purpose of the lateral mountings is to absorb vibration and swaying movement of the car and cabin.

## (2) Cabin Mountings

Installed between the cabin and chassis are four lateral mountings, two arrester hooks, four tie-rods and two tie-bars. The description of the mountings is as follows:

## (a) Lateral Mountings

Each of the four lateral mountings has a cover assembly containing a shock absorber unit.

The upper flange of the cover attaches to the underside of the cabin floor and the lower flange of the cover attaches to the flange on the shock absorber. The shock absorber is installed inside the cover assembly and is attached with an Allen headed bolt and washer to the chassis. All the shock absorber and covers are similar in construction, the main difference in the four lateral mountings is the attachment angles and the size of the lateral mounting covers that house the two shock absorbers.

## (b) Tie-rods

Four tie-rods are attached to forkends on the underside of the cabin floor and to forkends on the upper surface of the chassis.



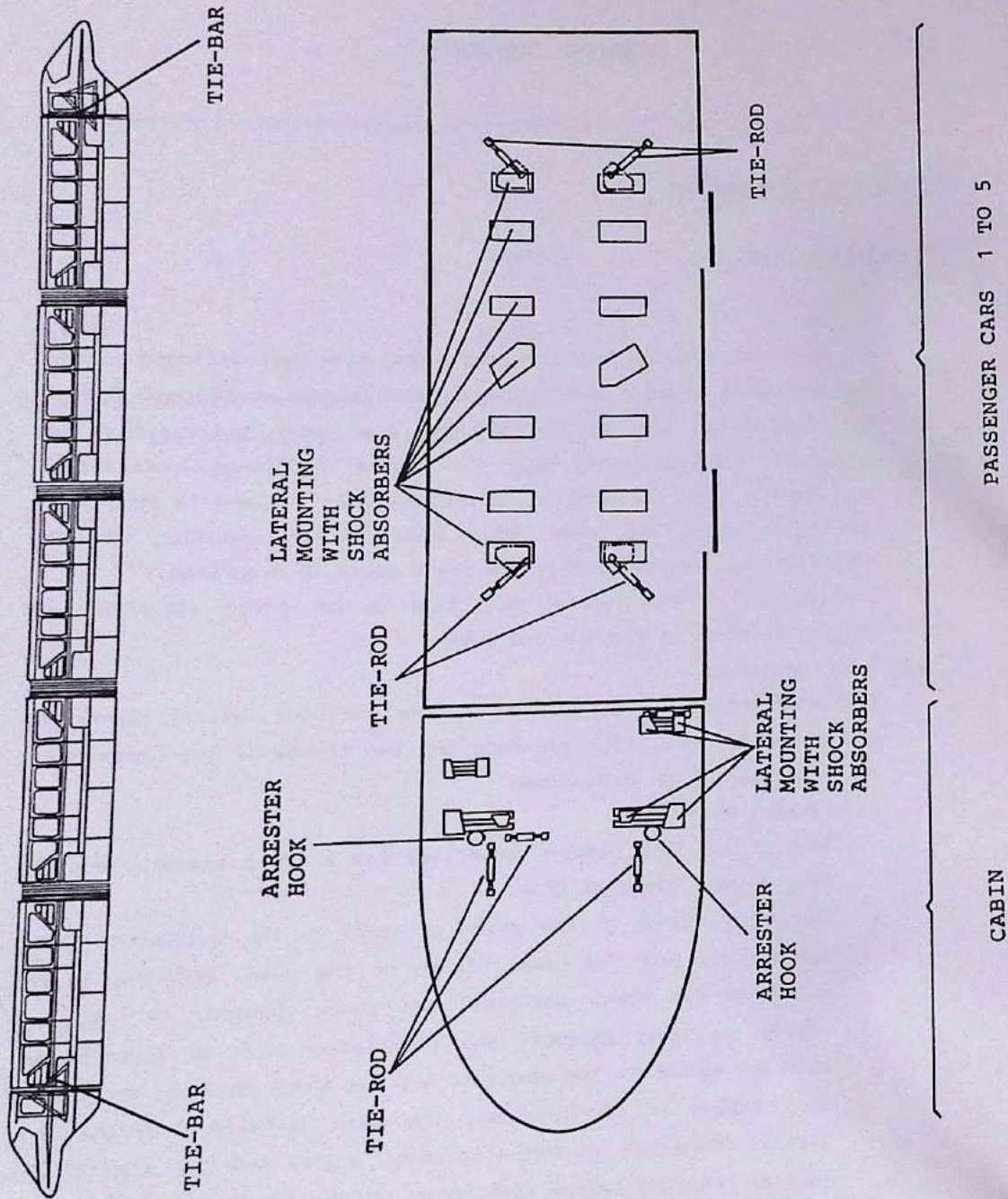


Fig. 1 - Mounting Equipment - General Arrangement



The tie-rods are attached to the fork-ends with clevis pins and made secure with cotter pins. At each end of a tie-rod, is an eye-end fitted with shock absorbant spherical bearings. Each eye-end has a threaded end; one eye-end is left hand threaded and the other is right hand threaded. The eye-ends screw into a turn-barrel that has left hand and right hand threaded ends. A nut and lock washer are fitted to each eye-end.

(c) Tie-bars and Attachment Points

Two tie-bars are installed between attachment points on the exterior surface of the endwall of the cabin and to the chassis of the next passenger car. The eye-ends of the tie-bar, mate with the attachment points. Shouldered steel pins and washers fix the tie-bars to the attachment points. The steel pins are secured with cotter pins. The attachment points are welded forkends on the chassis and endwall. The forkends on the exterior surface of the endwall of the cabin have welded tubular inserts in which are installed special shock absorbent bushes. The bushes have outer and inner metal casings with a rubberized insert. At each end of the tie-bar is an eye-end fitted with a spherical bush. The eye-ends are threaded, one left hand and one right hand threaded head. Each has a nut and lock washer installed. The center section of the tie-bar is fitted with welded end pieces. One end piece has a right hand thread, the other end piece has a left hand thread.

(d) Arrester Hooks

Two arrester hooks are installed under the cabin floor. The hooks are secured to the floor structure with six bolts and lock washers. The purpose of the hooks is to provide additional attachment safety points between the cabin structure and the chassis.

(3) Car Mountings

Each passenger car has fourteen lateral mountings and four tie-rods. The description of the fittings is as follows:

(a) Lateral Mountings

Each lateral mounting has two shock absorbers with a mounting cover assembly. The shock absorber is installed on the underside of the car floor and attached with an Allen-headed bolt and washer. Access to the Allen-headed bolt is through sealed access covers in the floor of each car. Between the top of the



shock absorber and the base of the car floor structure is a pressure pad. the purpose of the pressure pad is to prevent damage to the floor and to distribute the load factor given by the movement of the shock absorber. The base of the shock absorber is attached to the top of the chassis retaining plate by two bolts and washers.

(b) Tie-rods

Each tie-rod has two eye-ends, one with a left hand threaded end and the other with a right hand threaded end. Each eye-end is fitted with a shock absorbant spherical bearing. The eye-ends screw into a turn-barrel with left and right hand threaded ends. A nut and lock washer secure each eye-end and prevent unscheduled adjustment of a tie-rod. The tie-rods are attached to forkends on the underside of the car floor and to forkends on the upper surface of the chassis. The tie rods are attached to the forkends with clevis pins and made safe with cotter pins.

**B. Operation**

Tie-bars attach both cabins to the passenger cars. The tie-bars protect the cabins from the inertia effect caused by accelerating and braking forces acting on the cabin chassis. The tie-bars act both in compression and expansion modes to counter the effect of these braking and acceleration forces.

The tie-bars are adjusted on installation and any further adjustment should be unnecessary until a replacement is fitted. Lateral mountings installed between the monorail chassis and the floors protect the structure of the cabins and cars from sudden shocks. These lateral mountings each have two shock absorbers that suppress any vibration and shocks from being transmitted to the floors of the cars and cabins and consequently to the passengers.

Tie-rods, fitted between the chassis and floors of the cabins and cars, protect the cars from lateral forces caused by the swaying motion of the cars. The tie-rods are installed diagonally from the car and cabins along a fore and aft axis.



3. Maintenance Practices

The maintenance schedule is shown in Table 301.

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
1	Mounting System-Cabins	General serviceability check	TI-01.0001	Annual
2	Mounting System-Cars	General serviceability check	TI-01.0002	Annual
3	Shock Absorbers	General serviceability check. Inspect rubber for cracks and the unit for freedom from leaks.	TI-01.003	Annual
4	Tie-rods	General serviceability check	TI-01.0004	Annual
5	Tie-bars	General serviceability check	TI-01.0005	Annual
6	Attaching parts	General serviceability check	TI-01.0006	Annual

Table 301 - Maintenance Practices



5. Removal/Installation

A. Car Shock Absorber

(1) Removal

Fig. 501

- (a) Open the tire door and gain access to the work area.
- (b) Remove the carpet in the required area of the car floor.
- (c) Remove seat(s) if required. (Chap. 25-00)
- (d) Remove the access cover (5) from the floor structure.
- (e) Using an Allen wrench, remove the bolt (6) and washer (7) securing the pressure pad (8) and shock absorber (3) to the floor.
- (f) Unlock the safety tabs on the lock washers (1).
- (g) Remove two bolts (2) and lock washers (1) attaching the shock absorber (3) and retaining plate (4) to the mounting cover. Remove the shock absorber.

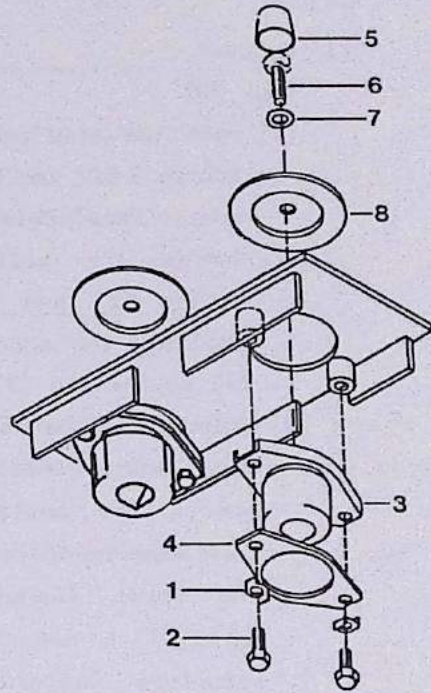


Fig. 501

(2) Install

- (a) Examine the structure for cleanliness and freedom from damage.
- (b) Examine the shock absorber and components for serviceability.
- (c) Fit the retaining plate to the base of the shock absorber and secure to the mounting cover with two bolts and new lock washers. Make safe the lock washer tabs.
- (d) Fit the pressure pad and shock absorber to the underside of the car floor and secure the shock absorber with the Allen-bolt and washer. Torque tighten the bolt to 105.7 ft.lbs (78 Nm).
- (e) Fit the access cover to the floor structure and seal with sealant (Sikaflex 221).
- (f) Replace the carpet in the car.
- (g) Install any seats removed. (Chap. 25-00)



- (h) Make sure the work area is clean and free from debris and that all tools are removed.

### B. Cabin Shock Absorber (Typical)

#### (1) Removal

Fig. 502

- (a) Open the tire door and gain access to the underfloor area of the cabin.
- (b) Remove the bolt (1) and washer (2) and plate (12) securing the shock absorber (4) to the rib (3).
- (c) Unlock the safety tabs on the lock washers (5) and remove the bolts (6) and lock washers (5) attaching the upper flange of the cover (7) to the cabin floor structure. Discard the lock washers.
- (d) Unlock the safety tabs on the lock washers (9) and remove the nuts (8), lock washers (9) and bolts (10) attaching the shock absorber (4) to the bottom flange of the cover (7). Discard the lock washers.

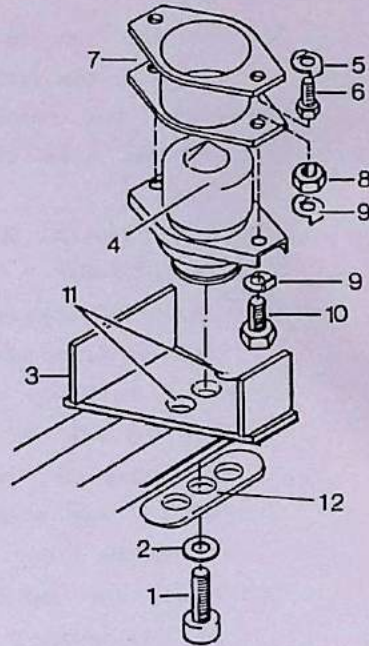


Fig. 502

#### (2) Install

- (a) Examine the structure for freedom from damage.
- (b) Examine the shock absorber and components for serviceability.
- (c) Fit the shock absorber (4) to the bottom flange of the cover (7). Secure with two nuts (8), bolts (10) and new lock washers (9). Make safe the locking tabs on the lock washers.

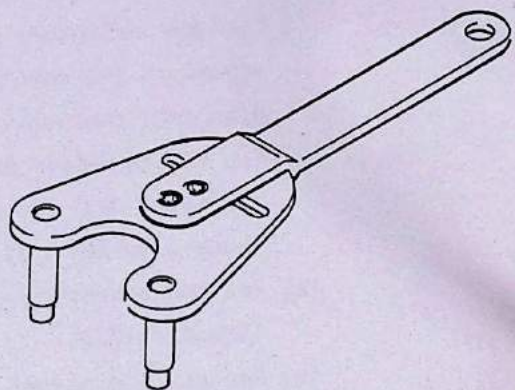


Fig. 502-1



- (d) Fit the upper flange of the cover (7) to the floor structure and secure with two bolts (6) and new lock washers (5). Make safe the locking tabs on the lock washers.

---

**CAUTION**

---

WHEN INSTALLING THE BOLT (1) AND WASHER (2), USE SPECIAL TOOL 502-1 LOCATED IN HOLES (11) TO PREVENT THE SHOCK ABSORBER FROM TURNING.

---

- (e) Install the bolt (1), washer (2) and plate (12) to secure the shock absorber (4) to the rib (3). Torque tighten the bolt to 74.5 ft.lbs (55 Nm).
- (f) Make sure the work area is clean and free from debris and that all tools are removed.

**C. Tie-rod (Typical)****(1) Removal**

Fig. 503

- (a) Gain access to the work area.
- (b) Remove and discard the cotter pins (1).
- (c) Remove the clevis pins (2) and washers (3).
- (d) Remove the tie-rod assembly.

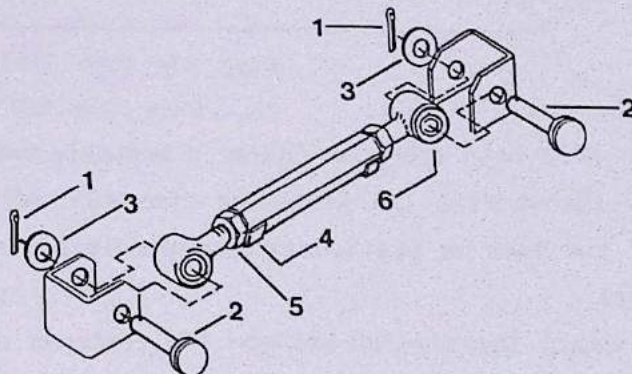


Fig. 503



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**NOTE**

---

The tie-rod assembly can be disassembled for eye-end renewals as follows:

---

- 1 Measure and record the distance between eye-end centers.
- 2 Unlock the safety tab on both lock washers (4) and slacken both nuts (5).

---

**CAUTION**

---

OBSERVE ONE NUT IS A LEFT HAND THREAD AND ONE IS A RIGHT HAND THREAD. ATTEMPTING TO TURN A NUT IN THE WRONG MOTION WILL DAMAGE THE COMPONENT.

---

- 3 Unscrew the eye-ends (6) and discard the lock washers (4).
- 4 Fit nuts (5) and new lock washers (4) to the eye-ends (6).

---

**NOTE**

---

Do not tighten nuts or make safe the lock washers at this stage.

---

- 5 Hold both eye-ends (6) by a suitable method and turn the center turn-barrel (7) until the dimension between the eye centers is the same as previously recorded in step (1).
- (2) Install
- (a) Install the tie-rod between the forkends on the structure and fit the clevis pins (2) and washers (3).
  - (b) Make safe the clevis pins (2) with cotter pins (1).



NOTE

If the clevis pins cannot be easily fitted, the tie-rod requires adjustment as follows:

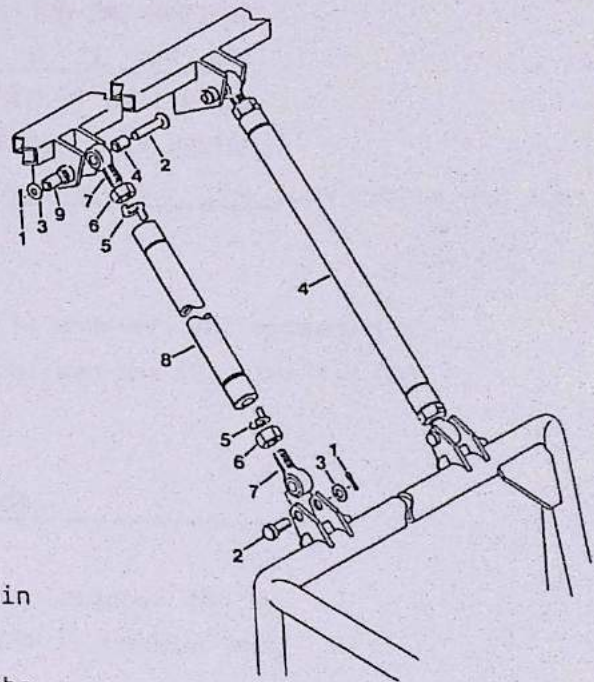
- 1 With the tabs on the lock washer unlocked and both nuts slackened, turn the turn-barrel in a clockwise or counter clockwise direction to shorten or lengthen the distance between eye-ends.
  - 2 Tighten the nuts and safety the tabs on the lock washers.
- (c) Make sure the work area is clean and free from debris and that all tools are removed.

D. Tie-bar

- (1) Removal  
Fig. 504

WARNING

DO NOT DISCONNECT THE TIE-BARS BEFORE THE CABIN AND CAR ARE SUITABLY SUPPORTED.



- (a) Open the tire door and gain access to the work area.
- (b) Remove and discard the cotter pin(s) (1).
- (c) Remove the clevis pin (2) and washer(s) (3).

Fig. 504



---

**NOTE**

---

If rebushing the upper fork end,  
proceed to step (3).

---

- (d) Remove the tie-bar assembly (4).
- (2) Replacing a Tie-bar Eye-End
- (a) Measure and record the distance between eye-end centers.
- (b) Unlock the safety tab on both lock washers (5) and slacken both nuts (6).

---

**CAUTION**

---

OBSERVE ONE NUT IS A LEFT HAND THREAD  
AND ONE IS A RIGHT HAND THREAD.  
ATTEMPTING TO TURN A NUT IN THE WRONG  
MOTION WILL DAMAGE THE COMPONENT.

---

- (c) Unscrew the eye-ends (7) and discard the lock washers (5).
- (d) Fit nuts (6) and new lock washers (5) to the eye-ends (7).

---

**NOTE**

---

Do not tighten nuts or make safe the  
lock washers at this stage.

---

- (e) Hold both eye-ends (7) by a suitable method and turn the center turn-barrel (8) until the dimension between the eye centers is the same as previously recorded in step (1) or listed in Table 601.



- (f) Tighten the locknuts (6) and safety with lock washers (5).
- (3) Re-bushing the Fork End
  - (a) Disconnect the upper end of the tie-bar (4).
  - (b) Press out and discard the bush (9). Press in a new bush until seated.
  - (c) Reconnect the upper end of the tie-bar (4).
- (4) Install
  - (a) Install the tie-bar between the forkends on the structure and fit the clevis pins. (2) and washers (3).
  - (b) Make safe the clevis pins (2) with new cotter pins (1).

---

NOTE

---

If difficulty is experienced when installing the clevis pins, the tie-bar requires adjusting (Sect. 6A)

---

- (c) Make sure the work area is clean and free from debris and that all tools are removed.



**6. Adjustment/Test****A. Adjustment****(1) Tie-bar adjustment**

---

**WARNING**

---

SUITABLY SUPPORT THE CABIN AND CAR  
BEFORE DISCONNECTING THE TIE-BARS.

---

- (a) With the tabs on the lockwasher unlocked, and both nuts slackened, rotate the turn-barrel in a clockwise or counter clockwise direction to lengthen or shorten the distance between eye-ends.

---

**NOTE**

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The nominal distance between eye-ends  
is given in Table 601.

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**CAUTION**

---

AFTER ADJUSTMENT, THE MAXIMUM DIMEN-  
SION BETWEEN EYE-END CENTERS GIVEN IN  
TABLE 601, MUST NOT BE EXCEEDED.

---

- (b) Tighten the nuts and make safe the tabs on the lock washers.



ITEM	NOMENCLATURE	QTY	LENGTH BETWEEN EYE-END CENTERS	REMARKS
1	Tie-bar (front)	2	50.492in min. 51.200in max.	If the dimension is outside those given the eye- ends threads may not be in safe- ty.
2	Tie-bar (rear)	2	47.716in min. 48.425in max.	

Table 601 - Tie-bar Dimensions.

## 7. Cleaning/Painting

### A. Cleaning

The cleaning of the mounting equipment is limited to the periods of inspection contained in the Maintenance Practices (Section 3) Table 301. It is good maintenance practice to clean items before inspection. The mounting equipment can be cleaned using a strong solution of a detergent free cleaning agent applied with a soft brush. The agent should be washed off with clean water and the components left to dry.

### B. Painting

For localized paint repairs refer to Chap. 11-00.



# CHAPTER 09-00 COMPRESSED AIR SYSTEM



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## CHAPTER 09-00

## COMPRESSED AIR

1. Description and OperationA. Description (Fig. 1)

## (1) General

The five car monorail has a compressed air system to operate the doors (Refer Chap. 22). The compressed air system contains:

- a check valve
- a 50 litre air reservoir
- a pressure regulating valve and gage
- a main valve.

## (2) Check Valve

A check valve is installed in the pressure input line to the 50 litre air reservoir. The valve is located under car 4 on the non station side. The purpose of the check valve is to prevent pressure leaking downstream of the air reservoir when the main system compressor is off line.

## (3) Air Reservoir

A cylindrical air reservoir is installed to the rear of and under car 4 on the non-station side. The reservoir is designed to contain 50 litres of compressed air. Two flange plates are welded to the reservoirs end walls. The purpose of the plates is to support the air reservoir on the rectangular metal sub-frame of the car chassis. The reservoir is made secure with hexagonal nuts, bolts and washers. A pressure relief and water drain tap is fitted to the base of the reservoir.

## (4) Pressure Regulating Valve

A pressure regulating valve is installed in the output line from the air reservoir. The purpose of the valve is to regulate the air supply pressure from the reservoir to the door operating line. The valve has a manual controlled pressure control knob. The purpose of the knob is to let the system down line of the regulating valve be isolated from the air reservoir in the event of maintenance procedures being



performed down system. A glass fronted pressure gage 0 to 160 psi is installed on the pressure regulating valve.

(5) Main Valve

A 24 V.dc solenoid operated main valve is installed to the outlet of the pressure regulating valve. The valve is secured to the sub-frame of the car chassis by two hexagon bolts and washers.

**B. Operation**

With the main compressors operating, air pressure is supplied to the 50 litre air reservoir. The pressure contained in the reservoir is sufficient to do three single operations of the doors. With the DOOR AIR ON/OFF switch in OFF position or in case of loss of the power supply, the solenoid main valve vents the door system pressure to ambient. Operation of the DOOR AIR ON/OFF switch on the drivers secondary control panel, supplies 24 V.dc to the solenoid on the main valve. The valve moves to open and lets a regulated air pressure to the monorails plug door system. (Refer Chap. 22)

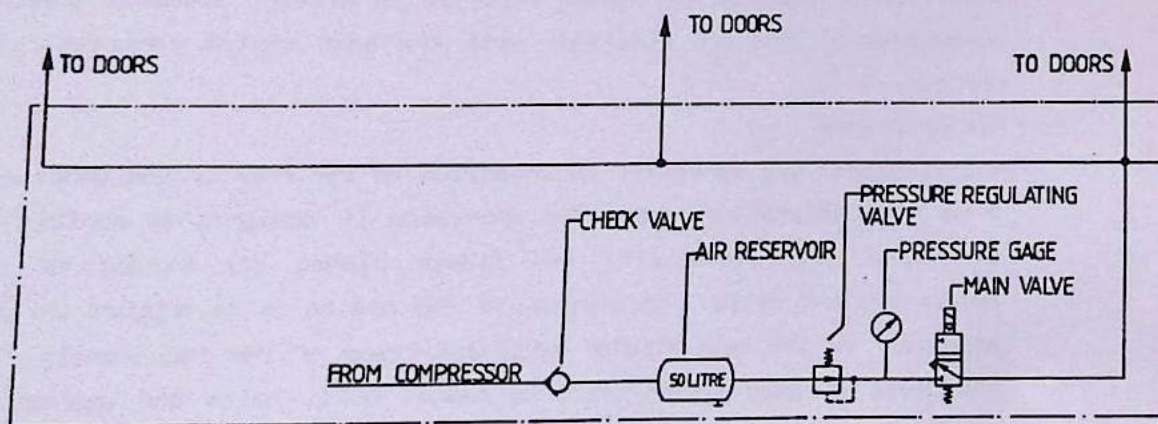


Fig. 1 Compressed Air System - Schematic



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# CHAPTER 10-00

## MIRRORS



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## CHAPTER 10

## MIRRORS

1. Description and OperationA. Description (Fig. 1)

## (1) General

The drivers cabin of the Mk V monorail has two rear view mirrors. The purpose of the mirrors is to let the driver have a rear looking view of the exterior sides of the monorail cars while he remains seated at the control console. The mirror installed on the non-station the (RH) side of the monorail is located on the forward edge of fixed window. The window is a non-opening type and so provision is made for the driver to turn and tilt the mirror from a control knob installed on the R.H. window trim. The mirror installed on the station (LH) side of the monorail is located on the cabin plug door. The plug door window is a non-opening type and a control knob is fitted through a hole in the door trim panel to allow the mirror to be adjusted from inside the cabin when the door is closed. A rubber seal prevents ingress of dirt between the aperture in the window trim panel and the control knob.

## (2) Mirrors

The mirrors are of similar construction and therefore only the mirror on the RH side is described. Any differences for the LH side mirror is given in parenthesis.

The mirror is installed in an anti-vibration housing. Two sets of nuts, washers and screws attach the mirror housing to the structure of the cabin (RH mirror) and to the structure of the door (LH mirror). A rubberized seal is installed under the mirror housing to prevent the ingress of water to the interior of the monorail. A countersunk screw secures the wind fairing.

Three control cables are installed in the mirror housing and protrude through the base of the housing to the control knob. The cables are attached individually to the rear of the mirror at three locations.



**B. Operation**

Movement of the control knob through a 360 degree motion will operate the three control cables within the mirror housing. The cables pull in unison with the control knob and apply a force which pulls the rear face of the mirror to the position selected by the control knob. Thus when the rear face is moved the reflective front surface of the mirror reflects the image of the trains side.

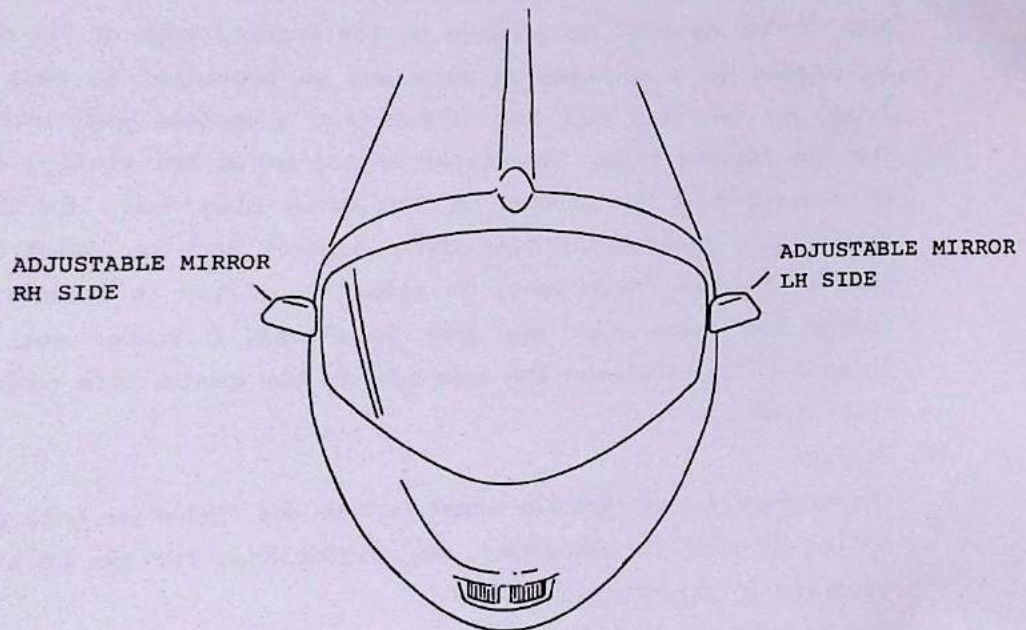


Fig. 1 Mirrors - General Arrangement



5. Removal / Installation

A. RH Mirror (complete)

(1) Removal

Fig. 501

- (a) Remove the window trim (Chap. 21-00)
- (b) Remove countersunk screw (1) securing wind fairing (2) to mounting bracket and remove the wind fairing.
- (c) Remove the two nuts (4), spring washer (5), washers (6) and screws (7) securing the mirror housing to the cabin shell. Remove the distance piece (11).
- (d) Support the mirror on the exterior of the cabin.
- (e) Remove the control knob (8) and nut (9) and push the knob through the hole in the cabin wall while supporting the mirror.
- (f) Discard the rubber seal (10) if unserviceable.

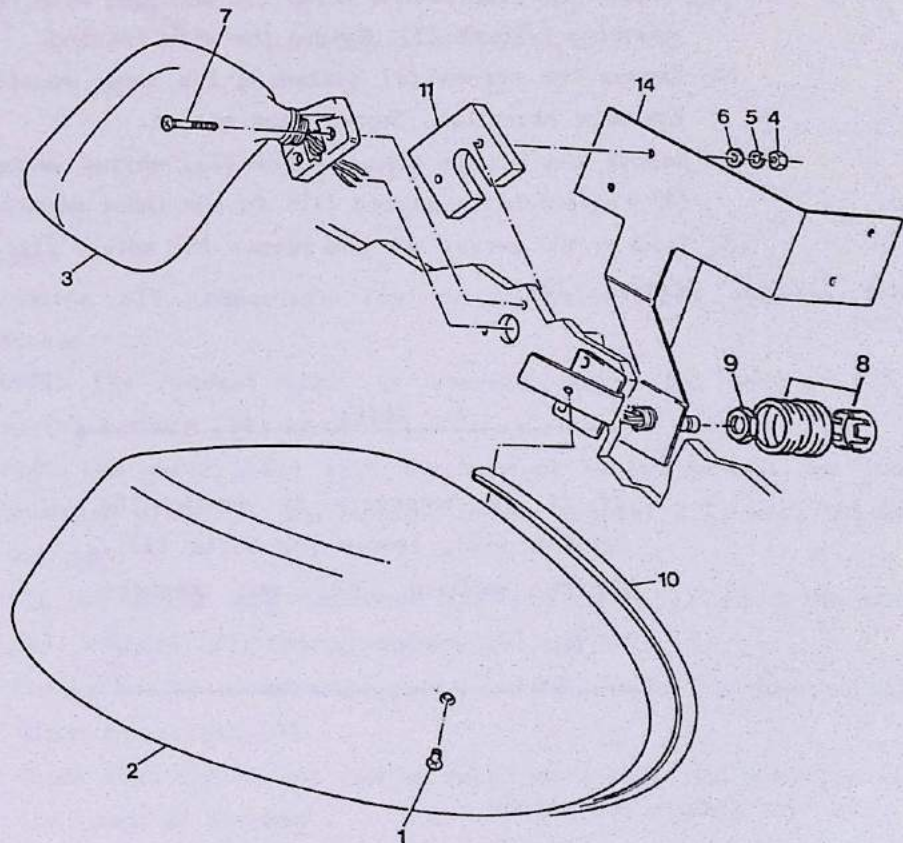


Fig. 501



- (2) Install
  - (a) Examine all components for serviceability and freedom from damage.
  - (b) Ensure all mating surfaces are clean, dry and free from damage.
  - (c) Position the mirror housing to the body shell and secure with two nuts, spring washers, washers and screws.
  - (d) Fit the wind fairing and the rubber seal and secure with the countersunk screw.
  - (e) Fit the control knob nut and the control knob.
  - (f) Install the window trim (Chap. 21-00).
  - (g) Adjust the mirror to the desired position.

**B. LH Mirror (complete)****(1) Removal**

Fig. 502

- (a) Remove the countersunk screw (1) securing wind fairing (2) to the mounting bracket (3). Remove the wind fairing.
- (b) Remove the screws (4) fastening the inner mounting plate (5) to the door structure. Support the mirror.
- (c) Remove the screws (6), washers (7), spring washers (8) and nuts (9) fastening the mirror (10) to the inner mounting plate.
- (d) Slacken the swivel nut and remove the swivel (11) from the bracket (12).

---

**NOTE**

---

If it is necessary to remove the bracket (12), remove the bolts (13), spring washers (14) and washers (15).

---

- (c) Remove the mirror.



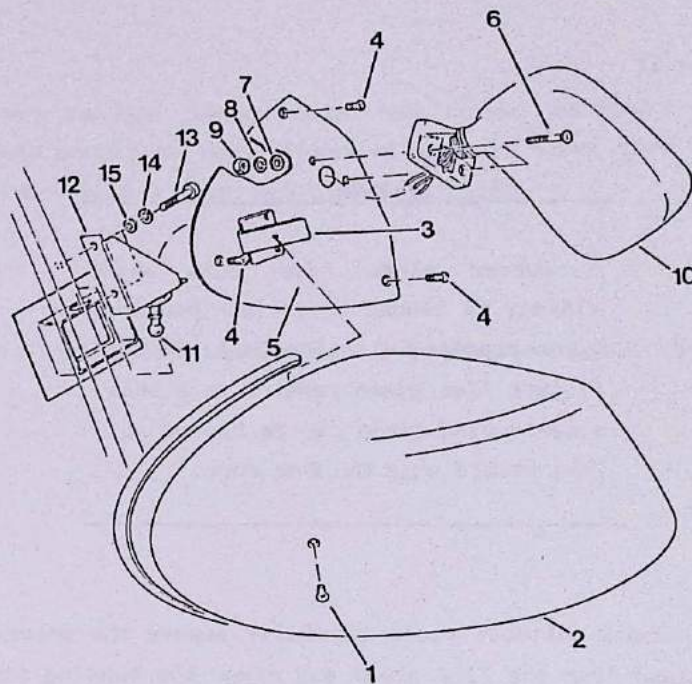


Fig. 502

(2) Install

- (a) Examine all components for serviceability and freedom from damage.
- (b) Refit the bracket (12), if removed, using the washers (15), spring washers (14) and bolts (13).
- (c) Push the swivel (11) with the control cable through the inner mounting plate (5) and connect to the bracket (12) with the swivel nut.
- (d) Fit the mirror onto the inner mounting plate (5) using the screws (6), washers (7), spring washers (8) and nuts (9).
- (e) Locate the inner mounting plate and fasten to the door structure using the screws (4).
- (f) Check that the mirror can be moved to a selected position within the range of movement.
- (g) Fit the wind fairing and the rubber seal using the countersunk screw (1).
- (h) Adjust the mirror to the desired position.



**C. Mirror Glass****(1) Removal**

---

**NOTE**

---

A curved glass, for wide angle vision, is bonded to a flat (backing) glass supplied with the unit. If sufficient flat glass remains as a base, a new curved glass can be bonded on. This should only be done once.

---

(a) Using a suitable tool, carefully remove the unserviceable curved glass from the flat glass and clean the bonding area.

**(2) Install**

(a) Bond a curved glass to the backing glass using SIKAFLEX 221 TECHNIQUE or equivalent.



**7. Cleaning / Painting****A. Cleaning**

The mirrors can be cleaned using any normal detergent free cleaning agent. They should be well rinsed with clean water then allowed to dry then polished with a clean dry lint free cloth.

**B. Painting**

The wind fairing is painted with a high-gloss paint. Refer to Chapter 11-00.



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# CHAPTER 11-00 PAINTING

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## CHAPTER 11

## PAINTING

1. Description and OperationA. Description

## (1) General

The four Mk V monorail trains are treated, primed, filled and painted with a polyurethane intermediate coat. The high standard of finish is achieved with a top coat of high gloss, acrylic paint. The trains are painted white above and below the bulge. The skirts are painted gray. The bulge, which is installed to the length of the train is painted as follows:

Train 1 - purple

Train 2 - orange

Train 3 - blue

Train 4 - red.

The color on the bulge is extended from the front cabin to the rear cabin and is bordered by a 1 in. (25 mm) thick black stripe. The colors below the bulge taper to a point at each end of the train and are separated by a 0.23 in. (6 mm) black stripe. The legend "DISNEYLAND MONORAIL SYSTEM" in 5 in. (127 mm) high letters is painted in light blue across the gray skirt on the platform side and the non-platform side of car 1.

## (2) Exterior

Before the exterior of the train is painted, it is sand blasted with finely grained, blast furnace slag (grade 200-600). It is then cleaned with clean cloths dampened with a recommended degreasing agent. The aluminum parts are anodized.

After cleaning, a chromate free primer with hardener is applied to improve adhesion. The surface is filled using a filler paste with hardener. When the filler paste is hard, it is rubbed down with 400 grade wet and dry paper. The surface is now painted with a sand coloured, polyurethane intermediate coat with hardener followed by a finishing coat of high gloss acrylic paint. Finally a coat of clear



polyurethane lacquer is applied. The walkway along the roof from the escape hatches is painted with a silver gray anti-slip coating and hardener. The purpose of the anti-slip paint is to give passengers an anti-slip surface on the roof if an emergency exit is used.

(3) Interior

The interior surfaces are rubbed smooth before painting with wet and dry paper (400 grade) then cleaned and dried. Next, a chromate free primer with hardener is applied to improve adhesion, followed by a flame resistant white filler and liquid hardener. When the white filler is hard, a matt intermediate coat with hardener is applied, followed by a textured finishing coat with hardener. All G.R.P materials not seen by the passengers are treated with fire protective paint and a clear laquer.

(4) Supports and Mountings

All supports and mountings are treated and cleaned before painting. The aluminum parts are etched and the steel parts are sand blasted. The supports and mountings are undercoated with a chromate free primer with a hardener and finished with a yellow or grey polyurethane top coat.

B. Operation

Not applicable.

7. Cleaning/Painting

A. Cleaning

For general cleaning of the interior, a weak solution of a detergent free cleaning agent can be applied. The surface to be cleaned should be wiped with a damp cloth and polished with a lint free dry cloth. The exterior of the monorail can be cleaned with a detergent free cleaning agent and persistent marks can be removed using a strong solution of the detergent free cleaning agent applied with a soft cloth. The cleaning agent must then be neutralized with clean water and the surface dried with a lint free dry cloth.



**B. Painting**

For repairs to the paintwork refer to the Tables 701 to 703 for Materials.

PURPOSE	MATERIAL																
Cleaning	Blast furnace slag (grade 200-600) for sandblasting																
Degreasing	MEK or other approved degreasant																
Priming	EP Primer chromate free and Hardener																
Filler	UP-Filler and UP-paste Hardener																
Intermediate coat	Polyurethane base coat N58750 Hardener for above																
Finishing coat	<table border="0"> <tr> <td>Autocolor-2K</td> <td>Colour Code</td> </tr> <tr> <td>acrylic paint</td> <td>D-1944 PURPLE, TRAIN 1</td> </tr> <tr> <td>P420 High gloss</td> <td>D-1954 ORANGE, TRAIN 2</td> </tr> <tr> <td>and P210-760</td> <td>D-1378 BLUE, TRAIN 3</td> </tr> <tr> <td>normal hardener</td> <td>D-1948 RED, TRAIN 4</td> </tr> <tr> <td></td> <td>D-2085 WHITE, BODY</td> </tr> <tr> <td></td> <td>D-2081 GRAY, SKIRTS</td> </tr> <tr> <td></td> <td>D-1942 BLUE, LETTERING</td> </tr> </table>	Autocolor-2K	Colour Code	acrylic paint	D-1944 PURPLE, TRAIN 1	P420 High gloss	D-1954 ORANGE, TRAIN 2	and P210-760	D-1378 BLUE, TRAIN 3	normal hardener	D-1948 RED, TRAIN 4		D-2085 WHITE, BODY		D-2081 GRAY, SKIRTS		D-1942 BLUE, LETTERING
Autocolor-2K	Colour Code																
acrylic paint	D-1944 PURPLE, TRAIN 1																
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normal hardener	D-1948 RED, TRAIN 4																
	D-2085 WHITE, BODY																
	D-2081 GRAY, SKIRTS																
	D-1942 BLUE, LETTERING																
Anti-slip coating for walkway	Silver-gray slip proof coating, and Hardener N391327																

Table 701 Materials-Exterior Use



PURPOSE	MATERIAL
Preparation	Wet-and-dry paper (400 grade)
Priming	EP Primer 5805-1102 chromate free
Filler	UP-Filler N59300/white, flame resistant
Intermediate coat	DAN 1200 DA 2.1 (MATT) and Hardener
Finishing coat	DAN 1200 DA 2.1 (Textured) and Hardener
GRP Parts not seen by passengers	Fire protection paint 588 18 31
Clear poly. laquer	N502419

Table 702 Materials - Interior Use

PURPOSE	MATERIAL
Cleaning aluminum	Etch
Cleaning steel	Sand blast
Primer	EP Primer, chromate free
Finishing coat	Polyurethane base coat N58750

Table 703 Materials - Used on Supports and Mountings



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**CHAPTER 13-00  
SKIRTS AND  
MAINTENANCE DOORS**

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## CHAPTER 13

SKIRTS AND  
MAINTENANCE DOORS1. Description and OperationA. Description (Fig. 1)

## (1) General

The five car monorail has a skirt and tire door installation covering the chassis. The purpose of the installation is to continue the monorails upper structure to below platform level and give to passengers, a safety barrier from the chassis and moving parts. The skirt also provides a cosmetic finish to the aerodynamic design of the monorail. The tire doors give access to the tires and under car maintenance areas.

Note that the skirt and tire door installation is similar for all the cars, therefore only car one is described with any differences for other cars given in parenthesis. The installation, fitted to each side of the car, consists of two service doors, two removable doors, two tire doors and a skirt. Rubber seals are fitted to the car structure to mate with the doors closing surfaces. The inside of the doors is either painted with a fire protection paint (Refer Chapter 11-00), or protected by fire protection matting. (See Fig. 1)

## (2) Service Doors

The service doors are constructed from sandwiched fibreglass laminate with an insulation filler. Threaded inserts are set into the laminate. Each door is attached with a hinge to the skirt. The doors are provided with a sliding latch mechanism that is operated from one locking handle for each door. The door handle is located at the lowest curvature point of the door contour so that it is only accessible to service personnel. The door handle is a pull and turn mechanism recessed into the outer laminated skin of the door. Attached to the inner surface of the door is a spring loaded pivot mechanism with two bars acting as latches. The latching bars extend or retract when the door handle is turned. The bar latches withdraw from two security



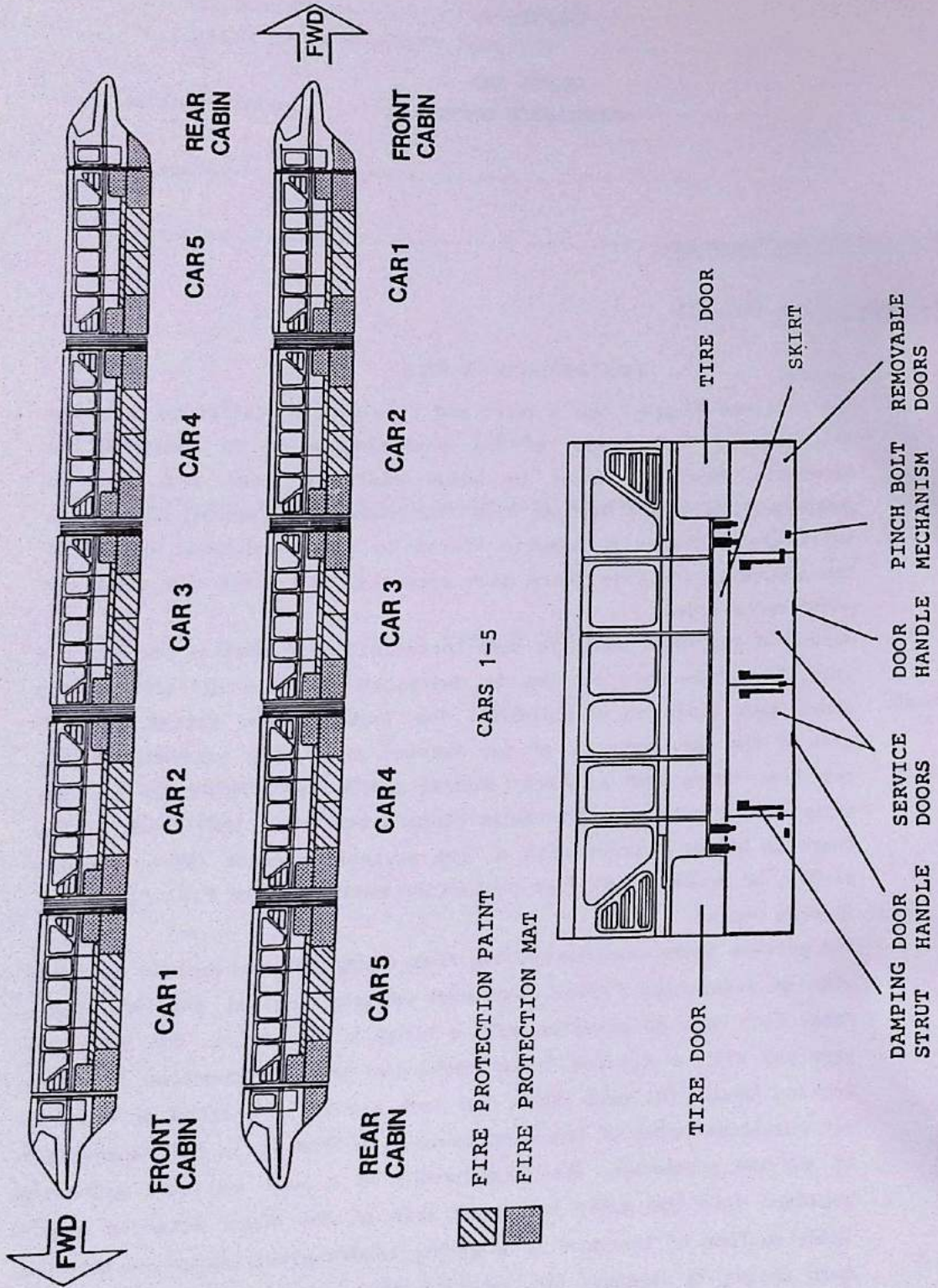


Fig. 1 Skirts and Maintenance Doors-General Arrangement.



brackets when the door handle is turned to UNLOCK. Two gas springs, fitted to each door and to the car chassis, have a damping effect on the doors movements to the open/close modes. The gas springs also act as door supports when the door is in the open position.

### (3) Removable Doors

The removable doors are constructed from sandwiched fibreglass laminate with a hard foam core. Threaded inserts are set into the laminate. Each door has a pivot hinge point plus two hinges. The pivot spigot of the door is secured to the pivot block on the chassis by a circlip. A pulley guide, attached to the door, retains the steel cable on the bellows. (Refer Chapter 24-00) The hinges are attached to the door with hexagon headed bolts and washers and attached to the underside of the car body by countersunk screws going into threaded inserts in the car structure. A hinge pin with a rectangular shaped handle connects the two hinges. The two hinges and the pivot hinge, provide the axis on which the door opens. The door has a clamping pinch bolt mechanism which is accessible through an orifice at the lowest curvature point of the door.

The pinch bolt locking mechanism acts in a clamping manner to secure the door in the closed position.

### (4) Tire Doors

Four tire doors are installed to each car and one to each cabin. The cabin tire door which is smaller than the car tire doors is located on the non-station side of the cabin to the rear of the cabin. The car tire doors are located two on each side of each car and below the fixed windows. All the doors are similar in construction except for the size, therefore only the cabin tire door is described. The tire door is constructed from sandwiched fibreglass laminate with a hard foam core. Threaded inserts are set into the laminate. Each door is attached with two hinges to the structure. The door is provided with a latch mechanism that is operated from a locking handle. The door handle is located at the lowest point of the door contour and it has a pull and turn mechanism recessed into the outer laminated skin of the door. A gas spring, fitted to the door and to the structure, has a damping effect on the doors movement during the open/close modes. The gas spring also act as a door support when the door is in the open position.



(5) Skirts

A skirt is fitted on each side of the car to close the space between the maintenance doors and the car body while leaving a gap of 2,5 inches to ventilate the undercar electrics. The skirt is handed, LH (station side), RH (non-station side) for each car with all cars the same except for the non-station side of Car 2. This has a metal rain deflector at the forward end instead of the continuous rubber strip fitted to all other skirts and a fire protection mat. The skirt is constructed from sandwiched fibreglass laminate with a hard foam core. Threaded inserts are set into the laminate. Each skirt is attached by four skirt brackets bolted to the structure.

**B. Operation**

When the door handle on the service door is pulled and turned, the pivot mechanism turns with a spring loaded action and withdraws the two latch bars from the security brackets, the service door can be opened. The gas springs on the door act in a restraining manner to prevent the door being opened to quickly. With the door fully open, the gas spring strut braces the door against unscheduled closing. To close the door, a downward force greater than that supplied by the gas spring, must be applied. The gas spring will act in a restraining manner to prevent the door being closed to quickly. The door handle can now be turned to LOCK and the latch bars will extend into the security brackets. If the handle is in the closed position, the handle must be returned manually to it's recessed position in the door.

To open the removable door the pinch bolt locking mechanism must be slackened and pressure applied to the base of the door. The locking mechanism will then pivot to let the door open sufficiently to gain further access. To remove the door, remove the spring clip securing the pivot pin on the pivot block. The hinge pin must then be extracted using the rectangular handle to pull the hinge pin from both hinges and the door can now be removed with a sideways movement.



**3. Maintenance Practices**

The maintenance schedule is shown in Table 301.

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
1	Skirt (All)	Inspect all fastenings.	TI-13.0001	Annual
2	Skirt in resistor area (car 2 - non station side)	Examine fire protection mat	TI-13.0003	Half annual
3	Tire door (All)	General function check. In particular inspect all fastenings.	TI-23.0101	Annual
4	Tire door (Cars)	Examine fire protection paint.	TI-23.0103	Half annual

Table 301 - Maintenance Practices



**4. Servicing**

The servicing schedule is shown in Table 401.

Item	Description	Service Required	Test and Inspection Instruction	Service Interval
1	Maintenance door	Grease	TI-13.0002	Annual
2	Maintenance door	Grease	TI-13.0004	Annual
3	Lock linkages	Grease	TI-13.0005	Annual
4	Tire door hinges	Grease	TI-23.0102	Annual
5	Tire door-lock and linkages.	Grease	TI-23.0104	Annual

Table 401 - Servicing



5. Removal / Installation

A. Removable Door (Typical)

(1) Removal

Fig. 501

- (a) Open the service door (Sect. 5B).
- (b) Slacken the pinch bolt (1) and pull the removable door (2) outwards.
- (c) Remove the bellows steel cable from the door (Chap. 24-00).
- (d) Remove spring clip (9) and the pivot pin (6) from the spigot block (7) on the upper corner at the door.
- (e) Withdraw the hinge pin (8) and remove the door in on outwards direction.

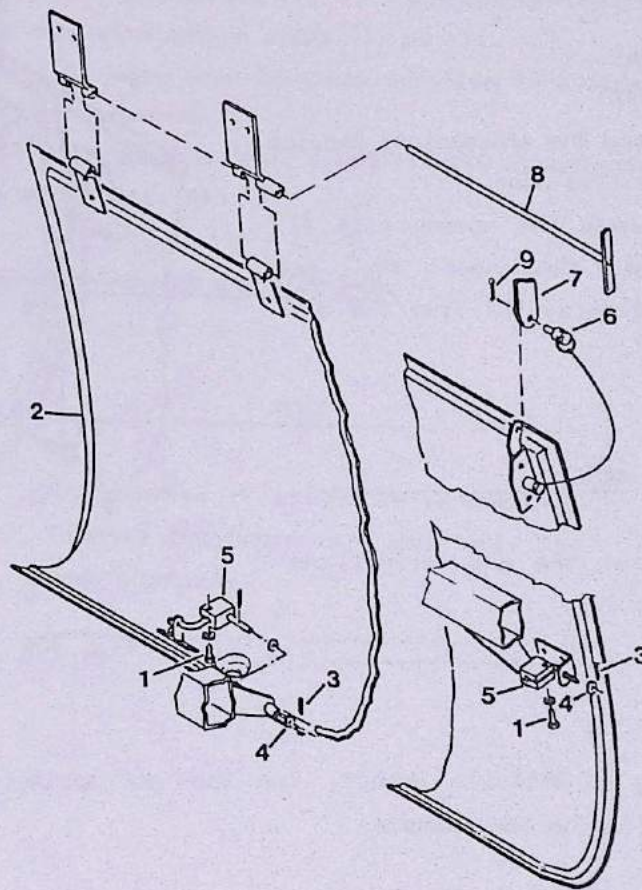


Fig. 501



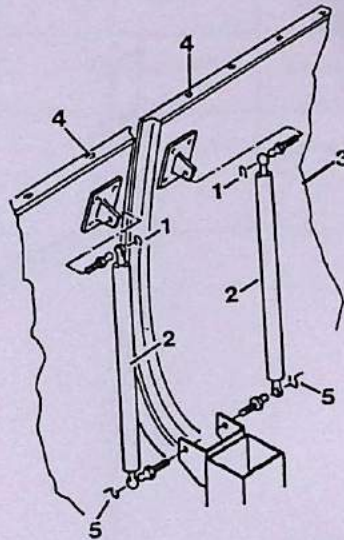
- (2) Install
- (a) Examine the door for serviceability and freedom from damage.
  - (b) Examine the hinge points for freedom from wear.
  - (c) Position the door on to the spigot and the pinch block mechanisms (5). Do not tighten the bolt (1) at this stage.
  - (d) Lift the door and position it in the forkend of the spigot block (7). Secure with spring clip (9) and pivot pin (6).
  - (e) Align the two hinges and insert the hinge pin (8).
  - (f) Fit the bellows steel cable (Chap. 24-00).
  - (g) Ensure the work area is clean and free from debris and remove all tools.
  - (h) Close the door, if the door needs adjustment refer to Sect. 6A.
  - (j) Tighten the bolt (1).

#### B. Service and Car Tire Door

(1) Removal

Fig. 502

- (a) Open the appropriate service or tire door.
- (b) Remove the spring clip (1) and disconnect the gas spring(s) (2) from the door (3).



**NOTE**

The tire door has one gas spring, the service door has two.

Fig. 502

- (c) Using a suitable method, tie the gas spring(s) in a stowed position on the chassis.



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**NOTE**

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If the gas spring is to be removed, remove the spring clip (5) and disconnect the gas spring from the chassis bracket.

---

- (d) Remove the countersunk screws (4) that secure the door hinge to the car body and remove the door.
- (2) Install
  - (a) Position the door to the car body and secure with countersunk screws (4).
  - (b) Secure the gas spring (2) to the chassis bracket and the door. Make safe with spring clips (1) or (5).
  - (c) Ensure the work area is clean and free from debris and all tools have been removed.
  - (d) Close and lock the door. If difficulty is encountered, adjust. (refer to Sect. 6A)

**C. Locking Mechanism-Service and Tire Door**

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**NOTE**

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The removal of all locks is similar, however the cabin tire door only has one latch bar.

---



## (1) Removal

## Fig. 503 (Service Door)

- (a) Gain access to the door lock mechanism to be removed.
- (b) On the lock mechanism remove the pin securing the lock handle (1) to the lock shaft. Remove the handle.
- (c) Slacken the locknut (2) securing the latch bar (3) to the pivot mechanism (4). Unscrew the latch bar(s).

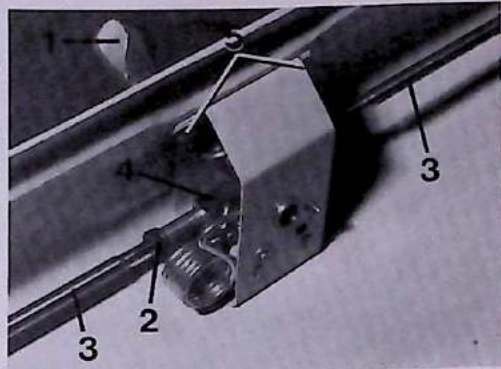


Fig. 503

- (d) Remove the screws, spring washers and washers (5) that secure the lock mechanism to the door. Remove the mechanism.

## (2) Install

- (a) Examine the lock mechanism for serviceability and freedom from damage.
- (b) Install the lock mechanism to the door and secure with screws, spring washers and washers.
- (c) Screw the latch bar (3) into the pivot mechanism (4). Only hand tighten the locknut (2) at this stage.
- (d) Fit the lock handle (1) to the lock shaft and secure with the pin.
- (e) Operate the door handle (1) and ensure the latch bar(s) (3) freely engage the security brackets attached to the structure. If adjustment is necessary, refer to Sect. 6A.
- (f) Hold the latch bar with a suitable tool and tighten the locknut (2). Do not let the latch bar rotate or readjustment will be necessary.
- (g) Ensure the work area is clean and free from debris and all tools have been removed.



D. Tire Door-Cabin

(1) Removal

Fig. 504

- (a) Open the door (3) and suitably support the door in the open position.
- (b) Remove the spring clip (1) and remove the gas spring (2).
- (c) Remove the six countersunk screws (4) attaching the hinge.
- (d) Remove the door.

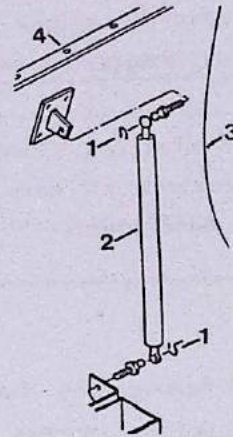


Fig. 504

(2) Install

- (a) Examine the structure and door for serviceability and freedom from damage.
- (b) Position the tire door to the structure and fit the six countersunk screws to attach the hinge.
- (c) Fit the gas spring and make safe with safety clip.
- (d) Do an adjustment of the tire door (Sect. 6).



**E. Skirt**

(1) Removal

(a) Remove the removeable and service door below the skirt.

Fig 505

**NOTE**

To assist installing, identify each skirt on removal if more than one skirt is to be removed.

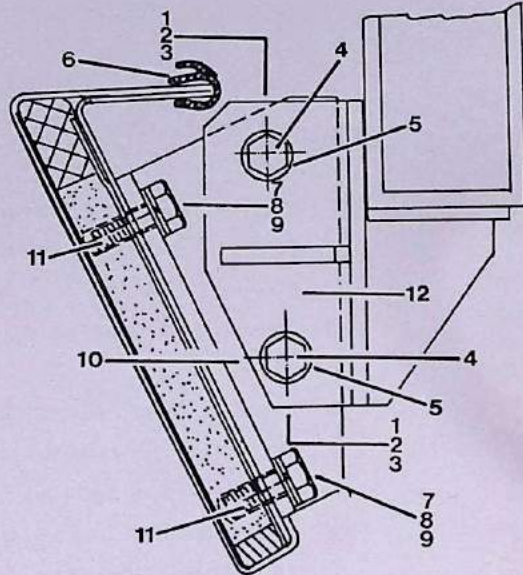


Fig. 505

- (b) Remove the two nuts (1), spring washers (2) and the plate washers (3) from the center two of the four skirt mounting brackets (12). Remove the bolts (4) with washers (5).
- (c) Remove the two nuts (1), spring washers (2) and the plate washers (3) from the outer two of the four skirt mounting brackets.
- (d) Holding the skirt so that it does not fall, remove the remaining bolts (4) with washers (5).
- (e) If required, pull off the weather strip (6).
- (f) If required, remove the four bolts (7), spring washers (8) and plate washers (9) fastening the bracket(s)(10) but see Note.

**NOTE**

Frequent removal of items 7 thru 9 may weaken the threads of the bonded insert (11).



(2) Install

---

NOTE

---

Contact areas between aluminum and steel must be coated with a luting and insulating paste after treatment with epoxy resin applied on metal primer. Fastening devices are to be coated with a luting and insulating paste.

---

- (a) If removed, fit the bracket(s) (10) using the plate washers (9), spring washers (8) and bolts (7).
- (b) If removed, fit the weather strip (6).

---

CAUTION

---

THE NON-STATION SIDE SKIRT ON CAR 2 IS SPECIAL. IT HAS A METAL WEATHER STRIP AND FIRE PROTECTION MAT TO WITHSTAND THE HEAT GENERATED BY ELECTRICAL EQUIPMENT. A REPLACEMENT SKIRT WITH A RUBBER WEATHER STRIP MUST NOT BE USED.

---

- (c) Position the skirt to the brackets (12) and connect using the washers (5), bolts (4), plate washers (3) spring washers (2) and nuts (1).
- (d) Close the removeable and service doors.



6. Adjustment/Test

A. Adjustment

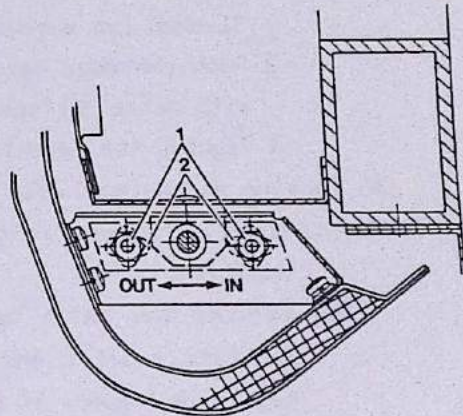
(1) Removable Door

- (a) Ensure the door is closed and the lock mechanism is fully engaged.
- (b) Using a straight edge, determine if the removable door is flush with the service door and the skirt. If adjustment is required proceed as follows:
  - 1 Slacken the bolt on the pinch block.
  - 2 Apply a pressure to the door skin until the door surface is flush with the adjacent skirt door.
  - 3 Tighten the pinch bolt on the block.

(2) Service Door and Tire Door

Fig. 601

- (a) Open the door. Loosen the bolts (1) so that they still grip but will allow the door to move in the adjustment slots (2).



- (b) Close the door, check if the upper door profile is flush.

- 1 Move the top of the door in or out in the horizontal slot until a satisfactory profile is achieved. Open the door and tighten the bolts (1).

Fig. 601

- (c) Close the door and lock. Check that the latch bar enters and retracts freely when the lock handle is turned. (See 6A (3)).

(3) Locking Mechanism-Service Door and Car Tire door

- (a) Ensure the door is closed and the locking handle is in the LOCK position.
- (b) Examine the latch bars, to ensure they fully engage with the security brackets and enter and retract freely when the lock handle is turned. If necessary adjust as follows:



- 1 Slacken the locknut on the latch bar that requires adjustment.
  - 2 Using a suitable tool, rotate the latch bar until the off-set angled end of the latch bar fully enters the security bracket.
  - 3 Hold the latch bar with a suitable tool to prevent it rotating on its axis and tighten the locknut.
- (4) Tire Door-Cabin
- (a) Ensure the door is closed and the latch mechanism is fully engaged.
  - (b) Using a straight edge, determine if the tire door is flush with the structure. If adjustment is required, first proceed as follows:
    - 1 Slacken the locknut on the rubber stop.
    - 2 Screw the rubber stop in/or out until the face of the stop is just in contact with the rear face of the door.
    - 3 Tighten the locknut on the rubber stop.
  - (c) After adjusting the door stop proceed as follows:
    - 1 Slacken two screws on latching plate.
    - 2 Push the door hard against the rubber stop until door is flush with outer surface of structure.
    - 3 Tighten the latching plate screws.
- (5) Locking Mechanism-Cabin Tire Door
- (a) Ensure the door is closed and the locking handle is in the LOCK position.
  - (b) Examine the latch bar to ensure it is fully engaged with the security bracket and enters and retracts freely when the lock handle is turned. If necessary adjust as follows:
    - 1 Slacken the locknut on the latch bar.
    - 2 Using a suitable tool, rotate the latch bar until end of the latch bar fully enters the security bracket.
    - 3 Hold the latch bar with a suitable tool to prevent it rotating on its axis and tighten the locknut.



**7. Cleaning/Painting****A. Cleaning**

The skirts and tire doors can be cleaned using a detergent free cleaning agent. The doors should be rinsed off and allowed to dry. Polish with a lint free cloth.

**B. Painting**

The exterior of the skirts and tire doors are painted with a high gloss paint. The interiors of all tire doors, all removable doors and the service doors on the non-station side of car 2 have fire protection mats installed. The remaining service doors are painted with fire protection paint (Refer to Chap. 11-00).



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**CHAPTER 20-00  
BODYSTRUCTURE  
AND  
EMERGENCY EXITS**

Jan. 88



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## CHAPTER 20

BODYSTRUCTURE  
AND  
EMERGENCY EXITS1. Description and OperationA. Description (Fig. 1)

## (1) General

The body of the monorail is five similar cars linked by bellows (Chap. 24-00). A front and rear cabin is attached to cars 1 and 5 so that, although they form one unit, there is no passage from car to cabin or car to car.

## (2) Main Body Structure

The cars are of monocoque construction having an outer fiber glass shell stabilized by an inner fiber glass shell. The gap between the shells is sandwich filled with PVC foam. The cabins have a shell fixed to a metal box-sectioned, welded steel frame. The floor of the cabin is aluminum plates with bonded stiffeners. Cut-outs in the car and cabin shells are for doors (Chap. 22-00), windows (Chap. 23-00), access doors (Chap. 13-00) and emergency exit hatches.

## (3) Emergency Exit Hatches

Each car has two recessed emergency exit roof hatches which are unlocked by a grab handle recessed into the hatch. The roof exterior has a grab rail and is painted with anti-slip paint. On the endwall beneath each hatch, an illuminated emergency sign is installed. There is an escape hatch in the rear cabin, but as the drivers cabin door can be opened mechanically from the inside the requirement for a roof hatch in the drivers cabin is eliminated.

Magnetic switches are fitted on the end of the roof's grab rail. The switches are part of an electrical safety loop which warns the driver when a hatch is open.

## (4) Controls and Indicators (Emergency Exit Hatches)

## (a) Primary Control Panel

Three red warning indicator captions are installed on the drivers



primary control panel. The captions read as follows:

- ROOF OPEN
- DOOR FAIL
- DOOR BYP

(b) Secondary Control Panel

Two switches are installed on the drivers secondary control panel. The switches are marked as follows:

- DOOR BYP-ON/OFF
- EMERG LT-ON/OFF

(c) Emergency Exit Lights

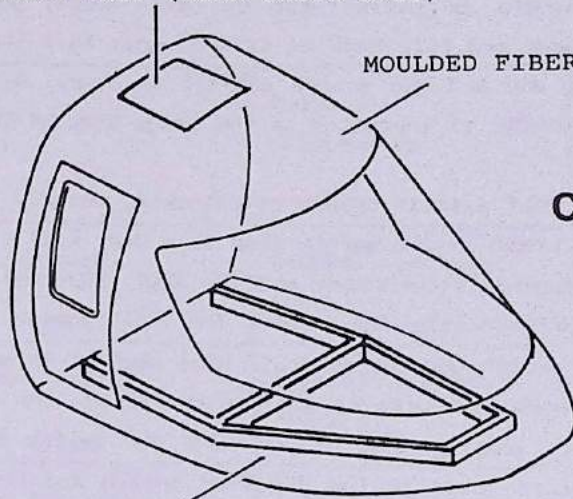
Exit lights marked EXIT EMERGENCY ONLY are installed below each exit hatch. The light is attached to the endwall and is of rigid construction. Arrows on the lights direct the passengers to the emergency exit.



EMERGENCY EXIT (REAR CABIN ONLY)

MOULDED FIBERGLASS BODY

**CABINS**

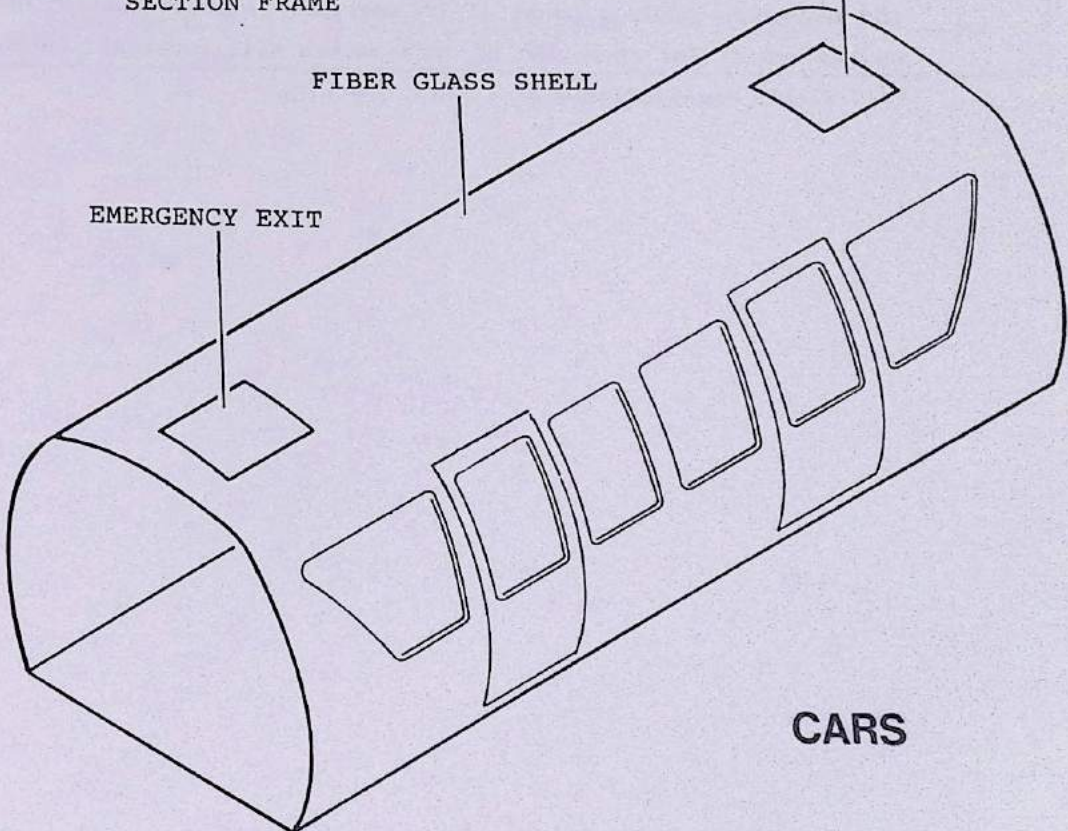


BOX STEEL  
SECTION FRAME

EMERGENCY EXIT

FIBER GLASS SHELL

EMERGENCY EXIT



**CARS**

Fig. 1 Structure - General Arrangement



**B. Operation****(1) Emergency Roof Exit**

When the grab handle is pulled and the exit hatch pushed, the exit hatch will open and fall back on it's hinges. Exit is then made by using the seat and a ledge on the endwall as steps. An emergency telephone (Chap. 39-00) is installed in the ledge step of the forward endwall.

When an emergency roof exit is opened or unlocked, the PCU (Chap. 76-00) processes the break in the safety loop as a door fail signal. The DOOR FAIL red indicator illuminates and the ROOF OPEN red indicator illuminates to differentiate the cause. The PCU removes the power from the RUN/STOP switch and the monorail will stop if in motion.

If a false alarm (misuse of the handle) is confirmed, the driver may override the safety loop by setting the DOOR BYP switch to ON, the PCU will then restore power to the RUN/STOP switch and the monorail can then be driven. The driver will operate the EMERG LI switch on the secondary control panel if an emergency exit evacuation has to be performed. The operating of this switch will cause all EMERGENCY EXIT lights to illuminate.



### 3. Maintenance Practices

The maintenance schedule is shown in Table 301.

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
1	Hatch, car	General function check	TI-01.0200	Monthly
2	Hatch, cabin	General function check	TI-01.0201	Monthly
3	Lock assembly	Function test	TI-01.0202	Quarterly
4	Rubber seals	Renew if necessary	TI-01.0203	5 years

Table 301 - Maintenance Practices



**4. Servicing**

The items listed in Table 401 are shown against a recommended maximum elapsed time, it is not an instruction to wait out the time before servicing.

Item	Description	Service Required	Test and Inspection Instruction	Service Interval
1	Rubber extrusions	Powder with talcum	II-01.203	Annual

Table 401 - Servicing



5. Removal / Installation

A. Emergency Roof Exit

(1) Removal

Fig. 501

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NOTE

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The procedure for all emergency hatches is similar.

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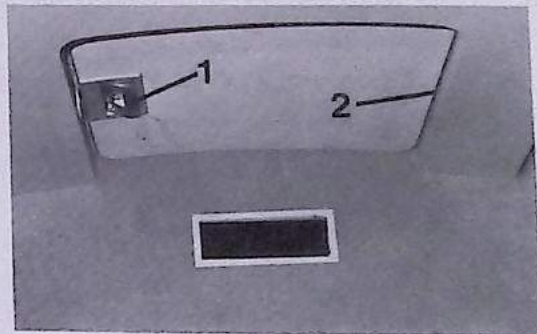


Fig. 501

- (a) Remove and discard the tell-tale wire.
- (b) Pull the handle (1) downwards and open the exit hatch.
- (c) Remove the four countersunk screws attaching each hinge (2) to the structure.
- (d) Remove the hatch.
- (2) Install
  - (a) Examine the exit hatch and surrounding structure for freedom from damage.
  - (b) Position the hatch in the roof aperture.
  - (c) Fit the four countersunk screws to secure each hinge (2) to the structure. Tighten the screws.
  - (d) Close the door and lock it.
  - (e) Do a functional test of the emergency exit indication system. (Sect. 6) (Ref. Chap. 22-00)
  - (f) Wire off the handle (1) with tell-tale wire.



**6. Adjustment/Test****A. Adjustment****(1) Microswitch Adjustment.**

- (a) Open the appropriate exit hatch.
- (b) Slacken the screws retaining the switch body to the structure.
- (c) Close the exit hatch and slide the microswitch on the slots until the adjustment is correct to let the ROOF OPEN indicator caption go off when the exit hatch is closed, after pressing ALARM RESET switch.
- (d) Tighten the screws and open and close the exit hatch. If necessary re-adjust the microswitch.

**B. Test****(1) Emergency Exit Indication-Functional Test.**

- (a) Ensure 24V dc is available and that PCU is operational.
- (b) Ensure all emergency exits and passenger door's are closed.
- (c) On primary console observe the following red indicator captions are not illuminated:
  - ROOF OPEN
  - DOOR BYP
- (d) Open then close in turn each emergency exit and observe on the primary control panel that the following red indicator illuminates with the opening of each exit:
  - ROOF OPEN



**7. Cleaning/Painting****A. Cleaning**

Not applicable (N/A).

**B. Painting**

For a comprehensive list of painting materials and their uses, refer to Chapter 11-00.



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**CHAPTER 21-00  
COVERS-  
EXTERIOR AND INTERIOR**

Jan. 88



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CHAPTER 21  
COVERS  
INTERIOR AND EXTERIOR1. Description and OperationA. Description (Fig. 1)

## (1) General

The interior furnishings are panels, covers and trims which conceal the services and provide easy access for maintenance and troubleshooting. The trim panels also create a furnished appearance to the interior of the cars and cabins. The interior furnishings consist of the following:

- (a) Hatracks
- (b) Side Wall Trim
- (c) Door Frame Trim
- (d) Door Lock Cover
- (e) Ceiling Trim - Cabins
- (f) Window Trim
- (g) Front Fairing
- (h) Corner Fairing

## (2) Hatracks

Each car has six overhead hatracks installed on either side of the car. The hatracks are made from thermo-formed polycarbonate and vary slightly in shape according to the position in which they are fitted. The four center hatracks installed on each side of a car can be removed or swung open to provide access to various systems. The two corner hatracks on each side of a car have to be removed because the contour of the end walls prevent them from being fully opened. The front and rear cabins each have two hatracks, one over the door and one over the window.

The RH hatrack in the front cabin has:

- an access panel for the radio
- apertures for the microphone and loudspeaker for radio communication system
- an aperture for a light.



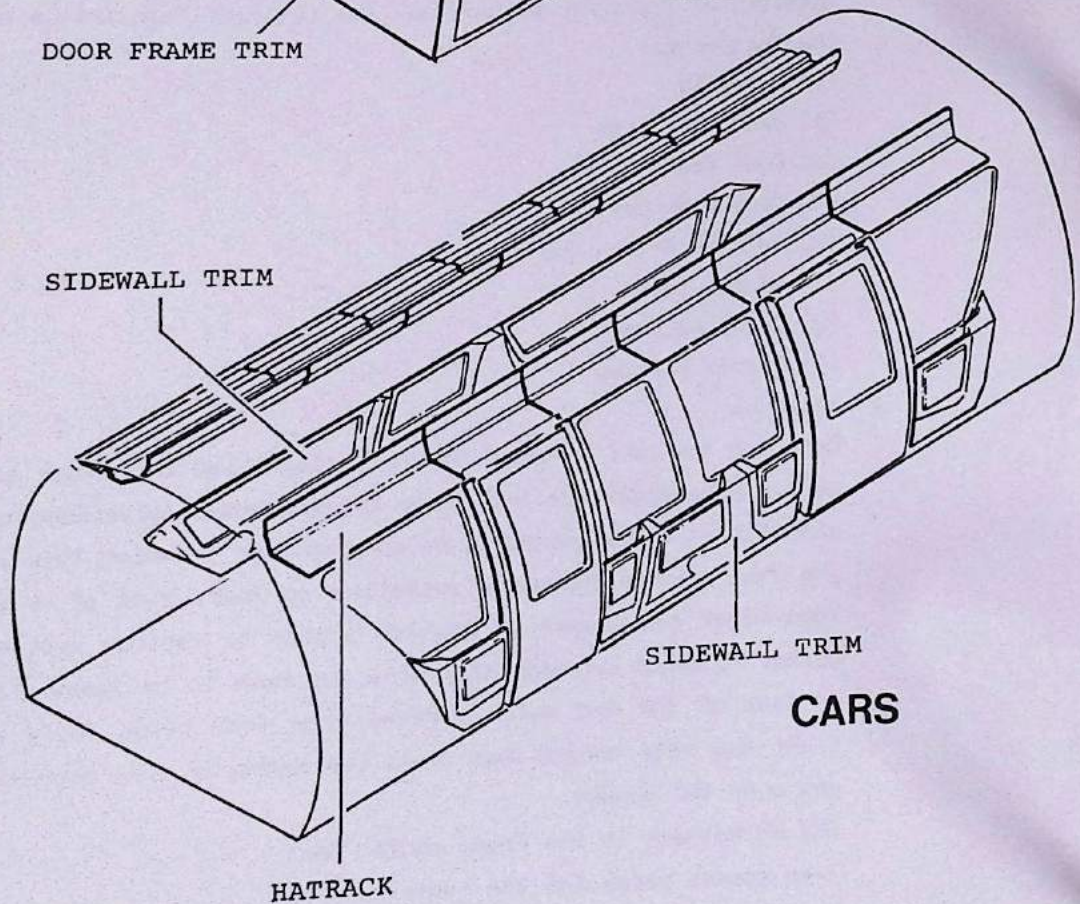
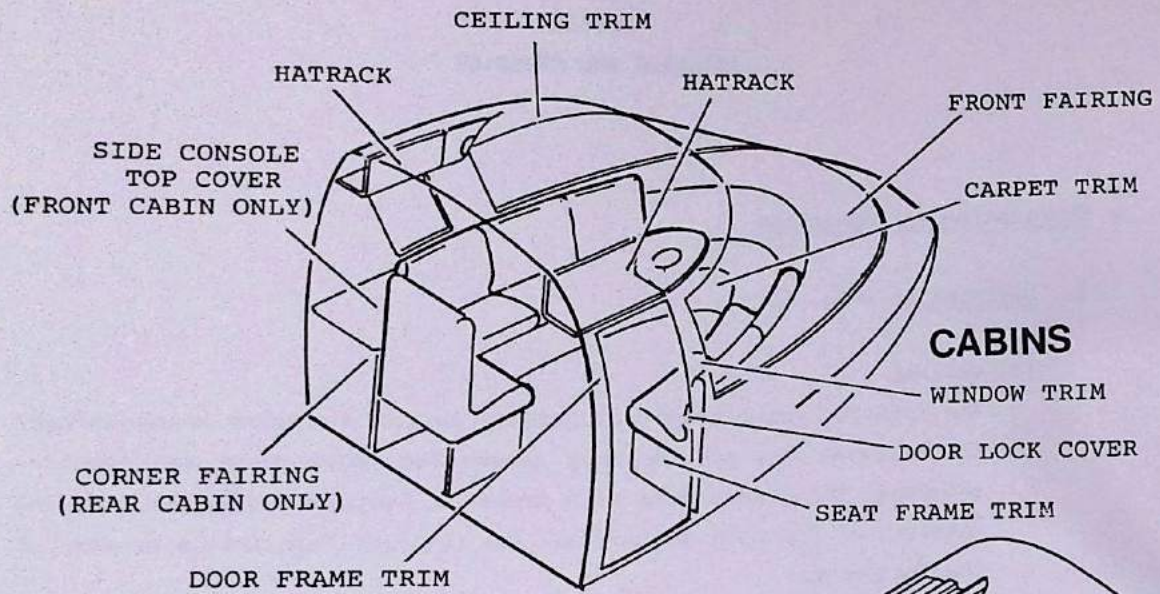


Fig. 1 Interior Trim - General Arrangement



(3) Side Wall Trim-Cars

Side wall trim panels made from thermo-formed polycarbonate are fitted on both sides of each car from below the window to the seat pan level. Some are located in channel strips attached at the lower end to the air ducting. All the trim panels are secured with VELCRO tape and screwed at the upper end to the window frame. Access to the window mechanism is gained by removing the side wall trim panels.

(4) Side Wall Trim (Cabins)

The side wall trim panels in the front and rear cabins are identical. The panels are symmetrical and cover the area from the side ceiling trim to the top of the bench seats. The panels are installed from the rear of the windscreen to the door frame on the LH side (RH side rear cab) and from the rear of the windscreen to the side window on the RH side (LH side rear cab). The upper edge of the panel is attached to the side ceiling trim fixing strips and retained by a length of rubber beading. The lower edge is secured by four screws on the station side and three screws on the non-station side. An aperture in the LH side panel (RH rear cab) is provided to accommodate a grab handle.

(5) Door Frame Trim

The door frame trim in the cars is a "U" shape section trim cover of thermo-formed polycarbonate in three sections. The door frame trim in the cabins is a "U" section trim cover of GRP in three sections. They are held in place around the doorpost by VELCRO tape and screws. An upper section is fitted above the door lock mechanism and a lower section is fitted below the lock. On the opposite side of the door lock, a long third section is fitted between the ceiling trim and floor level.

(6) Door Lock Cover

The door lock covers which cover the door locking mechanisms are the same material as the door frame trim covers. They are attached by screws and "VELCRO" tape.

(7) Ceiling Trim-Cabins

The ceiling trim panels in the front and rear cabin are identical. They consist of four moulded sections, two overhead (front and rear) one at the front LH side and one at the front RH side. The sides of the ceiling trim are clipped into fixing strips and retained place by lengths of rubber beading. In the center of the ceiling, the overhead ceiling panels are attached to a gap cover with VELCRO tape. The rear



ceiling trim shares the hatrack fixing strips and the front ceiling trim shares the side ceiling trim fixing strips. The side ceiling trim is attached overhead to the front ceiling trim fixing strip and at its lower edge to the side trim fixing strip. The trims are kept in place by lengths of rubber beading. In the rear cabin, the rear overhead ceiling trim has a large cut-out to accommodate an emergency exit hatch.

(8) Window Trim

The window trims are the same material as the doorframe trims. The window trims surround the window frames. In cars 1-5 the window trims are located by pegs which fit below the window frame. The upper end of the trims are clipped into the hatrack fixing strips. A length of rubber beading inserted between the hatrack and window frame trim retains the trim in position. The window trim in the front cabin is clipped into the hatrack fixing strips at the upper end and held in place by a length of rubber beading and VELCRO tape. The trim is secured below the window frame by three screws. A round cut-out on the trim accommodates the adjuster for the rear view mirror. The window trim in the cabins is clipped into the hatrack fixing strip at the upper end and secured by three screws along its lower edge. To gain access to these screws in the front cabin, the drivers side console cover must be removed.

A small trim panel is fitted below the rear of the windscreen in the front and rear cabin and is attached to the seat framework by bolts. It is kept in place around the windscreen by VELCRO tape.

(9) Front Fairing

The front fairing is a large moulding in two sections fitted below the windscreen in the nose of the front and rear cabin. The fairing conceals the circulation fan unit for the air conditioning. Both sections are bolted to the seat framework. The upper section rests on strips of foam rubber bonded to the support framework. The fairing is retained around the lower edge of the windscreen by VELCRO tape bonded to blocks fitted at regular spacing just below the windscreen. The upper section has a lip along the lower edge which mates with a strip attached to the upper edge of the lower section. A length of rubber beading is inserted between the two sections of the fairing and compresses the two sections together. A length of angled aluminum is bolted to the upper edge of the lower section and to two of the vertical supports on the seat framework.



(10) Corner Fairing-Rear Cabin

The corner fairing assembly consists of two moulded sections (upper and lower) bolted together. The corner fairing is fitted in the corner below the window to the left of the forward facing seat and is bolted to the seat framework.

(11) Carpet Trim

A carpet trim is installed below the bench seats in the front and rear cabins.

(12) Seat Framework Trim - Cabins

Located at the passenger doors below the bench seats, are seat framework trims. Each trim is of metal grille type construction with a cut-out for the installation of a door entrance light. The trims are retained to the seat frames with quick release fasteners. (See Sect. 5V)

(13) Side Console Top Cover

An aluminum top cover is fitted to the top of the driver's side console. It has a slot to accommodate the power lever and an orifice to accommodate a fresh air louver. It is retained in position with screws.



5. Removal/Installation

A. Hatracks Over Windows-Cars

(1) Removal

Fig. 501

(a) Remove length of rubber beading securing lower edge of hatrack and upper edge of window trim to fixing strip.

(b) With one hand, press the curvature (3) to spring the hatrack from the fixing strip while, at the same time, pull down on the edge (4).

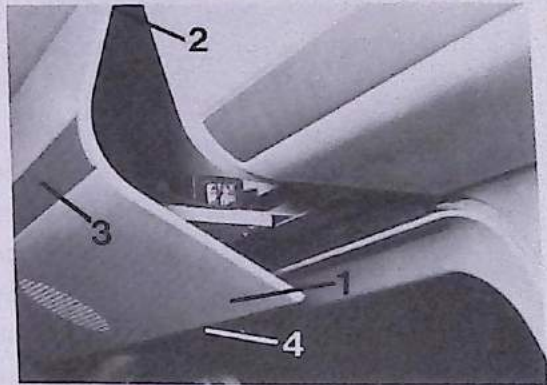


Fig. 501

(c) Squeeze the two spring loaded, knurled hinge bolts (2) together on both ends of the hatrack and remove the hatrack (1).

(2) Install

(a) Examine the hatrack and structure for freedom from damage.

(b) Position hatrack and squeeze the spring loaded hinge bolts until hatrack can be secured to structure.

(c) Close the hatrack (1) by pushing it outwards.

(d) Insert rubber beading.



**B. Hatracks Over Doors-Cars**

## (1) Removal

Fig. 502

- (a) Remove rubber beading securing lower edge of hatrack and upper edge of door trim to fixing strip.
- (b) Grasp the hatrack lower edge (1) with both hands and push then pull gently outwards away from the fixing strip.
- (c) Swing hatrack upwards, squeeze the two spring loaded, knurled hinge bolts together on both sides of the hatrack and remove the hatrack.



Fig. 502

## (2) Install

- (a) Examine the hatrack and structure for freedom from damage.
- (b) Position hatrack and squeeze the spring loaded hinge bolts until hatrack can be secured to structure.
- (c) Insert rubber beading between hatrack and window trim.

**C. Corner Hatracks-Cars**

## (1) Removal

Fig. 503

- (a) Remove both rubber beading (1) securing lower edge of hatrack and upper edge of window trim to fixing strip.
- (b) Swing hatrack upwards and slide away from the end wall.

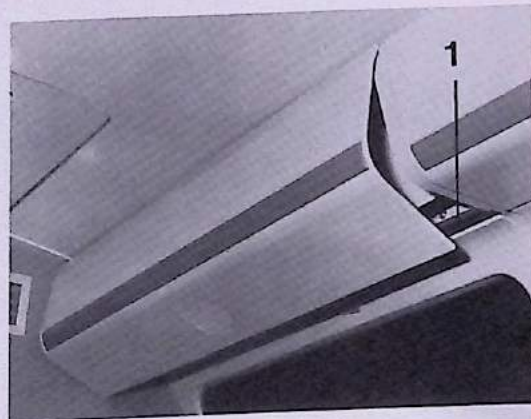


Fig. 503

## (2) Install

- (a) Examine hatrack and structure for serviceability and cleanliness.
- (b) Examine area for cleanliness.
- (c) Position hatrack into retaining strips.



- (d) Slide hatrack towards end wall and close hatrack.
- (e) Insert rubber beading.

**D. Hatrack Over Door-Cabins**

(1) Removal

Fig. 504

- (a) Remove length of rubber beading securing upper edge of hatrack (1) and ceiling panel to fixing strip.
- (b) Remove length of rubber beading securing lower edge of hatrack (2) and upper edge of doorframe trim to fixing strip.

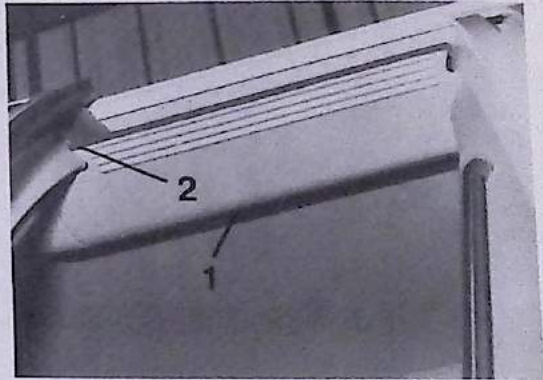


Fig. 504

- (c) Grasp the hatrack lower edge with both hands. Push then pull gently away from the fixing strip.
- (d) Remove hatrack.

(2) Install

- (a) Examine hatrack and structure for cleanliness and serviceability.
- (b) Position hatrack in fixing strip.
- (c) Close hatrack and insert rubber beading.

**E. Hatrack Over Window-Cabins**

(1) Removal

Fig. 505

- (a) Remove the microphone.  
(Front cabin only) (Chap. 39-00)
- (b) Remove length of rubber beading from between lower edge of hatrack and window trim.
- (c) Support the hatrack with one hand and remove length of rubber beading from between hatrack and ceiling trim.
- (d) Remove hatrack from the fixing strip.

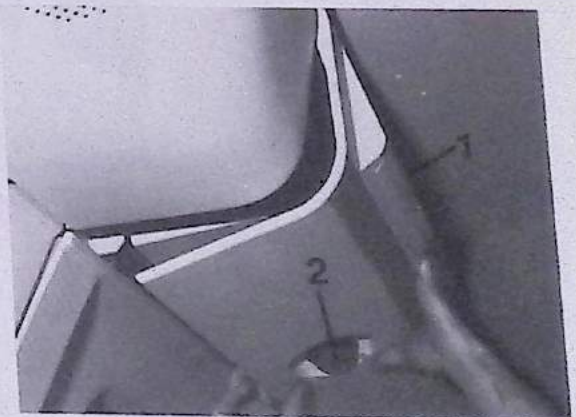


Fig. 505



- (e) Disconnect the driver's light (2). (Front cabin only)
- (2) Install
  - (a) Examine the hatrack and structure for cleanliness and serviceability.
  - (b) Connect the driver's light (2).
  - (c) Position hatrack on fixing strip.
  - (d) Close hatrack and insert rubber beading.
  - (e) Install the microphone. (Chap. 39-00)
  - (f) Examine the work area for cleanliness.
  - (g) Close the access door (1).
  - (h) Do a functional test of driver's light.

**F. Side Wall Trim-Cars**

- (1) Remove
  - Fig. 506
    - (a) Remove appropriate window trim (Sect. 5P).
    - (b) Remove appropriate bench seat (Chap. 25-00).
    - (c) Remove all screws along top edge of side panel (1) and lift the panel out from behind the seats.



Fig. 506

- (2) Install
  - (a) Examine work area for freedom from damage.
  - (b) Examine all components for serviceability.
  - (c) Fit side wall trim to side wall structure and retain with screws.
  - (d) Install bench seat (Chap. 25-00).
  - (e) Install window trim (Sect. 5P).



G. Side Wall Trim-Cabin

(1) Removal

Fig. 507

- (a) Remove hatrack above door (Sect. 5D).
- (b) Remove bench seat below side wall trim (Chap. 25-00).
- (c) Remove grub screw from bottom of grab handle (1).
- (d) Remove bolt securing grab handle upper end to bracket on door frame.
- (e) Remove grab handle.

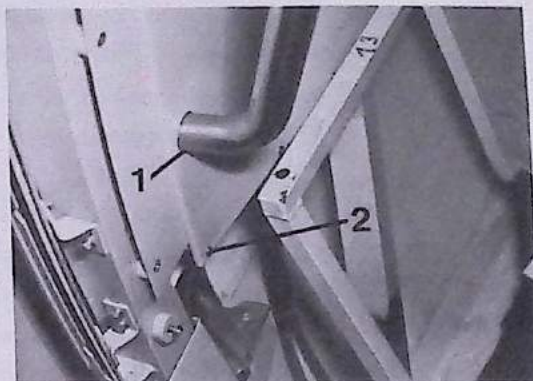


Fig. 507

- (f) Remove length of rubber beading securing side wall trim and side ceiling trim to fixing strip.
- (g) Remove the screws (2) along lower edge of side wall trim and the screw securing side wall trim to cabin frame.
- (h) Remove side wall trim.

(2) Install

- (a) Examine area and components for freedom from damage.
- (b) Position side wall trim and fit four screws (2) and the screw securing side wall trim to cabin frame.
- (c) Insert rubber beading.
- (d) Position grab handle to structure and secure with bolt and grub screw.
- (e) Install bench seats (Chap. 25-00).
- (f) Install hatrack (Sect. 5D).



**H. Side Wall Trim-Front Cabin****(1) Removal**

Fig. 508

- (a) Remove bench seat (1) next to console. (Chap. 25-00).
- (b) Remove windscreen trim (see 59) and the screws from lower edge of side trim (2), located behind the console.
- (c) Remove length of rubber beading (3) securing side wall trim (4) to side ceiling trim fixing strip.

- (d) Remove side wall trim (4).

**(2) Install**

- (a) Examine work area for freedom from damage.
- (b) Examine components for serviceability.
- (c) Position side wall trim (4) to structure and secure with screws.
- (d) Insert rubber beading
- (e) Install bench seat (1) (Chap. 25-00).

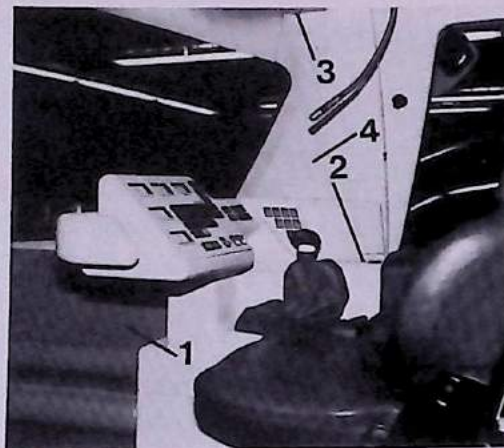


Fig. 508

**J. Side Wall Trim-Rear Cabin****(1) Removal**

Fig. 509

- (a) Remove seat (1) below side wall trim (Chap. 25-00).
- (b) Remove four screws from lower edge of side wall trim.
- (c) Remove length of rubber beading (2) securing side wall trim panel to side ceiling trim fixing strip.
- (d) Remove side wall trim.

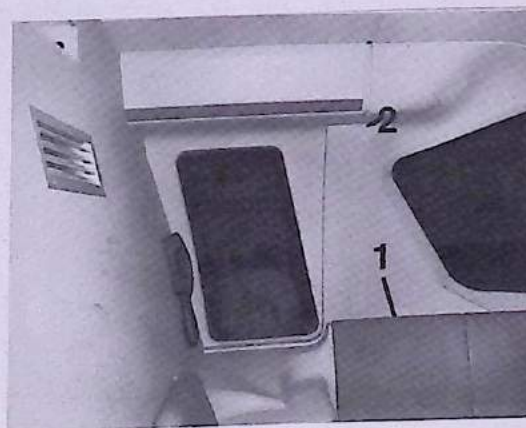


Fig. 509



## (2) Install

- (a) Examine trim panel for serviceability.
- (b) Position trim to structure and secure with four screws.
- (c) Insert rubber beading.
- (d) Install bench seat (Chap. 25-00).

**K. Door Frame Trim-Cars**

## (1) Removal

Fig. 510

- (a) Remove screws (1) from appropriate door frame trim (2) and remove length of rubber beading securing door frame trim (2) to hatrack over door fixing strip.
- (b) Pull trim upwards and outwards away from VELCRO tape.

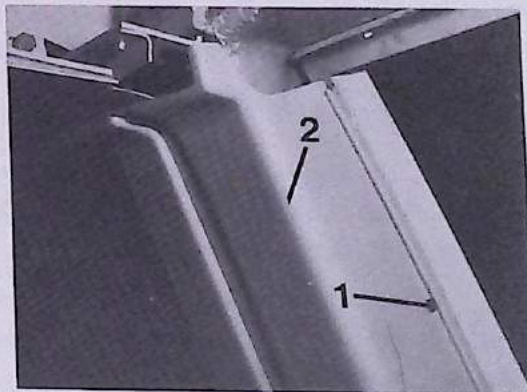


Fig. 510

## (2) Install

- (a) Examine trim for serviceability.
- (b) Fit trim and align the screw holes with the holes in door frame.
- (c) Secure the trim with screws and insert rubber beading.
- (d) Depress all edges to secure VELCRO fastening.



**L. Side Ceiling Trim (Typical)****(1) Removal**

Fig. 511

(a) Remove rubber beading (1) from between front ceiling panel and side ceiling trim (2).

(b) Remove rubber beading (3) from between side ceiling trim and side wall trim (4). If necessary remove grab handle by slackening grub screw from the bottom and removing bolt from top of grab handle.

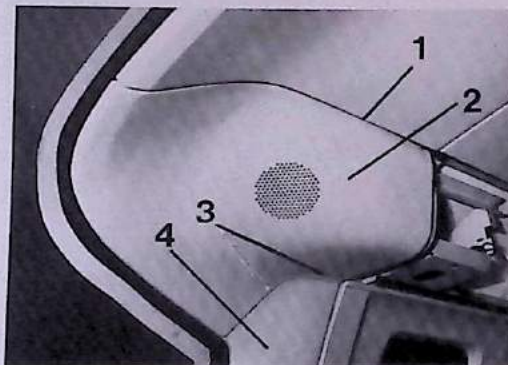


Fig. 511

(c) Push the side ceiling panel forward to unhook the front edge and then pull downward to remove.

**(2) Install**

(a) Examine ceiling panel for serviceability.

(b) Locate front edge onto fixing strip, pull rearwards to hook on.

(c) Swing up and press into position.

(d) Install rubber beading (1, 3).

(e) Install grab handle if removed.

**M. Door Lock Cover (Typical)****(1) Removal - Cabin**

Fig. 512 (cabin cover shown)

(a) Remove door trims above and below door lock cover (see Sect. 5X).

(b) Remove screws (1) and door trim (2) below door lock.

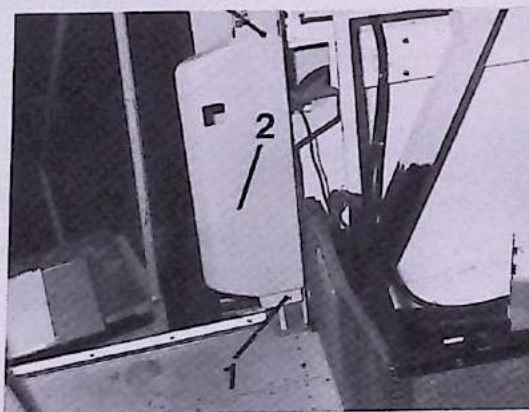


Fig. 512

(c) Remove screws from edges of door lock cover.

(d) Pull downwards to clear the lip on the door frame trim above lock.

(e) Pull cover from VELCRO tape and remove.



- (1) Removal - Cars
  - (a) Remove screw from bottom bracket.
  - (b) Remove the two screws from top bracket.
  - (c) Pull door lock cover from VELCRO tape and remove.
- (2) Install
  - (a) Examine the cover for serviceability.
  - (b) Position cover over lock mechanism and secure with screw.
  - (c) Press cover onto VELCRO tape.
  - (d) Fit door trim below and above the door lock and secure with rubber beading and screws.

#### N. Ceiling Trim-Typical (Cabins)

---

##### Note

The following is a two man operation.

---

#### (1) Removal

Fig. 513

- (a) Support panel (1) and remove rubber beadings (2) from between ceiling panel and hatracks.
- (b) Support the panel and pull the panel from its fixing strips.

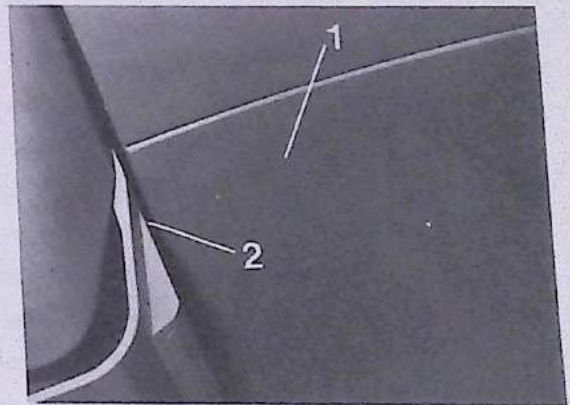


Fig. 513

#### (2) Install

- (a) Examine ceiling panel for serviceability.
- (b) Position panel onto fixing strips.
- (c) Insert rubber beadings between panel and hatracks.



**P. Window Trim-Cars****(1) Removal**

Fig. 514

- (a) Remove length of rubber beading (1) securing window trim (2) and hatrack (3) to fixing strip.
- (b) Pull window trim from fixing strip.
- (c) Reach behind window trim and carefully release VELCRO tape.
- (d) Lift window trim out of locating holes and remove.

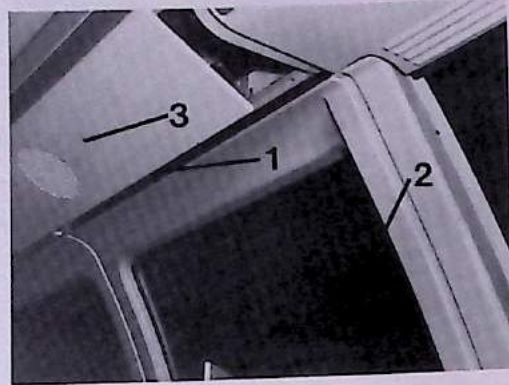


Fig. 514

**(2) Install**

- (a) Examine the window trim for serviceability.
- (b) Position trim onto fixing strips.
- (c) Position trim in locating holes and press VELCRO taped areas.
- (d) Close hatrack and insert rubber beading.

**Q. Window Trim-Rear Cabin****(1) Removal**

Fig. 515

- (a) Remove corner fairing (1) (Sect. 5U).
- (b) Remove length of rubber beading securing window trim and hatrack to fixing strip.
- (c) Remove three screws from lower edge of window trim (2).
- (d) Pull away from VELCRO tape and remove.

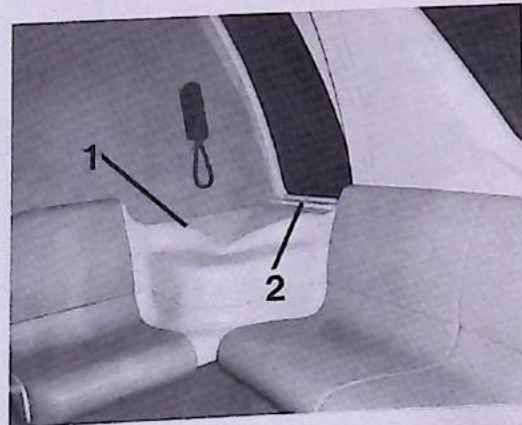


Fig. 515

**(2) Install**

- (a) Examine all components for serviceability.
- (b) Ensure area to be covered are clean and free from foreign articles.



- (c) Position trim to structure and secure at base with three screws.
- (d) Insert rubber beading.
- (e) Install corner fairing (Sect. 5U).

**R. Window Trim-Front Cabin**

(1) Removal

Fig. 516

- (a) Remove the five screws from the top corner of drivers side console (1).
- (b) Remove top cover of drivers side console.
- (c) Disconnect drivers fresh air flexible ducting (see Chap. 29, Sect. 5 H).
- (d) Remove the three screws (2) along lower edge of window trim.
- (e) Remove length of rubber beading located between hatrack (3) and window trim.

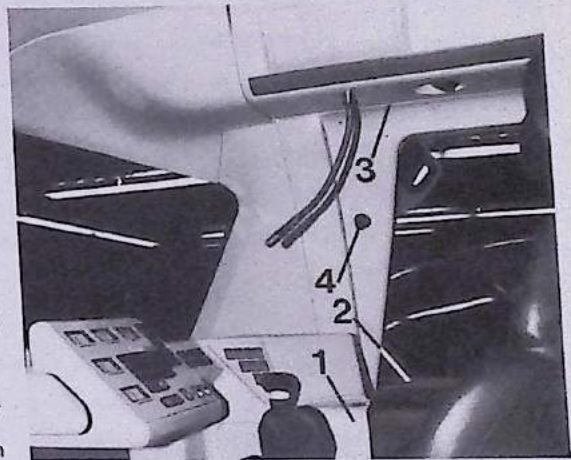


Fig. 516

- (f) Remove the rear view mirror knob and bellows (4).
- (g) Pull window trim from the VELCRO tape and remove.

(2) Install

- (a) Examine components for serviceability.
- (b) Ensure work area to be covered is clean.
- (c) Position window trim to structure and refit the rear view mirror bellows and knob (4).
- (d) Secure trim along lower edge with three screws.
- (e) Fit top cover to side console and secure with screws.
- (f) Connect drivers fresh air flexible ducting.
- (g) Remove all tools and equipment from work area and ensure area is free from debris.



**S. Windscreen Trim****(1) Removal**

Fig. 517

- (a) Remove seats below windscreen trim (see Chap. 25-00) and gap cover behind seat back cushion.
- (b) Remove bolts attaching windscreen trim (2) to seat framework
- (c) Pull upwards from VELCRO tape and from underneath edge of front fairing.

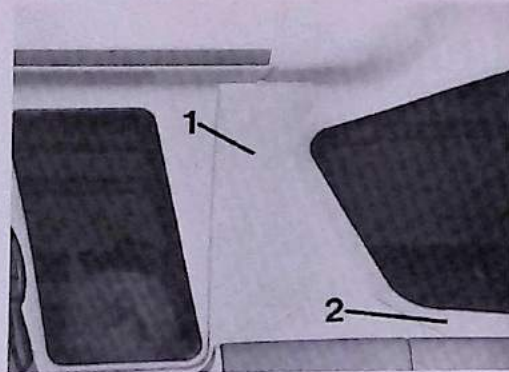


Fig. 517

**(2) Install**

- (a) Examine trim for serviceability.
- (b) Position window trim to structure, if necessary lift the front fairing.
- (c) Secure trim to seat framework.
- (d) Install seats (see Chap. 25-00) and gap cover.

**T. Front Fairing****(1) Removal**

Fig. 518

---

**CAUTION:**

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Take care not to scratch the windscreen during these procedures.

---

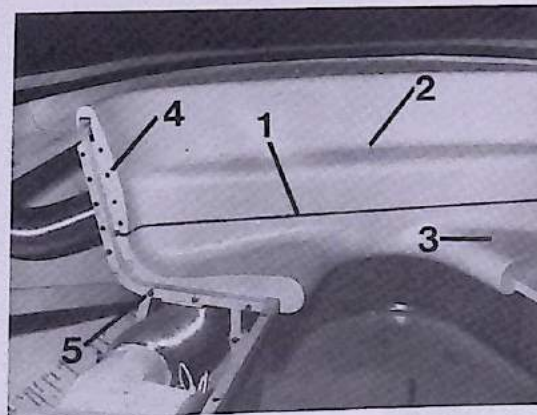


Fig. 518

- (a) Remove the two side bench seats (Chap. 25-00).
- (b) Remove rubber beading (1) between the upper fairing (2) and lower fairing (3) section.
- (c) Remove the four countersunk screws (4) from each side of the upper fairing (2) attaching it to the seat framework.



- (d) Remove upper fairing from VELCRO tape by pushing downward and outwards then lifting at the lower edge.
  - (e) Remove the two bolts, nuts, washers, and lock washers securing the length of angled aluminum to the two vertical supports.
  - (f) Loosen bolts (5) nuts and washers retaining the lower fairing (3) to the seat frame.
  - (g) Remove front fairing lower section (3).
- (2) Install
- (a) Examine the fairing for serviceability.
  - (b) Inspect the area under the fairings for cleanliness.
  - (c) Position the lower fairing (3) to the angle section and secure with nuts bolts and washers.
  - (d) Position upper fairing (2) to seat bench and secure with counter-sunk screws.
  - (e) Insert rubber beading between upper and lower fairing.
  - (f) Install bench seats (Chap. 25-00).

#### U. Corner Fairing-Rear Cabin

##### (1) Removal

Fig. 519

- (a) Remove rearward facing seat (Sect. 25-00) and loosen the screws attaching corner fairing to seat box.
- (b) Remove two bolts (1) under seat (2) and swing seat upwards.
- (c) Loosen the screws (3) attaching corner fairing to seat framework.



Fig. 519

- (d) Lift corner fairing away from VELCRO tape and remove.
- (2) Install
- (a) Examine components for serviceability.
  - (b) Position corner fairing to seat structure and secure with screws (3).



- (c) Secure the fairing to the forward facing seatbox with screws.
- (d) Lower the bench seat and secure with two bolts (1).
- (e) Install rearward facing seat (Chap. 25-00).

#### V. Seat Framework Trim-Front Cabin

##### (1) Removal

Fig. 520

- (a) Remove and disconnect the door entrance light (1).
- (b) Release the four quick release fasteners (2).
- (c) Remove trim (3).

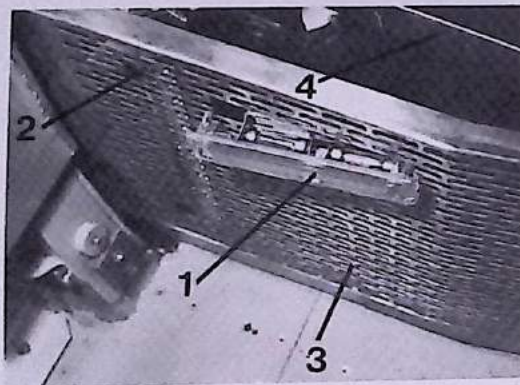


Fig. 520

##### (2) Install

- (a) Examine work area for cleanliness.
- (b) Examine components for serviceability.
- (c) Position the trim (3) to the seat structure (4) and secure with quick release fasteners (2).
- (d) Install door entrance light (1).
- (e) Operate the door to open/close to test the door entrance light.



**W. Front Ceiling Trim - Cabins (Typical)**

(1) Removal

Fig. 521

(a) Remove lengths of rubber beading (1) from between front ceiling panel (2) and side ceiling trim (3).

(b) Remove the trim:

1 Gently pull the rear end downwards to separate the VELCRO tape.

2 Lightly push the trim forward to unhook from the fixing strip.

3 Remove the trim downward.

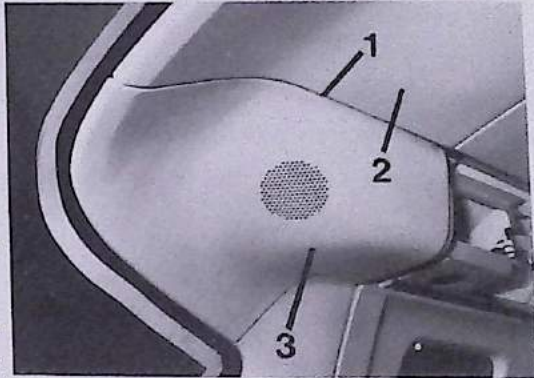


Fig. 521

(2) Install

(a) Examine ceiling panel for serviceability.

(b) Position front end of panel on fixing strip.

(c) Swing up rear end and press onto VELCRO tape.

**X. Endwall Door Frame Trims - Cabins (Typical)**

(1) Removal

(a) Remove screws from appropriate door frame trim.

(b) Carefully lift the carpet on the endwall.

(c) Remove the screws attaching the door frame trim to the endwall.

(d) Remove the door frame trim.

(2) Install in the reverse sequence.

**Y. Door Frame Trims - Lockside (Typical)**

(1) Removal

(a) Remove screws from appropriate door frame trim.

(b) Remove length of beading from upper end of door frame.

(c) Remove the trims.

(2) Install in the reverse sequence.



**7. Cleaning/Painting****A. Cleaning**

The interior furnishings should be cleaned using a soft cloth dampened with a weak solution of a non-detergent cleaning agent in warm water. Persistent marks may be removed using a soft brush and a stronger cleaning agent but this should be immediately followed with sufficient water to neutralize the agent. The furnishings should be wiped dry with a lint free cloth.

**B. Painting**

Refer Chap. 11-00.



**MBB**

Transportation  
Technology Division

# CHAPTER 22-00 DOORS

Jan. 88



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## CHAPTER 22

## DOORS

1. Description and OperationA. Description (Fig. 1)

## (1) General

The five car monorail has twelve pneumatically-operated doors, each of which is a sliding plug door suspended by rollers on guide rails. The doors are identical in construction but differ in shape to suit a particular entrance, and are handed for LH and RH opening. There are, in principle, five types of doors identified A, B, C, D and E for reference purposes only.

In the closed position the door is flush with the outer skin of the car body, the surrounding aperture sealed by rubber strips on the door. The door, on opening, swivels around the door post on which a door lock is attached, to the outside and runs parallel to the car body wall.

The drivers door is opened or closed by either a pushbutton installed below the driver's console in the front cabin, or a pushbutton in the drivers door panel outside the car. The pushbutton outside the driver's door, can open/close all doors except the rear cabin door. The remaining doors are individually selected open or closed using pushbuttons outside the cars. The pushbutton electrical signal indirectly operates a two-way cylinder jack the piston of which is directly connected to a door. When the monorail is set to move, the electrical supply to operate the doors is removed. When a door is open, the monorail can not be set to move unless the driver overrides a door open inhibit signal. Should the normal door system cease to function, a door can be unlocked by a mechanical door handle on the outside of the door; the drivers mechanical door handle can also be operated from the inside. A passenger can not electrically open or close a



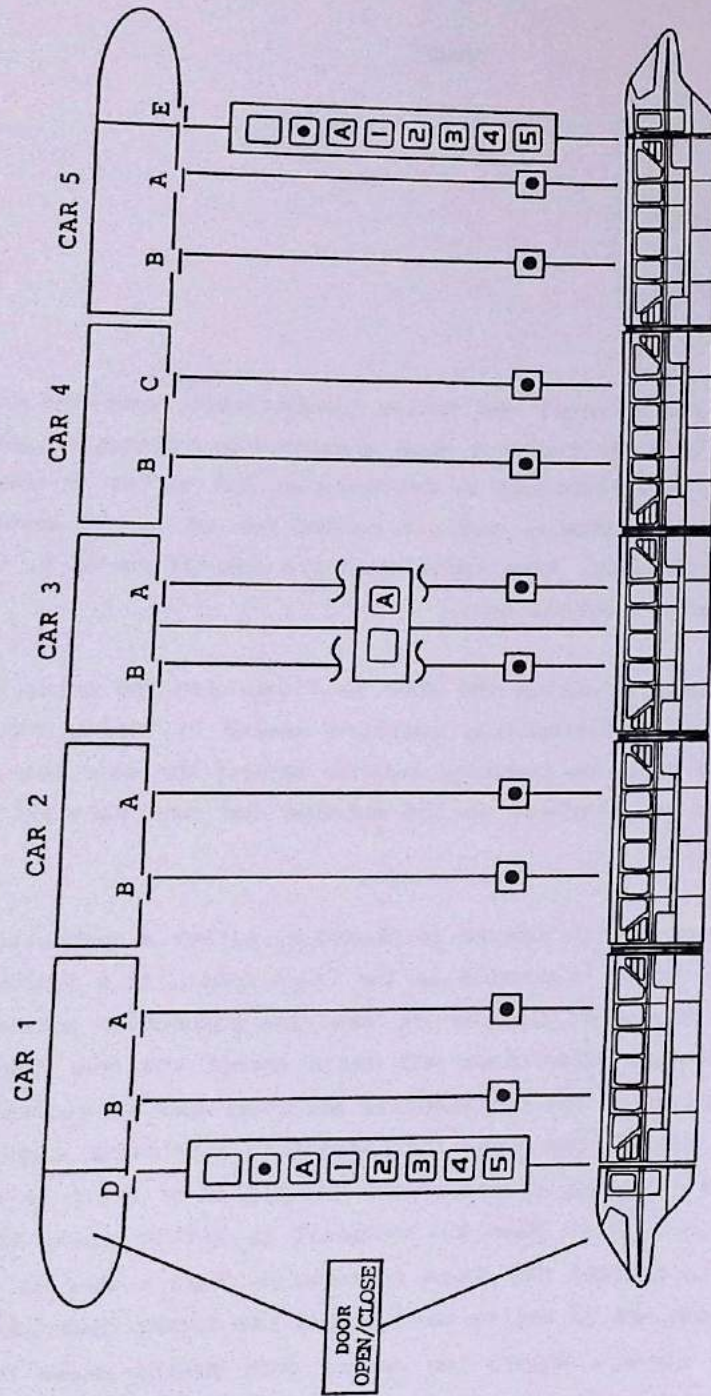


Fig. 1 Door Type and Control



door from inside a car, and can not physically open a door unless mechanically unlocked from the outside.

(2) Door System

(a) Electrical system (refer to electrical drawing set, Chapter 76-00, Chapter 22-00)

1 The door normal operating electrical system is routed over a programmable control unit (PCU) (Chapter 76-00). The PCU receives and monitors various incoming electrical signals. When all signals are correct, the PCU transfers a door pushbutton command as a short-pulse electrical signal to a pneumatic valve unit and to either the "open" or "close" fast exhaust valves (see (3) below). The signals which are processed by the PCU or which have a function in the door system are:

- door closed; from a magnetic switch operated when the door fills the door entrance
- door locked; from a magnetic switch in the door lock which is operated by the door lock overcentering-to-lock plate.
- exit hatch locked; from a roof microswitch which breaks the continuity of the door locked signal if an emergency exit hatch is open (see Chap. 20-00)
- door open/door closed command; from a pushbutton
- main valve open/close
- RUN selected on the drivers RUN/STOP switch which removes the +24 V DC from the PCU door circuit power board when RUN is selected and vice versa
- obstructed door; from a switch activated by a pressure sensitive edge on the door (see (3) below)
- 10 mm switch; from a magnetic switch at 10 mm before end of closing travel (see (3) below) which cuts out the pressure sensitive edge switch
- electrical safety backup; from a switch which automatically reacts to an obstruction if the door sensitive edge circuit has not operated
- mechanical open; from a microswitch on the door lock which is mechanically operated by the door handle when the door is locked closed
- entrance door light on/off; switched by the door locked signal.

2 The PCU transfers a "door open" electric pulse to the pneumatic valve unit when the following are present:



- door pushbutton switch pressed
- ON selected on the DOOR AIR-ON/OFF switch
- STOP selected on the RUN-STOP switch.

3 The PCU transfers a "door close" electric pulse to the pneumatic valve unit when the following are present:

- ON selected on the DOOR AIR ON/OFF switch
- STOP selected on the RUN-STOP switch
- door pushbutton switch pressed

but will reverse a "door close" signal to a "door open" signal if, during closing:

- the door pushbutton switch is pressed
- the PCU receives a signal from the pressure sensitive edge switch
- a door locked signal is not received within ten seconds after a door pushbutton has been pressed

and will signal the pneumatic valve unit to release the air pressure used to drive the door if, during closing:

- an obstructed door signal has not been given but a force of 25 lbs has activated the electrical backup safety switch before the door has closed.

(b) Pneumatic System

The pneumatic system obtains air pressure from a main air accumulator pressurized from an engine-compressor (see Chap. 09-00). The main air accumulator is connected to each door pneumatic valve unit by plastic pipe. An electrical shut-off main valve in the system is controlled by a DOOR AIR ON/OFF switch (see (4) below). The valve is energized open so that an electrical power supply failure cuts off the compressed air supply and depressurizes the door system. A mechanical shut-off valve (see (3) below) in the system before each door pneumatic valve unit, cuts off the pressurized air supply to an individual car door.

A mechanically operated valve automatically reacts to an obstruction if the obstructed door signal (pressure sensitive edge) has failed.

A non-return valve in the line between the compressor and the accumulator maintains the accumulator at pressure in the event of the compressor not working. The accumulator has a capacity of 50 litres; 16 litres is sufficient to operate all doors open.



(3) Door Components (Fig. 2)

Apart from the electrical interconnections which connect the door components with the PCU, and the pressurized air system which connects the pneumatic system with the pressurized air supply source, each door has:

- a door panel (1)
- an inner guide rail (15) supporting a top roller assembly (16)
- an outer guide rail (4) supporting a side roller assembly (2)
- a door slider (20)
- peripheral rubber seals (21), the leading edge seal (17) being pressure sensitive
- an electrically-operated pneumatic valve unit (8)
- a pneumatically operated long-stroke two-way cylinder jack (12)
- three solenoid-operated fast exhaust valves (22, 23)
- a door locking mechanism (18) and door handle (5)
- a mechanical air shut-off valve (7)
- a linkage mechanism which operates an electrical safety backup switch (24) or a mechanical depressurization valve (25) if the electrical switch does not operate.

(a) Door panel

The door panel is of sandwich design with aluminum cover plates flanged around an aluminum frame and filled with PUR foam below a window. The window is acrylic material with a rubber lip surround, glued into the aluminum frame. Strong points on the door are for mounting a traction lever, a side roller assembly, the door mechanical handle and a spigot which engages the door lock.

(b) Inner guide rail and upper roller assembly

The inner guide rail (15) is a straight Nirosta pipe attached at both ends to brackets bolted to the car body. The upper roller (11), which is both a door support and guide roller, runs on the rail which is angled to allow for the outward movement of the door. Each end of the rail has bolts (9) to adjust the rail height and transverse direction of the door panel. The door roller (11) casters to allow for the directional changes when the door opens.

(c) Outer guide rail and side roller assembly

The outer guide rail (4) supports and guides the side roller (2). The guide rail is curved at the door post then runs parallel to the car outside body so that the initial opening movement of the



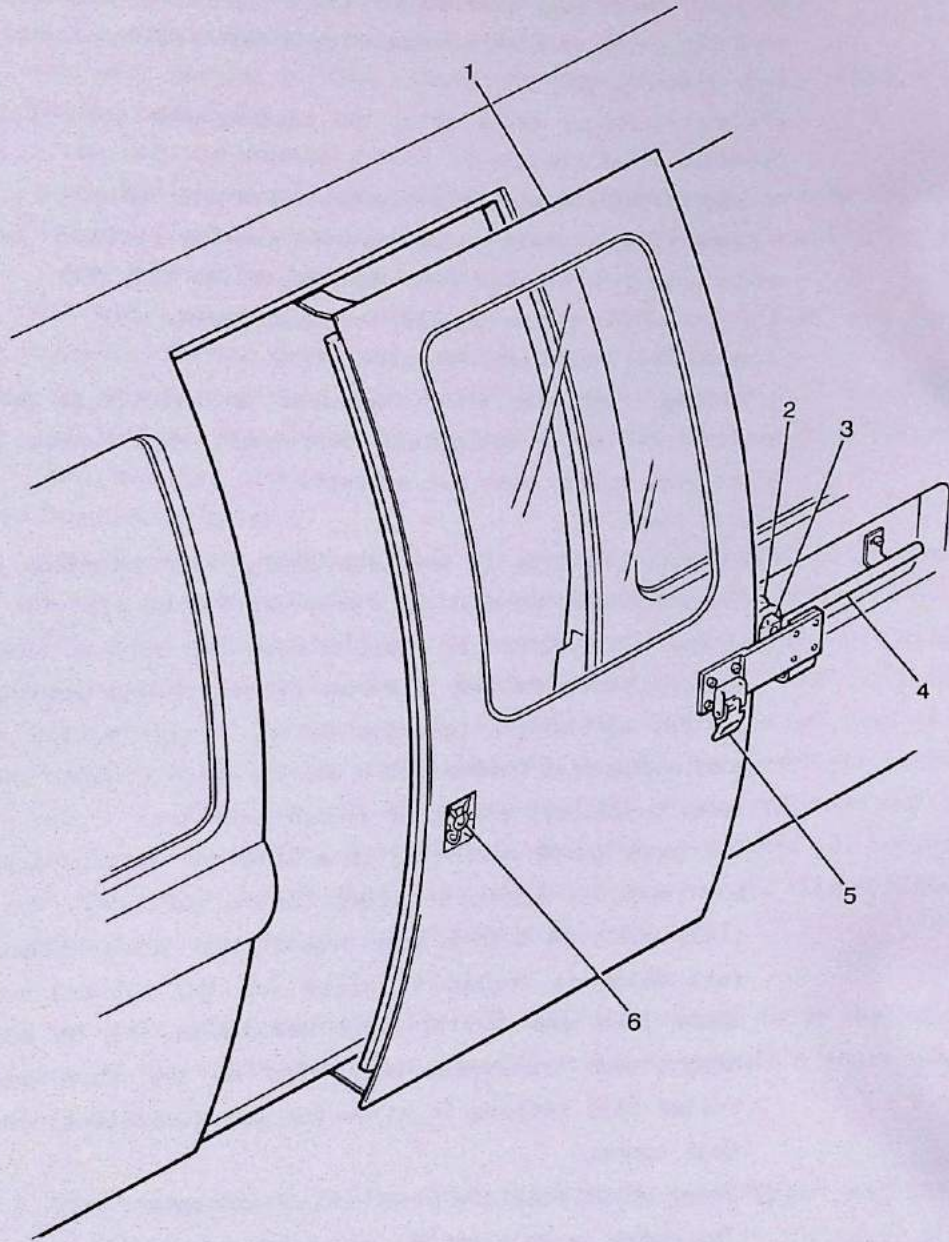
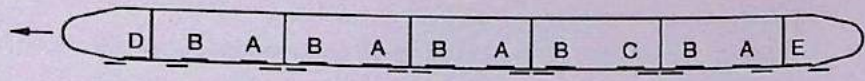


Fig. 2 Door Type A (Sheet 1 of 2)



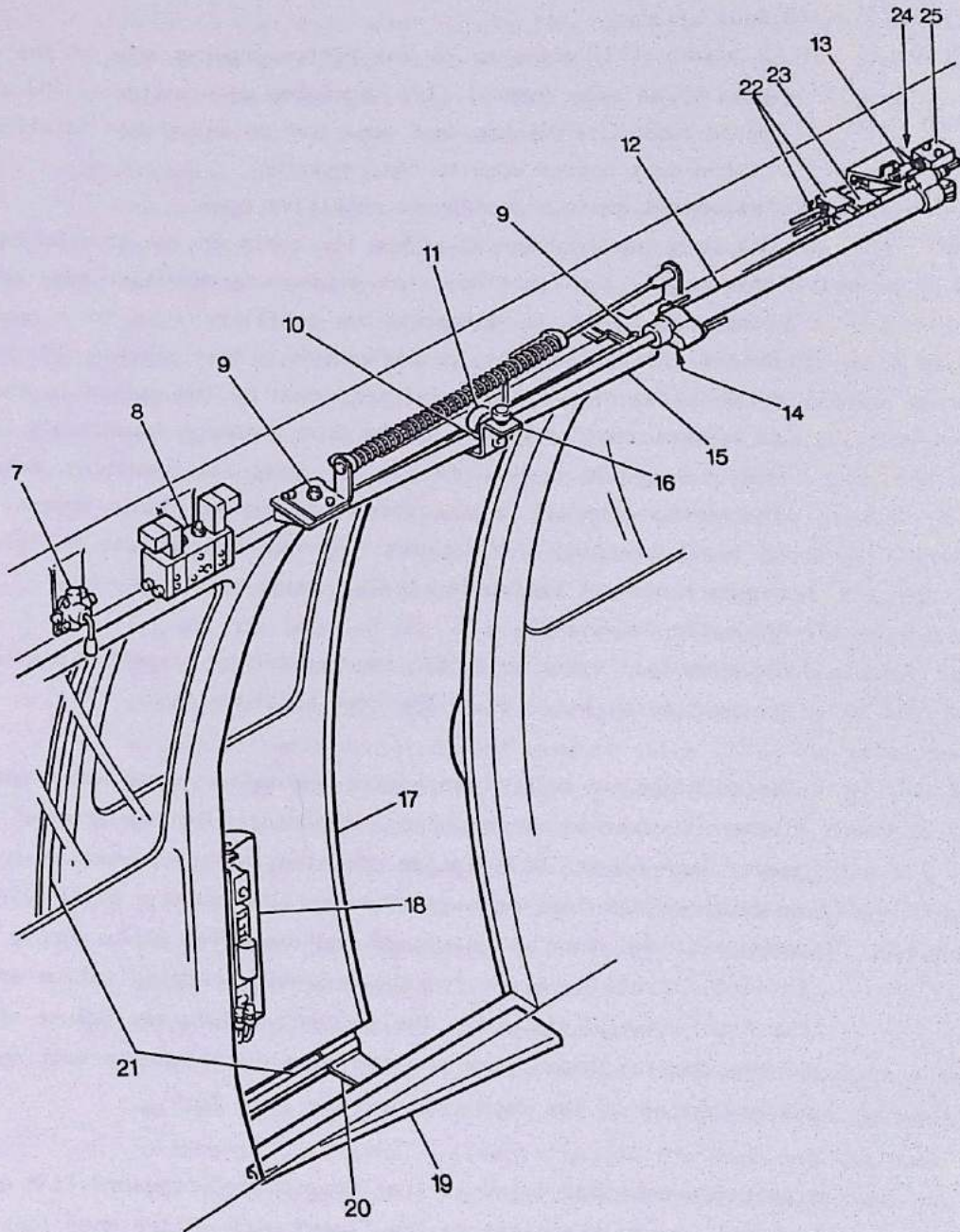


Fig. 2 Door Type A (Sheet 2 of 2)



door is outwards to clear the door post before moving sideways down the outside of the car. The side roller is mounted on a bracket attached to the outside of the door. The guide rail mountings are slotted to allow for door alignment.

(d) Door slider

A slider (20) attached to the bottom leading edge of the door, runs in an open channel (19) under the door entrance. The slider gives stability to the door edge and is adjustable to align the closed door bottom edge to the car body.

(e) Peripheral seals and pressure sensitive edge

The door has high-grade rubber lip seals on the top, bottom and rear edges. The front seal has a pressure sensitive edge approx. 25mm high which is connected by capillary tube to a membrane switch (6) in the door. Resistance to a door closing felt by the pressure sensitive edge is transferred by the switch to the PCU as a "door open" command and the door movement immediately reverses. A magnetic switch (14) on the upper rail mounting, cuts out the membrane switch signal when the door is within approx. 10mm of final closing; this allows the door to complete the closing sequence without activating the pressure sensitive edge.

(f) Pneumatic valve unit

The pneumatic valve unit (8) is connected by plastic pipes to the door air main-line, and to the door cylinder jack.

The unit has two solenoid-operated pneumatic valves which open or close in response to a pulsed electrical input signal of door open, door close. Being pulse-operated, a valve remains in the position of the last command. When a valve opens a supply line to pressure, the other valve closes and opens the other supply line to vent. Throttle valves for the solenoid-operated valves are on the front face of the unit. The valves regulate the volume of air to the door cylinder jack and the door lock thereby setting the response time of the door jack and the door lock.

A pressure switched valve in the "door close" pressure line opens to supply pressurized air to the "lock" side of the door lock cylinder when the piston of the door jack reaches the end of closing travel and approx. 3,5 bar back pressure is built up in the door "close" supply. This pressure overcomes the resistance of



the switch.

The "door open" pressure line is directly connected to the "unlock" side of the door lock cylinder. A pressure switched valve in the "door open" supply line opens to supply pressurized air to the door "open" side of the door jack when approx. 3,5 bar back pressure is built up in the door "open" supply line after the door lock cylinder has unlocked the door.

(g) Pneumatic cylinder jack

The pneumatic cylinder jack (12) has a long-stroke piston powered in and out by air pressure from the pneumatic valve unit. The body of the jack has a socket which sits on a ball attached to a lever, the lever being mounted on a bracket fastened to the cabin wall; the piston of the jack has a socket which sits on a ball mounted on the door traction lever (10). The traction lever directly transfers the piston drive to the door. The cylinder has exhaust valves for each direction of piston return. Each end of the cylinder has an adjustable throttle to damp the exhaust valves over the last 6 ins of door opening and closing, thereby avoiding shock deceleration when the door stops at the end of travel. The body of the jack has three drillings, two connecting the close side of the jack with two solenoid-operated fast exhaust valves (22) and one connecting the open side of the jack with a solenoid-operated fast exhaust valve (23). The valve opens momentarily to release the latent pressure built-up in the jack when the pushbutton is pressed to close the door. A throttle (13) on the open side of the jack is adjustable; it regulates the venting of door open pressure during the door close sequence thereby setting the closing speed (and time) of the door. Mechanical stops limit the movement of the door.

(h) Door locking mechanism and door handle

The door lock (18) is a double-action hook which engages a spigot on the door. The door spigot on entering the hook mechanically overcomes the "open" overcentering of the hook and the hook pulls the door spigot in. The lock piston then overcenters the hook against a spring and firmly closes the door against the resistance of the door seals and any accumulation of dirt. A magnetic metal segment, moved by the spigot, operates a magnetic "door locked" switch only when the door hook is locked and overcentered.



Normal operation of the lock is by pressurized air from the pneumatic valve unit operating a two-way locking cylinder. Operating a mechanical lever above the spring trips the spring, depressurizes the cylinder, and opens the lock. The door mechanical handle is operated from the outside by pushing a plate which lifts up a wedge shaped lever on the inside of the door. With the door seated and fully locked, the wedge shaped lever sits under the lock spring trip lever. Pushing the mechanical handle lifts up the trip lever which opens the lock under the influence of the spring. An electrical microswitch (S5N) on the lock, signals the pneumatic valve unit directly, which depressurizes the door by venting the door close side of the valve unit. As the open side is already at vent, the door can then be easily opened by hand.

(j) Pressurized air shut-off valve

Each pneumatic valve unit has an associated lever-operated shut-off valve (7) which is used during maintenance to cut off the pressurized air supply from the main air system to the pneumatic valve unit.

(4) Controls and Indicators

(a) Pushbuttons (Fig. 1)

The doors are operated by pushbuttons the function of which is marked on the pushbutton. Single pushbuttons for door open/door closed are on the door bulge of all car doors. The drivers door and the end cabin door have a panel of pushbuttons which can select; open all car doors, open both doors on a selected car, the car door associated with the panel. The end cabin rear door panel can not open the drivers door, the drivers door panel can not open the end cabin rear door. Car three has an extra panel which can open all doors, excepting the drivers door and the rear cabin door. The driver has a button below the primary console which electrically opens and closes the drivers door. There is no remote closing of a passenger door, each door must be closed from the outside by operating a door button associated with the door. A white indicator on the drivers outside panel, car 3 center panel and the end car rear door panel lights when the RUN/STOP switch is set to STOP.



## (b) Consoles (Fig. 3)

The door system is controlled from two consoles, primary and secondary, in the drivers cabin. The indicators and switches have inscribed captions which are backlighted in colour to show the status of the door system, the colour being indicative of the status, i.e., red is a warning, amber is a caution, green or white is system go, blue indicates that power is connected to a selected function. The controls and indicators on the consoles are:

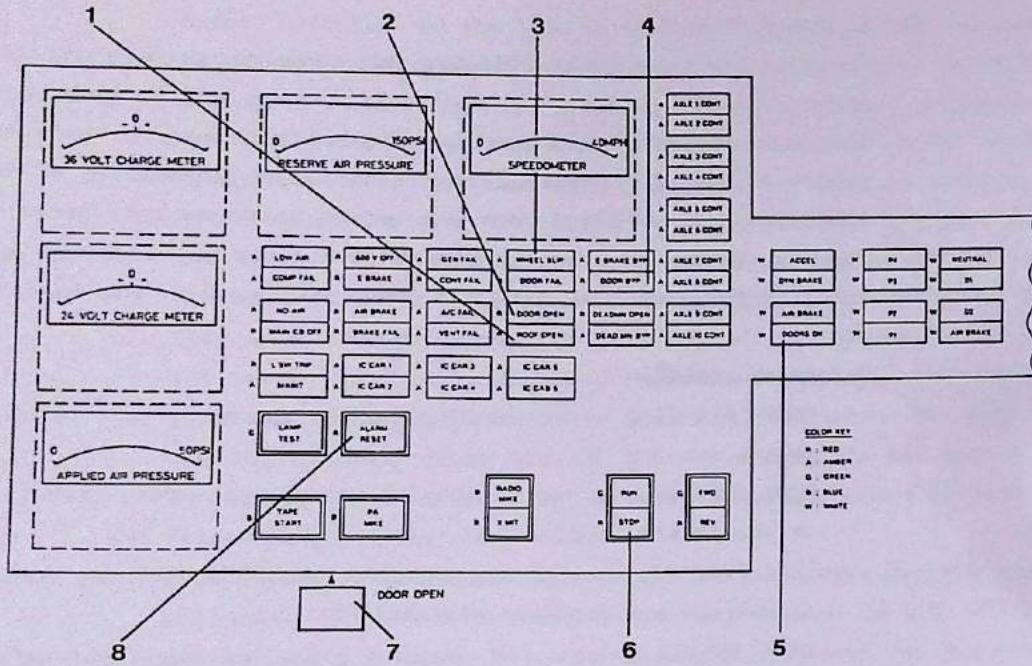
1 Primary console

- ROOF OPEN (1); a red warning that an emergency exit hatch is open
- DOOR OPEN (2); a red warning that the door safety circuit is or was interrupted
- DOOR FAIL (3); a red warning from the PCU, that any control signal was not received correctly
- DOOR BYPASS (4); a red warning that the door-/roof-safety-circuit is bypassed
- DOORS OK (5); a green indicator which lights when STOP is selected and all doors are closed
- RUN/STOP (6); a rocker switch which operates a relay over which the power supply to the circuit board supplying the pulsed signals to the pneumatic valve unit is routed so that a selection of RUN removes the power. Conversely a door open, and/or a roof open signal does not allow RUN to operate, except when the DOOR BYPASS is switched ON.
- Door open (7); a pushbutton which opens and closes the drivers door
- ALARM RESET (8); a red pressbutton which resets a roof open or a door open warning when a failure in the safety circuit has been cleared.

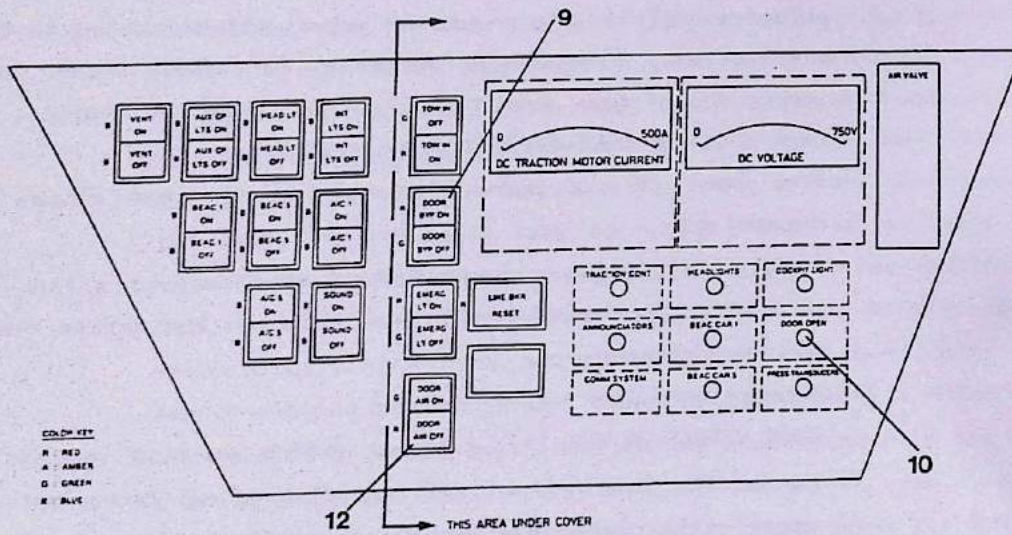
2 Secondary console

- DOOR BYPASS ON/OFF (9); a rocker switch which at ON (red) bypasses the door fail circuit (simulating all doors and emergency exits closed and locked) thereby enabling the RUN/STOP switch
- DOOR OPEN (10); a circuit breaker in the power supply to all door electrical control signals





Primary Console



Secondary Console

Fig. 3 Drivers Consoles



- DOOR AIR-ON/OFF (12); selecting ON (green) electrically energizes the main pressurized air shutoff valve to open. Either a selection of OFF (red) or a power failure closes the valve to pressurized air and opens the system to vent.

## B. Operation (Fig. 6 and 7)

### (1) Opening

- (a) With the door closed, pressing a pushbutton commands the programmable control unit to open the door or all the doors selected by the button.
- (b) Providing the RUN-STOP switch is set to STOP, the PCU sends a pulsed electrical signal to the "open" side of the pneumatic valve unit.

#### 1 Pneumatically:

- the "open" valve opens and pressurizes the "door open" line
- the "close" valve closes to pressure and opens the "door close" line to vent
- the pressure in the "close" side of the valve is released
- the pressure in the "lock open" line unlocks the door
- the pressure in the "door open" line recovers after opening the door lock
- the door "open" valve operates to open the "door open" pressure line to the door cylinder jack
- the jack piston extends and drives the door open to the limit of an external mechanical stop.

#### 2 Electrically:

When the door is open or opening:

- lights the DOOR OPEN lamp on the primary control panel
  - isolates the RUN command of the RUN-STOP switch
  - lights the door entrance light
  - switches off the DOORS OK light.
- (c) On opening, the door swivels around the door post to the outside and runs parallel to the car at a distance of 3,2 ins from the car body wall. It is then held firmly open by the air pressure in the door jack which is not released until the PCU sends a door



close signal to change over the valves in the pneumatic valve unit.

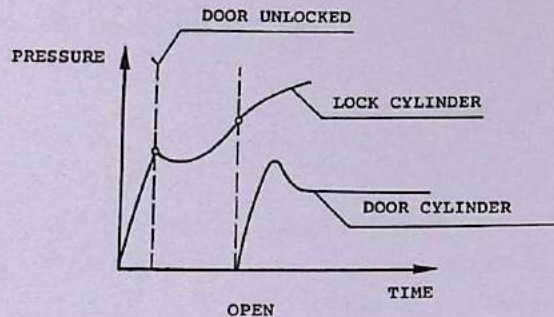


Fig. 4 Door Open - Pneumatic Scheduling

(2) Closing

- (a) With the door open, a door can be selected closed by pressing the individual door pushbutton which commands the programmable control unit to close that door only.
- (b) Providing that the RUN-STOP switch is set to STOP, the PCU sends a pulsed electrical signal to the "close" side of the pneumatic valve unit, and to the solenoid-operated fast exhaust valve (EMV 10).

1 Pneumatically:

- the "close" valve opens and pressurizes the "door close" line
- the "open" valve closes to pressure and opens the "door open" line to vent
- the pressure on the "door open" valve is released
- the fast exhaust valve opens momentarily to release the build-up of pressure on the "open" side of the ram piston which held the door open. This allows immediate and smooth closing of the door.
- The door closes
- the pressure in the "door close" line retracts the jack piston
- the pressure in the "door close" line recovers after the jack piston reaches end of travel



- the "door lock" pressure switched valve operates to open the pressureline to the door lock cylinder
- the door lock closes

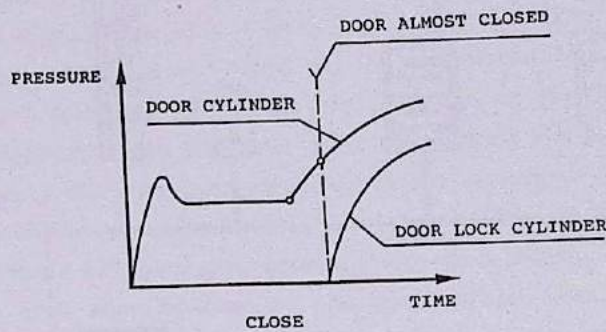


Fig. 5 Door Close - Pneumatic Scheduling

2 Electrically:

At 10mm before end of closing travel, the 10mm magnetic switch deactivates both the pressure sensitive edge switch circuit and the electrical safety backup switch and the door will close into the door entrance aperture. When the door closes:

- the door closed switch operates and signals door closed
- the door lock switch operates and signals door locked
- the entrance light goes out
- the DOOR OPEN indicator remains lit if any door is not closed
- the DOORS OK indicator lights when all doors are closed.

(c) Pressing a door pushbutton starts a timer in the PCU. If a door locked signal is not received within ten seconds then the PCU will signal door open to the pneumatic valve unit. The door close procedure must then be restarted.

(d) If, during closing, and before the "10mm before closed" magnetic switch is activated, an obstruction operates the pressure sensitive edge, the membrane switch signals the PCU. The PCU then signals the pneumatic valve unit which changes the valves to reverse the door "close" command to "door open", and the two fast exhaust relief valves (EMV11-1, 11-2) on the "close" side which open momentarily to relieve the "close" pressure and ensure the quick response of the door to the "open" pressure; the door will now open without hesitation. The door close procedure must then be restarted.



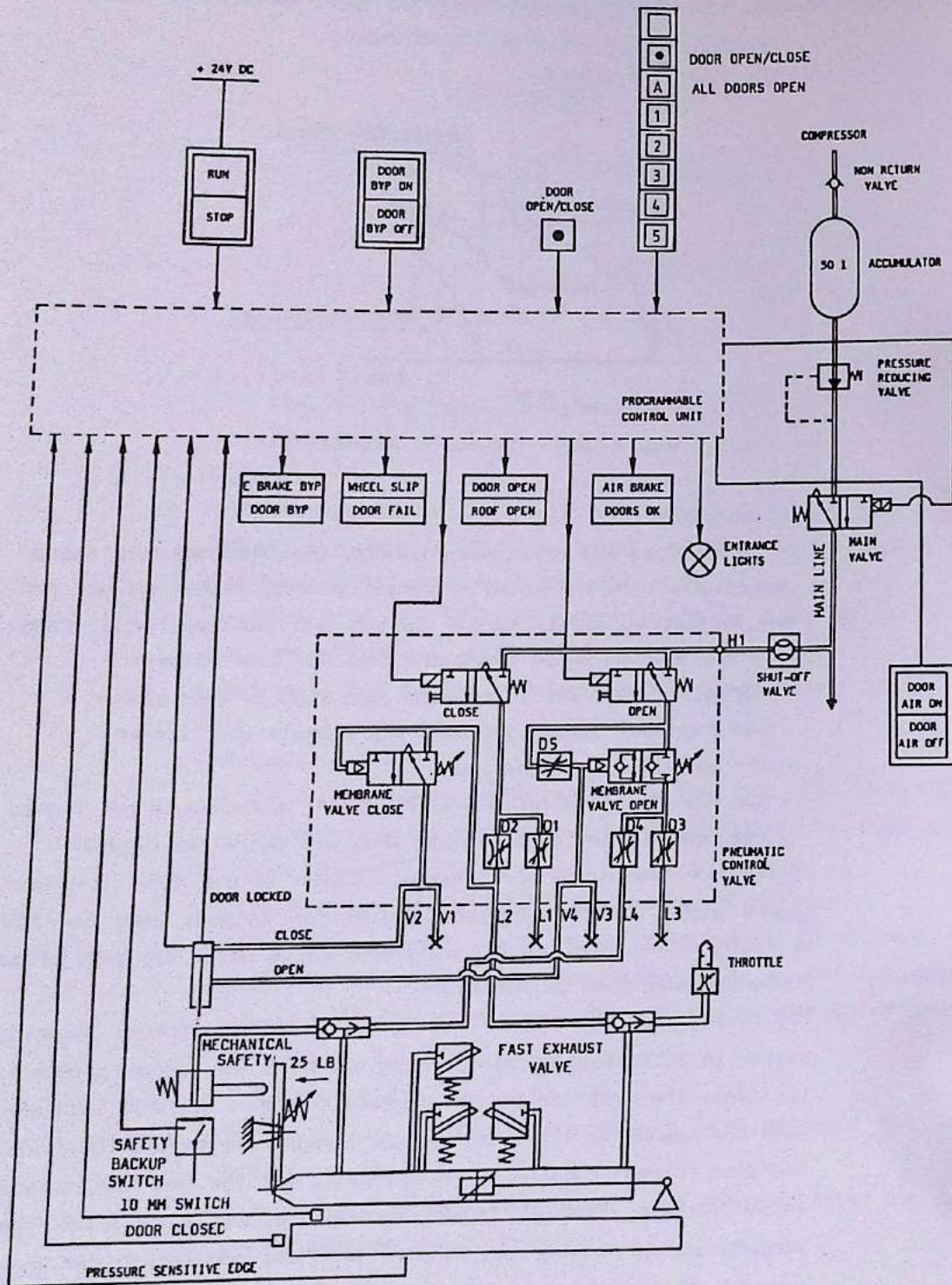


Fig. 6 Door Circuit Schematic



- (e) If the pressure sensitive edge fails to operate when a door hits an obstruction then the pressure is transferred to the swivel lever attached to the door jack mounting. If the force is 25 lbs or more, the lever operates the electrical backup safety switch which signals the PCU to stop the door from closing. The PCU then signals; the "close" side of the pneumatic valve unit and the "close" valve shuts off the air pressure to the "door close" line and depressurizes the door jack by opening the "door close" line to vent; the two overpressure relief valves on the door "close" side which open momentarily to release some of the closing pressure thus bringing the door quickly to a halt. The door movement will then stop because of the obstruction, and as the door open valve has remained open to vent, the door can easily be opened by hand.
- (f) As a final safety, if the electrical backup safety switch also does not operate, the swivel lever on the door jack mounting operates the mechanical air valve which opens to vent the door close pressure line. As the door open line is already at vent, the door movement will stop.
- (g) Both "door closed" and "door locked" signals for all doors must be received by the programmable control unit. Should either signal not be present, then the DOOR FAIL indicator on the primary control panel will light to indicate a failure. The door "locked" signal is part of the safety loop which prevents the operation of the RUN command on the RUN-STOP switch. To enable the monorail to be driven off the circuit for repair, the safety loop fail signal can be overridden by setting the DOOR BYP switch to ON.
- (h) In an emergency, a door can be unlocked from the outside using the door handle. Pressing the handle mechanically opens the door lock. The open lock activates a microswitch which signals the pneumatic valve unit to depressurize the door system as in (f) above. The door is then easily opened from either the inside or the outside.



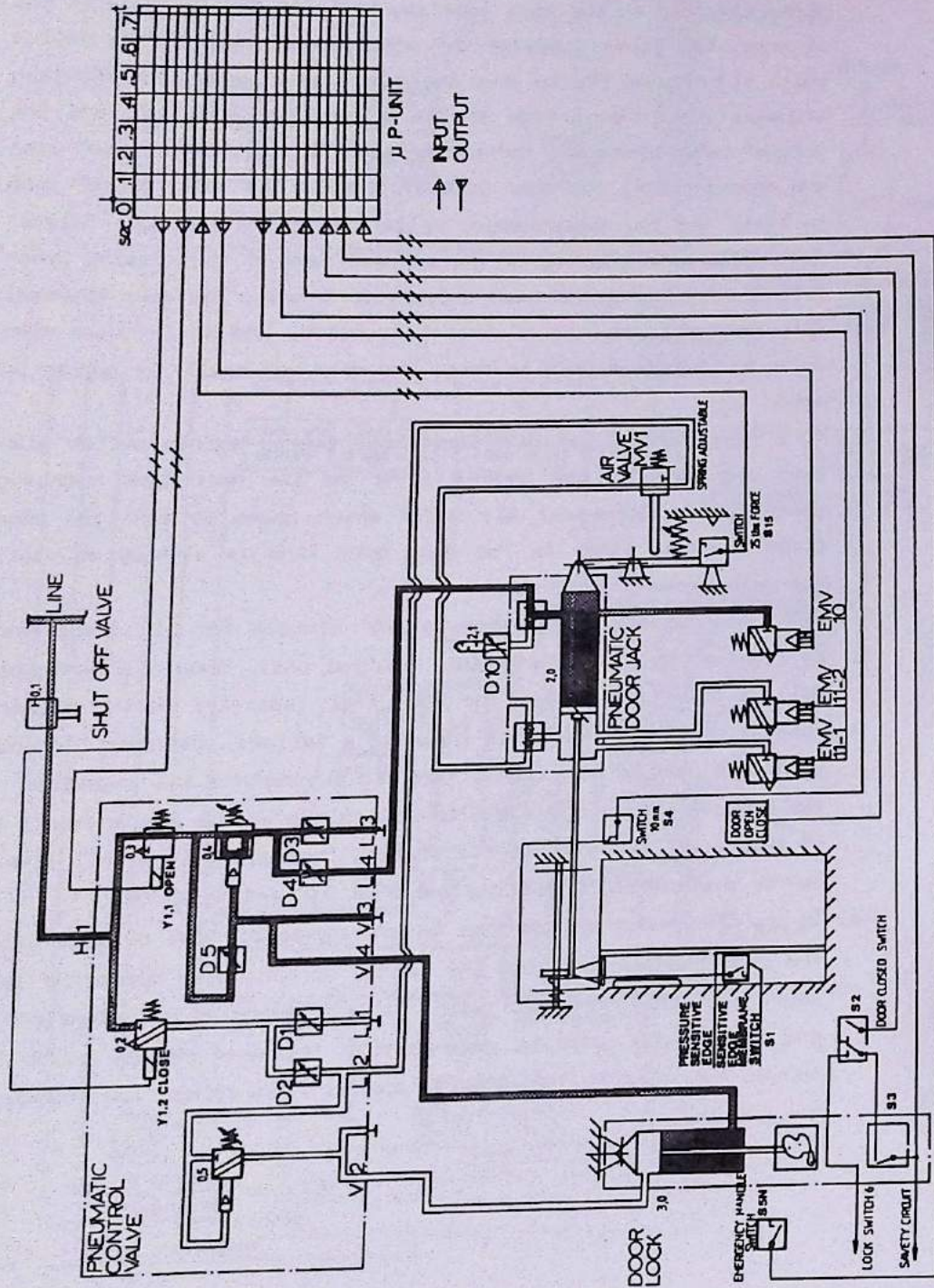


Fig. 7 Door Operation (1) - Door Open







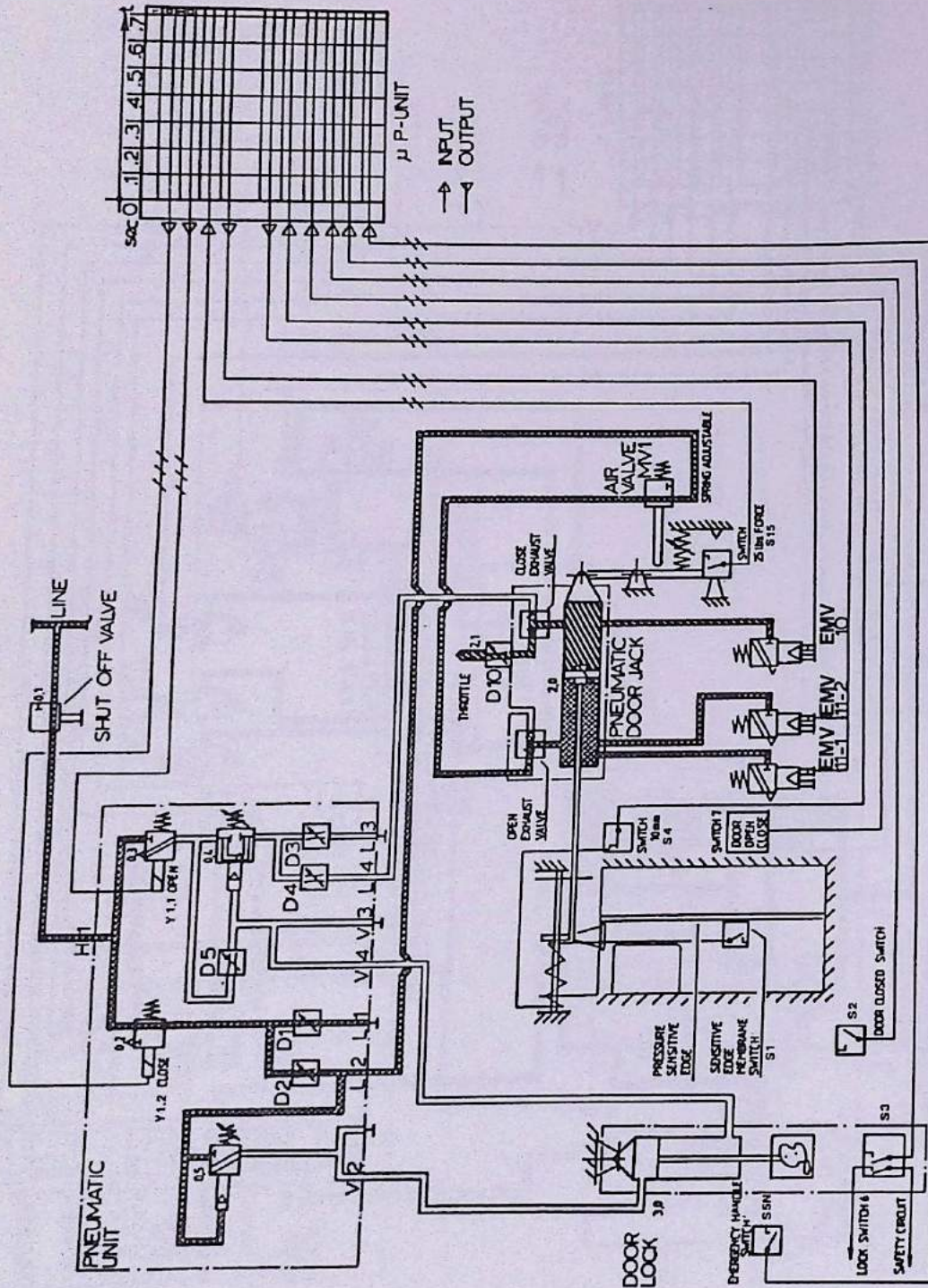


Fig. 7 Door Operation (3) - Door Closes



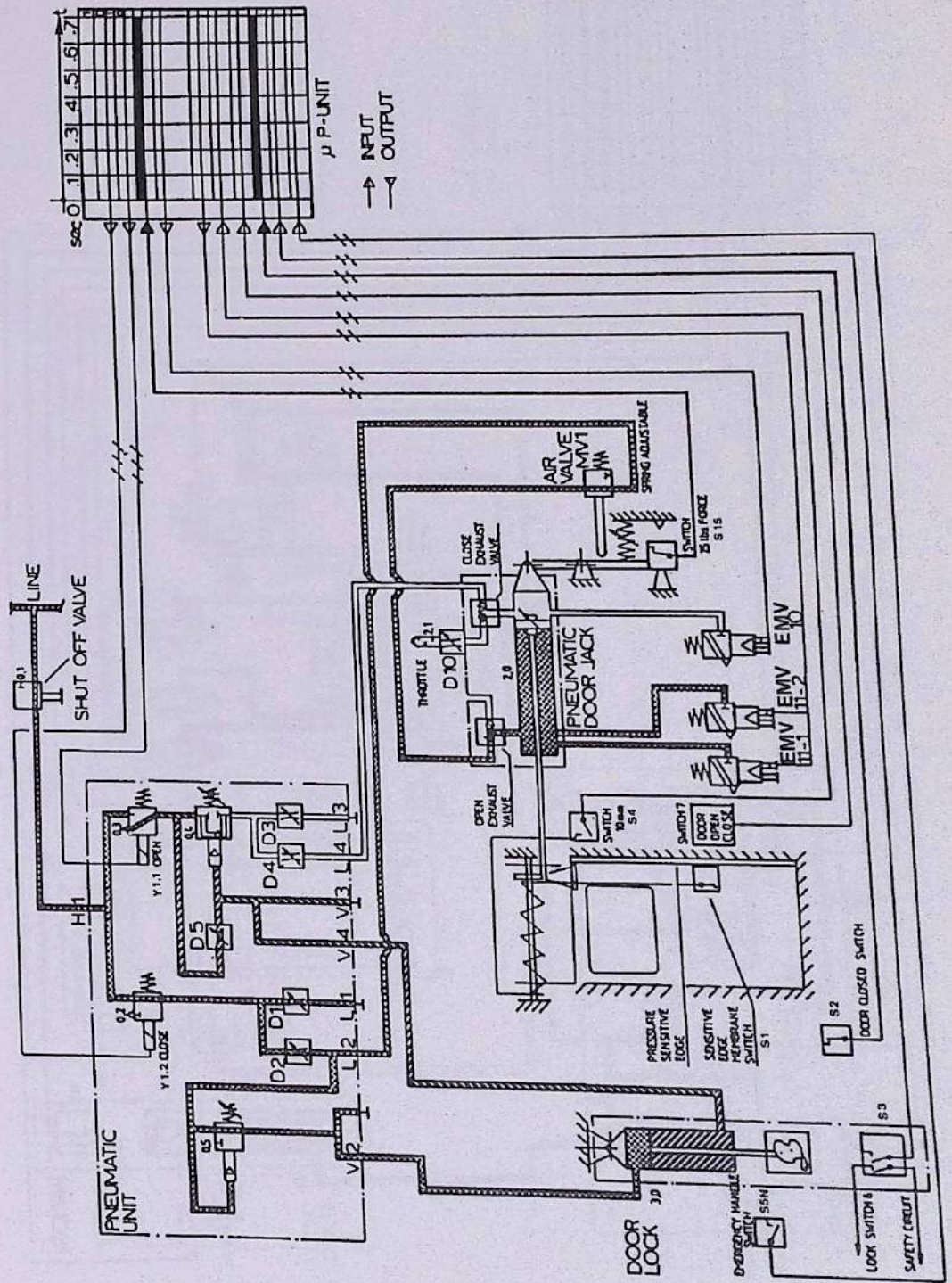


Fig. 7 Door Operation (4) - Door Closed, Lock Closes



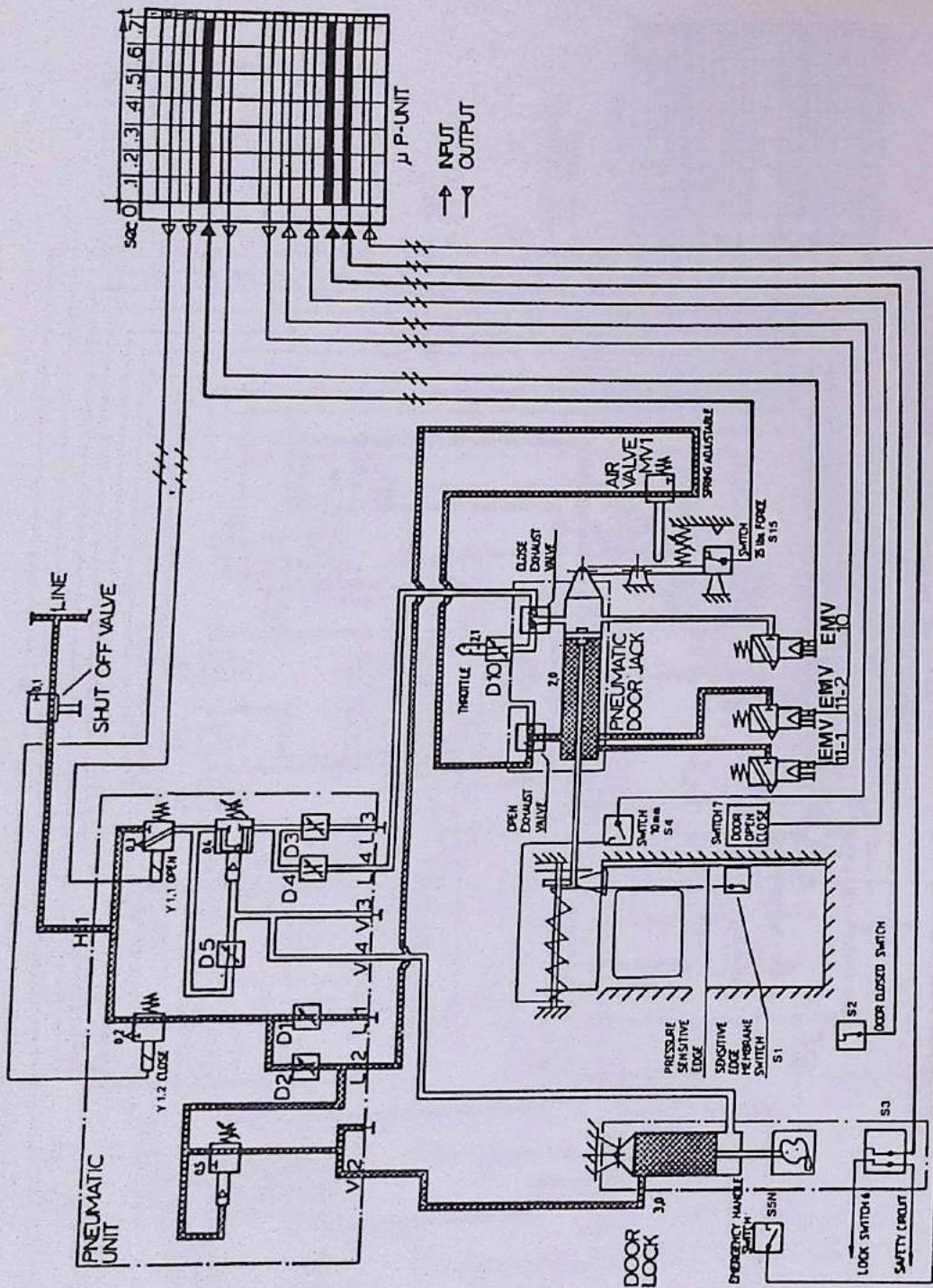


Fig. 7 Door Operation (5) - Door Closed and Locked







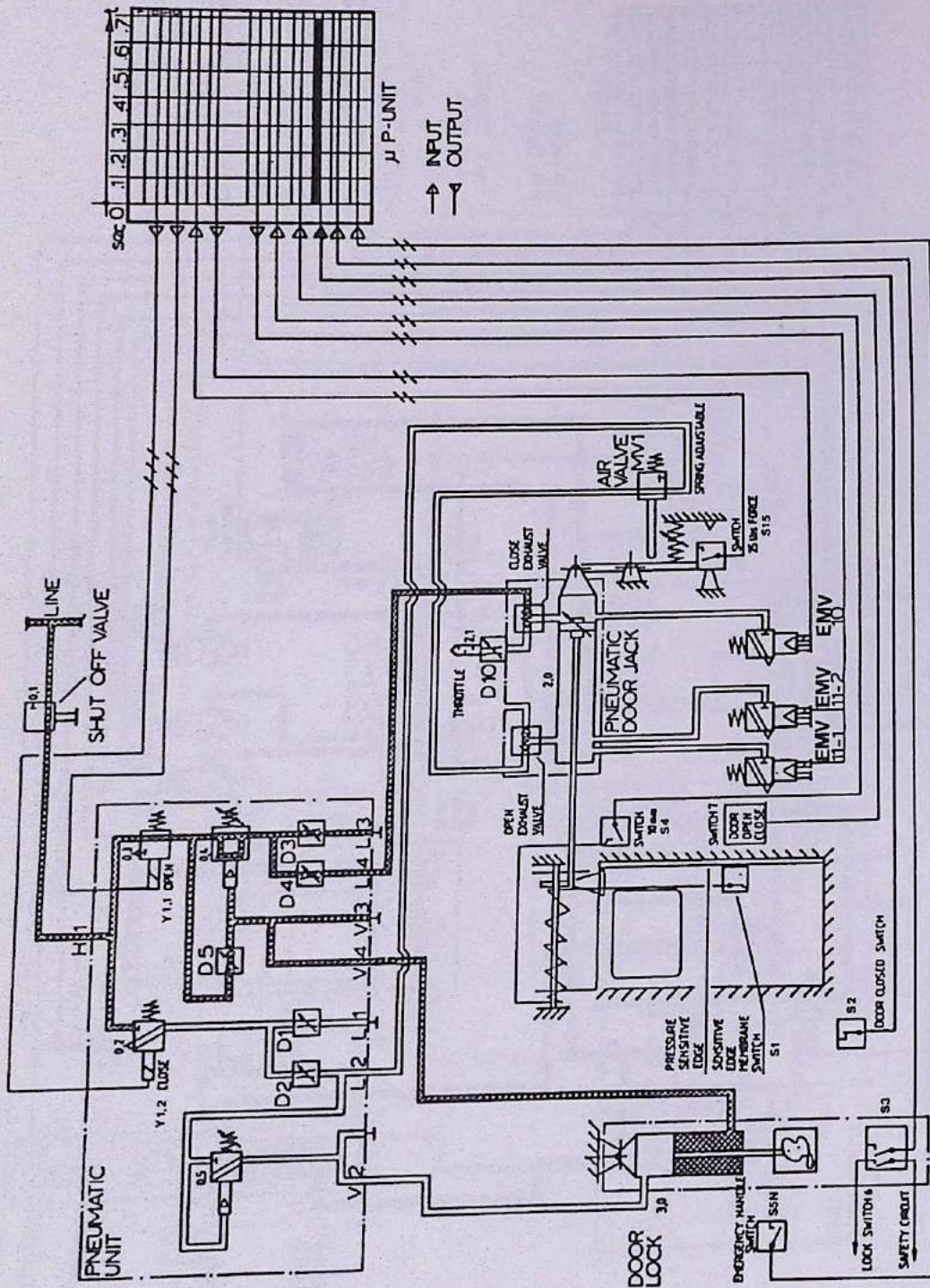


Fig. 7 Door Operation (7) - Door Unlocked, Door Opens



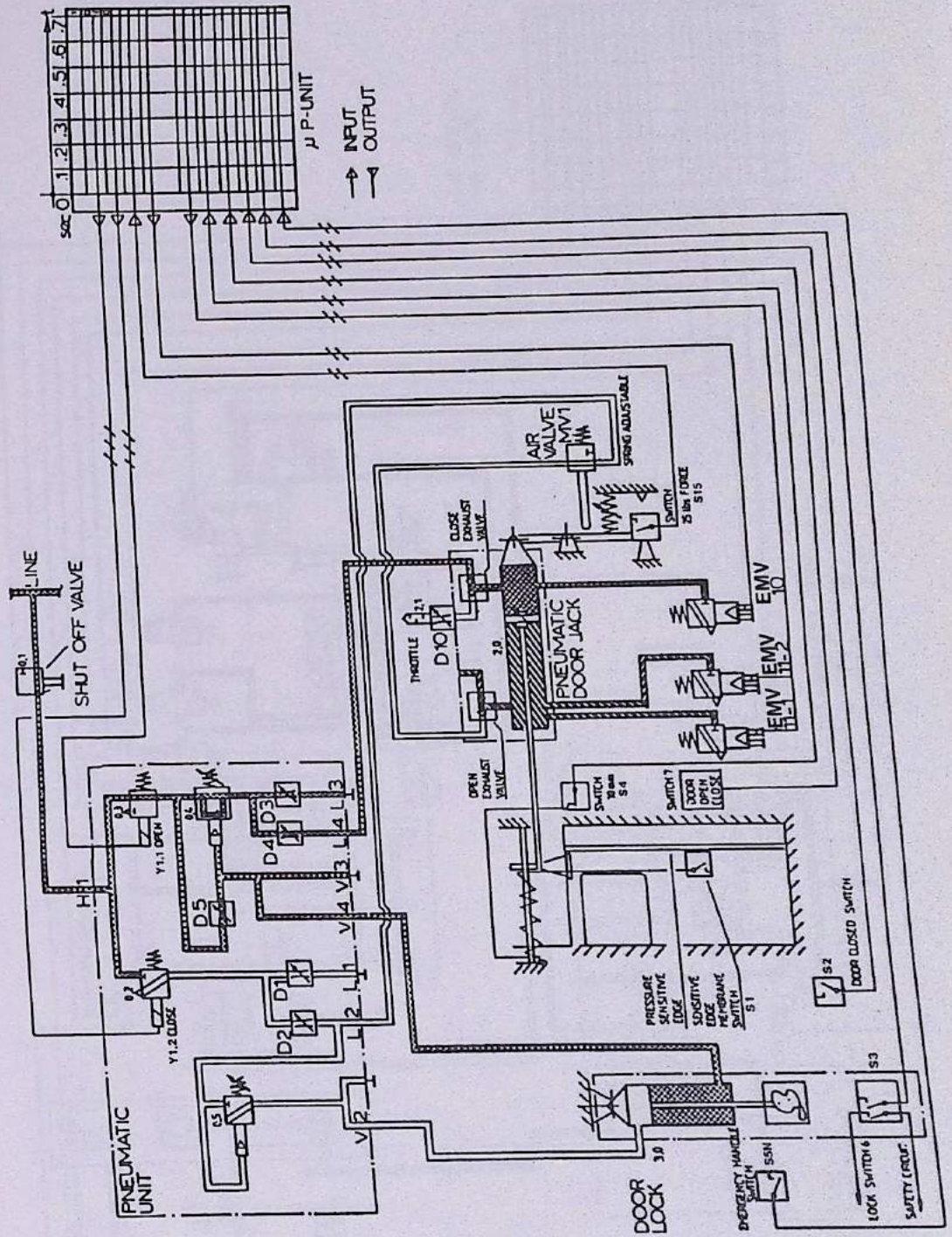


Fig. 7 Door Operation (8) - Door Opens



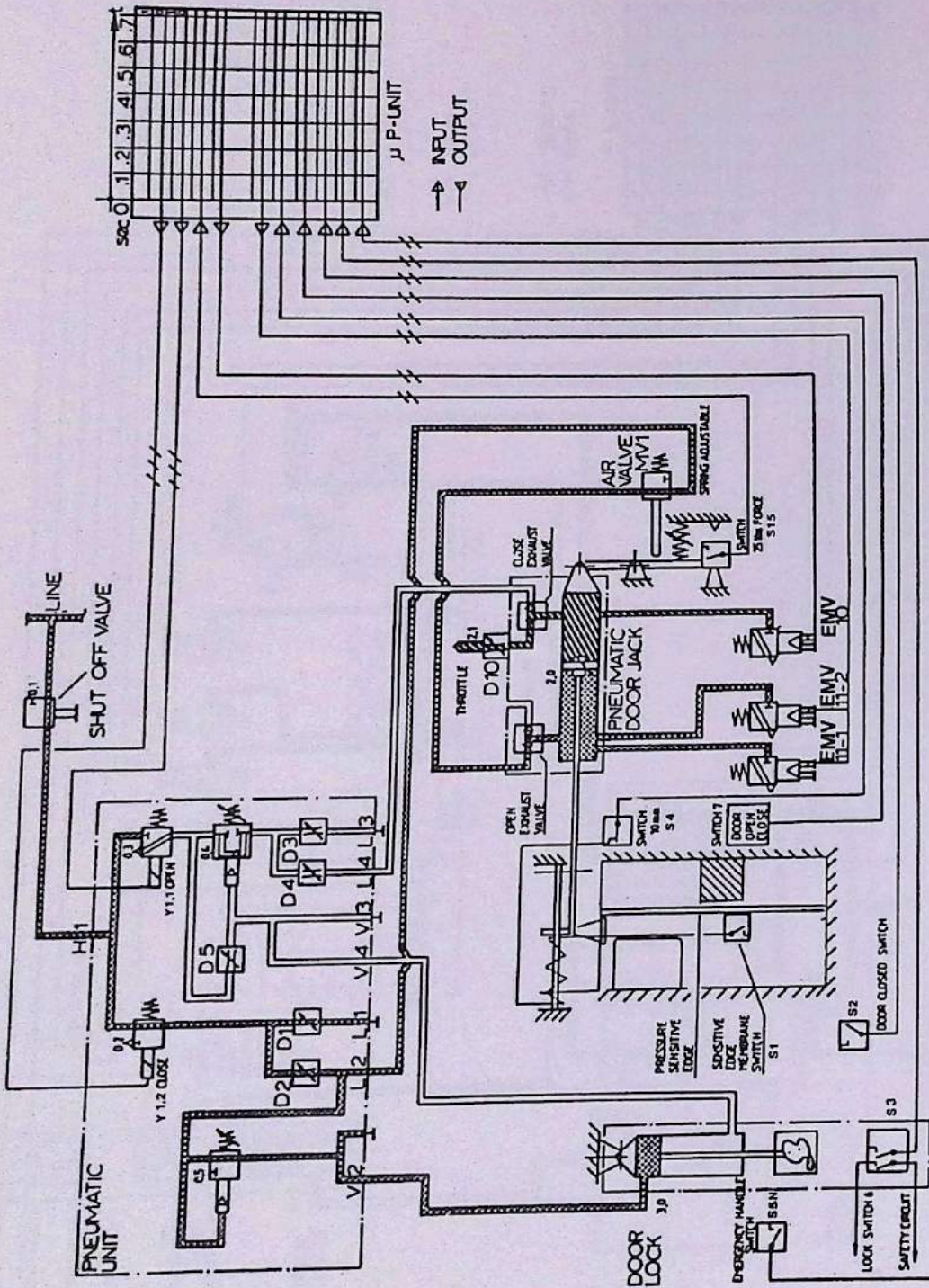


Fig. 7 Door Operation (9) - Door Closes, Entrance Obstructed



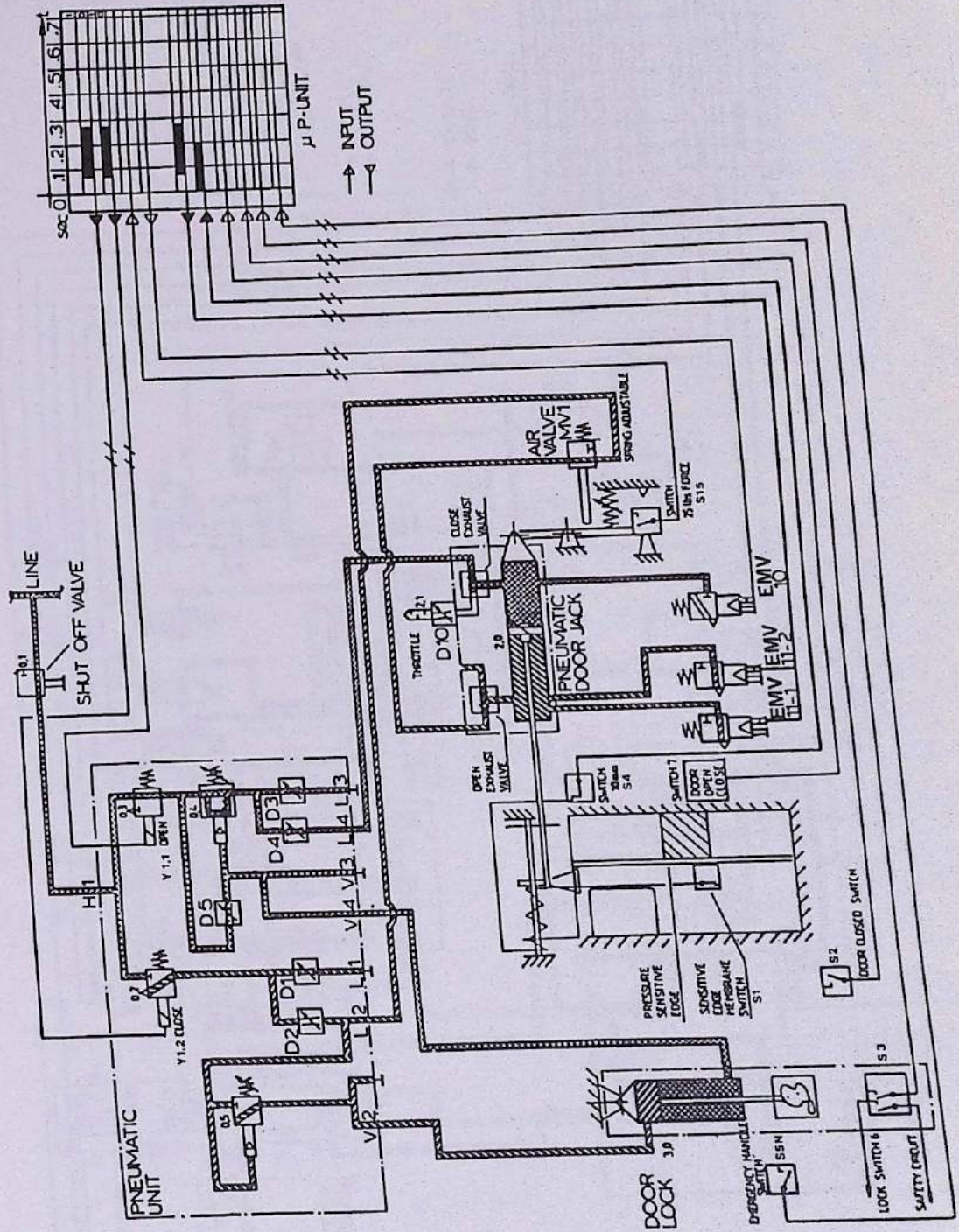


Fig. 7 Door Operation (10) - Pressure Sensitive Edge Operates



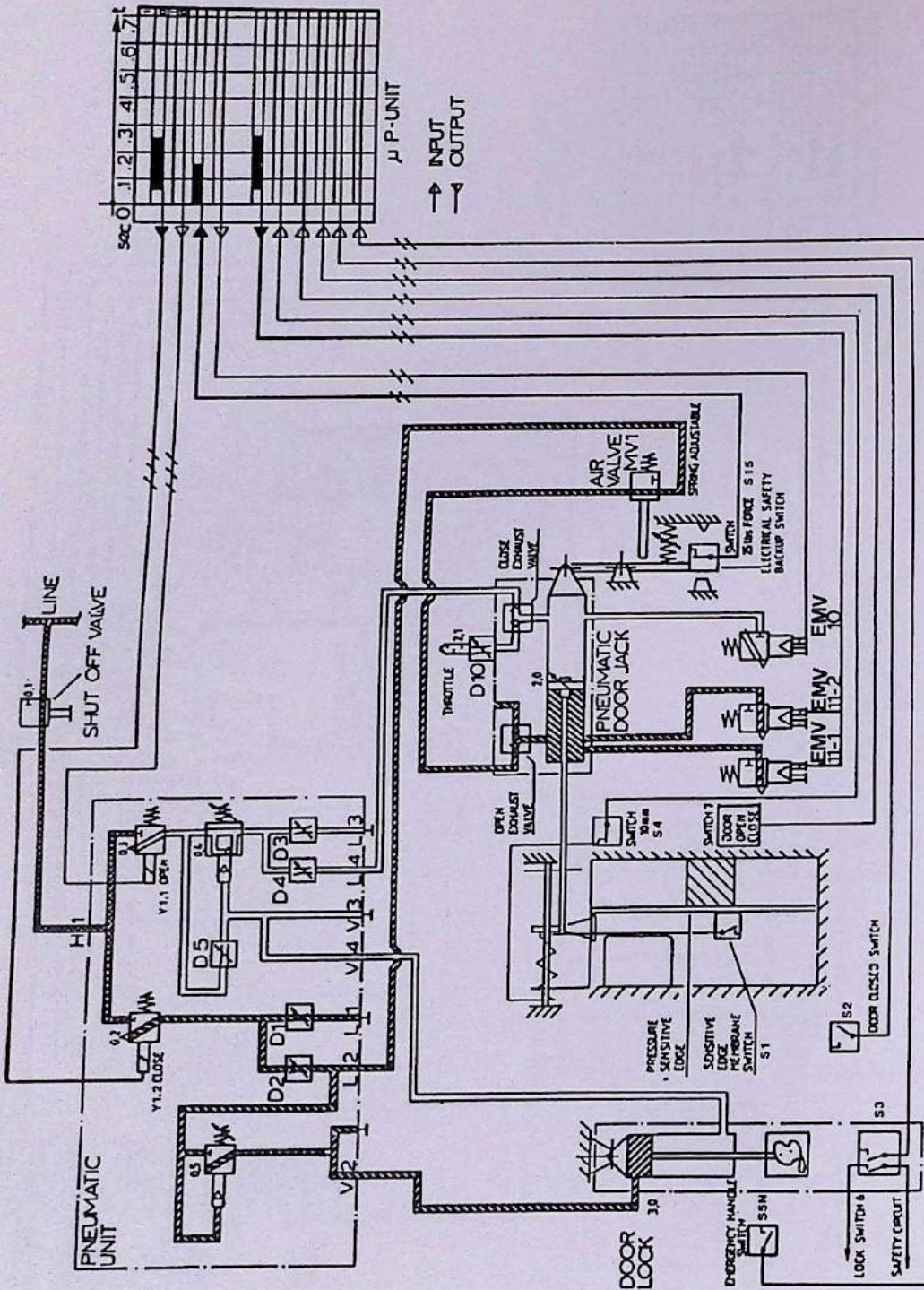


Fig. 7 Door Operation (11) - Pressure Sensitive Edge Circuit Inoperative, Electrical Safety Backup Switch Operates



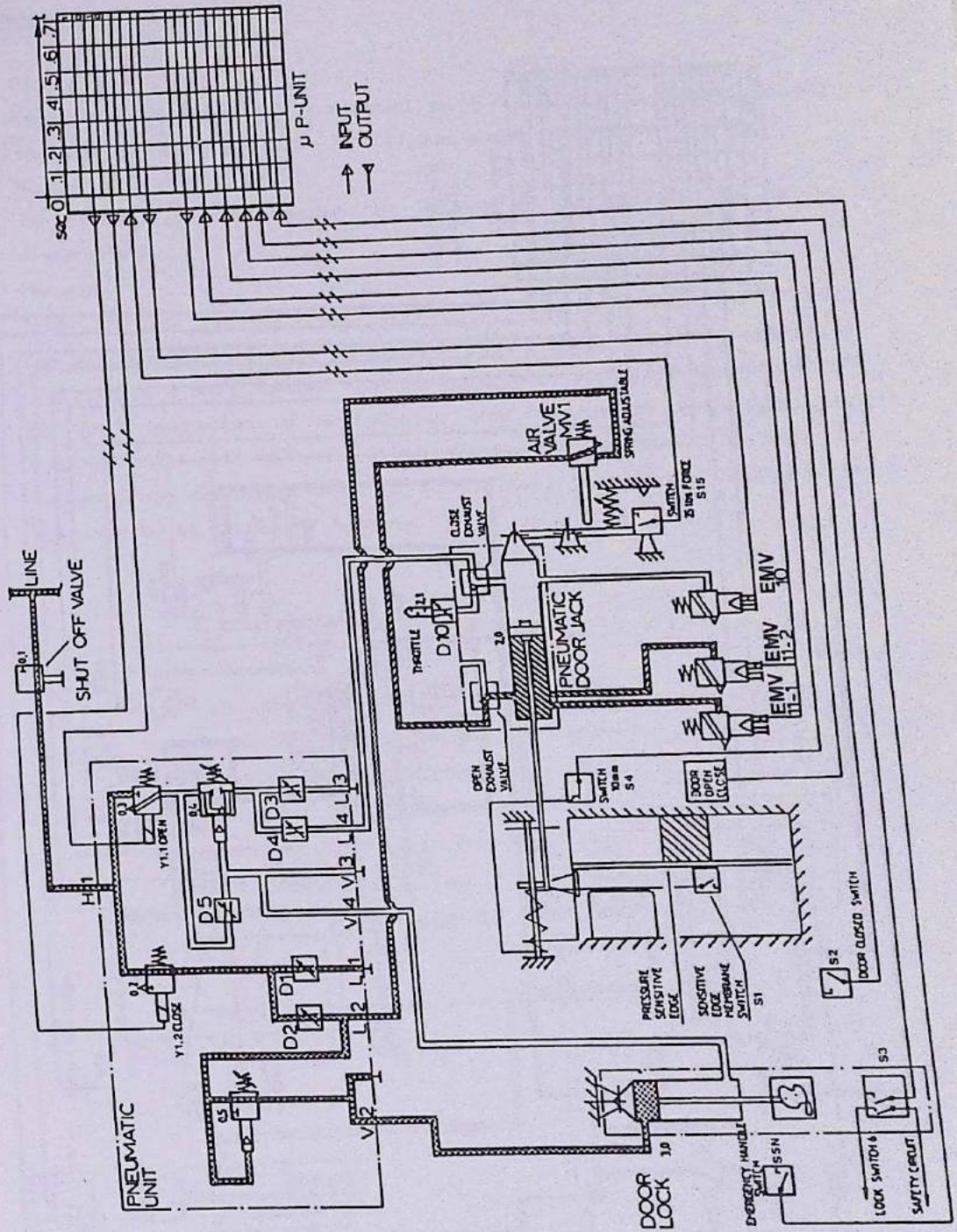


Fig. 7 Door Operation (12) - Pressure Sensitive Edge Switch Inoperative, Electrical Safety Backup Inoperative, Mechanical Safety Valve Operates



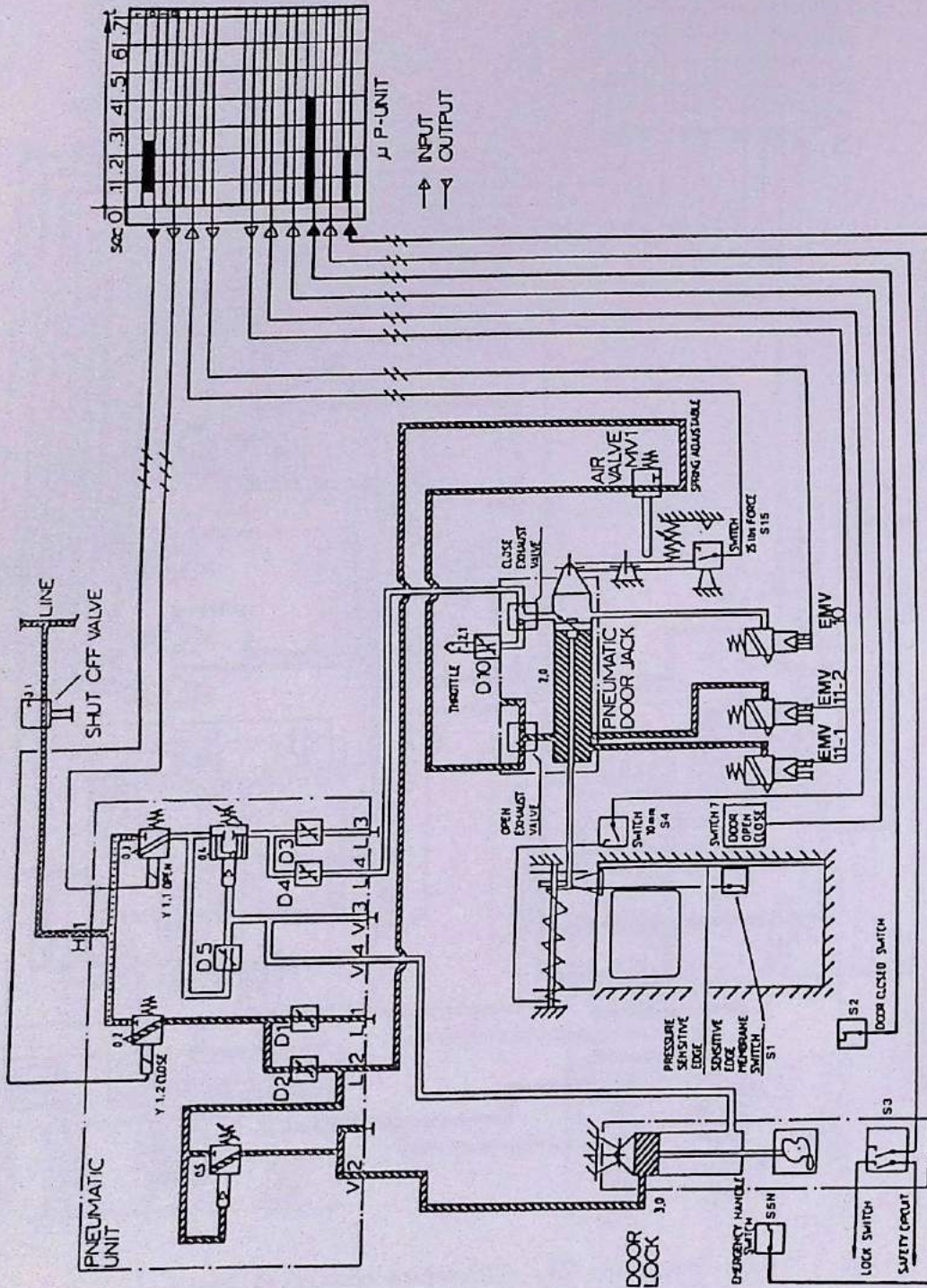


Fig. 7 Door Operation (13) - Door Opened by Mechanical Handle



## 2. Fault Isolation

(1) Electrical

Electrical failures are indicated on the PCU board indicators and isolated by using the built-in test equipment (see Chap. 76-00).

(2) Mechanical

The probability of a mechanical failure is so unlikely, it can be disregarded.

(c) Pneumatic

After proving the electrical system, a failure of a pneumatic unit can be isolated by first, ascertaining that air pressure is available upstream of a unit, second that no leakage is occurring downstream of the unit suspected of a failure, and finally by exchanging the suspect unit with a unit known to be serviceable. The work to exchange any pneumatic unit is so minimal, that fault diagnosis is not seen to be more practicable.

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NOTE

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It is possible that the door lock hook can be tripped closed by a person poking past the lock guard. If a "door open" is indicated, and the door is not flush with the outer skin of the carbody this "fault" can easily be reset by opening the door, and closing.

---



**3. Maintenance Practices**

The maintenance schedule is shown in Table 301.

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
1	Sliding door Type A B C D E	General function check	TI-22.0001 TI-22.0001 TI-22.0002 TI-22.0003 TI-22.0004	Quarterly
2	Lock assembly - pneumatic cylinder	Wear check Renew wearing parts	TI-22.0010 II-22.0017	Quarterly 5 years
3	Roller assembly, top - Roller	Wear check Wear check Renew roller	TI-22.0011 II-22.0013	Quarterly Quarterly 5 years
4	Roller assembly, side - Roller	Wear check Wear check Renew roller	II-22.0012 II-22.0013 II-22.0013	Quarterly Quarterly 5 years
5	Slider	Wear check Renew slider	II-22.0014	Quarterly 5 years
6	Pneumatic cylinder, jack	Renew wearing parts	II-22.0015	5 years
7	Pneumatic cylinder, lock	Renew wearing parts	II-22.0015	5 years
8	Pneumatic valve units	Function check	II-22.018	Annual
9	Air couplings	Test for leaks	II-22.019	Annual
10	Pressure sensitive edge	Function check	II-22.020	Quarterly
11	Rubber extrusions	Renew	II-22.021	5 years

Table 301 Maintenance Practices



4. Servicing

The items listed in Table 401 are shown against a recommended maximum elapsed time, it is not an instruction to wait out the time before servicing.

Item	Description	Service Required	Test and Inspection Instruction	Service Interval
1	Lock assembly	Grease	TI-22.0010	Quarterly
2	Pneumatic cylinder, jack	Grease piston rod	TI-22.0015	Quarterly
3	Pneumatic cylinder, lock	Grease piston rod	TI-22.016	Quarterly
4	Rubber extrusions	Powder with talcum	TI-22.021	Annually
5	Roller assembly, top	Renew grease	TI-22.0011	5 years
6	Roller assembly, side	Renew grease	TI-22.0012	5 years

Table 401 - Servicing



## 5. Removal / Installation

### NOTE

The door in Removal/Installation is a Type A door. Any difference between this door and another door is identified in the text.

### A. Door

#### (1) Removal

- (a) Door electrical power and DOOR AIR - ON/OFF switch. (Chap. 76-00)  
Switch off. (Fig. 3)
- (b) Hatracks. Open or remove. (Chap. 21-00)
- (c) Air supply shut-off lever. Set to close.
- (d) Door bulge. Remove.

#### (2) Procedure

Fig. 501

- (a) Side roller bracket (1) Disconnect. Remove the three Allen-headed bolts (2).

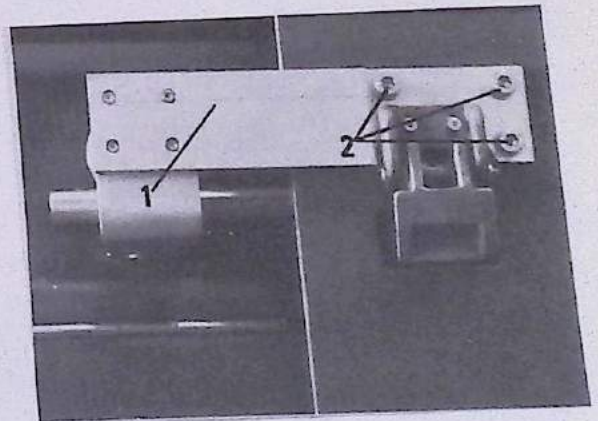


Fig. 501



Fig. 502

- (b) Pressure sensitive edge switch wiring (1). Disconnect from traction lever (2).



Fig. 502

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**CAUTION**

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STEP (C) WILL RELEASE THE SUPPORT OF THE DOOR  
THE WEIGHT OF WHICH IS:

PASSENGER AND DRIVER DOOR	24 KG APPROX.
PASSENGER DOOR, WIDE ENTRANCE	27 KG APPROX.
END CAR REAR DOOR	22 KG APPROX.

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Fig. 503

- (c) Door. Remove. Support the door from below. remove the four Allen-headed bolts (2) from the traction lever (1). Drop the door downwards to free the slider from the guide, then outwards to remove the door.

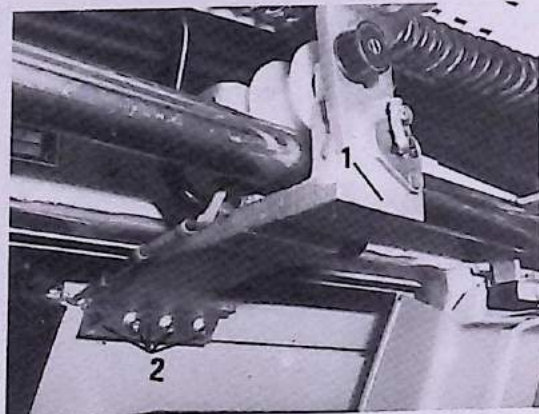


Fig. 503

**(3) Install**

- (a) Locate the door. Support the door from below and position the door with the slider in the guide.
- (b) Connect the door to the traction lever (1). Fasten the door to



- the traction lever using the four Allen-headed bolts (2).
- (c) Connect the side roller bracket (1, Fig. 1) to the door. Fasten the bracket (1) to the door using the three Allen-headed bolts (2).
  - (d) Pressure sensitive edge switch wiring (1). Reconnect.
- (4) Completion
- (a) Door alignment. Adjust. (Section 6)
  - (b) Door electrical power. Switch on. (Chap. 76-00)
  - (c) Air supply shut-off lever. Set to open.
  - (d) Door. Test. (Section 6)
  - (e) Hatrack doors. Close. (Chap. 21-00)
  - (f) Door bulge. Replace. (Chap. 21-00)

### **B. Pneumatic Valve Unit**

#### (1) Removal

- (a) Door electrical power. Switch off. (Chap. 76-00) (Fig. 3)
- (b) Open the door using the outside handle.
- (c) Hatrack door(s). Open. (Chap. 21-00)
- (d) Air supply shut-off lever. Set to close.

#### (2) Procedure

Fig. 504

- (a) Electrical connectors (1,3). Disconnect.
- (b) Air pipes, H1,V2,V4,L2 and L4. Disconnect.
- (c) Pneumatic valve unit. Remove. Remove the two nuts, washers, bolts and spring washers (2).

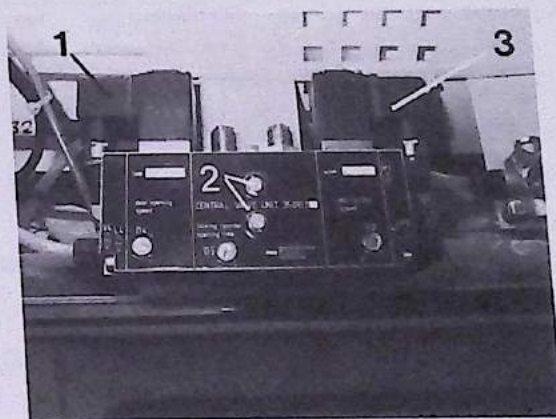


Fig. 504



- (3) Install
- (a) Pneumatic valve unit. Install. Install using the two bolts, spring washers, washers and nuts. Hand tighten the nuts.
  - (b) Air pipes H1,V2,V4,L2 and L4. Connect.
  - (c) Electrical connectors (1,3). Connect.

---

NOTE

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The door may move open or close when  
air pressure is applied.

---

- (4) Completion
- (a) Air supply shut-off lever. Set to open. Check air supply pipes for leaks. If the main accumulator is exhausted, recharge.
  - (b) Door electrical power. Switch on (Chap. 76-00). Observe that the door entrance light comes on, if the door is open.
  - (c) Pneumatic valve unit. Set the throttle valves as follows:
    - D5 - screw in half way
    - D2 - screw out until flush with valve front edge
    - D4 - set to approximately the position on the removed unit.
  - (d) Door. Open and close the door several times using the pushbutton. Adjust throttle D4 until the door opens smoothly and between 3,5 and 4.0 seconds. Check that the door closes in 4,5 to 6,0 seconds.
  - (e) Hatrack doors. Close (Chap. 21-00)

C.. Door lock

- (1) Removal
- (a) Door. Open.
  - (b) Hatrack. Open.
  - (c) Air supply shutoff lever. Set to close.
  - (d) Door electrical power. Switch off. (Chap. 76-00)
  - (e) Door lock cover. Remove. (Chap. 21-00)



(2) Procedure

Fig. 505

- (a) Mechanical open switch (1).  
Remove.
- (b) Door lock switch (2).  
Remove.
- (c) Lock cylinder pressure pipes  
(3). Disconnect.
- (d) Door lock. Remove. Remove  
the four Allen-headed bolts  
and washers (4,5).

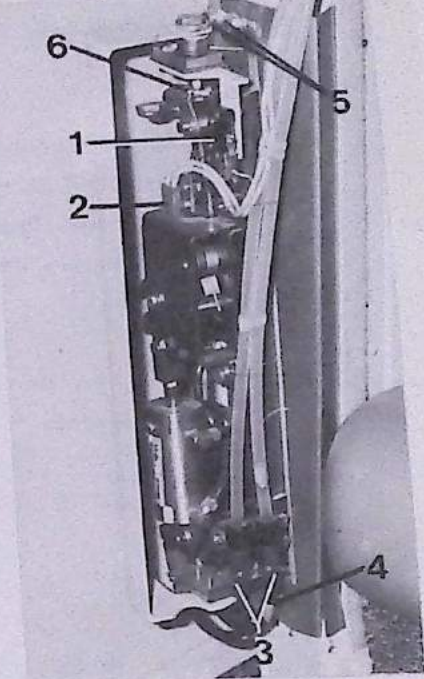


Fig. 505

(3) Install

NOTE

If the lock is to be replaced, transfer the striker plate (6) from the old lock to the new.

- (a) Door lock. Install. Fasten with the four Allen-headed bolts and washers (4,5) the longer bolts to the outside of the car.
  - (b) Lock cylinder pressure pipes. (3) Connect. Do not overtighten.
  - (c) Door lock switch. Replace.
  - (d) Mechanical open switch. Replace.
- (4) Completion
- (a) Air supply shutoff lever. Set to open.
  - (b) Door electrical power. Switch on. (Chap. 76-00)
  - (c) Door lock. Adjust. (Section 6A).
  - (d) Door lock cover. Replace. (Chap. 21-00)
  - (e) Hatrack. Close. (Chap. 21-00)



**D. Door Cylinder Jack**

- (1) Remove
  - (a) Door electrical power. Switch off. (Chap. 76-00)
  - (b) Open the door with the door handle.
  - (c) Hatracks. Open. (Chap. 21-00)
  - (d) Air supply shutoff lever. Set to close.

- (2) Procedure

Fig. 506

- (a) Main system air pipe (1).  
Disconnect.



Fig. 506

Fig. 507

- (b) Main system air pipe (1).  
Disconnect.
- (c) Solenoid valve pipes (2, 3  
and 4). Disconnect from the  
jack.

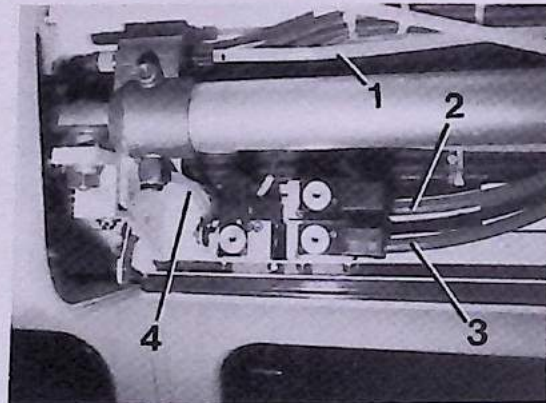


Fig. 507

- (d) Door cylinder jack. Remove. Using care, lever off the ball joints at either end using a suitable lever.

- (3) Install

- (a) Door cylinder jack. Fit. Using care, fit on to the ball joints at either end using a C-clamp.



- (b) Air supply pipes (five of). Connect. (see removal, above)
- (4) Completion
  - (a) Air supply shutoff lever. Set to open.
  - (b) Door electrical power. Switch on. (Chap. 76-00)
  - (c) Door cylinder jack. Adjust (Sect. 6)
  - (d) Door. Test. (Sect. 6)
  - (e) Hatrack. Close. (Chap. 21-00)

#### E. Upper Roller Assembly

- (1) Remove
  - (a) Open the door using the door handle.
  - (b) Door electrical power. Switch off. (Chap. 76-00)
  - (c) Hatrack. Open. (Chap. 21-00)
  - (d) Air supply shutoff lever. Set to close.
  - (e) Door. Remove. (Sect. 5,A)
  - (f) Door cylinder jack. Lever off the ball joint of the upper roller assembly.

- (2) Procedure

Fig. 508

- (a) Disconnect flexible cable (5).
- (b) Remove and discard clamping sleeve that secures axles (1).
- (c) Using suitable tool, push out the axle pin (2). Securing nylon roller (3).

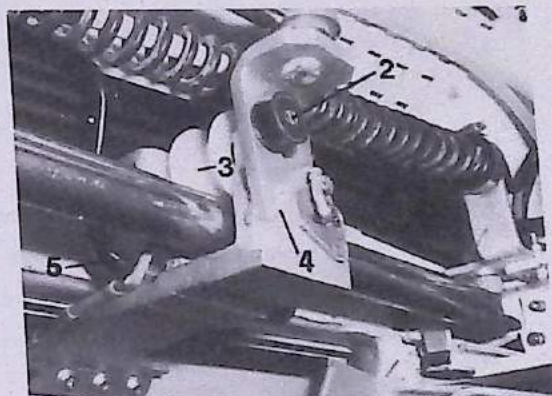


Fig. 508

---

NOTE

Support bracket (4) from below during this operation.

---

- (3) Install

- (a) Upper roller assembly. Fit onto the rail. Fasten the roller and



- secure with new clamping sleeve.
- (b) Position flexible cable (5) and secure.
- (4) Completion
- (a) Door. Refit. (Sect. 5,A)
  - (b) Door cylinder jack. Reconnect. (Sect. 5,D)
  - (c) Door. Adjust. (Sect. 6)
  - (d) Air supply shutoff lever. Set to on.
  - (e) Door electrical power. Switch on. (Chap. 76-00)
  - (f) Door. Test. (Sect. 6)
  - (g) Hatrack. Close. (Chap. 21-00)

#### F. Side Roller Assembly

- (1) Remove
- (a) Hatrack. Open (Chap. 21-00)
  - (b) Air supply shutoff lever. Set to off.
  - (c) Door bulge. Remove.
  - (d) Body bulge section. Remove.
  - (e) Door post and side panel. Remove (Type D and E doors only)  
(Chap. 21-00)

(2) Procedure

Fig. 509

- (a) Support the door panel from below.
- (b) Side roller assembly bracket (2). Disconnect. Remove the three Allen-headed bolts and washers (3).

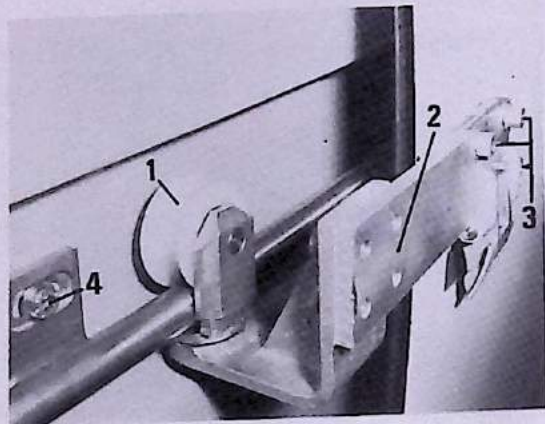


Fig. 509

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NOTE

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Item (b) applies to type D and E door only.

---



Fig. 510

- (c) Side guide rail fastenings.  
Remove (4, Fig. 509, 1,  
Fig. 510).



Fig. 510

- (d) Side roller assembly. Remove. Remove from the side guide rail.  
(3) Install

---

**NOTE**

---

Grease the roller assembly before  
installation.

---

- (a) Roller. Attach to the roller assembly.  
(b) Side roller assembly. Position on guide rail.  
(c) Side guide rail. Reconnect. (Type D and E doors only).  
(d) Side roller assembly bracket. Reconnect to door. Reconnect to the  
door using the three Allen-headed bolts and washers.
- (4) Completion
- (a) Door. Adjust. (Section 6)  
(b) Door bulge. Refit.  
(c) Body bulge section. Refit.  
(d) Air supply shutoff lever. Set to on.  
(e) Hatrack. Close. (Chap. 21-00)



**G. Slider**

- (1) Remove
  - (a) Door. Open and release the pressure.

- (2) Procedure

Fig. 511

- (a) Slider arm. Remove. Remove the three Allen headed bolts.
- (b) Slider. Remove. Release the locking screw (1) to free the slider and remove.
- (c) Slider stop. Remove if required. Remove the rubber buffer to expose the screws. Remove the two screws.

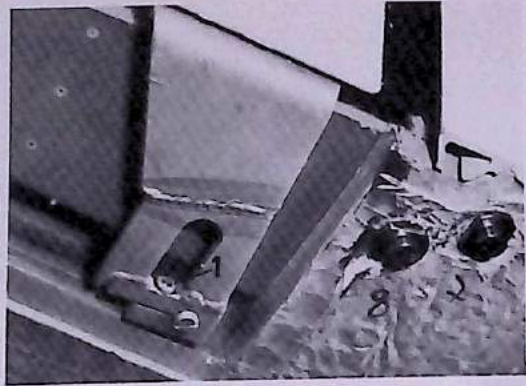


Fig. 511

- (3) Install

- (a) Slider. Install. Insert the slider and fasten with the locking screw (1).
- (b) Slider arm. Refit and secure to the door using the three Allen bolts.
- (c) Slider stop. Install. Install using the two screws. Bond a new rubber buffing strip cut from a sheet.

- (4) Completion

- (a) Slider. Adjust. (Sect. 6).

**H. Door Edge Sealing Strips**

Special tools: Sharp-edged cutting tool.

- (1) Remove
  - (a) Door. Remove. (Sect. 5A)
- (2) Procedure
  - (a) Carefully cut through the glued corners with a sharp-edged cutting tool.
  - (b) Withdraw the seal by pulling out of the channel.



- (3) Install
  - (a) Insert a length of seal into the channel and guide it the length of the door edge until each free end protrudes 35 mm.
  - (b) Cut the overlapping corners so that they butt at 45 degrees.
  - (c) Glue the joint together. Do not glue the seal into the channel.
- (4) Completion
  - (a) Door. Refit. (Sect. 5A). It is not necessary to adjust or test the door if no other work has been carried out.

**J. Weather Strip**

Fig. 512

- (1) Remove
  - (a) From the door frames (6), (10), remove the glued-on rubber strip (1) using a suitable tool.
  - (b) Clean off the old bonding agent.
- (2) Install
  - (a) Measure and pre-cut a length of weather strip. Bond using a rubber-to-composite bonding agent ICEMA K200 or similar.

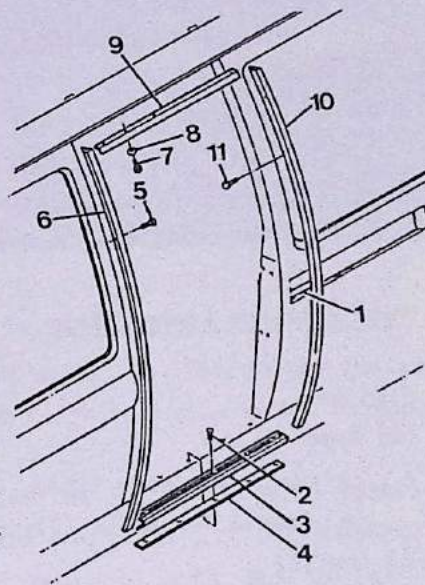


Fig. 512

**K. Door Entrance Weather Strip(s)**

Fig. 512

- (1) Remove
  - (a) Hatrack open. (Chap. 21-00)
  - (b) Door frame trim and door lock cover. Remove. (Chap. 21-00)
  - (c) Door lock. Remove. (See Sect. 5 C)
  - (d) Remove the door frame (6 or 10) by removing either the ten Allen bolts (5) or the eight countersunk screws (11).
- (2) Install
  - (a) When installing take care not to deform the frame strip by over-tightening the fastenings.



- (b) Door lock. Install. (See Sect. 5 C)
- (c) Door frame trim and door lock cover. Refit. (Chap. 21-00)
- (d) Hatrack. Close. (Chap. 21-00)
- (e) Seal the gap between the frame strips and the body structure using Sikaflex 221 or similar.

**L. Door Entrance Kick Strip**

Fig. 512

- (1) Remove
  - (a) Remove the five countersunk screws (2), the kick strip (3) and the distance piece (4).
- (2) Install
  - (a) Using the old kick strip or the distance strip as a template, drill through and countersink a new kick strip.
  - (b) Position the distance strip and the kick strip and fasten using the countersunk screws.

**M. Door Entrance Lintel Strip**

Fig. 512

- (1) Remove
  - (a) Hatrack. Open. (Chap. 21-00)
  - (b) Remove the bolts (7), washers (8) and the strip (9).
- (2) Install
  - (a) Examine the strip for damage.
  - (b) Install using the washers (8) and bolts (7).
  - (c) Install a new plastic strip to metal strip.
  - (d) Hatrack. Close. (Chap. 21-00)



**N. Fast Exhaust Valves**

(1) Remove

- (a) Hatrack. Open. (Chap. 21-00)
- (b) Release the pressure in the door system and set the air supply shut-off lever, to close.

Fig. 513

**NOTE**

The fastenings for valves 4 and 15 are common.

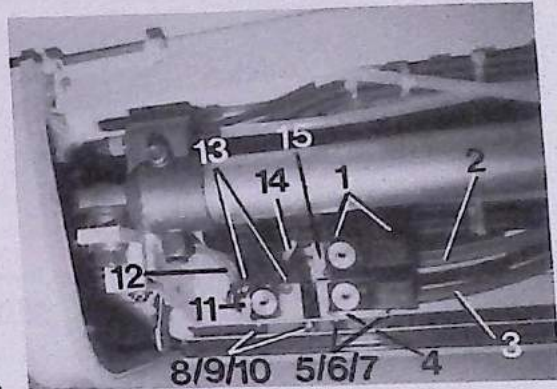


Fig. 513

- (a) To remove the valves (4 and 15), remove the nuts (5), spring washers (6) and washers (7) and withdraw the two bolts (1). Disconnect the electrical plug(s) with the solenoid coils (not shown) and disconnect the air pipe(s) (2,3).
  - (b) To remove the valve (11), remove the nut (8), spring washer (9) and washer (10) and withdraw the two bolts (13). Disconnect the electrical plug (14) with the solenoid coil and the air pipe (12).
- (2) Install
- (a) Install in the reverse sequence.
  - (b) Test. The valves can be heard to operate.

**P. Mechanical Safety Back-up Valve**

(1) Remove

- (a) Hatrack. Open. (Chap. 21-00)
- (b) Air supply shut-off lever. Set to close.



Fig. 514

- (c) Disconnect the air connections (1, 2). Remove the two nuts (3), spring washers (4) and washers (5) and with draw the two bolts (not shown).

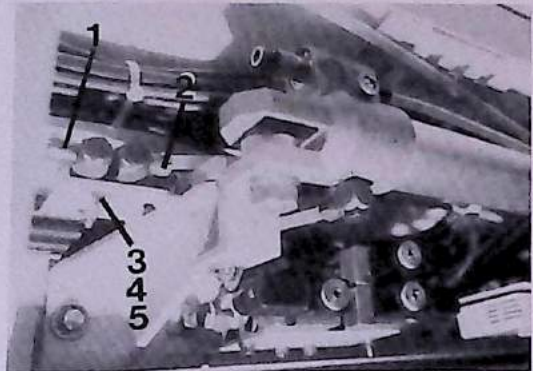


Fig. 514

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**NOTE**

---

The spring of the actuator is under tension. Take care not to lose the spring when removing the valve.

---

- (2) Install
- (a) Install in the reverse sequence.
  - (b) Adjust. (see Sect. 6A)
  - (c) Test. (see Sect. 6B)



6. Adjustment/Test

A. Adjustment

(1) Door

Special tools: Ruler

- (a) Door bulge and body bulge section. Remove.
- (b) Hatracks. Open or remove (Chap. 21-00)
- (c) Air supply shut-off lever. Set to close.
- (d) Door cylinder jack. Remove from the door. (Sect. 5)
- (e) Lock cover. Remove. (Chap. 21-00)
- (f) Side guide rail. Set to the mid position of adjustment slots and secure with the bolts.
- (g) Close and manually lock the door.
- (h) Upper guide rail. Adjust:
  - 1 Slacken off the locknuts on both adjusters
  - 2 Adjust the rail until the door gap (see Fig. 601) is approx. 0,4 ins (10 mm).
  - 3 Lock the adjusters.

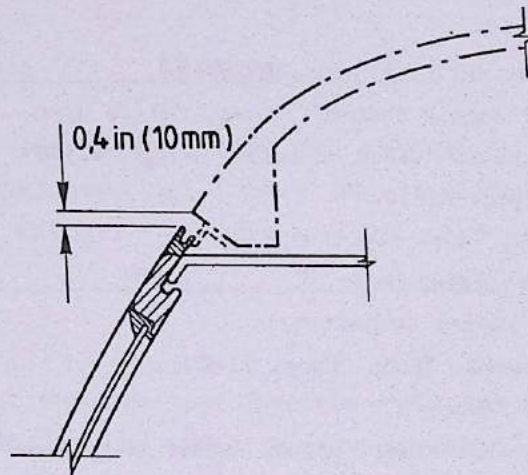


Fig. 601 Door Adjustment

(j) Open and close the door:

- 1 Check that the door runs parallel. Raise or lower the ends of the upper guide rail to adjust. Adjust again so that the upper



part of the door is flush with the car body. Lock the adjuster.

- 2 Check that the door does not cant when opened. Adjust the side roller guide rails that the door does not cant when opened or closed and so that the center part of the door is flush with the car body.
- (k) Close and lock the door.
- (l) Check the closed door fit. Adjust the slider until the best possible alignment is obtained:
- 1 Unscrew the locking screw to loosen.
  - 2 Turn the adjustment screw to align the door.
  - 3 Tighten the locking screw.

---

NOTE

---

Re-adjust the upper and side guide rails or lock if necessary. (see 6A (7)).

---

- (m) Door cylinder jack. Reconnect.
- (n) Air supply shut-off lever. Set to open.
- (p) Hatracks. Close or refit. (Chap. 21-00)
- (q) Bulges. Refit.
- (r) Door. Test. (Section 6 B)
- (2) Pneumatic Valve Unit
- Special tools: Stopwatch
- (a) Hatracks. Open. (Chap. 21-00)
- (b) Door. Open.
- (c) Door electrical system. Switch on. (Chap. 76-00)
- (d) Door air system. Ensure on.
- (e) Pneumatic valve unit. Adjust:



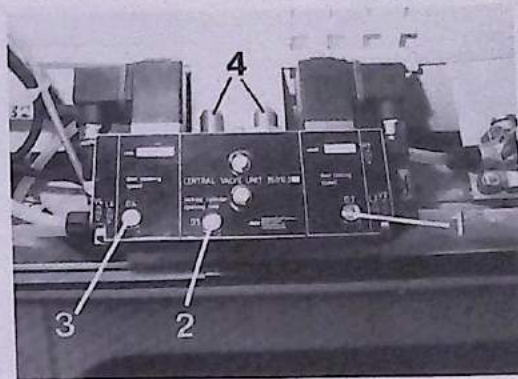


Fig. 602 Pneumatic Valve Unit Adjustment

- 1 Adjust the close throttle D2 (1) until the head is flush with the valve unit face.
- 2 Adjust throttle D5 (2) until it is halfway.
- 3 Adjust the open throttle D4 (3) until the door unlocks and opens in not more than 4,0 secs

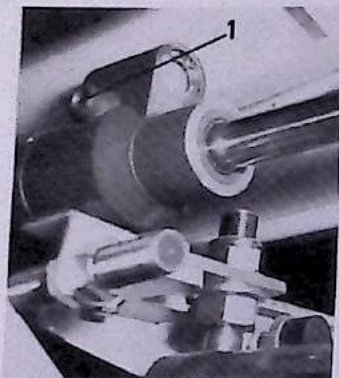
CAUTION

THE ADJUSTERS (4) FOR THE PRESSURE SWICHD VALVE ARE FACTORY PRESET. DO NOT ADJUST.

- 3 Readjust the door open throttle until the door opens smoothly and without undue force. Do not reduce the door open time below 3,5 secs; do not increase the door open time above 4,0 secs.
- (f) Hatrack. Close. (Chap. 21-00)
  - (3) Door Cylinder Jack
    - (a) Hatracks. Open. (Chap. 21-00)
    - (b) Door electrical system. Switch on. (Chap. 27-00)
    - (c) Door air system. Ensure on.
    - (d) Door cylinder jack. Adjust:



door opening



door closing

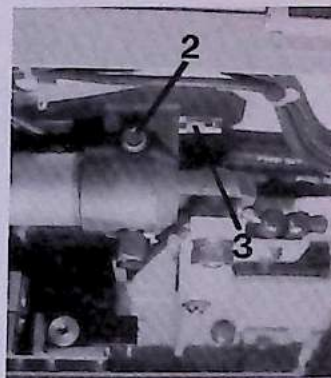


Fig. 603 Door Cylinder Jack Adjustment (Only Door Types A, B, D, E)

- 1 Adjust the throttle (3) until the door closes and locks between 4.0 and 6.0 seconds.
- 2 Adjust the vent valve restrictor (1) until the door cushions very smoothly to the mechanical door stop at the end of opening travel.
- 3 Adjust the vent valve restrictor (1) until the door cushions to a stop for the last 6 ins (100 mm) of opening travel

---

**NOTE**

---

The door should close firmly, without hesitation, without impact. A door not under maintenance can be used as a guide.

---

- 4 Adjust the pneumatic valve unit if the opening time is outside 3.5 to 4.0 seconds and the closing time is outside the limits of 4.0 to 6.5 secs.

- (e) Hatracks. Close. (Chap. 21-00)
- (4) Pressure Sensitive Edge
  - (a) Door bulge. Remove. (Chap. 21-00)
  - (b) Switch cover plate. Remove. (Location see Fig. 2)
  - (c) Door electrical power. Switch on. (Chap. 76-00)



- (d) Air supply shut-off lever. Set to close.
- (e) Pressure sensitive edge switch. Adjust:

---

**CAUTION**

---

THE ADJUSTERS FOR THE PRESSURE SENSITIVE EDGE SWITCH ARE FACTORY PRESET. DO NOT ADJUST, UNLESS IT IS ABSOLUTELY NECESSARY.

---

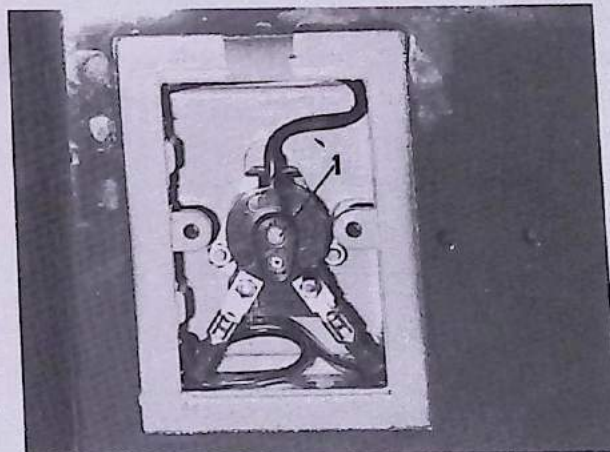


Fig. 604 Pressure Sensitive Edge Adjustment

- 1 Very carefully screw the switch set screw (1) clockwise until the door pneumatic valve is heard to switch over from "door close" to "door open". Then unscrew the set screw (1) a quarter of a turn counter clockwise.
- 2 Press and hold the pressure sensitive edge. Check that the switch "door obstructed" signal cancels after 8 to 15 seconds.



---

**NOTE**

---

When the time from pressing the pressure sensitive edge to the "door obstructed" signal cancels is less than 2 seconds, check the pressure sensitive edge for leaks.

---

- (f) Switch cover plate. Refit.
- (g) Door bulge. Refit. (Chap. 21-00)
- (5) Electrical Safety Backup Switch (Fig. 606)
  - (a) Using the pushbutton, open the door.
  - (b) Loosen two screws (3) and slide the pusher(s) against the microswitch (4) until the microswitch plunger is fully depressed.
  - (c) Tighten screws (2).

---

**CAUTION**

---

TO AVOID DAMAGE TO THE MICROSWITCH (4)  
ENSURE THE BODY OF THE SWITCH DOES NOT  
CONTACT THE PUSHER (5).

---

- (d) Assemble a rope connected to a spring balance, the spring balance having a sliding pointer. Tie one end of the rope to a post and the other end to the door side roller assembly so that the door will be stopped by the rope at approx. one third before end-of-closing.



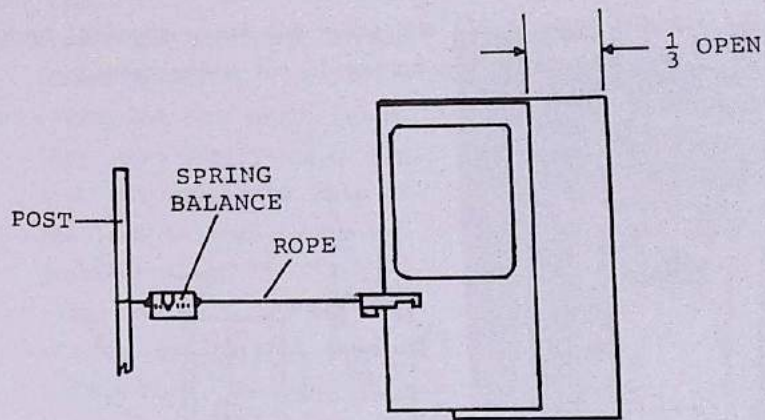


Fig. 605 Layout of Equipment

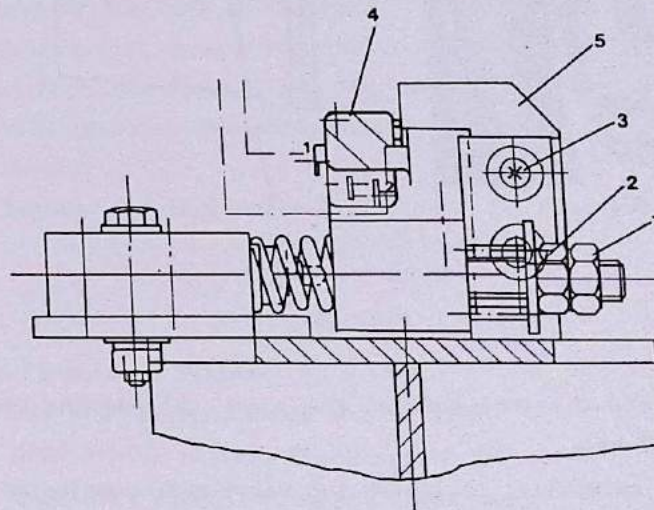


Fig. 606 Safety Backup Adjustment

- (e) Close the door using the pushbutton.
  - (f) The door will be stopped by the rope. The force on the scale must not exceed 25 lb.
  - (g) Open the door and recheck the microswitch setting.
  - (h) If necessary, adjust the valve spring adjuster (2) and safety with locknut (1).
- (6) Mechanical safety backup valve (Fig. 607)
- (a) Disconnect the electrical safety backup switch (3)



- (b) Assemble a rope as in (5) (d)
- (c) Slacken locknut (1) and screw out the mechanical backup valve adjuster (2) until the spring is not under tension

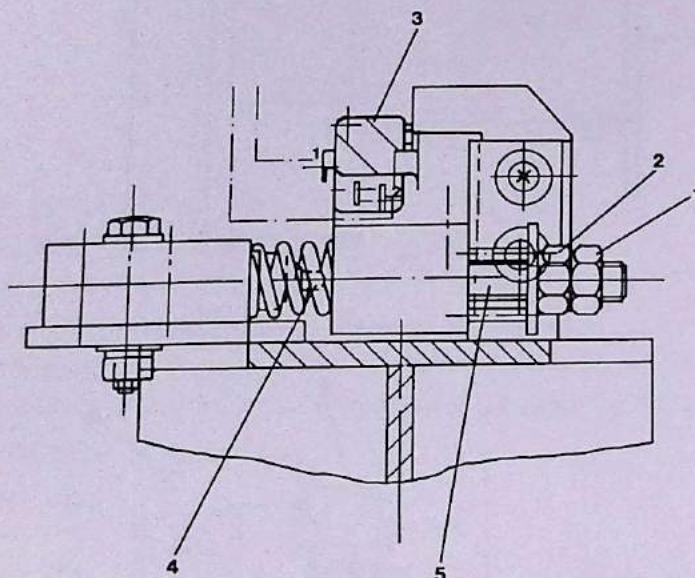


Fig. 607

- (d) Set the distance between the block (5) and the pin (4) to 0.008 in (2 mm).
- (e) Very carefully, retighten the valve spring adjuster (2) until the spring starts to compress and then turn five more complete turns of the adjuster.
- (f) Close the door using a pushbutton. Check that when the door stops the spring balance reads a max. of 25 lbs. Readjust if necessary. Tighten the locknut (1); recheck.
- (g) Reconnect the electrical safety backup switch.
- (h) Reconnect the pressure sensitive edge switch.
- (j) Remove the rope.
- (k) Hatrack. Close. (Chap. 21-00).
- (l) Door. Test. Carry out a practical test only by operating the door.



**(7) Door Lock**

- (a) Remove the door lock cover.  
(Chap. 21-00)
- (b) Loosen the four bolts (1) so that they still grip the lock but allow the body of the lock to move in the adjustment slots.
- (c) Close the door. Set the body of the lock so that it does not prevent the door from closing flush to the car body.
- (d) Operate the door. Adjust the body of the lock so that the door spigot enters the lock without restriction and the lock operates correctly and easily.
- (d) Tighten the four bolts (1).

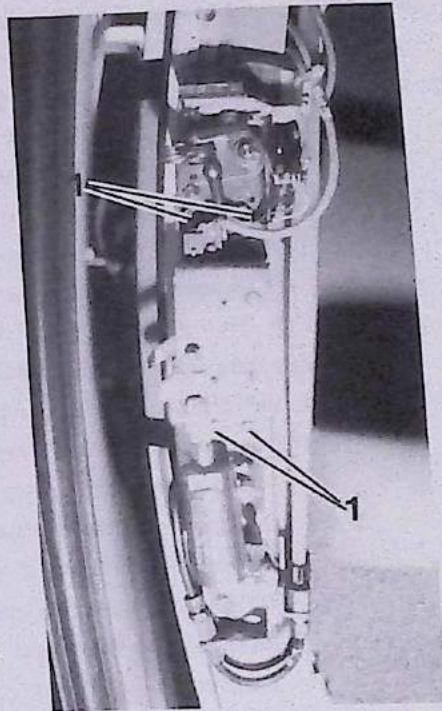


Fig. 608

**B. Test****(1) Door Electrical System**

- (a) RUN/STOP switch. Check set to STOP.
- (b) DOOR BYPASS switch. Check set to OFF.
- (c) DOOR OPEN circuit breaker. Check made.
- (d) Door electrical power. Switch on. (Chap. 76-00)
- (e) System air pressure. Check on. Set the DOOR AIR ON/OFF switch to ON.
- (f) Door post panels. Remove. (Chap. 21-00)
- (g) Hatracks. Open (Chap. 21-00)
- (h) Door electrical system. Test:
  - 1 Operate the doors open and closed using the pushbuttons. Make certain that:
    - each pushbutton operates the door(s) assigned to it
    - the DOORS OK indicator lights when all doors are closed
    - the white indicator on the front door, end car rear door and car 3 panels lights when the RUN-STOP switch is at STOP and



- the DOOR AIR-ON/OFF switch is at ON to show that the doors are ready for operation
- the door entrance lamp lights when a door opens.
  - the DOORS OK light goes out
- 2 Open a door. Check that the DOOR OPEN indicator lights. Set the RUN/STOP switch to RUN Check that:
- the monorail can not be set in motion with any door open
- 3 Set the RUN/STOP switch to STOP.
- 4 Close the doors.
- 5 Open an emergency exit hatch. Check that the ROOF OPEN indicator lights. Set the RUN/STOP switch to RUN. Check that:
- the monorail can not be set in motion.
- 6 Set the RUN/STOP switch to STOP.
- 7 Close the emergency exit hatch. Press the ALARM RESET - push button and check that the ROOF OPEN indicator light goes out.
- 8 Open all doors.
- 9 Close each door in turn. Strike the pressure sensitive edge with a hand before the door reaches the 10 mm before closing switch Check that:
- the door opens immediately and without hesitation
  - the force required to operate the sensitive edge switch would not hurt or injure a person struck by the door.
- 10 Open all doors.
- 11 Close the door shutoff valve
- 12 Select each door to close in turn. Check that the door pneumatic valve is heard to switch over from "door close" to "door open" after 10 seconds.
- 13 Open the door air shutoff valve
- 14 Disconnect the pressure sensitive edge switch wiring from the door immediately before commencing item 15.
- 15 Close each door in turn. Prevent the door from closing by allowing the door to hit an obstruction before it can enter the door aperture. Check that:
- the door stops closing
  - the door can be moved by hand without opposing air pressure from the door jack.
- 16 Reconnect all door pressure sensitive switches wiring.
- 17 Doors. Close.



- 18 Doors. Open each door in turn by using the mechanical handle before carrying out item 19. Check that the door opens without opposing air pressure from the door jack.
- 19 Disconnect each door locked switch in turn. Close and lock the door. Check that:
- the DOOR OPEN indicator lights
- 20 Reconnect each door locked switch after item 19 and before checking the next door.
- 21 Disconnect each door closed switch in turn. Close and lock the door. Check that:
- the DOOR OPEN and the DOOR FAIL indicators light
- 22 Reconnect each door closed switch after item 23 and before checking the next door.
- 23 Close all doors.
- 24 DOOR AIR ON/OFF switch. Set to DOOR AIR OFF.
- 25 Open or close the doors until the pressure fails.
- 26 DOOR AIR ON/OFF switch. Set to DOOR AIR ON.
- 27 Any door. Open. Check that the DOOR OPEN indicator lights. RUN-STOP switch, set to RUN.
- 28 DOOR BYP ON/OFF switch. Set to DOOR BYP ON. Check that:
- the monorail can be set in motion.
- 29 RUN/STOP switch. Set to RUN.
- 30 DOOR BYP ON/OFF switch. Set to DOOR BYP OFF.
- 31 All doors. Close
- 32 Set the monorail in motion.
- 33 Select DOOR OPEN on the drivers door from the primary console. Check that:
- the door does **not** open

---

**CAUTION**

---

CARRY OUT ITEMS 34 AND 35 ONLY WHEN SUFFICIENT CLEARANCE AROUND THE TRAIN IS AVAILABLE TO AVOID A COLLISION WITH AN OPEN DOOR OR AN OPEN ROOF EXIT.

---



34 During a slow run, open the drivers door. Check that:  
- the monorail stops

35 During a slow run, open an emergency roof exit hatch. Check that:  
- the monorail stops.

(j) Restore the system to normal operation.

(2) Door Air System

---

NOTE

---

All pneumatic units can be heard when operating.

---

(a) Hatracks, Open if closed. (Chap. 21-00)

(b) Door electrical power. Check on. (Chap. 76-00)

(c) Door air system. Check on.

(d) Door air system. Test:

1 Operate the doors open and closed. Make certain that:

- each door opens within 3,5 to 4,0 seconds and closes within 4,5 to 6,0 seconds
- The door cushions to a stop at the end of travel in both directions

2 With the air generator stopped, check that the accumulator retains sufficient pressure to open all doors

(e) Hatracks. Close. (Chap. 21-00)



## 7. Cleaning / Painting

### A. Cleaning

- (1) The outer paintwork and glass windows can be cleaned using any normal detergent-free cleaning agent. The Plexiglass windows should be well rinsed with clean water, allowed to dry and then polished using a suitable plastic polishing compound and a non-abrasive cloth.
- (2) The inside of the door should be cleaned using a soft cloth damped with a weak solution of a non-detergent cleaning agent in warm water. Persistent marks may be removed using a soft brush and a stronger cleaning agent but this should be immediately followed with sufficient water to neutralize the agent.

### B. Painting

The outside surface of the door is painted with high-gloss paint. Refer to Chapter 11-00.



***MBB***

Transportation  
Technology Division

# CHAPTER 23-00 WINDOW SYSTEM

Jan. 88



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## CHAPTER 23

## WINDOW SYSTEM

1. Description and OperationA. Description (Fig. 1)

## (1) General

The Mk V monorail has fixed and opening windows in the passenger cars and only fixed windows and a windscreen in the cabins. Maintenance staff pre-set the opening windows to either the open, mid open or closed position. The position of the opening windows cannot be changed by the passengers.

## (2) Windscreen (Front/Rear Cabin)

The windscreens are large mouldings made from 0.23 in (6mm) grey tinted, acrylic material. They are retained to the structure of the cabins with black rubber weather strip seals. The seal acts as a watertight seal and a vibration absorbing medium.

## (3) Fixed Windows

The fixed non-opening windows in the cars and cabins are of similar construction, the difference being the shape of the windows and the addition of an angle strip with distance piece on the windows in the cars. Each window has an acrylic transparency set with a rubber seal into an anodized window frame. The window frame is attached to the window mounting with countersunk screws. The window mounting is bonded into the window aperture. The assembly must be removed and replaced as a complete assembly.

## (4) Plug Door Windows

The window in each plug door is bonded into the window aperture of the door. The bonded joint acts as a watertight seal.

## (5) Opening Windows

The opening windows have plastic grips fitted on each side near the top of the window transparency. A latching mechanism is fitted to an angle bracket on the lower edge of the window assembly. A lock under the seats and the latching mechanism on the window are interconnected



with a Bowden Cable.

A window frame houses the transparency guide rails and is screwed to the main window mounting. The window mounting is bonded to the inside of the window aperture. A rubber weather strip is fitted into a keyway in the window frame. This strip impinges on the outside of the transparency and on the car body. If any rainwater should seep through the seal, a rubber gutter and a drain tube are fitted to the bottom of the window compartment to drain away the moisture.

(6) Latching Mechanism

The latching mechanism is mounted on a long plate which is bolted to a long rightangled mounting bracket fitted to the bottom of the window frame. The mechanism is free to move up and down with the window. Riveted to the long plate are rightangled guide brackets with two horizontal, spring tensioned rods. Welded to the outer ends of the rods are forkends fitted with "U" shaped rollers and retained with a clevis pin and cotter pin. The "U" shaped rollers travel on rails fitted with distance pieces to the inside of the window frame. There are three detent notches cut out of each side of the rails. The detents are located one at the top end of travel, one midway, and one at the lower end. A cam attached to a lever is mounted in a bush on the long plate between the inner ends of the horizontal rods. The rollers can be locked into one of three positions. A sliding adjuster with a grubscrew is fitted to both horizontal rods. The purpose of the adjuster is to tension the springs and to compensate for loss of spring tension.

Installed on the shorter horizontal rod is a return spring anchor plate and a clevis forkend. The clevis is fitted to the cam lever. Underneath the longer rod is an anchor plate for the Bowden cable adjuster.

(7) Window Lock

A lock is fitted under each of the center seats of the back to back bench. The two forward windows on the right of the forward facing bench and the forward window on the left of each car are locked from the lock under the forward facing seat. The two rear windows on the right and the rear window on the left of each car are locked from the lock under the rear facing bench.

The lock is a web channel shaped unit with an eccentric barrel at one end and three apertures in the web to accommodate the cable adjuster.



ters. A flat plate fitted to the eccentric barrel has three holes to retain three tensioning springs.

(8) Bowden Cable

Bowden cables are fitted between the cam lever on the latching mechanism and the lock under the seats. The cam lever end has a fork-end fitting. A cable with a soldered end to prevent fraying, is connected to a cable clamp by a clamp bolt. The outer casing of the cable sits in cable adjusters which are anchored adjacent to the lock and latch mechanism. The cable adjusters are each threaded and locked to side anchor plates by locknuts. The cable adjusters provide adjustment in the system if parts wear or the cable stretches. The cable is tensioned by a spring attached between the cable clamp and the eccentric barrel on the lock.

B. Operation

(1) Window Locking and Unlocking

A key unlocks the bowden cables to the windows to be unlocked. Two window grips are used to pull the window until the rollers on the latch mechanism engage into the appropriate detent notches for the window position required i.e. closed, open, or half open.

If the latch rollers are engaged before this operation is started, sufficient force must be applied to overcome the spring force between the cable clamp and the eccentric barrel on the lock.

(2) Window Locking

When the desired detent notch has been engaged, the appropriate key is turned clockwise to lock the appropriate window. The barrel of the lock will now turn and draw the Bowden cable inner cable through the outer casing against the tension of the spring. On the latch mechanism, the cam lever attached to the other end of the cable will be pulled. This will rotate the cam in the bush and impinge the crests of the cam against the ends of the horizontal rods. The window will now be locked in the required position.

(3) Window Unlocking

To unlock the window, the window in the seat lock is turned counter-clockwise. The barrel in the lock turns and the inner cable is slackened and tension taken up by the return spring on the other end of the cable. The cam lever moves the cam crests away from the horizontal rod ends. The window is now in the unlocked position.



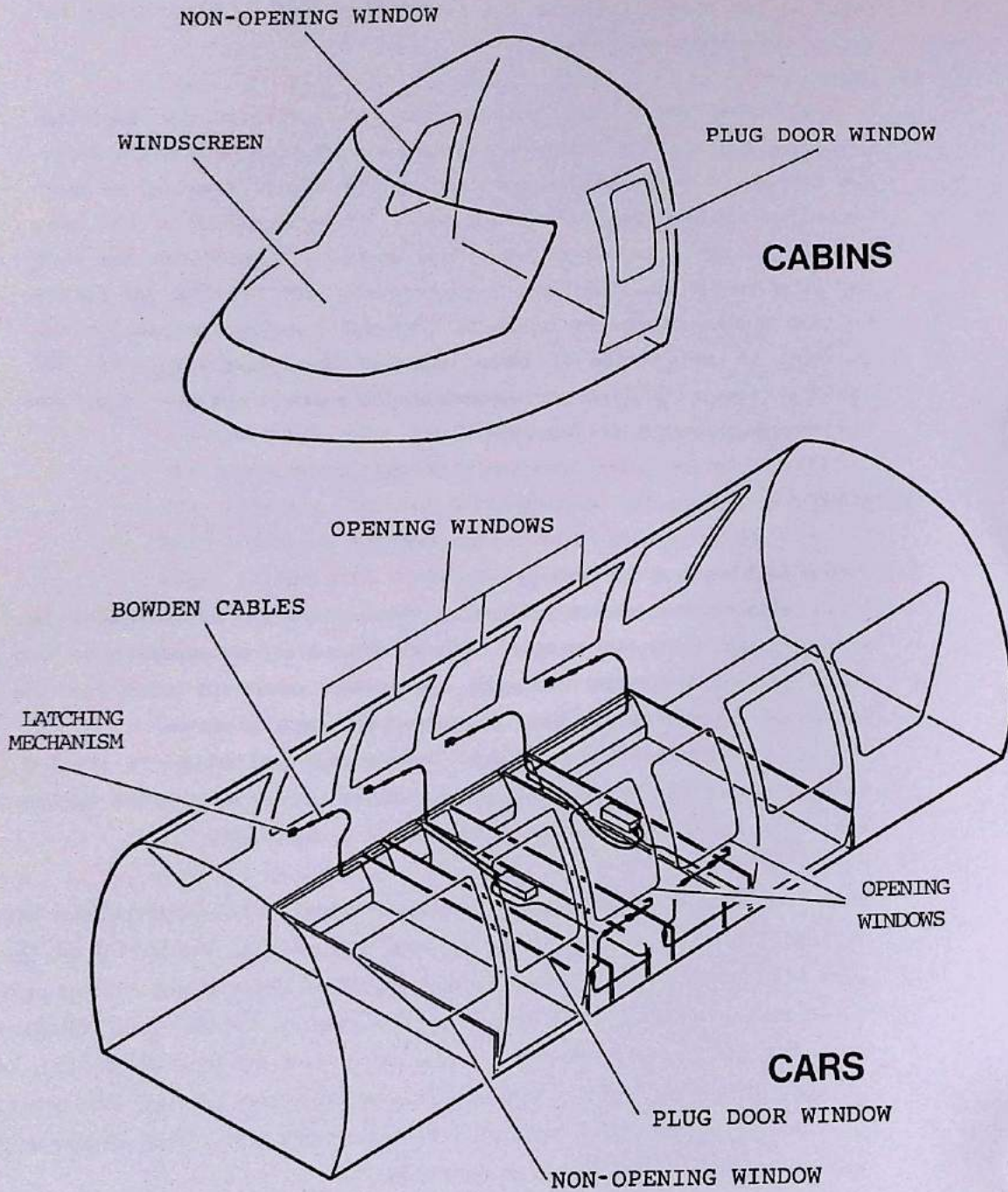


Fig. 1 Windows-General Arrangement



## 2. Fault Isolation

### A. Opening window

- (1) Window does not lock or unlock;
  - (a) Remove a seat (Chap. 25-00) to gain access to the lock.
    - 1 Adjust the Bowden cable (see Sect. 6A)
    - 2 Replace the Bowden cable if frayed or broken (see Sect. 5).
  - (b) Ensure the Bowden cable is secure at the lock end;
    - 1 Adjust the Bowden cable (see Sect. 6A)
    - 2 Replace the Bowden cable if frayed or broken (see Sect. 5).
  - (c) Remove the seat (Chap. 25-00) to gain access to the window panel.
  - (d) Remove the side panel(s) (Chap. 21-00) to gain access to the window latch;
    - 1 Retighten and adjust the Bowden cable (see Sect. 6A)
    - 2 Replace the Bowden cable if frayed or broken (see Sect. 5).
  - (e) Operate the lock and inspect the shoot bolts:
    - 1 Grease the shoot bolts if sticking
    - 2 Refer to the manufacturer for repair action if the bolt is unserviceable.
  - (f) Install the side panel(s). (Chap. 21-00)
  - (g) Install the seat(s). (Chap. 25-00)



**3. Maintenance Practices**

The maintenance schedule is shown in Table 301.

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
1	Fixed Window - Cars	Inspection of bonding seals and rubber seals.	TI-23.0001	On replacement and annual
2	Fixed Window - Cabins	Inspection of bonding seals and rubber seals.	TI-23.0002	On replacement and annual
3	Windshield - Cabins	Inspection of rubber seals.	TI-23.0002	On replacement and annual
4	Opening window Cars	Functional test of windows. Inspection of bonding seals and rubber seals.	TI-23.0004	Quarterly Annual
5	Bowden cable	Function test of windows. Examination of cable condition	TI-23.0004	Quarterly Annual
6	Guide Roller	General function check	TI-23.0010	Quarterly
7	Spring	General function check	TI-23.0010	Quarterly
8	Cross bar	General function check	TI-23.0010	Quarterly



Table 301. (Continued)

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
9	Guide rail	General function check	TI-23.0011	Quarterly
10	Guide rail	General function check	TI-23.0011	Quarterly
11	Guide rail	General function check	TI-23.0011	Quarterly

Table 301 - Maintenance Practices (Sheet 2 of 2)



**5. Removal/Installation****A. Windscreen**

(1) Removal

Fig. 501

- (a) Remove filler (1) from seal  
(2) using non-metallic tool  
(Fig. 502-1).

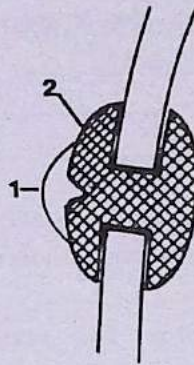


Fig. 501

---

**CAUTION**

---

The seal is very flexible. If it is to be reused, it must be removed with care.

---

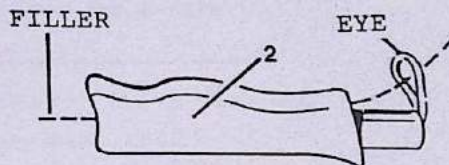


Fig. 502

Fig. 503

- (b) Remove seal (1) from  
windscreen (2).

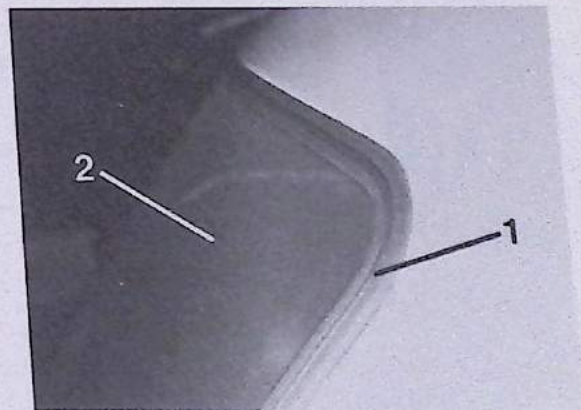


Fig. 503



---

**WARNING**

---

USE A MINIMUM OF TWO MEN TO REMOVE THE WINDSCREEN. IT WEIGHS APPROX. 70 LBS.

---

(f) Ease the seal off the windscreen surround from inside the cab and remove the windscreen complete with seal.

(2) Install

- (a) Examine the structure for freedom from damage. Repair the paintwork (Chap. 11-00) if damaged.
- (b) Examine the transparency for freedom from scratches or cracks.
- (c) Replace the seal if necessary.

---

**NOTE**

---

A new windscreen is supplied complete with a new seal and filler.

---

(d) Lay a line of wire or suitable cord in the seal groove around outside of seal.

---

**WARNING**

---

THE WINDSCREEN WEIGHS APPROX. 70 LBS.

---

- (e) Pull the seal onto the windscreen surround using the wire (cord) on the inside and the tool. (Fig. 502-1)
- (f) Apply a soap and water solution to the filler groove in the seal.
- (g) Using the special tool (Fig. 502-2), insert the filler into the groove.



---

**NOTE**

---

Do not start installing the filler at the clamp profile joint. To help installation, press the filler into the groove with the thumb and simultaneously, draw the tool with filler around the total circumference of the windscreen seal.

---

- (h) Test the windscreen for leaks.

---

**NOTE**

---

If a leak is found, remove the filler. Spread a layer of a suitable non-hardening elastomer between the seal and the outer windscreen. Press the seal into place. Install the filler and press on the seal to spread the elastomer. Wipe off any excess elastomer and test the windscreen for leaks.

---

- (j) Install the side wall and windscreen trims. (See Chap. 21-00)  
(k) Install the front fairing. (See Chap. 21-00)  
(l) Install the seats. (See Chap. 25-00)

**B. Fixed Window****Fig. 504****(1) Removal**

- (a) Remove the corner seat.  
(Chap. 25-00)  
(b) Remove the side wall trim  
(1) and the window surround  
trim (2). (See Chap. 21-00)

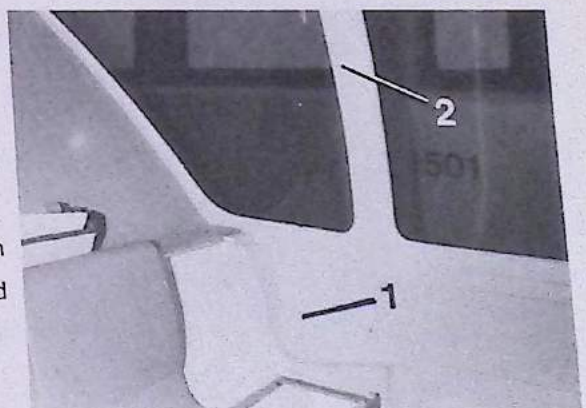
**Fig. 504**



Fig. 505

---

**CAUTION**

---

THE SEAL IS OBSTINATE TO REMOVE BE-  
CAUSE OF ITS SHAPE. TAKE CARE WHEN  
REMOVING IF IT IS TO BE REUSED.

---

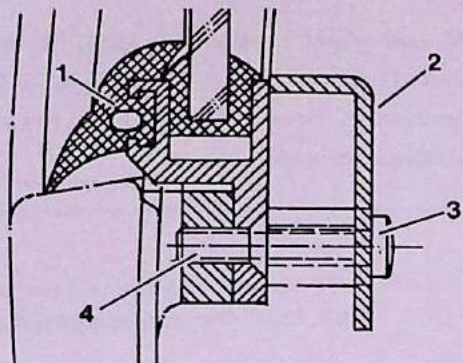


Fig. 505

- (c) Using a suitable non-metallic tool (Fig. 502-1), insert tool behind weather seal (1) and remove beginning at the seal joint.

Fig. 506

- (d) Remove the foam strip (1) from the window mounting.

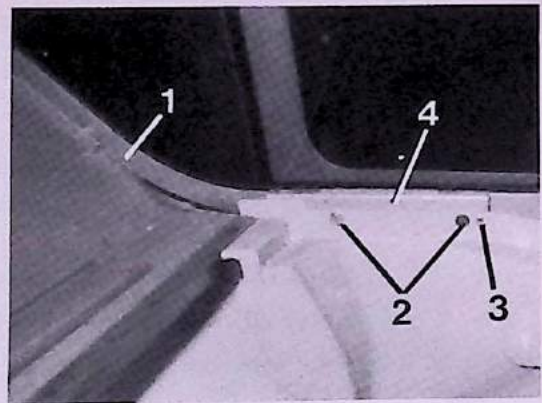


Fig. 506

- (e) Remove the screws (Fig. 505.3), fastening the angle (Fig. 505.2). Remove the angle (Fig. 505.2) and the distance pieces (see also Fig. 506.3 and 4)
- (f) Remove the transparency by removing the screws (Fig. 505.4) from the window mountings.
- (2) Install
- (a) Examine the window mounting for freedom from damage.



---

**NOTE**

---

A replacement window is supplied complete with new matched mounting strips which have to be bonded to the window surround.

---

- (b) Examine the transparency for freedom from scratches or cracks.
- (c) Install the transparency to the window mounting using the screws (505.4).
- (d) Fit a new self-adhesive strip.

---

**NOTE**

---

Use locally purchased self-adhesive draft excluding strip.

---

- (e) Refit the angle (Fig. 505.2) using the screws. (Fig. 505.3)
- (f) Install the weather seal. (Fig. 505.1)
- (g) Test the window for leaks.
- (h) Install the window trim (Fig. 504.2) and the side wall trim. (Fig. 504.1) (Chap. 21-00)
- (j) Install the corner seat. (Chap. 25-00)

**C. Opening Window****(1) Removal**

- (a) Remove the seats as required. (Chap. 25-00)

**Fig. 507**

- (b) Remove (as required) the side wall trim (1) and window surround trim (2). (Chap. 21-00)

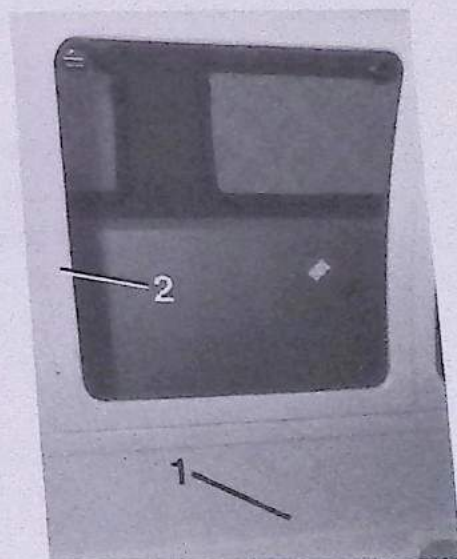
**Fig. 507**



Fig. 508

---

**CAUTION**

---

THE SEAL IS OBSTINATE TO REMOVE BECAUSE OF ITS SHAPE. TAKE CARE WHEN REMOVING IF IT IS TO BE REUSED.

---

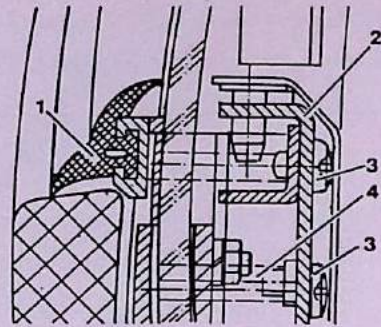


Fig. 508

- (c) Using a suitable non-metallic tool (Fig. 502-1), insert tool behind weather seal (1) and remove beginning at the seal joint.

Fig. 509

- (d) Remove the screws (1) and (2) fastening the angle (3) (see also Fig. 508.2, 3). Remove the angle and distance pieces (Fig. 508.4).

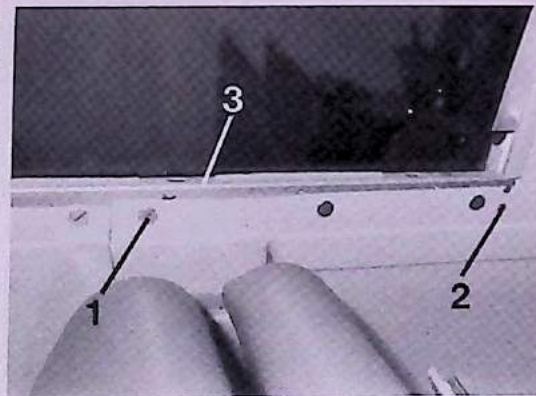


Fig. 509

Fig. 510

- (e) Disconnect the Bowden cable (1) from the cam lever (2) and the cable adjuster (3). (See Sect. 5. F)

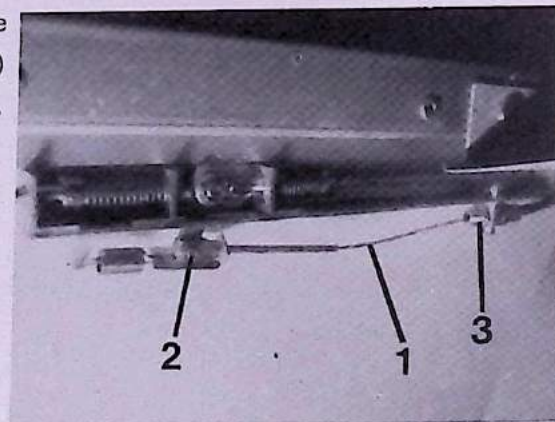


Fig. 510



Fig. 511

- (f) Remove the screws (3) securing angle at top of window frame. Remove angle.
- (g) Remove plastic rivets (4) from LH/RH side of window frame and remove gap cover (1).
- (h) Remove screws (2) securing window frame and carefully remove upper frame.
- (j) Remove lower section of the window frame by removing the screws attaching the frame to the bonded base.

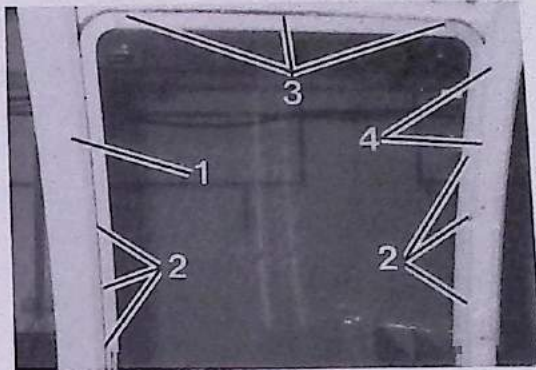


Fig. 511

---

**NOTE**

To gain access to these screws, the interior air ducting must be removed.

---

**(2) Install**

- (a) Examine the window mountings for freedom from damage.

---

**NOTE**

A replacement window is supplied complete with new matched mounting strips which have to be bonded to the window surround.

---

- (b) Examine the transparency for freedom from scratches or cracks.



- (c) Install the window to the bonded window mountings in reverse sequence to removal.

---

NOTE

---

When installing the gap cover, use new plastic rivets if necessary.

---

- (d) Refit the angle (Fig. 509.3) using the distance pieces (Fig. 508.4) and screws (Fig. 509.1, 2)
- (e) Reconnect the Bowden cable to the latching mechanism. (See Sect. 5.F)
- (f) Adjust the Bowden cable (See Sect. 6.A)
- (g) Test the windows locking mechanism (See Sect. 6.B)
- (h) Install the weather seal (Fig. 508.1)
- (j) Test the window for leaks.
- (k) Install the window surround (Fig. 507.2) and the side wall trim (Fig. 507.1) (Chap. 21-00)
- (l) Install any seats removed. (Chap. 25-00)

#### D. Plug Door Window

- (l) Remove
  - (a) Close, lock and immobilize the door. (Chap. 22-00)
  - (b) Using a suitable non-metallic tool (Fig. 502.1), insert tool behind weather seal and remove beginning at the seal joint.

---

CAUTION

---

THE SEAL IS OBSTINATE TO REMOVE BECAUSE OF ITS SHAPE. TAKE CARE WHEN REMOVING IF IT IS TO BE REUSED.

---

- (c) Using a sharp knife, cut around the edge of the transparency and remove.



---

**NOTE**

---

As an alternative to (c), pierce a hole through the adhesive at the edge of the window and cut out the window using a wire.

---

**(2) Install**

- (a) Remove all old adhesive.
- (b) Examine the transparency for freedom from scratches or cracks.
- (c) Glue the window into the door frame using SIKAFLEX TECHNIQUE 255. (or equivalent)
- (d) Remove excess adhesive.
- (e) Test for leaks. Seal any leaks with adhesive.

---

**NOTE**

---

Allow the adhesive to cure before testing for leaks.

---

- (f) Install the weather seal.

---

**NOTE**

---

Seat the seal by tapping on a piece of wood placed against the seal.

---

- (g) Retest for leaks.



**E. Lock Mechanism**

(1) Removal

Fig. 502

- (a) Remove seat (Chap. 25-00)
- (b) Operate lock (1) to unlock window and remove tension from Bowden cables (2).
- (c) Disconnect the three Bowden cables from the eccentric barrel.
- (d) Loosen screws from cable clamps and remove locknuts (3) from the three cable adjusters (4).

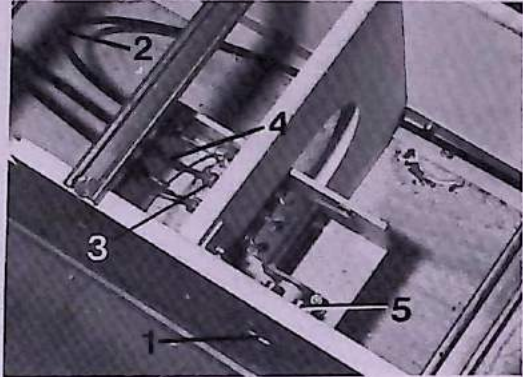


Fig. 502

- (e) Remove cable adjusters from anchor plate.
- (f) Refit locknuts to cable adjusters.
- (g) Remove bolts (5) and spring washers securing lock to inside of seat box.
- (h) Remove lock.

(2) Install

- (a) Align bolt holes in lock with threaded inserts in seat box and fit bolts (5) and spring washers.
- (b) Remove nuts (3) from the three cable adjusters (4).
- (c) Insert cable adjusters into anchor plate.
- (d) Fit locknuts (3). Do not tighten at this stage.
- (e) Connect the inner cables to the clamps.
- (f) Do an adjustment of Bowden cables (Sect. 6A).
- (g) Do a test of window locking mechanism (Sect. 6B).
- (h) Fit seat (Chap. 25-00)
- (j) Ensure that the work area is clean and free from debris, and that all tools have been removed.



F. Bowden Cable

(1) Remove

Fig. 503

- (a) Remove appropriate side panel (Chap. 21-00).
- (b) Disconnect return spring (6) from clevis forkend.
- (c) Remove cotter pin (1) from clevis pin (2).
- (d) Remove clevis pin (2) and washer (3) to disconnect forkend from cam arm.
- (e) Loosen nut (4) unscrew forkend from cable adjuster and remove nut and forkend.
- (f) Loosen nut (7) holding cable adjuster to anchor bracket.
- (g) Remove cable adjuster from anchor bracket.
- (h) Refit nut (4) removed at operation 1 (e).
- (j) Remove appropriate seat (Chap. 25-00).
- (k) Disconnect appropriate inner cable (8) from lock barrel by slackening the screw on the clamp.
- (l) Loosen nut (10) holding cable adjuster (11) to anchor bracket.
- (m) Remove cable adjuster from anchor bracket.
- (n) Loosen nut (12) on gland assembly in ducting.
- (p) Withdraw Bowden cable and remove.

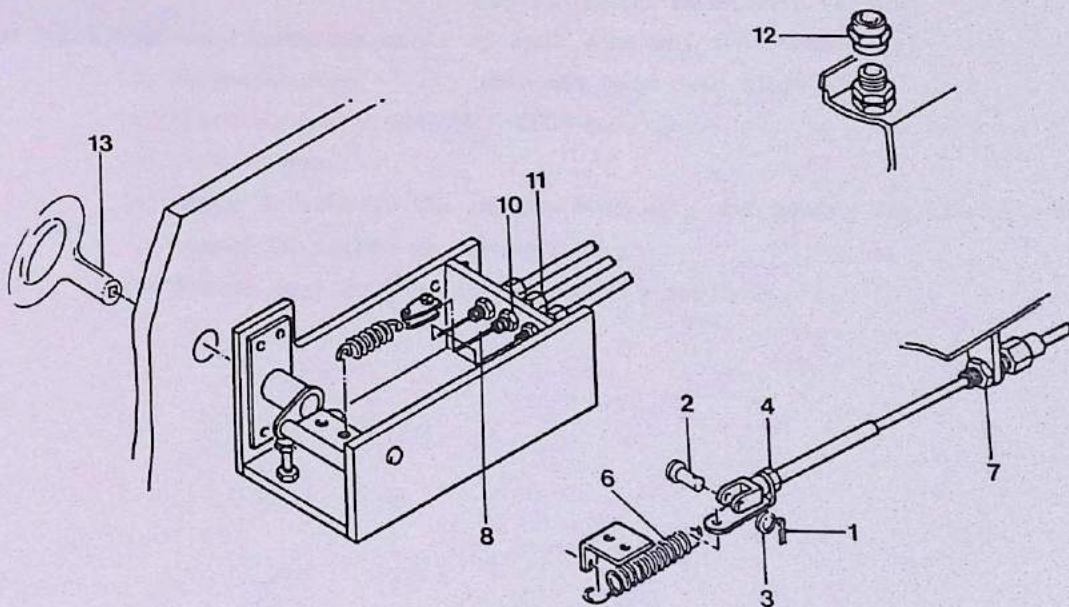


Fig. 503



- (2) Install
- (a) Remove nut (4) from the clevis end of the cable adjuster.
  - (b) Pass inner cable through cable adjuster. Refit nut (7) to anchor bracket.
  - (c) Refit nut (4), forkend and bracket to the inner cable and tighten nut (4).
  - (d) Align holes in clevis and cam arm, fit clevis pin (2) and make safe with cotter pin (1).
  - (e) Route Bowden cable and pass through gland assembly.
  - (f) Tighten nut (12) on gland assembly.
  - (g) Remove nut (10) from cable adjuster (11) at lock end.
  - (h) Pass cable through anchor plate and refit adjuster into anchor bracket.
  - (j) Fit nut (10) (do not tighten at this stage).
  - (k) Turn the key (13) in a counter clockwise direction.
  - (l) Connect inner cable to cable clamp.
  - (m) Connect return spring (6) to bracket on clevis at the latch end of cable.
  - (n) Do an adjustment of Bowden cable (Sect. 6A)
  - (p) Do a test on window locking mechanism (Sect. 6B)
  - (q) Fit seat (Chap. 25-00)
  - (r) Fit side panel (Chap. 21-00)
  - (s) Ensure that the work area is clean and free from debris and that all tools have been removed.



**6. Adjustment/Test****A. Adjustment**

- (1) Adjustment of Bowden cable
  - (a) Loosen two locknuts on cable adjuster on the lock mechanism under the seat.
  - (b) Screw the cable adjuster to a central position on the anchor plate.
  - (c) Tighten locknuts.
  - (d) Lock the window in any of the three locking positions: OPEN, CLOSED, HALF OPEN.
  - (e) Loosen the two locknuts on cable adjuster on the window latching mechanism.
  - (f) Turn cable adjuster on latching mechanism anchor plate until the crests of the cam are horizontal, (horizontal rods fully extended).
  - (g) Tighten locknuts.
  - (h) Test window lock (Sect. 6 B)

**B. Test**

- (1) Window Lock Mechanism
  - (a) Unlock window.
  - (b) Place window in the HALF OPEN position.
  - (c) Lock window.
  - (d) Apply a force to the window hand grip and ensure that the window cannot be raised or lowered.
  - (e) Repeat test in the CLOSED and OPEN position.



**7. Cleaning/Painting****A. Cleaning**

(1) The window frame paintwork and transparencies can be cleaned using a detergent-free cleaning agent. The Plexiglass transparencies should be rinsed with clean water, allowed to dry and polished using a suitable plastic polishing compound and a lint free cloth.

**B. Painting**

The window frame is painted with high-gloss paint. Refer to Chap. 11-00.



**MBB**

Transportation  
Technology Division

# CHAPTER 24-00 BELLOWS

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## CHAPTER 24

## BELLOWS

1. Description and OperationA. Description (Fig. 1)

## (1) General

The five independent cars of the Mark V monorail, are linked with a concertina type bellows arrangement attached to the car body and to the car skirt. The purpose of the bellows is to give a cosmetic appearance to the passenger car and to protect the passengers from the electrical and mechanical systems that are installed at the rear of each car chassis. All the bellows are similar in construction therefore only the bellows between car one and car two are described.

## (2) Bellows

The bellows are of concertina construction and are made from waterproofed material.

## (3) Bellow Attachment

Each bellows is clamped to the passenger car endwall with a steel cable in an aluminum framework. The framework which is a channel shaped profile is secured to the car with nuts, bolts and washers. The flexible bellows sit in the channel profile and are kept in position with a steel cable. The steel cable is routed from the top of the endwall over a two pulley arrangement located between the skirt and the car body. The steel cable has a thimble connection at both ends and is retained to the skirt structure with a special shouldered stud. The stud is secured with nuts, washers and bolts. The upper end of the steel cable is clamped to the thimble with two "U" shaped bolts and clamping plates. A cantilever mechanism is attached to the upper end of the steel cable. At the lower end, the steel cable is fixed to the removeable skirt door.



**B. Operation**

The bellows are positioned in the aluminum channel profile by a steel cable that flexes and tensions with the movement of the monorail. The cable is held in tension by the contour of the car and skirt profile which narrows at the waist. A cantilever situated at the center of the upper car structure, tensions the steel cable.

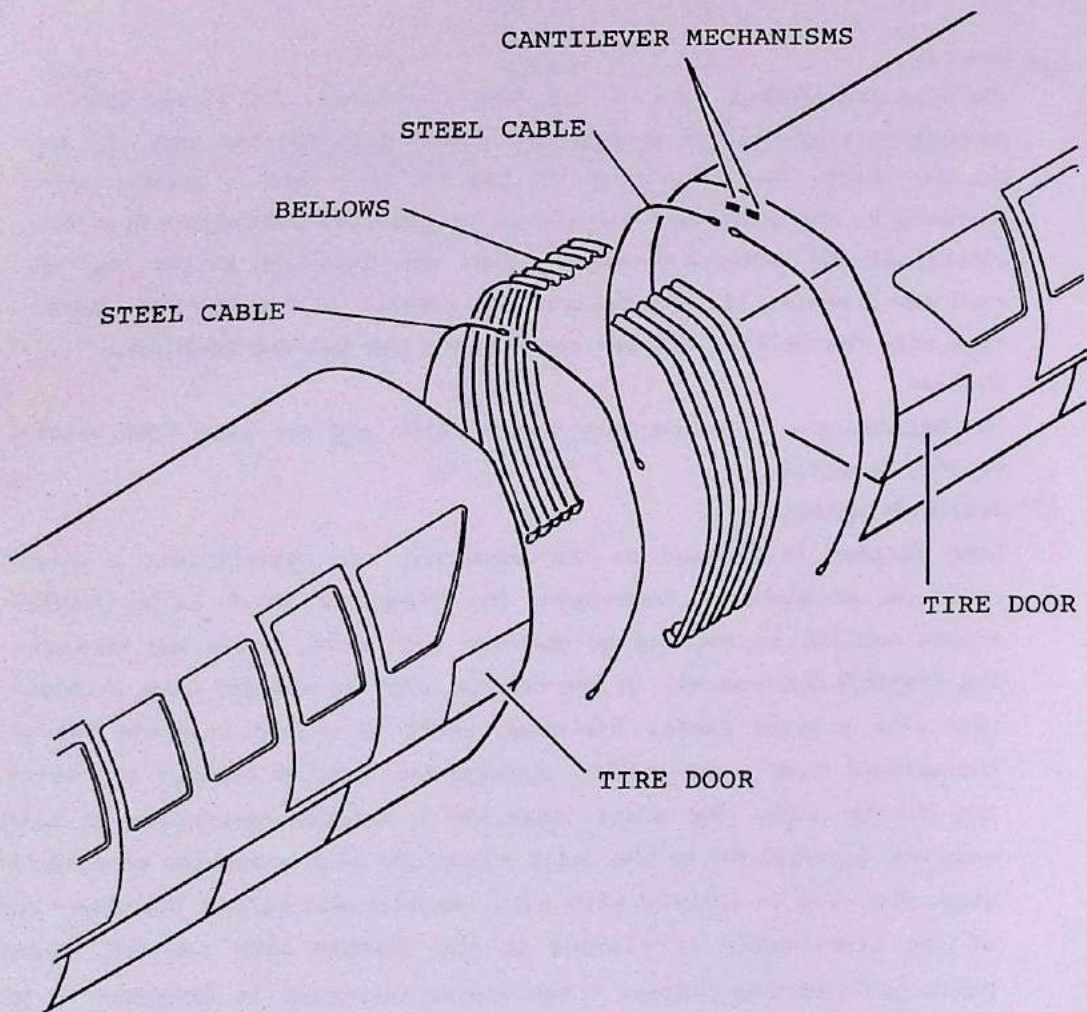


Fig. 1 Bellows - General Arrangement



**3. Maintenance Practices**

The maintenance schedule is shown in Table 301.

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
1	Bellows	Inspect all fastenings for serviceability. General function check.	II-24.0001	On replacement and annually

Table 301 - Maintenance Practices



5. Removal/Installation

A. Steel Cable

(1) Removal

Fig. 501

- (a) Open the tire door and gain access to the work area.
- (b) Remove nut, spring washer, washers, spacers and special stud retaining cable to the skirt door.

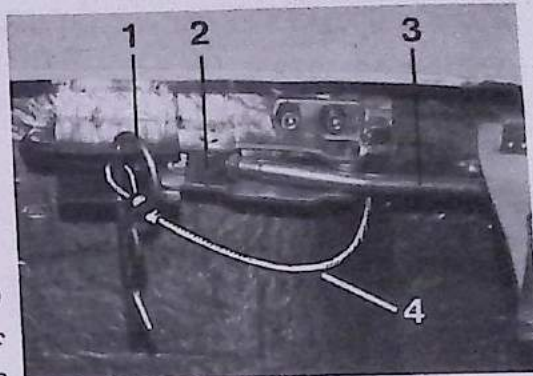


Fig. 501

- (c) Remove the safety pin (1) and unlock the cantilever mechanism (2). Re-attach the safety pin to the retaining cord (4) to prevent loss.

- (d) Unhook the cable from the top attachment bar (3).

- (e) Remove the steel cable from the skirt guide pulleys and pull out the cable with the bellows.

(2) Install

- (a) Examine the cable for freedom from broken strands and general serviceability.

- (b) Examine the bellows for freedom from tears.

- (c) Route the cable over the skirt pulleys.

- (d) Fit special stud through steel cable and secure to skirt with spacers, washers, spring washers and nuts.

- (e) Fit the steel cable to the upper attachment bar (3).

- (f) Operate the cantilever (2) to tension the cable and make safe with safety pin (1) making sure that the pin retaining cable is over both legs of the pin and between the bracket.

- (g) Remove all tools and equipment from the work area.



**7. Cleaning/Painting****A. Cleaning**

- (1) The bellows should be cleaned using a soft cloth damped with a weak solution of a non-detergent cleaning agent in warm water. Persistent marks may be removed using a soft brush and a stronger cleaning agent but this should be immediately followed with sufficient water to neutralize the agent.

**B. Painting**

Not applicable (N/A).



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Transportation  
Technology Division

# CHAPTER 25-00 SEATS

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## CHAPTER 25

## SEATS

1. Description and OperationA. Description (Fig. 1)(1) General

The passenger seats are individually moulded glass reinforced plastic (GRP) shells padded with foam rubber and covered with leather type cloth. The seats in the five cars and the rearward facing seat in the rear cabin, are mounted on seat rails. The seat rails are fitted to seat boxes attached to the floor. The seats are secured to the seat boxes with two bolts which pass through lugs underneath the front edge of the seat. The car endwall seat backrests are interconnected to provide the additional stability required when they are used as a step during exit through a roof hatch.

Cars 1, 2, 3, and 5 are fitted with four rows of five bench seats and one row of two bench seats (two benches separated by a gangway). The benches provide seating for 24 passengers facing forward and aft. Car 4 has three seating configurations:

- 24 passengers
- 19 passengers and 1 wheelchair
- 16 passengers and 2 wheelchairs

The front cabin has seating for the driver and five passengers, three on the LH side facing inwards, and two on the RH side facing inwards. The rear cabin has seating for seven passengers, three on each side facing inwards and one in the center facing backwards. The inward facing passenger seats in the front and rear cabins are bolted to a framework with two bolts under the seat squab and two hingebolts at the top of the back rest. These hinge-bolts enable the seat to be hinged upwards for access to services. The five seats, facing the rear endwall in car four, fold as a bench of; three seats to make space for one wheelchair, two seats to make space for a further wheelchair.



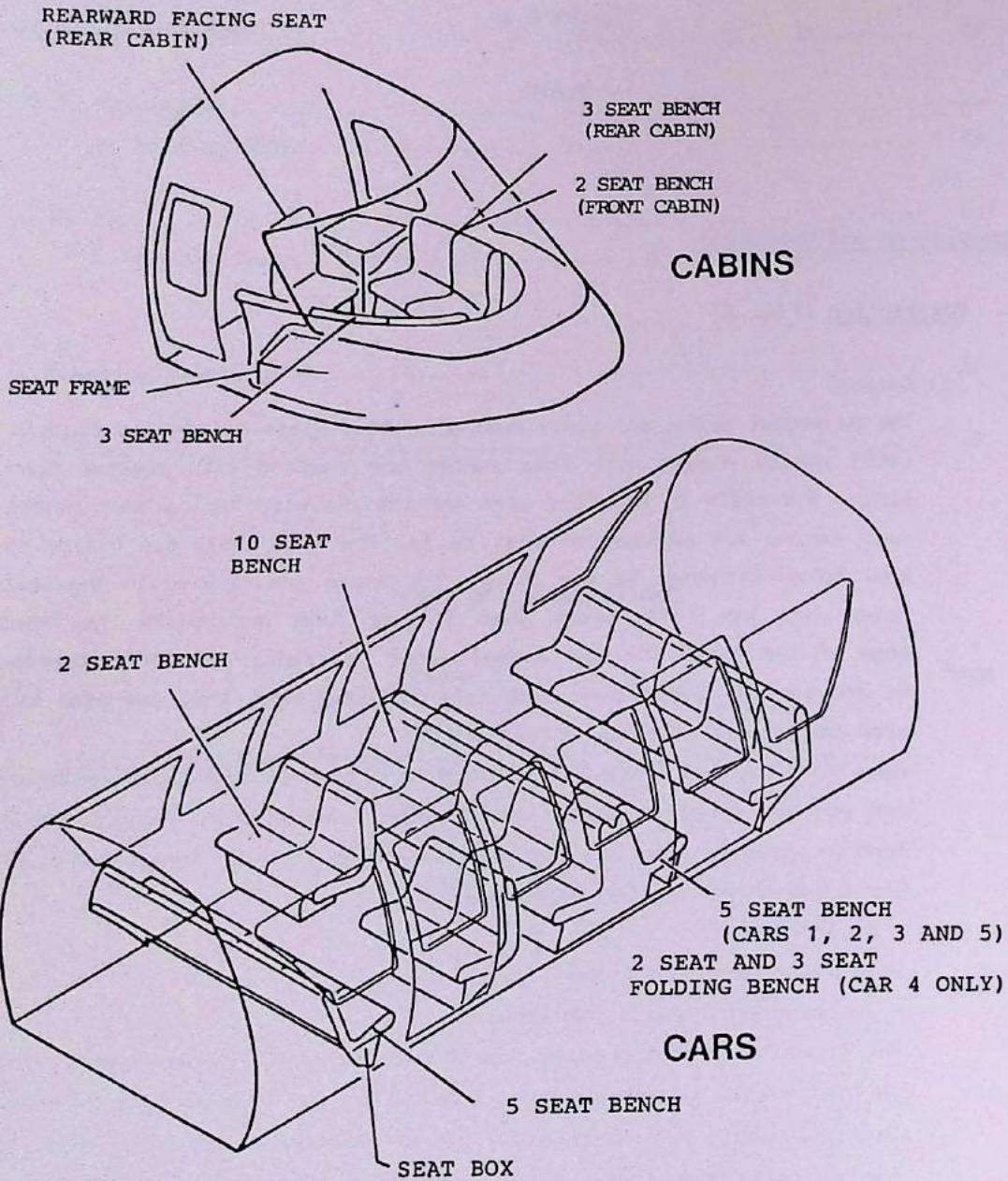


Fig. 1 Seats - General Arrangement



(2) Seat Framework-Cabins

The seat framework in the front and rear cabin is 25 mm hollow steel square section, welded to form a rectangular box angled to fit the contour of the cabin side walls. The framework is supported by legs which are welded to footplates. The footplates are bolted to the floor. Horizontal extensions at the top of the seat framework are welded to two vertical supports on either side of the nose section. These vertical supports have mounting plates welded to the sides and to the base. The mounting plates are bolted to the side chassis member. A long horizontal strut is bolted to the top of the vertical supports and a short strut is bolted across the end legs of the seat framework. The purpose of the struts is to provide rigidity and act as supports for the front fairing upper section. Strips of foam rubber are bonded to the struts to provide vibration free support for the front fairing upper section.

(3) Seat Boxes-Cars

The sides of the seat boxes are of fiber glass construction and retained to the floor of the cars by angle section. The angled sections are screwed to the floor and to the seat box sides. The sides of the seat boxes are attached to each other with seat runners. The seat boxes also house the Bowden Cables which lock the windows (Refer Chap. 23-00). The ends of the seat boxes are secured to the air ventilating ducting and side wall trims.

B. Operation

To raise or lower the folding seat in car four, pull out the handle, turn in the direction indicated on the handle and lift or lower the seat. Lock in position by turning and pushing the handle into the recess.

---

NOTE

---

When the seat is in the raised position, the two halves of the hinged front panel must be flat before returning the handle to the locked position.

---



---

**NOTE**

---

When lowering a seat, do not overcome any interaction between the two seats by force. Some assistance may be required to start the front panel hinge from the vertical position.

---

**2. Fault Isolation****A. Car 4 folding seat**

- (1) Seat does not lock or unlock.
  - (a) Check the Bowden cable. Adjust (See Sect. 6) or replace (See Section 5).
  - (b) Service the shoot bolts. (See Sect. 4)
  - (c) Replace the lock.

**4. Servicing**

The items listed in Table 401 are shown against a recommended maximum elapsed time, it is not an instruction to wait out the time before servicing.

Item	Description	Service Required	Test and Inspection Instruction	Service Interval
1	Folding seat locking mechanism	Lubricate	N/A	Quarterly

Table 401 - Servicing



## 5. Removal / Installation

### A. Single Seat - Rear Cabin

#### (1) Removal

Fig. 501

- (a) Remove the two bolts and washers under the front edge of seat squab (1) which secure the seat to the seat box.
- (b) Slide seat out from rails (2) and remove it.

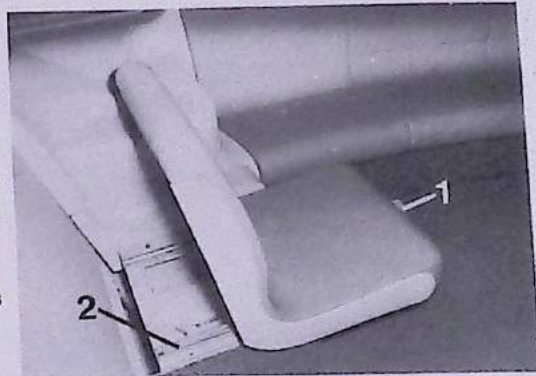


Fig. 501

#### (2) Install

- (a) Examine seat box for cleanliness and freedom from damage.
- (b) Examine seat for serviceability.
- (c) Position seat squab onto seat box rails and slide seat to closed position.
- (d) Fit bolts to secure seat to seat box.

### B. Seats - Front and Rear Cabin

#### (1) Removal

Fig. 502

- (a) Remove the two bolts, washers, and spring washers which secure the front edge of seat squab to seat framework.
- (b) Hinge seat upwards.
- (c) Remove the two nuts, washers, and spring washers from the hinge-bolts.
- (d) Lift seat complete with hinge-bolts out of seat framework.



Fig. 502



- (2) Install
  - (a) Examine seat for serviceability.
  - (b) Position seat onto seat framework and ensure the hinge bolts are located.
  - (c) Secure the hinge bolts with nuts, spring washers and washers.
  - (d) Hinge the seat down to closed position.
  - (e) Secure seat with bolts (1), spring washers and washer.

### C. Seat Framework-Cabins

#### (1) Removal

##### Fig. 503

- (a) Remove seats (Sect. 5B).
- (b) Remove windscreen fairing (Chap. 21-00).
- (c) Remove front fairing, upper and lower section (Chap. 21-00).
- (d) Remove nuts, washers, spring washers and screws (3) securing carpet trim panel brackets to seat framework.
- (e) Remove seat framework side trim (1) (Station side seat only) (Chap. 21.00).
- (f) Remove bolts washers, and spring washers, securing strut and seat framework upper extensions to vertical supports.
- (g) Remove packing pieces each side (note quantity for correct installation).
- (h) Remove bolts, washers and spring washers securing short strut to end seat legs (retain packing pieces for correct installation).
- (i) Remove the bolts (2), washers, and spring washers securing the footplates to the floor.
- (k) If necessary remove air conditioning ducting.

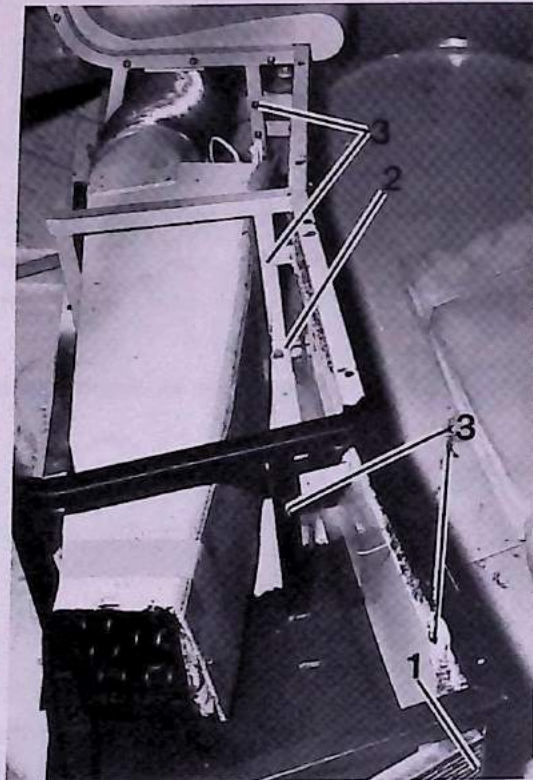


Fig. 503



- (l) On front cabin RH bench seat, remove nuts, washers, screws retaining the terminal boards mounting angles and the channel section and remove nuts, washers, retaining drivers console fairing to the seat framework
  - (m) Maneuver the seat framework from out of area.
- (2) Install
    - (a) Install in the reverse sequence.

#### D. Seats - Car End Walls

##### (1) Removal

Fig. 504

- (a) Remove the two bolts and washers (1) under the front edge of seat squab (2).
- (b) Lift back rest cover and remove the screw and washer of the interconnect fastenings.
- (c) Slide seat out from rails and remove.

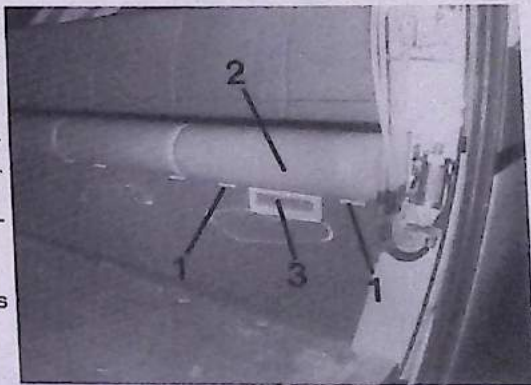


Fig. 504

##### (2) Install

- (a) Examine seat box(es) for cleanliness and freedom from damage.
- (b) Examine seat(s) for serviceability.
- (c) Position seat squab(s) onto seat box rails and align.
- (d) Fit fastenings to interconnect seat backrests.
- (e) Fit bolts to secure seat to seat box.



**E. Seats - Two Seat Bench**

- (1) Remove  
Fig. 505

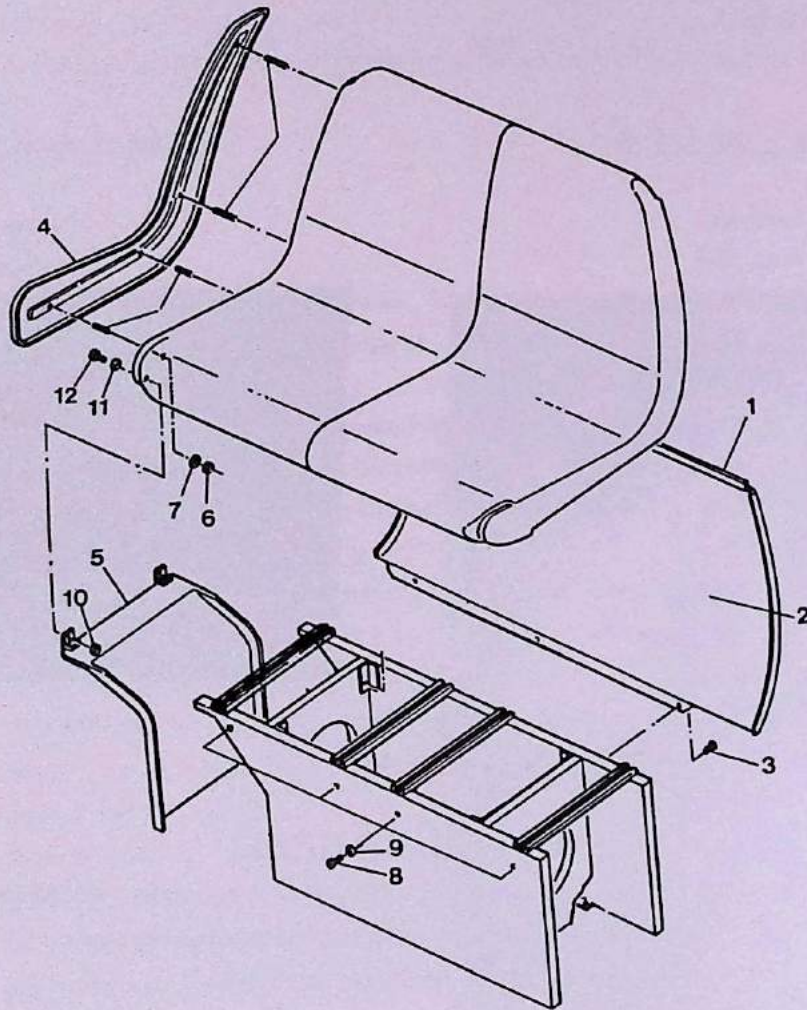


Fig. 505

- (a) Rear seat cover (2). Remove.

1 Ease the carpet off the base of the rear seat cover to expose the screws (3). Remove the screws.



---

**CAUTION**

---

THE REAR SEAT COVER MUST BE HANDLED WITH CARE. THE COVER CAN BREAK IF FORCED.

---

- 2 The upper edge (1) hooks onto the seat frame. Press down on the upper edge while easing the cover out of the seat frame.
- 3 Ease the rear cover out of the overlapping seat side cover (4) and remove.
- (b) Seat box end cover (5). Remove.
- 1 Remove the nuts (10, washers (11) and bolts (12).
- 2 Carefully pull away from the VELCRO tape.
- (c) Seat side cover (4). Remove.
- 1 Reach in behind the side cover and remove the four self-locking nuts (6) and washers (7).
- (d) Seat(s). Remove.
- 1 Remove the bolts (8) and washers (9) securing the seat to the seat frame.
- 2 Pull the seat forward off the seat rails.
- (2) Install
- (a) Seat(s). Install on the rails and secure with bolts (8) and washers (9).
- (b) Seat side cover (4). Install and fit four self-locking nuts (6) with washers (7).
- (c) Install the seat box end cover (5). Carefully press onto the VELCRO strip. Secure with the bolts (12), washer (11) and nuts (10).
- (d) Rear seat cover (2). Hook into the seat frame while easing the side under the seat side cover. Secure with the screws (3).
- (e) Bond the carpet to the seat using T470 adhesive (or equivalent).



**F. Seats - Ten Seat Bench**

## (1) Removal

---

**NOTE**

---

An inner seat must be removed to gain access to the outer seat connecting plate.

---

- (a) Inner seat(s). Remove. Remove the two bolts and washers securing the seat to the seat frame and pull the seat forward off the seat rails.
- (b) Outer seat connecting plate. Remove the Allen-headed bolts and washers securing the seat backs to the structure.

## (2) Install

- (a) Install in the reverse sequence.

**G. Folding Seats - Car Four**

## (1) Removal

---

**NOTE**

---

The procedure for removing the folding two-seat bench and the folding three-seat bench is the same.

---



Fig. 506

- (a) Raise the seat. Return and stow handle (1). Remove the screws and washers (2) from all seat squabs on the bench.
- (b) Lower the seat and return and stow the handle.

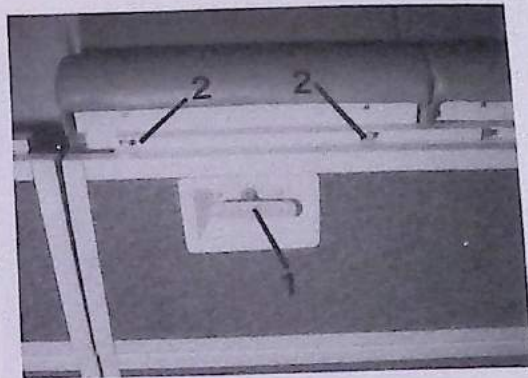


Fig. 506

Fig. 507

- (c) Raise the seat squabs and disconnect the clips (1) holding the Bowden cable to the underside of the seat.

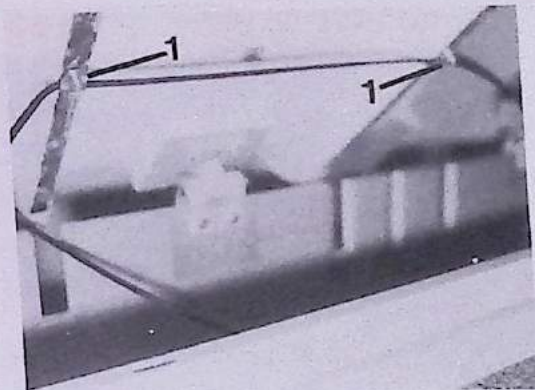


Fig. 507

---

**CAUTION**

---

WHEN THE SEAT SQUABS ARE RAISED THE FRONT PANEL WILL BECOME UNSUPPORTED. EITHER SUPPORT THE PANEL OR LOWER IT CAREFULLY TO THE FLOOR.

---

Fig. 508

- (d) Release the Bowden cable (1) from the locking handle mechanism by unscrewing the grub screw (2). Do not remove the grub screw.

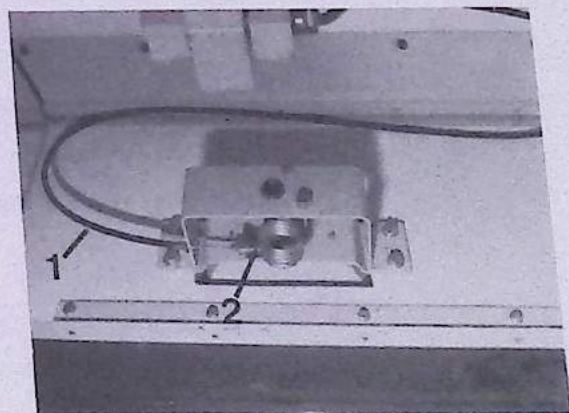


Fig. 508



Fig. 509

- (e) Remove the seat squabs by removing the Allen bolts (1) from the seat squab hinges.
- (f) If required, remove an individual seat squab by disconnecting the interconnecting bolts, washers and self-locking nuts.

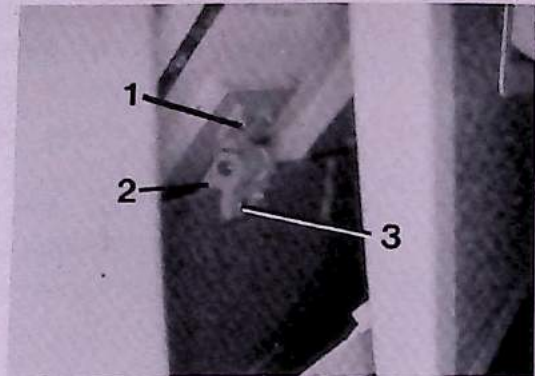


Fig. 509

---

**NOTE**

---

Gain access to the rear of the folding seats by removing the seats from the five-seat bench backing on to the folding seat.

---

- (g) If required, remove the squab hinge(s) (Fig. 509.2) from the seat frame by removing the screws, washers and self-locking nuts. (Fig. 509.3)
- (h) If required, remove a backrest by removing the bolts, washers and self-locking nuts interconnecting the backrest(s) through the seat frame.
- (j) If required, remove the lock.

Fig. 510

- 1 Pull the lock handle and remove the pin (1) from the handle shank. Discard the pin.

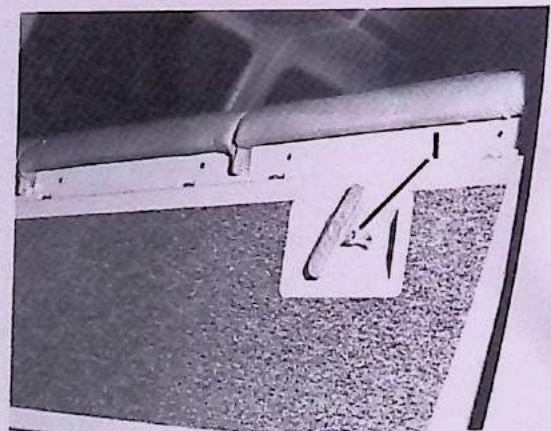




Fig. 511

- 2 Remove the two screws (1) holding the front plate (2) to lock. Remove the plate with care.

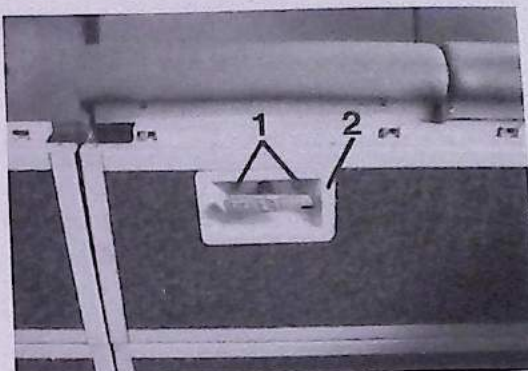


Fig. 511

Fig. 512

- 3 Remove the four Allen bolts and washers (1). Remove the lock.

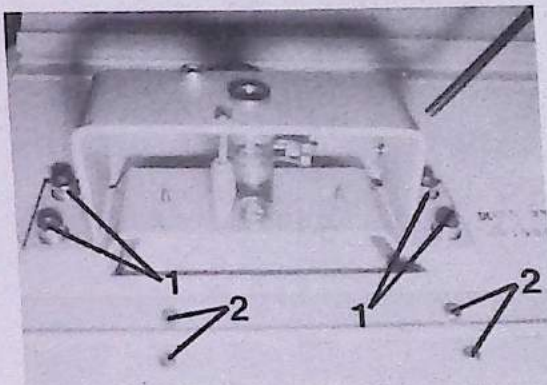


Fig. 512

- (h) If required, remove the shoot bolt from the seat squab by removing the Allen bolts.
- (j) If required, remove either shoot bolt catch (locked up, locked down) by removing the two Allen bolts and washer.
- (k) Disconnect any piano hinge(s) by removing the screws. (e.g. Fig. 512.2)
- (2) Install
- (a) Install the shoot bolt catch, if removed.
- (b) Install the shoot bolt to the seat squab, if removed.
- (c) Install any backrest, if removed.



- (d) Install any seat squab hinge(s), if removed.
- (e) Install the seat lock, if removed.
- (f) Position any seat panel removed and assemble using the piano hinges.
- (g) Reform the bench squab set by reconnecting any seat squab(s) removed.
- (h) Install the bench squabs.
- (j) Reconnect the Bowden cable and adjust. (Sect. 6A)

#### H. Seat Boxes - Cars

- (1) Removal - Endwall (Front and Rear)
    - (a) Seats. Remove (See Sect. 5D).
    - (b) Entrance door light. Disconnect and remove. (Chap. 27-00)
    - (c) Disconnect the front frame (4) from the ventilation ducting.
- Fig. 513
- (d) Remove the screws (1) and washers (2), fastening the angle (3) to the floor.

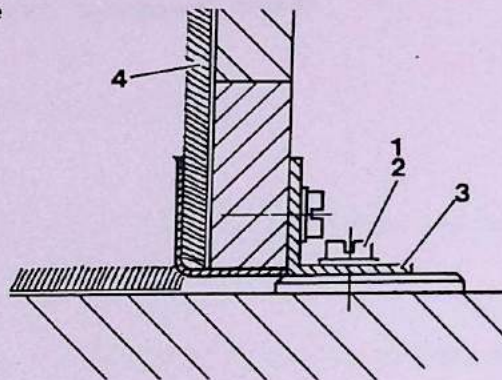


Fig. 513



Fig. 514

(f) Note the position of each seat rail before removal. Remove the screws (1), washers (2) and nuts (3) fastening the rear of the seat guide rails (4) to the end wall.

(g) Remove the guide rails from the front frame by removing the screws.

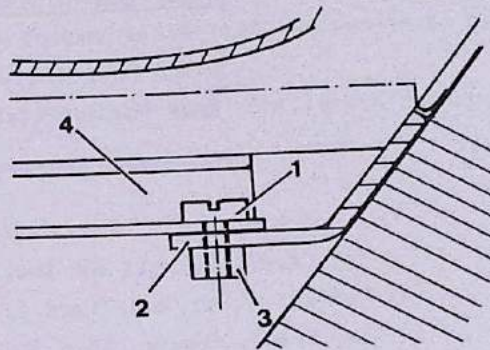


Fig. 514

(2) Removal - Two Seat (Left and Right)

(a) Seats. Remove. (See Sect. 5E)

Fig. 515A

1 Remove the screws (515A-1) and washers (515A-2) securing the seatbox front panel to the floor.

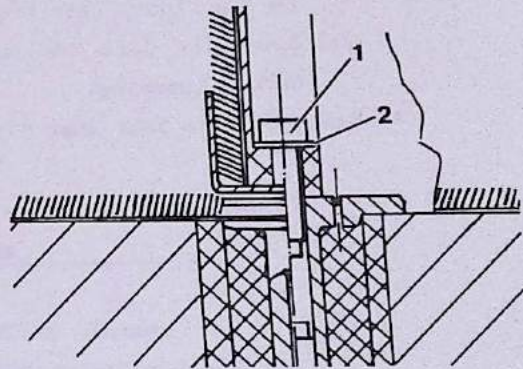


Fig. 515 A

2 Remove the screws (515B-3) and washers (515B-4) securing the seatbox rear panel to the floor.

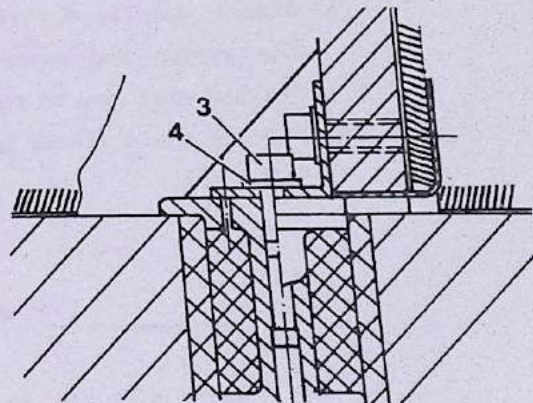


Fig. 515 B



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**NOTE**

---

Disconnect the side of the seat box from the ventilation ducting.

---

- (c) Carefully pull the seat box away from the wall before removing.
- (3) Removal - Ten Seat (Cars 1, 2, 3 and 5)
  - (a) Seats. Remove. (See Sect. 5F)
  - (b) Window locking mechanism. Remove. (Chap. 23-00)
  - (c) Seat boxes. Disconnect from the ventilation ducting.
  - (d) Remove the screws and washers fastening the seat box panels rails to the floor. (see Fig. 515)
  - (e) Carefully lift the seat box to clear the ventilation ducting before removing.
- (4) Removal - Ten Seat (Car 4)

---

**NOTE**

---

For removal of the fixed five-seat bench refer to (3) above.

---

- (a) Remove the fixed five-seat bench. (See Sect. 5H (3) and remove the screws and washers connecting the seat back frame of the folding seat box to the five seat box.
- (b) Folding seats (three seat bench and two seat bench). Remove. (See Sect. 5G)

---

**NOTE**

---

With care, it is possible to remove the folding seat box without dismantling the seat backs.

---



- (c) Window locking mechanism. Remove. (Chap. 23-00)
  - (d) Remove the screws and washers fastening the seat box panels to the floor.
  - (e) Carefully lift the seat box to clear the ventilation ducting before removing.
- (5) Install
- (a) Install in the reverse sequence.



**6. Adjustment/Test****A. Adjustment****(1) Folding Seats - Car 4**

- (a) Pull out and turn the handle.
- (b) Hinge up the seat squabs.
- (c) Return the locking handle to the locked and stowed position.
- (d) Loosen the Bowden cable grubscrew on the locking handle.
- (e) Pull on the free end of the Bowden cable until the shoot bolt is fully home.
- (f) Tighten the Bowden cable grubscrew on the locking handle.
- (g) Refasten the seat squabs. (Sect. 5)

**B. Test****(1) Folding Seats - Car 4**

- (a) Pull out and turn the handle.
- (b) Hinge up the seat squabs.
- (c) Operate the locking handle and ensure the shoot bolt engages/disengages the shoot bolt housing.

**7. Cleaning/Painting****A. Cleaning****(1) General cleaning**

The seats should be cleaned using a soft cloth damped with a weak solution of a non-detergent cleaning agent in warm water. Persistent marks may be removed using a soft brush and painters turpentine but this should be immediately followed with sufficient water to neutralize the agent.



## (2) Specific cleaning

---

CAUTION

---

DO NOT USE STRONG SOLVENTS SUCH AS PAINT REMOVER, THEY WILL PERMANENTLY DAMAGE THE SEAT MATERIAL.

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CAUTION

---

DO NOT USE WIRE WOOL OR SCOURING POWDERS AS THESE WILL SCRATCH THE MATERIAL.

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NOTE

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Permanent marking pens and dyes cause stains which are not removable by any method.

---

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NOTE

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It is important to act promptly on any stain as same stains become permanent if allowed to "set".

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## (a) Ball Point Pen Marks

Ball point in may sometimes be removed if rubbed immediately de-nature alcohol and a clean cloth.



(b) Grease-Type Stains

These include car grease, wax crayons, tar, oil, paint, mustard, lipstick, or shoe polish. Wipe off the excess material, then go over the area lightly with tar remover or painter's turpentine and a clean cloth. Finish with a cleaner and conditioner wax to restore the finish.

(c) Lacquer-Type Stains

Such stains include nail polish. Blot up the excess material at once; do not allow it to dry. Then use one of the cleaning fluids as for grease stains, followed by surface restorations.

(d) Water-Base Paints

This may be removed with water before the paint dries. Any dried material can be chipped away with the fingernail.

(e) Sulfide Stains

Permanent-wave solutions sometimes leave dark-colored stains, as do body wastes. Oxidize the stain away by keeping a clean cloth saturated with liquid chlorine bleach (to which a few drops of liquid dishwashing detergent have been added) in contact with the stain for several hours. Do not dilute the bleach. Follow with a spray cleaner and conditioner wax to restore the surface.



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# CHAPTER 27-00 LIGHTING

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CHAPTER 27

LIGHTING

1. Description and Operation

A. Description (Fig. 1)

(1) General

There is no general illumination of the interior of the cabins or cars, the internal lighting consists of:

- a door entrance light (5) which lights when the associated door is open
- an illuminated EXIT/EMERGENCY ONLY (3) sign which lights when the EMERGENCY LIGHT switch located in the secondary console is set to ON.
- an auxiliary light (1) to floodlight the drivers station.

The external lighting consists of:

- two roof mounted flashing beacons (2); (red - rear cabin, clear - front cabin)
- two twin light units (4); (red - rear cabin, clear - front cabin)

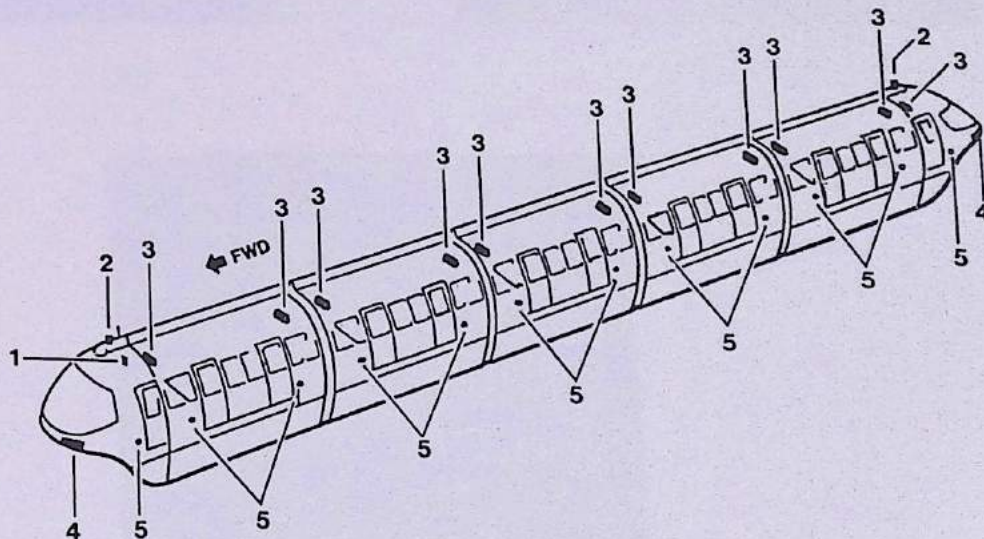


Fig. 1 Lighting - General



## (2) Internal lighting

- (a) Door entrance light (1). The door entrance light is set into the side panel of the seat box near the door step. Each light unit consists of a clip-in holder with fittings for two festoon bulbs, and a clear plastic light cover.
- (b) Exit sign (2). The exit sign is a prominent box in the cars and a recessed box in the rear cabin all with a bulb holder for a conventional auto-type bulb and a front screen which displays EXIT-EMERGENCY ONLY when backlighted by the lit bulb.
- (c) Auxiliary lamp (3). The auxiliary lamp is mounted in a recess on the hatrack above the driver so that the light is directed onto the drivers primary console.

## (3) External lighting

- (a) Flashing beacons (4). A flashing beacon unit is mounted on the spine of the front and rear cabins. The beacons serve to draw attention to the monorail.
- (b) Twin light units (5). The twin light unit on cabin 1 and the twin light unit on cabin 5 act as headlights and tail lights respectively. The light unit mounts two standard automobile-type lamps fitted with bulbs.



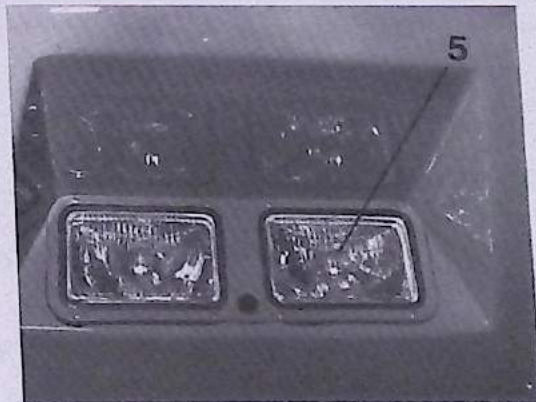
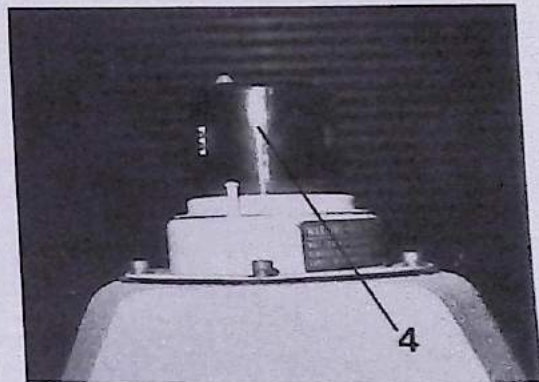
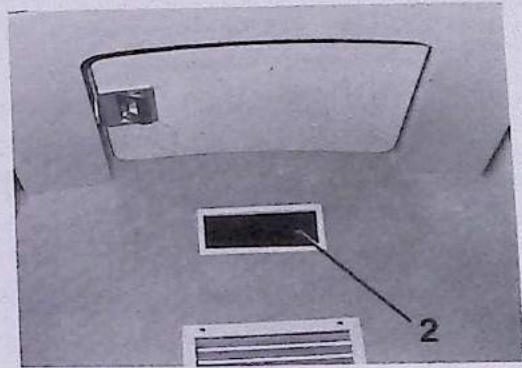
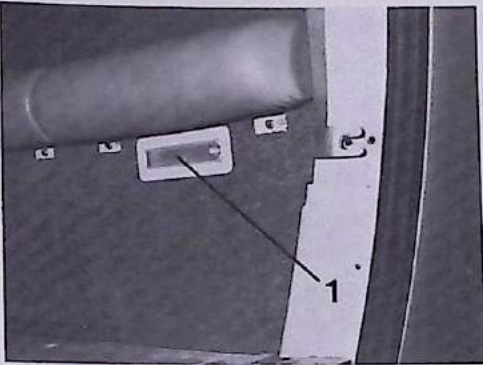


Fig. 2 Lighting - Units



(4) Controls and Indicators (Fig. 3)

The lights are selected by the following switches on the driver's secondary console:

(a) Internal lighting

- AUX CP LTS-ON/OFF (1); selects the auxiliary light on. To function, the COCKPIT LIGHT circuit breaker (6) must be set.
- INT LTS-ON/OFF (3); selects the door entrance lights to operate. To function, the DOOR OPEN circuit breaker (7) must be set and the fuse (F29) located LH side car 3 must be service-able.
- EMERG LT-ON/OFF (4); selects the emergency exit signs light on

(b) External lighting

- HEAD LT-ON/OFF (2); selects the headlights and the tail lights. To function, the HEADLIGHTS circuit breaker (5) must be set.

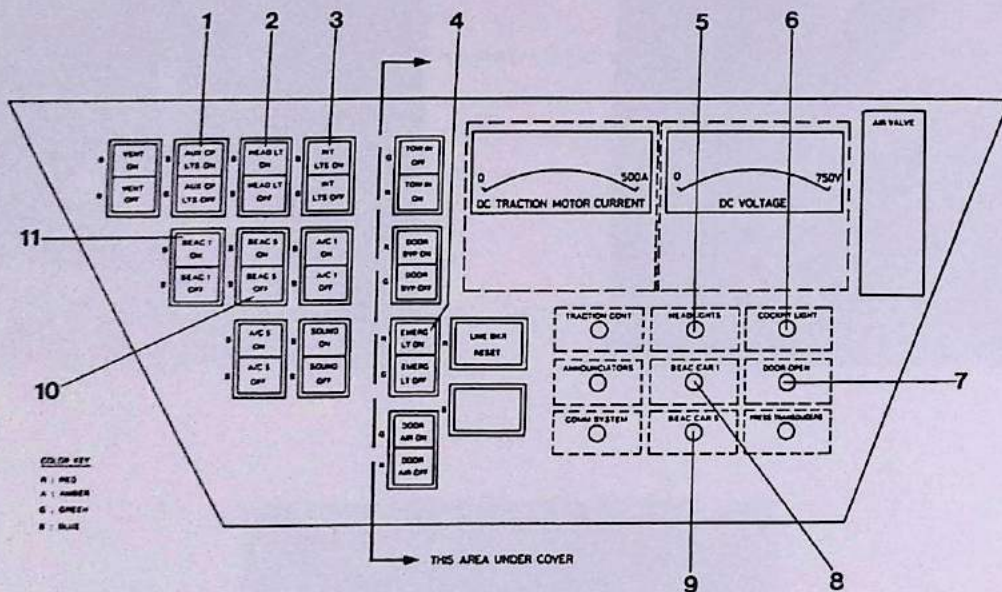


Fig. 3 Controls and Indicators

- BEAC 1-ON/OFF (11); selects the front beacon on. To function, the BEAC CAR 1 circuit breaker (8) must be set.
- BEAC 5-ON/OFF (10); selects the rear beacon on. To function, the BEAC CAR 5 circuit breaker (9) must be set.



**B. Operation****(1) Internal Lighting**

- (a) The door entrance lights are enabled when the INT LTS switch is set to ON and operate when the PCU (refer to Chap. 76-00) receives a door open signal from the door system (refer to Chap. 22-00). The operation of the lights is monitored by module A20 and A21 (type B814-001) of the PCU (refer to Chap. 76-00).
- (b) The lamps in the EXIT EMERGENCY ONLY exit signs light when the EMERG LT switch is set to ON. The power supply to the signs is monitored by module A15 (type B827-032) of the PCU (refer to Chap. 76-00).

**(2) External Lighting**

- (a) The headlights and tail lights light when the HEAD LT switch is set to ON. The power supplies to the lights is monitored by module A14 (type B827-032) of the PCU (refer to Chap. 76-00).
- (b) The flashing beacons are individually selected on by either BEAC 1 switch or the BEAC 5 switch. The power supply to the beacons is monitored by module A14 (type B827-032) of the PCU (refer to Chap. 76-00).
- (c) The auxiliary lamp lights when the AUX CP LTS switch is set to ON. The power supply to the light is monitored by module A14 (type B827-032) of the PCU (refer to Chap. 76-00).



**2. Fault Isolation****A. Internal lighting****(1) Door Entrance Lights**

- (a) The power supply to an individual light is interrupted if the associated indicator 00005 to 00015 on module A20 of the PCU is lit (refer to Chap. 76-00).
- (b) An overload which blows fuse F28 is indicated by 10003 on module A14 of the PCU (refer to Chap. 76-00).
- (c) Examine the bulb (see Sect. 4).
- (d) Check the wiring (refer to WDM, Chap. 27-00).

**(2) Emergency Exit Sign**

- (a) An overload which blows fuse F29 is indicated by 10036 on module A15 of the PCU (refer to Chap. 76-00).
- (b) Examine the bulb (see Sect. 4).
- (c) Check the wiring (refer to WDM, Chap. 27-00).

**(3) Auxiliary Light**

- (a) The power supply to the auxiliary light is interrupted if 10028 on module A14 of the PCU is lit (refer to Chap. 76-00).
- (b) Examine the bulb (see Sect. 4).
- (c) Check the wiring (refer to WDM, Chap. 27-00).

**B. External lighting****(1) Headlights**

- (a) The power supply to the headlights circuit is interrupted if 10030 on module A14 of the PCU is lit (refer to Chap. 76-00).
- (b) Examine the bulb (see Sect. 4).
- (c) Check the wiring (refer to WDM, Chap. 27-00).

**(2) Beacon, Cabin 1**

- (a) The power supply to the beacon on cabin 1 is interrupted if 10027 on module A14 is lit (refer to Chap. 76-00).
- (b) Check the wiring (refer to WDM, Chap. 27-00).
- (c) Replace the beacon (see Sect. 5).

**(3) Beacon, Cabin 5**

- (a) The power supply to the beacon on cabin 5 is interrupted if 10031 on module A14 is lit (refer to Chap. 76-00).
- (b) Check the wiring (refer to WDM, Chap. 27-00).
- (c) Replace the beacon (see Sect. 5).



**3. Maintenance Practices**

The maintenance schedule is shown in Table 301.

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
1	Door entrance light-cabins	On replacement	TI-27.0011	
2	Door entrance light-car 1 to 5	On replacement	TI-27.0012	
3	Auxiliary light	On replacement	TI-27.0010	
4	Emergency sign-cabin 5	On replacement	TI-27.0013	
5	Emergency signs-car 1 to 5	On replacement	TI-27.0014	
6	Headlight	On replacement	TI-27.0001	
7	Tail light	On replacement	TI-27.0001	
8	Beacons	On replacement	TI-27.0002	

Table 301 - Maintenance Practices



**4. Servicing**

The items listed in Table 401 are shown against a recommended maximum elapsed time, it is not an instruction to wait out the time before servicing.

Item	Description	Service Required	Test and Inspection Instruction	Service Interval
1	Door entrance light-cabins	Test and inspect	TI-27.0011	Quarterly
2	Door entrance light-car 1 to 5	Test and inspect	TI-27.0012	Quarterly
3	Auxiliary light	Test and inspect	TI-27.0010	Quarterly
4	Emergency sign-cab 5	Test and inspect	TI-27.0013	Quarterly
5	Emergency signs-car 1 to 5	Test and inspect	TI-27.0014	Quarterly
6	Headlight	Test and inspect	TI-27.0001	Quarterly
7	Tail light	Test and inspect	TI-27.0001	Quarterly
8	Beacons	Test and inspect	TI-27.0002	Quarterly

Table 401 - Servicing



## 5. Removal and Installation

### A. Door Entrance Light

---

**NOTE**

---

To preserve the life of a bulb use a cloth to handle the glass.

---

#### (1) Removal

---

**NOTE**

---

The unit shown is for cabin 1, the removal and installation procedure is the same for all units.

---

Fig. 501

- (a) The unit (1) is held by the spring clips (2). Remove by easing the unit out of the panel.
- (b) Disconnect the wiring.

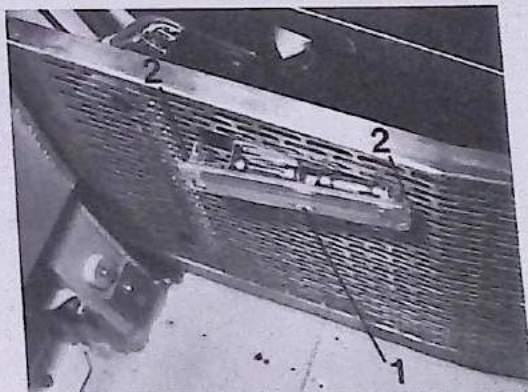


Fig. 501

#### (2) Install

- (a) Examine all components for serviceability. Replace the bulb if unserviceable.
- (b) Connect the wiring.



- (c) Press the unit into the panel until the spring clips seat.
- (3) Completion
  - (a) Test. (see Sect. 3)

**B. Auxiliary Light**

- (1) Removal
  - Fig. 502
  - (a) Open the hatrack.
  - (b) Disconnect the wiring.
  - (c) Remove the lamp insert.



Fig. 502

- (2) Install
  - (a) Install in the reverse procedure. Replace the bulb if unserviceable.
- (3) Completion
  - (a) Test. (see Sect. 3)

**C. Emergency Exit Sign (Cabin 5)**

- (1) Removal
  - Fig. 503
  - (a) Remove the four screws (2), and washers (1).
  - (b) Disconnect the wiring.

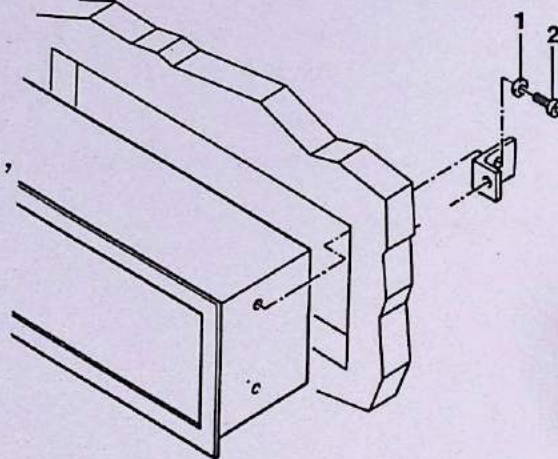


Fig. 503



- (2) Install  
(a) Install in the reverse sequence. Replace the bulb if unserviceable.

---

NOTE

---

To replace a bulb, remove only the glass.

---

- (3) Completion  
(a) Test. (see Sect. 3)

D. Emergency Exit Sign (Cars)

- (1) Removal

Fig. 504

- (a) Remove the four screws (1).  
(b) Remove the box complete with glass.

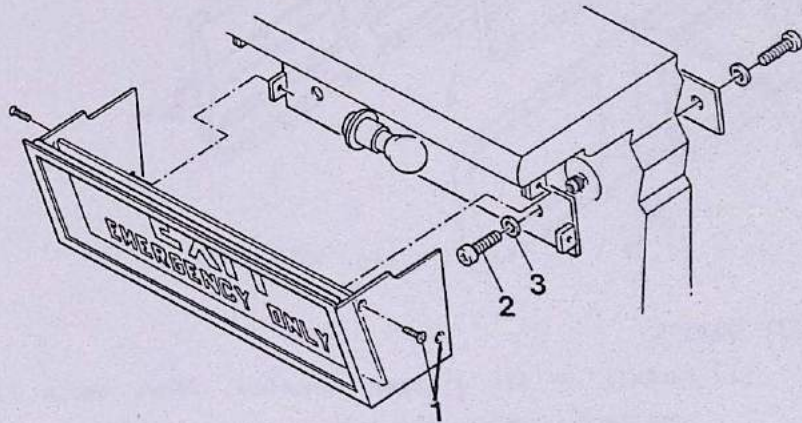


Fig. 504

- (c) Remove the two screws (2) and washers (3).  
(d) Disconnect the wiring.



- (2) Install
  - (a) Examine all components for serviceability. Replace the bulb if unserviceable.
- (3) Completion
  - (a) Test. (see Sect. 3)

#### E. Headlight and Tail light

##### (1) Remove

Fig. 505

- (a) Remove the four lower screws (1) and slacken the four upper screws (2).
- (b) Pull the unit downwards and outwards.
- (c) Disconnect the wiring.

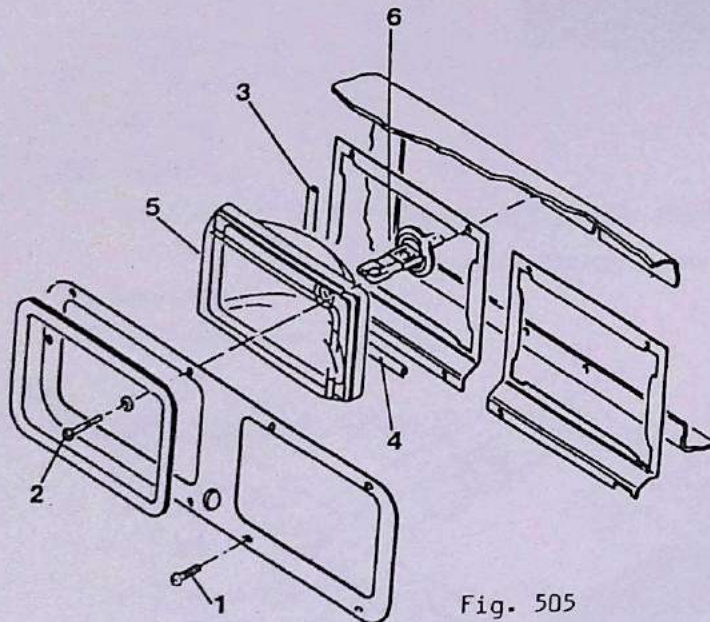


Fig. 505

##### (2) Install

- (a) Install in the reverse sequence. Renew seals (3) and (4) if necessary. Replace the bulb if unserviceable:
  - Remove the unit.
  - Unclip the bulb holder from the light unit (5).
  - Replace the bulb (6).
  - Clip the bulb holder into the light unit (5).
  - Install the unit.

##### (3) Completion

- (a) Test (see Sect. 3).



**F. Beacon**

- (1) Remove
  - (a) Remove the ceiling front trim (Chap. 21-00).
  - (b) Disconnect the wiring.
  - (c) Remove the beacon. Remove the five bolts and washers. Withdraw the unit complete.
  - (d) Clean off old sealant.
- (2) Install
  - (a) Install in the reverse sequence. Seal with SIKAFLEX.
- (3) Completion
  - (a) Test. (see Sect. 3)



**MBB**

Transportation  
Technology Division

**CHAPTER 29-00  
AIR CONDITION  
AND  
VENTILATION SYSTEM**

Jan. 88



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## CHAPTER 29

## AIR CONDITION AND VENTILATION SYSTEM

1. Description and OperationA. Description (Fig. 1)

## (1) General

The purpose of the air conditioning and ventilation system is to give a comfortable environment for the passengers and driver. The drivers cabin and rear cabin have an air conditioning system installed; the five passenger cars have ventilation systems.

Note that the air conditioning systems for the two cabins are similar, therefore only the drivers cabin is described, with any differences for the rear cabin given in parenthesis. The ventilation system for each of the five passenger cars is also similar, therefore only the system in passenger car one is described, with any differences for the passenger cars two to five given in parenthesis. All left and right hand references are for the drivers cabin and cars looking forward and the rear cabin looking aft. The description is as follows:

## (2) Cabin Air Conditioning

The cabin air conditioning system has the following equipment:

- a cool air pack
- a circulation fan and housing
- a flapper valve and pneumatic valve
- a bifurcated duct and distribution boxes
- air outlets and collector duct
- flexible ducting
- a temperature sensor. (driver cabin only)

The cabin air conditioning system takes air at an ambient temperature and cools it in the cooling pack, a circulation fan then pulls the cooled air through flexible ducting to a bifurcated duct. The air is now distributed from distribution boxes to the cabin air outlets installed between the windscreen and fairing panels. A louvered air outlet is installed on the drivers side console. In the event of a



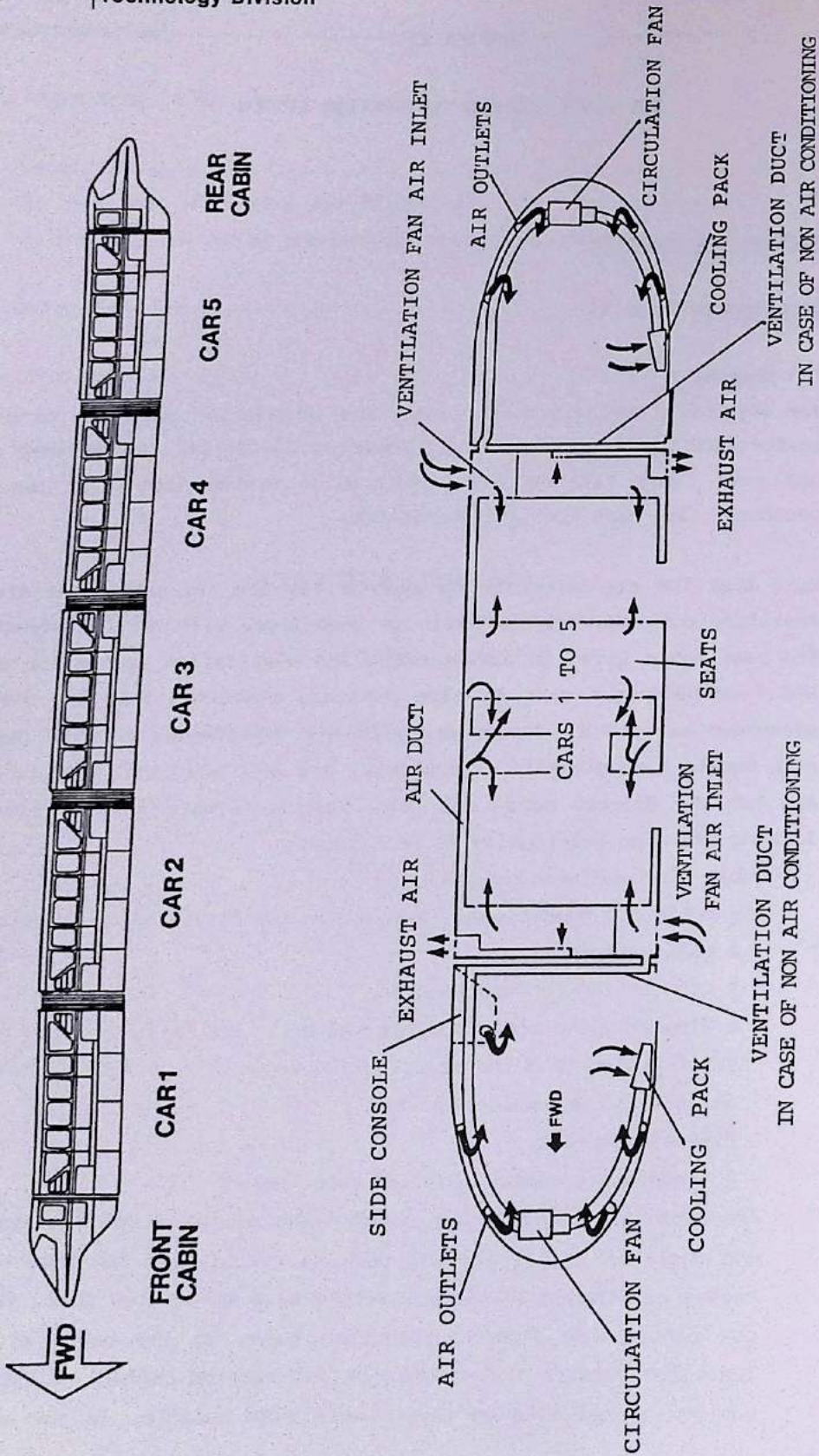


Fig. 1 Air conditioning - General Schematic



failure in the supply of cool air, the cooling system can be closed with a flapper valve and a crossfeed supply of ventilation air can be pulled through flexible ducting from car one (car five).

(a) Cooling Pack

The cooling pack is installed beneath the passenger seats adjacent to the left hand side wall.

A rectangular casing encloses the cooling pack. Air at ambient temperature, flows through a grille in the casing. The air then passes across cooling pipes and fins and into the flexible ducting.

(b) Circulation Fan and Housing.

A circulation fan and housing are installed under the front center fairing. (Refer Chapter 21-00). The fan is a 24V dc electric motor with a 160 watt rating. The purpose of the fan is to pull cool air from the cooling pack and distribute it along the flexible ducting to the air outlets. A flapper valve is fitted in the housing.

(c) Flapper Valve and Pneumatic Valve

A pneumatically operated valve located under the left hand (right hand) corner of the front lower fairing, (Refer Chapter 21-00), controls via a double acting cylinder a flapper valve installed in the fan housing. The piston of the double acting cylinder is directly connected to the flapper valve. Switches on the driver's secondary control panel control the pneumatic valve. When closed, the flapper valve which will seal off the flexible ducting from the cooling pack and expose the flexible ducting orifice that connects to car one (car five).

(d) Bifurcated Duct and Distribution Boxes.

A bifurcated duct is installed below the fan and fan housing. The duct has the circulation fan and the fan housing attached to it. Attached to each of the bifurcated duct outlets is a distribution box. Each distribution box has two outlets to which flexible ducting is connected. This flexible ducting lets air flow to the air collector duct installed under the front fairing. An extra air outlet on the drivers cabin RH distribution box facilitates the attachment of flexible ducting for the drivers fresh air louver.

(e) Air Outlets, and Collector Duct

Air outlets are part of the collector duct and let cool air flow



into the cabin. The fibreglass collector ducts are installed under the windscreen fairings.

(Refer Chapter 21-00). A louvered air outlet is installed in the drivers cabin to the right of the drivers speed control lever.

(f) Flexible Ducting.

Flexible ductings of coiled aluminum construction, let conditioned air flow to the cabin air outlets.

(g) Temperature Sensor.

A temperature sensor, automatically controls the cabin temperature. The sensor, located inside the hatrack, in the top right hand corner of the cabin endwall, is rectangular in construction with a rotary control on its facia. The control is calibrated in degrees celsius, the range is from 5 degree celcius to 30 degrees celsius (41 degrees fah. to 86 degrees fah).

(3) Ventilation System.

Each passenger car has an independent ventilation system with the following components:

- two ventilation fans and mounting trays
- rigid ducting
- two sets, rain protection covers and filters
- two vents for exhausted air.

The ventilation system, circulates air from the ventilation fans through ducting installed along the sidewalls to the seatboxes. The ventilation installation at each end of the car is similar therefore only one endwall installation is described.

(a) Ventilation Fan and Mounting Tray

A ventilation fan and tray is installed in a special compartment contained in the endwall. Access to the fan is gained through removable access and rain protection covers installed on the outside sidewall of the car. The fan is driven by a 24V dc electric motor with a 100 watt rating. A mounting tray with anti-vibration mountings is attached with four bolts to the compartment floor.

(b) Rigid Ducting

1 Rigid ducting is attached by quick release fasteners to the base of the special compartment that houses the fan. The ducting is installed on the exterior surface of the endwall and is attached with louvered quick release fasteners to an inlet vent.



2 Rigid ducting connects the exhaust vent on the end wall of the car to an exhaust outlet in a compartment opposite the ventilation fan compartment. The ducting consists of section of ducts bolted together and installed on the exterior or the endwall of the cars.

3 Rigid ducting is fitted on the interior of the car along the base of the sidewalls and attached to the seat boxes by nuts and bolts.

(c) Rain Protection Covers and Filters

A rain protection cover, attached with quick release fasteners, is fitted under the access cover to ensure no water reaches the filter. A filter, with quick release fasteners, protects the ventilation system against the ingress of foreign materials.

(d) Outlet Vent

An outlet vent of rectangular aluminum construction is attached with six bolts washers and nuts to the endwall of the car. The six bolts washers and nuts are also used for the first section of the rigid exhaust air ducting.

**B. Operation**

When the temperature sensor, installed on the endwall of the cabin, is selected to a temperature between 5 and 30 degrees cel. (41 and 86 degree fah.), and the cabin temperature rises above the sensor setting, the clutch of the air conditioning compressor is energized and coolant is pumped to the cooling pack. Ambient cabin air is pulled through the cooling pack by the cabin fan and with the cooling pack acting as a heat exchanger, the air loses temperature as it flows across the coils of the cooling pack. The cooled air now goes through flexible ducting and into the distribution boxes. From the distribution boxes the cooled air flows out of the air outlets to cool the cabin air. Cooled air also flows through flexible ducting to a louvered air outlet on the console to give cool air to the driver.

In the event of a fault in the air conditioning circuit or when the circulation fan will not operate and air cannot be pulled through the cooling pack to cool the cabin, ventilation air must be provided from the next passenger car. To let this ventilated air be diverted to the cabin, a flapper valve can be closed to seal off the ducting from the cool air



pack. The flapper valve is opened/closed by the piston of a double acting cylinder controlled by a pneumatic valve. The pneumatic valve has two solenoid-operated valves which operate to allow pressurized air, direct from the train supply, to extend or retract (close/open) the piston. The solenoid valves are controlled by switches on the secondary console. Ventilated air will flow from car one (car five) into the cabin when the VENT ON/OFF switch is set to VENT ON. Under normal operating condition, the cabins are air conditioned and each car is independently ventilated. The total rate of flow for both ventilating fans in a passenger car is 480 cu.ft/min. The ventilation air can be supplemented with the opening of the car windows (Refer to Chapter 23-00).

In car one, a temperature sensor is installed in the hatrack to the rear of the forward door. If the car temperature reaches a temperature higher than that set on the sensor, and the VENT ON/OFF switch is set to VENT ON, 24V dc is supplied to the electric fans in all the passenger cars and the fans will operate. Ambient air is pulled into the ventilation fan through a filter and the fresh air is blown into the ducting and subsequently to the air outlets under each seat.

Exhaust air rises to the height of the exhaust ventilators installed on the endwalls and the exhaust air is vented through ducting to the exterior of the train.

To avoid passenger discomfort in the event of an air conditioning failure and as previously detailed, ventilated air can be diverted from cars one and five to the two cabins. The air flows through flexible ducting into the distribution boxes in the cabin. For the operation and testing of temperature sensor, refer to the R and S manual.

An extractor fan fitted in the drivers console, cools the electrical equipment in the console.



3. Maintenance Practices

The maintenance schedule is shown in Table 301.

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
1	Ventilation System	General function check.	TI-29.0001	Quarterly
2	Ventilation fan	Test and general function check. Inspect carbon brushes. Renew carbon brushes.	TI-29.0002 TI-76.0800	Quarterly Quarterly Annual
3	Filter element	Renew.	TI-29.0003	Quarterly
4	Air Conditioning System	General function check.	TI-29.0100	Quarterly
5	Circulation fan	Test and general function check. Inspect carbon brushes. Renew carbon brushes.	TI-29.0101 TI-76-0801	Quarterly Quarterly Annual
6	Flapper valve	General function check.	TI-29.0102	Annual
7	Cooling pack	Test and general function check.	TI-29.0103	Quarterly
8	Filter element	Renew.	TI-29.0104	Quarterly

Table 301 - Maintenance Practices



**4. Servicing**

The servicing schedule is shown in Table 401

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
1	Ventilation fan	Clean.	TI-29.0002	Annual
2	Air ducts	Clean.	TI-29.0004	Annual
3	Circulation fan	Clean.	TI-29.0101	Annual
4	Flapper valve	Clean.	TI-29.0102	Annual
5	Cooling pack	Clean.	TI-29.0103	Annual
6	Air ducts	Clean.	TI-29.0105	Annual

Table 401 - Servicing



**5. Removal / Installation****A. Cabin Ventilation Ducting-Exterior Surface of Endwall**

---

**NOTE**

---

All metal to metal surfaces including bolts must be coated with anti-corrosion paste on installing.

---

**(1) Removal**

Fig. 501

- (a) Open the tire door and gain access to work area.
- (b) Slacken the clamp screw (1) that secures flexible duct (2) to the housing duct (3). Remove the flexible duct.
- (c) Remove the eight nuts (4), spring washers (5), washers (6) and bolts (7) attaching the housing duct (3) to the rigid duct (8).
- (d) Remove and discard the gasket (9).
- (e) Remove six nuts (10), spring washers (11), washers (12) and bolts (13) attaching the rigid duct (8) to the distance duct (14).
- (f) Remove the rigid duct (8) and discard the gasket (15).

**(2) Install**

- (a) Examine all components for freedom from damage or corrosion and for serviceability.
- (b) Ensure all mating surfaces are clean and dry.
- (c) Fit a new gasket (15) to the endwall inlet vent.
- (d) Position the rigid duct (8) to the endwall distance duct (14) and secure with six nuts (10), washers (9), spring washers (8) and bolts (7). Do not tighten the nuts at this stage.
- (e) Fit a new gasket (9) to the upper end of the rigid duct (8) and position the housing duct (3) to the rigid duct (8).
- (f) Secure the duct assemblies to the support bracket (16) with two nuts, spring washers, washers and bolts.
- (g) Fit the six nuts, spring washers, washers and bolt to secure the housing duct to the rigid duct (8). Tighten all nuts and bolts.
- (h) Ensure the work area is clean and free from debris and all tools



are removed.

(j) Do a leak test of the ducting. (Sect. 6)

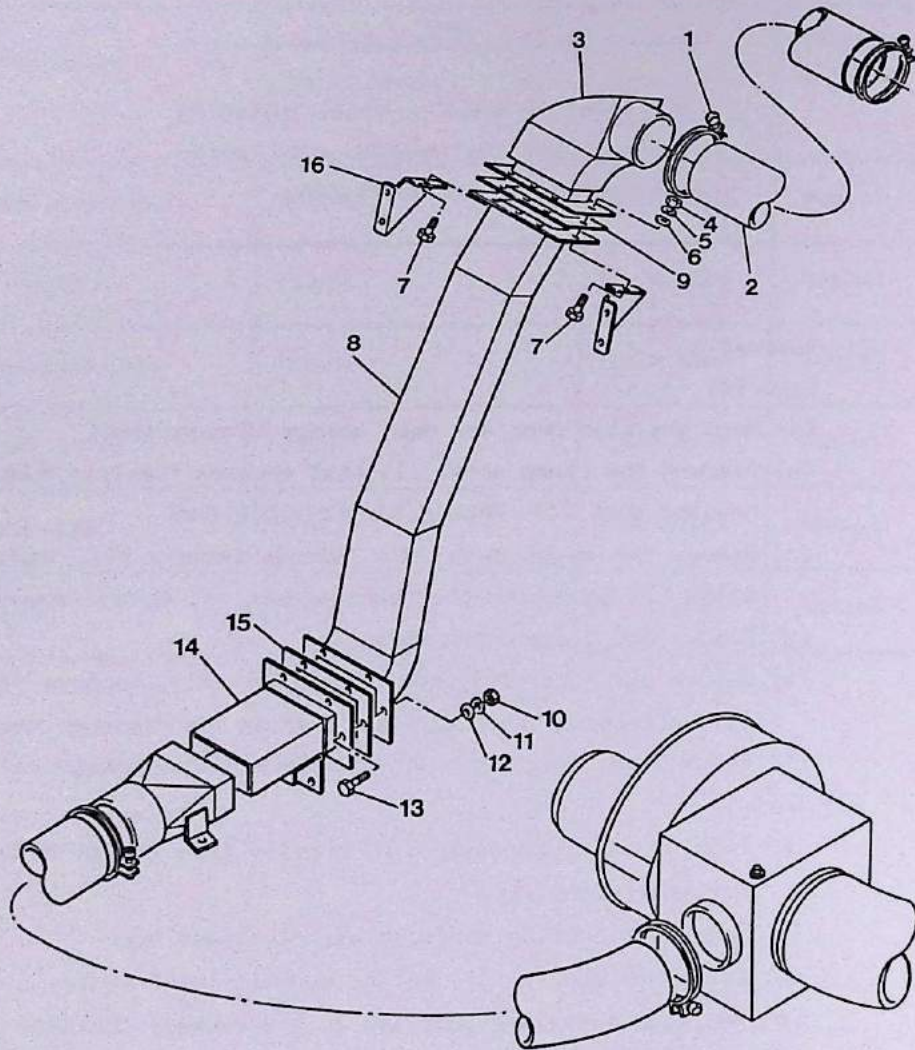


Fig. 501



**B. Ventilation Grille and Flexible Ducting**

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**NOTE**

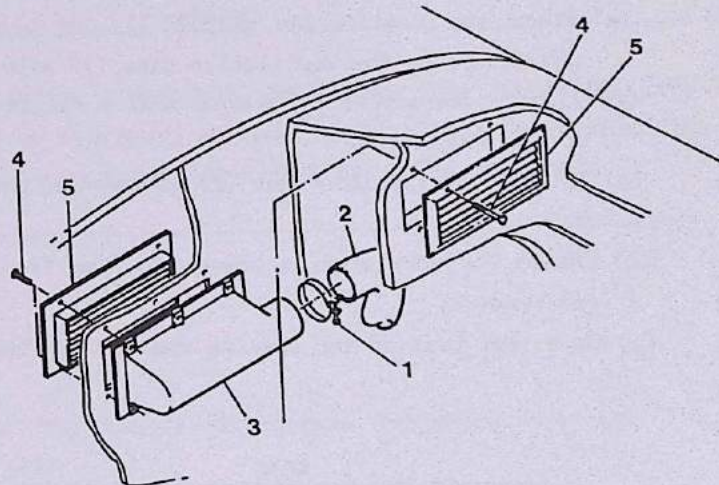
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All metal to metal surfaces must be coated with anti-corrosion paste when installing.

---

**(1) Removal****Fig. 502**

- (a) Open the tire door and gain access to the work area.
- (b) Slacken the clamp screw (1) that secures the flexible duct (2) to the ventilation case (3) and remove the duct.
- (c) Remove the four screws (4) attaching the ventilation grille (5) and ventilation case (3) to the endwall and remove the ventilation grille.

**Fig. 502**

---

**CAUTION**

---

BEFORE REMOVING THE NEXT STAGE,  
ENSURE THE VENTILATION CASE IS  
SUPPORTED.

---



- (d) Remove two screws and washers attaching ventilation case to the endwall.
- (e) Remove ventilation case.
- (1) Install
  - (a) Ensure the mating surfaces are clean and all old sealant has been removed.

---

NOTE

---

The sealant can be removed using a non-metallic scraper.

---

- (b) Use the approved sealant SISTA F103 - TRANSPARENT to make a seal on the contact surface of the items to be installed.
- (c) Support the ventilation case (3).
- (d) Position ventilation case to endwall and secure with screws.
- (e) Place the ventilation grille (5) in position and secure the grille (5) to the ventilation case (3) with the four screws (4).
- (f) Tighten the screws and ensure that a fillet of sealant is visible on all four sides.
- (g) Install the flexible duct (2) to the ventilation case and tighten the clamp (1).
- (h) Ensure the work area is clean and free from debris and all tools are removed.
- (j) Do a leak test of the ducting and joints (Sect. 6).

---

NOTE

---

Ensure the cure time for the sealant is fully expired before testing is performed.

---



**C. Ventilation Fan-Passenger Car (Typical)**

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**NOTE**

---

The removal for all ventilation fans is similar. However to do a tire change on the rear of car 5, the ventilation box must be removed. For this procedure see Section 5K.

---

---

**NOTE**

---

All metal to metal surfaces including bolts must be coated with anti-corrosion paste when installing.

---

---

**WARNING**

---

BEFORE REMOVING ELECTRICAL COMPONENTS, MAKE SURE THAT ELECTRICAL CIRCUITS ON WHICH WORK IS TO BE PERFORMED ARE MADE SAFE. DISPLAY A WARNING SIGN IN THE CABIN TO WARN THAT MAINTENANCE PRACTICES ARE BEING PERFORMED.

---

**(1) Removal****Fig. 503**

- (a) Release the two quick release fasteners and open the access cover (1).
- (b) Release the three quick release fasteners and remove the rain protector (2).
- (c) Release the four quick release fasteners (3) and remove the filter (4).
- (d) Remove the four screws and washers that attach the cover (5) of the junction box to the fan (6) and disconnect the electrical cables.
- (e) Remove the four nuts (7), spring washers (8), washers (9) and bolts (10) securing the fan (6) and tray to the special box.

29-00



- (f) Remove the fan and tray complete with anti-vibration mountings and thick rubberized seal.

---

**NOTE**

---

For removal of the ventilation fan from the ventilator motor, see Sect. 5G.

---

**(2) Install**

- (a) Ensure the anti-vibration mountings and rubberized seal on the fan tray are serviceable.
- (b) Install the fan and tray and secure with four nuts (7), spring washers (8), washers (9) and bolts (10).

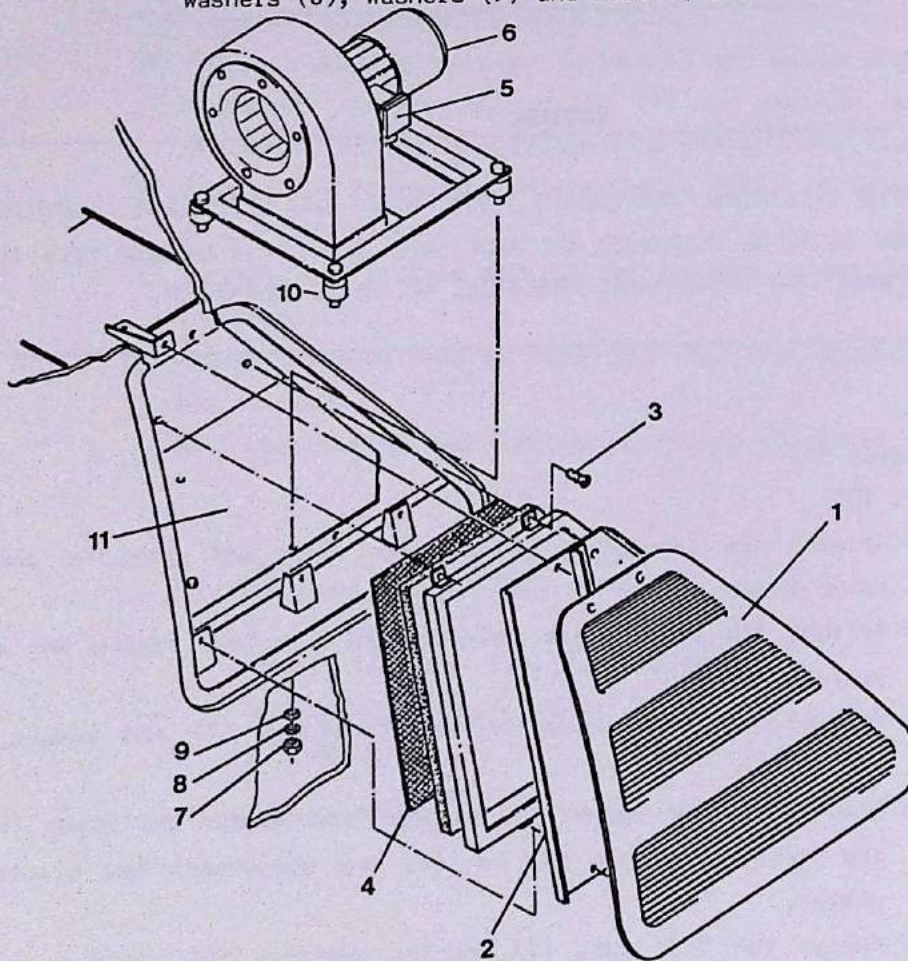


Fig. 503



- (c) Connect the electrical services to the fan (6) and fit the cover (5) to the junction box. Secure the cover with four screws and washers.
- (d) Make sure the work area is clean and free from debris and all tools are removed.
- (e) Install a cleaned or new filter (4) and secure with the quick release fasteners (3).
- (f) Install the rain protection cover (2) and secure with the quick release fasteners.
- (g) Install the access cover (1) and secure with the quick release fasteners.

**D. Car Inlet Ducting-Exterior Surface of Endwall**

NOTE

All metal to metal surfaces including bolts must be coated with anti-corrosion paste when installing.

(1) Removal

Fig. 504

- (a) Open the tire door and gain access to the work area.
- (b) Remove the endwall seats as necessary. (Chap. 25-00)
- (c) Release the four louvered quick release fasteners (1). Remove and discard lockwire and release the four quick release fasteners (2). Remove upper rigid duct (3).
- (d) Remove the six screws and washers securing the lower

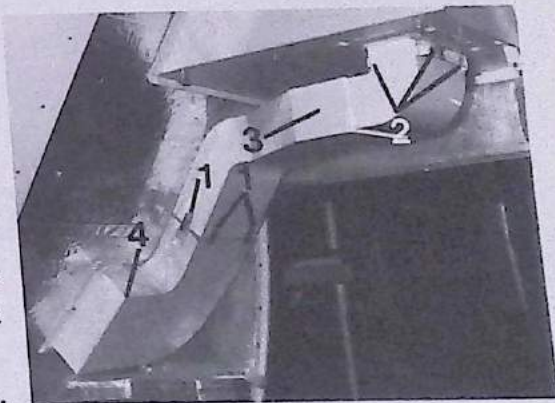


Fig. 504



rigid duct (4) to the exterior of the endwall.

(2) Install

- (a) Examine all components for freedom from damage and that all mounting surfaces are clean.
- (b) Fit the six screws and washers to secure the lower rigid duct (4) assembly to the endwall.
- (c) Fit a new gasket to the end of the ducting (3) that connects with the special box. Install the ducting to the special box and secure with louvered quick release fasteners (1, 2). Wire lock the quick release fasteners (2) in pairs.
- (d) Ensure the work area is clean and free from debris. Remove all tools.
- (e) Do a leak test of the ducting joints (Sect. 6).

E. Cooling Pack

---

NOTE

---

All metal to metal surfaces including bolts must be coated with anti-corrosion paste when installing.

---

(1) Removal

Fig. 505

- (a) Remove bench seats as necessary (Chap. 25-00).
- (b) Slacken the clamp screw that secures the flexible ducting to the cooling pack. Remove the flexible duct.
- (c) Disconnect the coolant pipes (2) from the cooling pack (1).

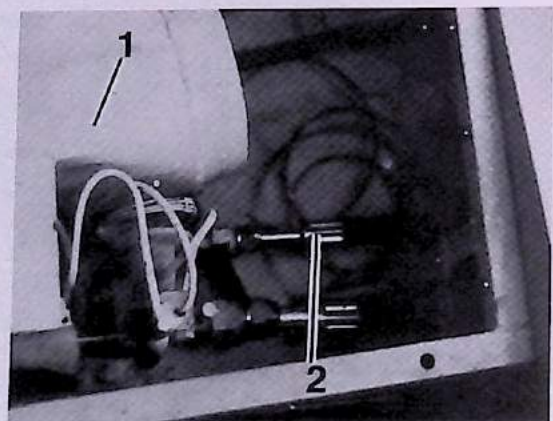


Fig. 505



---

**NOTE**

---

Ensure the cooling pack (1) is depressurized, before disconnecting coolant pipes (2).

---

- (d) Remove the three bolts, spring washers and washers that attach the cooling pack (3) to the structure. Remove the pack.

---

**NOTE**

---

If necessary remove the seat supports. (Chap. 25-00)

---

(2) Install

- (a) Ensure the cooling pack is serviceable.
- (b) Install the cooling pack (3) in position and connect the coolant pipes. Secure the pack with three bolts (4), washers and spring washers.
- (c) Fit the flexible ducting (2) to the cooling pack (3) and secure with clamp (1).
- (d) Ensure the work area is clean and free from debris and all tools are removed.
- (e) Replace the seats (Chap. 25-00).

F. Circulation Fan and Distribution Boxes-Cabin

---

**NOTE**

---

All metal to metal surfaces including bolts must be coated with anti-corrosion paste when installing.

---



---

**WARNING**

---

BEFORE REMOVING ELECTRICAL COMPONENTS, MAKE SURE THAT THE ELECTRICAL CIRCUITS ON WHICH WORK IS TO BE PERFORMED ARE MADE SAFE. DISPLAY A WARNING SIGN IN THE CABIN TO WARN THAT MAINTENANCE PRACTICES ARE BEING PERFORMED.

---

**(1) Removal**

Fig. 506

- (a) Remove the front fairings (1) (Chap. 21-00).
- (b) Remove the four screws and washers attaching the cover to the circulation fans junction box (2).
- (c) Disconnect the electrical wiring from the electric fan.
- (d) Remove and discard the plastic tie-wrap attaching the electrical cable to the fan tray.
- (e) Remove the two bolts and washers securing the seat tie-bar and remove the tie-bar (3).
- (f) Slacken the clamps on the flexible ducting (4) to the fan housing and remove the flexible duct.
- (g) Disconnect the flapper valve spindle from the actuator eye-end.
- (h) Remove the four washers, spring washers and nuts securing the fan and tray to the bifurcated duct. Remove the fan assembly.

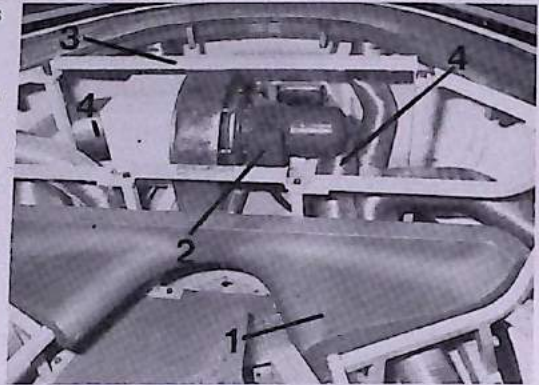


Fig. 506

---

**NOTE**

---

For removal of the ventilation fan from the ventilation motor, see Sect. 5G.

---



- (j) Slacken the clamps attaching the flexible ducting to the distribution boxes and remove the ducting.
  - (k) Remove the four nuts, washers, spring washers and bolts attaching the distribution boxes to the seat attachment supports.
  - (l) Remove the two bolts, washers, spring washers and bolts that attach the bifurcated duct to the floor structure. Remove the bifurcated duct and distribution boxes.
- (2) Installation
- (a) Make sure that all components are serviceable.
  - (b) Install the circulation fan and distribution boxes in position.
  - (c) Secure the circulation fan and boxes to the floor structure and seat supports with nuts, washers, spring washers and bolts.
  - (d) Connect the flapper valve spindle to the actuator eye-end.
  - (e) Fit the flexible duct (4) to the fan housing and distribution boxes and secure with the clamps.
  - (f) Connect the electrical cable to the junction box (2). Secure the cable to the tray with a new plastic tie-wrap.
  - (g) Fit the cover to the junction box and secure with four washers and screws.
  - (h) Install the seat tiebar (3) and secure with two bolts and washers.
  - (j) Ensure the work area is clean and free from debris, and all tools are removed.
  - (k) Do an adjustment of the flapper valve (Sect. 6)
  - (l) Fit the front fairing (Chap. 21-00).

G. Ventilation Fan from Electric Motor (Off Car)

---

NOTE

---

This task is written for workshop maintenance and not for on board maintenance. It is assumed therefore that the assembly has already been removed from the monorail as per section 5C.

---



## (1) Removal

Fig. 507

- (a) Prevent the fan blades from rotating.
- (b) Remove nut (5) and spring washer (6) securing the fan (3) to the shaft of the electric motor (2). Remove the fan.

---

**NOTE**

---

A antirotation woodruff key fitted to the shaft of the electric motor, keeps the fan located on the shaft. To remove the fan, the fan must be pulled from the shaft.

---

- (d) Remove nuts (2) and spring washers securing the fan housing (4) to the electric motor (1). Remove the fan housing.

## (2) Install

- (a) Ensure the electric motor is serviceable.
- (b) Install the fan housing (4) to the electric motor (1) and secure with spring washers and nuts (2).
- (c) Align the slot in the fans bearing surface with the Woodruff key on the shaft of the motor.
- (d) Slide the fan onto the shaft of the electric motor and secure with spring washer (6) and nut (5).
- (e) Bench test the electric motor with the fan to ensure the fan rotates freely and without obstructions.



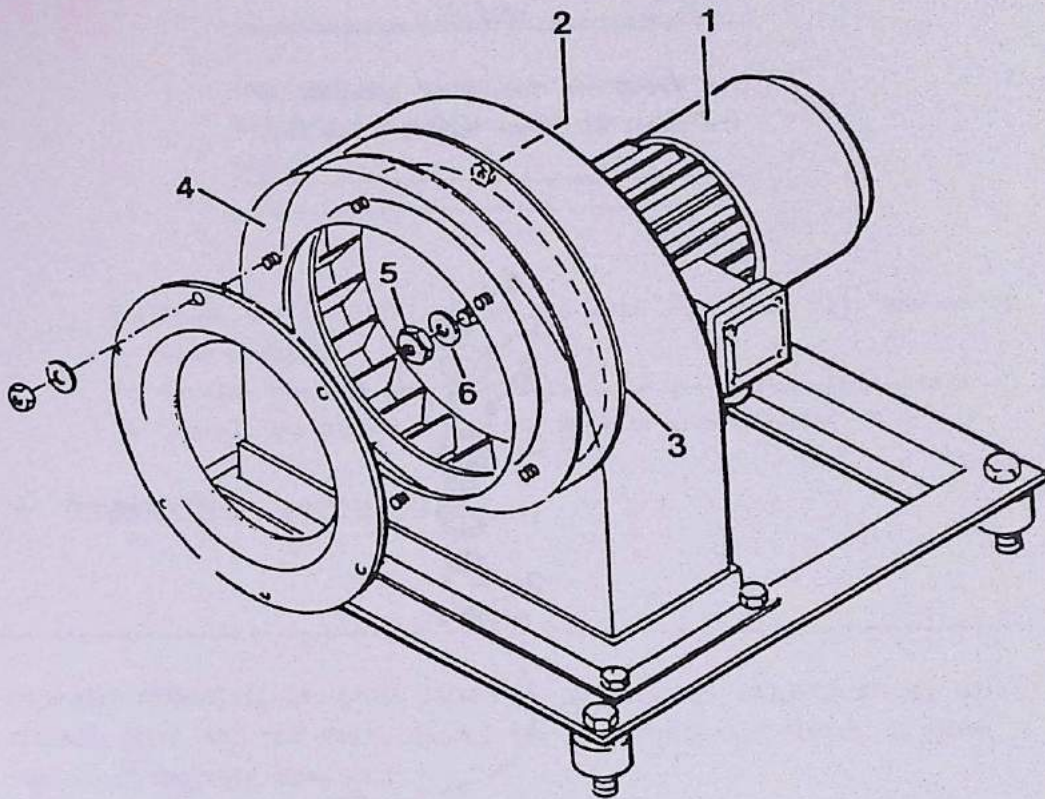


Fig. 507

**H. Drivers Fresh Air Louver**

(1) Removal

Fig. 508

- (a) Remove the side panel from the drivers console and gain access to the fresh air ducting.
- (b) Slacken the clamp (1) and remove the flexible ducting (2) from the louver (3)
- (c) Remove the fresh air louver (3) by pulling downwards and remove the bezel (4) from the console side panel top cover (5) by pushing upwards.



---

**NOTE**

---

The fresh air louver is retained in the bezel with four spring clips (6).

---

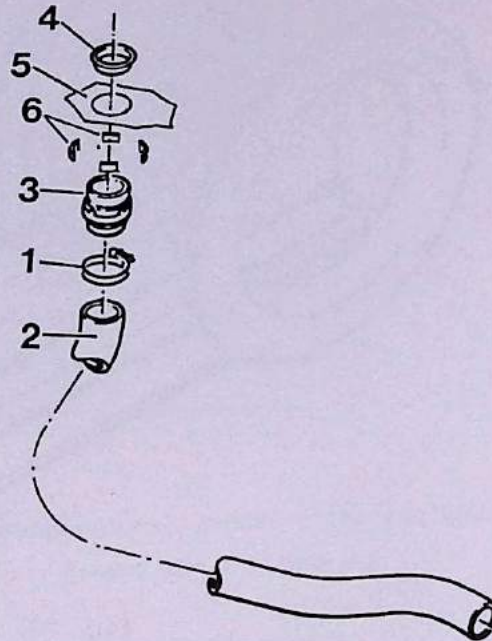


Fig. 508

(2) Install

- (a) Examine the ducting and louver for serviceability.
- (b) Position the fresh air louver (3) in the panel on the side console and press the bezel (4) onto the louver (3) to retain it in position.



---

**NOTE**

---

The fresh air louver should be inserted into the orifice from the underside.

---

- (c) Slide the flexible ducting (2) onto the louver (3) and secure with clamp (1).
- (d) Examine the work area for cleanliness and freedom from debris.
- (e) Install the side panel to the drivers side console.

**J. Pneumatic Valve and Actuator**

---

**WARNING**

---

PNEUMATIC COMPONENTS CAN CAUSE INJURY IF THEY ARE NOT ISOLATED BEFORE MAINTENANCE TASKS ARE PERFORMED. ENSURE THE MAIN PNEUMATIC SUPPLY IS DEPRESSURIZED BEFORE WORK COMMENCES.

---

---

**WARNING**

---

BEFORE REMOVING ELECTRICAL COMPONENTS, MAKE SURE THAT THE ELECTRICAL CIRCUITS ON WHICH WORK IS TO BE PERFORMED ARE MADE SAFE. DISPLAY A WARNING SIGN IN THE CABIN TO WARN THAT MAINTENANCE PRACTICES ARE BEING PERFORMED.

---



(1) Removal - Pneumatic Valve

Fig. 509

- (a) Disconnect the electrical cables from the solenoids (1) located each end of the pneumatic valve (2).
- (b) Disconnect the inlet pneumatic pipe (3) from the pneumatic valve (2). Fit blanks to all open pipe ends.
- (c) Disconnect both outlet pneumatic pipes (4) from pneumatic valve (2). Fit blanks to all open pipe ends.

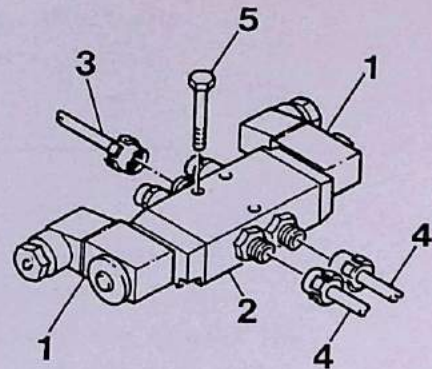


Fig. 509

- (d) Remove the nuts, washers and bolts (5) securing the pneumatic valve to the structure. Remove the valve.

(2) Removal - Actuator

Fig. 510

- (a) Disconnect both pneumatic pipes (1) from the actuator (2). Fit blanks to all open pipe ends.
- (b) Remove the safety clip (3) securing the eye-end (4) on the actuator to the bracket (5) on the flapper valve actuator (6).
- (c) Remove the circlip (7) retaining the actuator (2) to the forkend bracket (9) and remove the actuator.

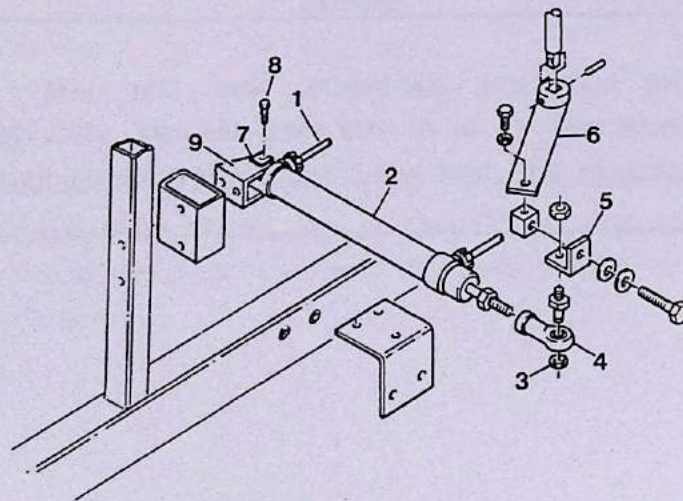


Fig. 510



**(3) Install - Actuator**

- (a) Examine the actuator and attachments for serviceability.
- (b) Examine the threaded orifices for freedom from damage and cleanliness.
- (c) Position the actuator (2) to the forkend bracket (9). Make safe with circlip (7).
- (d) Swivel the actuator (2) and if necessary extend the piston of the actuator until the eye-end (4) can be connected to the bracket (5). Make safe with safety clip (3).
- (e) Remove blanks from the pneumatic pipes (1) and connect the pipes to the actuator.

**(4) Install - Pneumatic Valve**

- (a) Examine the pneumatic valve (2) for serviceability, in particular that the pneumatic connections are not damaged.
- (b) Position the valve (2) to the structure and secure with nuts, washers and bolts (5).
- (c) Remove the blanks from the pneumatic outlet pipes (4) and connect the pipes to the valve (2).
- (d) Remove the blank from the pneumatic inlet pipe (3) and connect the pipe to the valve (2).
- (e) Connect the electrical cables to the solenoids (1).
- (f) Examine the work area for cleanliness and freedom from debris.

**(5) Completion**

- (a) Adjust the actuator. (See Sect. 6A)
- (b) Operationally test the pneumatic actuator and check the indication on the console. (See Sect. 6B)

**K. Ventilation Fan Housing - Car 5 (Rear)****(1) Removal**

Fig. 511

- (a) Remove the ventilation fan. (See Sect. 5C)
- (b) Remove motor housing (1).

1 Remove and discard lockwire, release quick release fasteners (2).



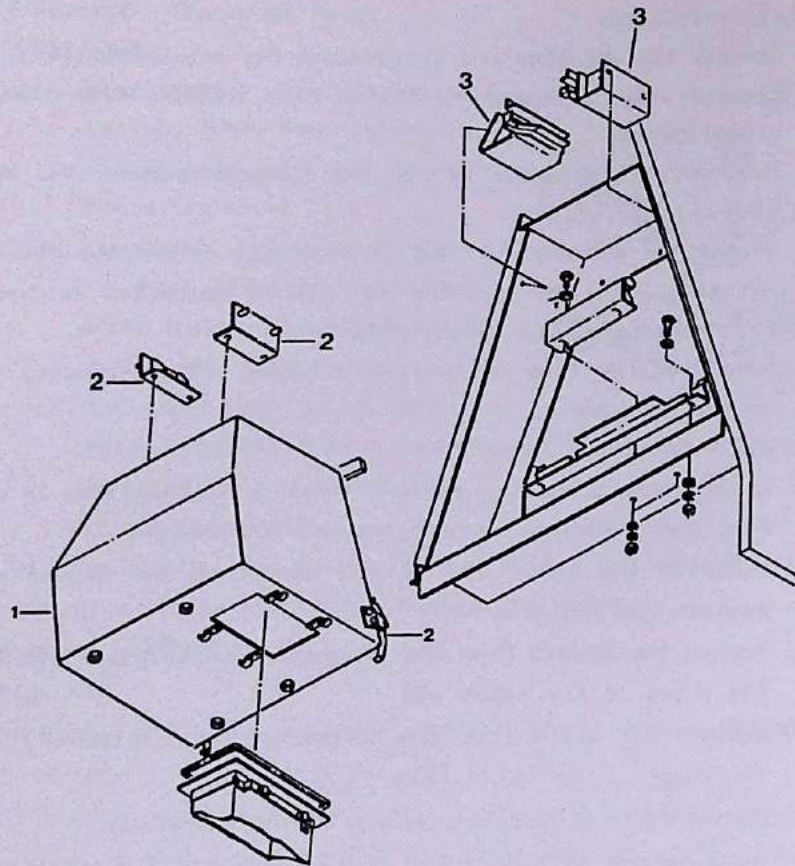


Fig. 511

2 Lift the housing (1) so the spigots (2) are raised from the spigot guides (3) simultaneously pull the housing (1) from its guides (3) and remove the housing.

(2) Install

- (a) Position housing (1) and enter spigots (2) onto guides (3).
- (b) Push the housing into the guides until the spigots (2) seat correctly.
- (c) Secure the housing in position with quick release fasteners (2).
- (d) Install the ventilation fan. (See. Sect. 5C)



**6. Adjustment/Test****A. Adjustment**

Not applicable (N/A).

**B. Test****(1) Leak Test of Ducting and Joints**

- (a) Ensure the circulation fan is operating.
- (b) Gain access to the ducting to be tested.
- (c) Make a weak solution of soap and water and apply the solution to the joint to be tested.
- (d) Observe the joint for freedom from leaks.

---

**NOTE**

---

A leak will be evident if the soap and water solution shows a bubbling effect. In the event of a leak, tighten the clamping arrangement. If the leak persists, remove the component, clean the mating surfaces and remove any corrosion or other anomalies. Fit a new gasket/seal (if installed) and tighten the joint. Retest the connection.

---

**(2) Pneumatic Actuator and Indication**

- (a) Ensure 24V dc power is available to circuit.
- (b) Ensure A/C1 - ON/OFF and A/C5 - ON/OFF switches on primary control panel are set to OFF then operate to ON and check the flap-per valve has closed.
- (c) Operate A/C1 and A/C5 ON/OFF switches to OFF and check the flap-per valve has opened.



**7. Cleaning/Painting****A. Cleaning**

- (1) The ducts should be cleaned with a weak solution of detergent free cleaning agent in warm water. After cleaning, the ducts should be dried using a dry lint-free cloth.

**B. Painting**

- (1) The outside surface of the fans, fan housing and cooling pack are painted with a gloss paint. (Refer to Chapter 11-00).



**MBB**

Transportation  
Technology Division

**CHAPTER 39-00  
AUDIO AND  
INTERPHONE SYSTEM**

Jan. 88



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## CHAPTER 39

## AUDIO AND INTERPHONE SYSTEM

1. Description and OperationA. Description (Fig. 1)

## (1) General

The Audio and Interphone System in the monorail consists of four sub-systems:

- Transceiver. To enable the driver to communicate with stations outside the monorail.
- Public Address (PA) System. To enable the driver to make announcements to the passengers.
- Tape System. To enable the driver to play pre-recorded tapes to the passengers.
- Emergency Intercom System. To provide a means of communication from cars 1 to 5 and from the rear cabin to the drivers cabin in the event of an emergency.

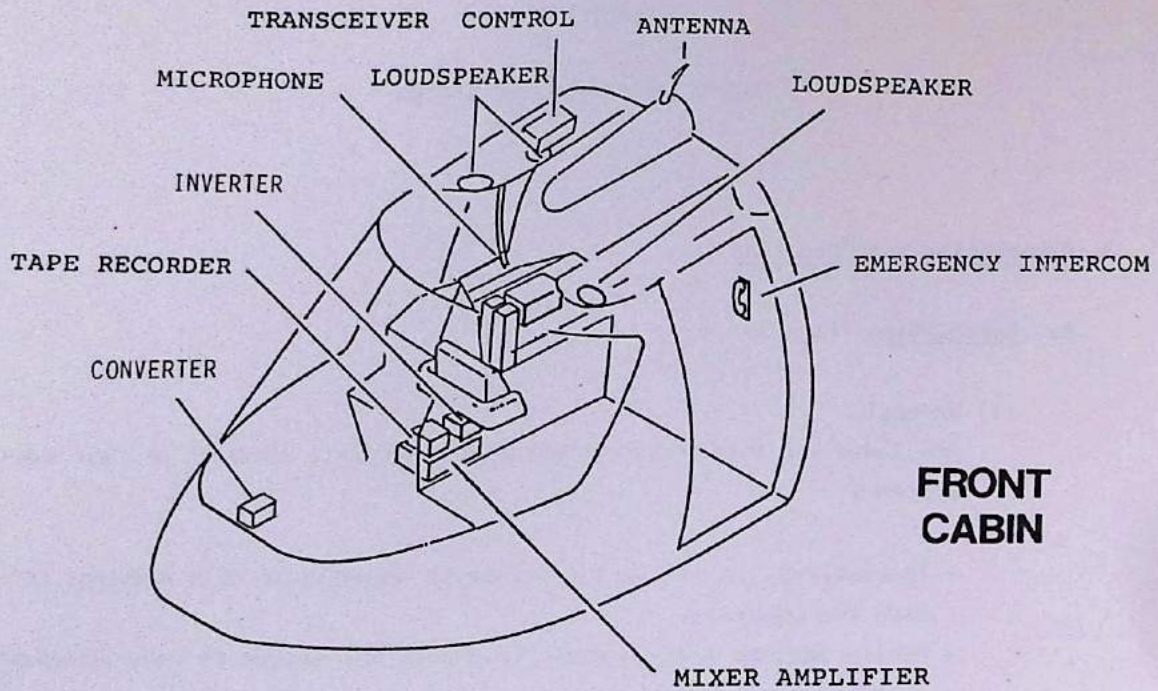
The system components, except for the emergency intercom system, which is self-contained, are operated by switches on the drivers primary and secondary control panel and by switches on the equipment itself. A set of lights on the drivers primary console serves to indicate to the driver the source of a call over the emergency interphone system.

A relay box is located in the compartment to the right hand side of the drivers seat. The relay box contains twelve relays for the switch circuits (Refer to electrical drawing set).

The power supplies for the audio and interphone system are:

- 24 VDC from the main batteries
- 12 VDC from a 24 VDC/12 VDC converter
- 110 VAC 60 Hz from a 24 VDC/110 VAC inverter.





EMERGENCY INTERCOM EXTENSION

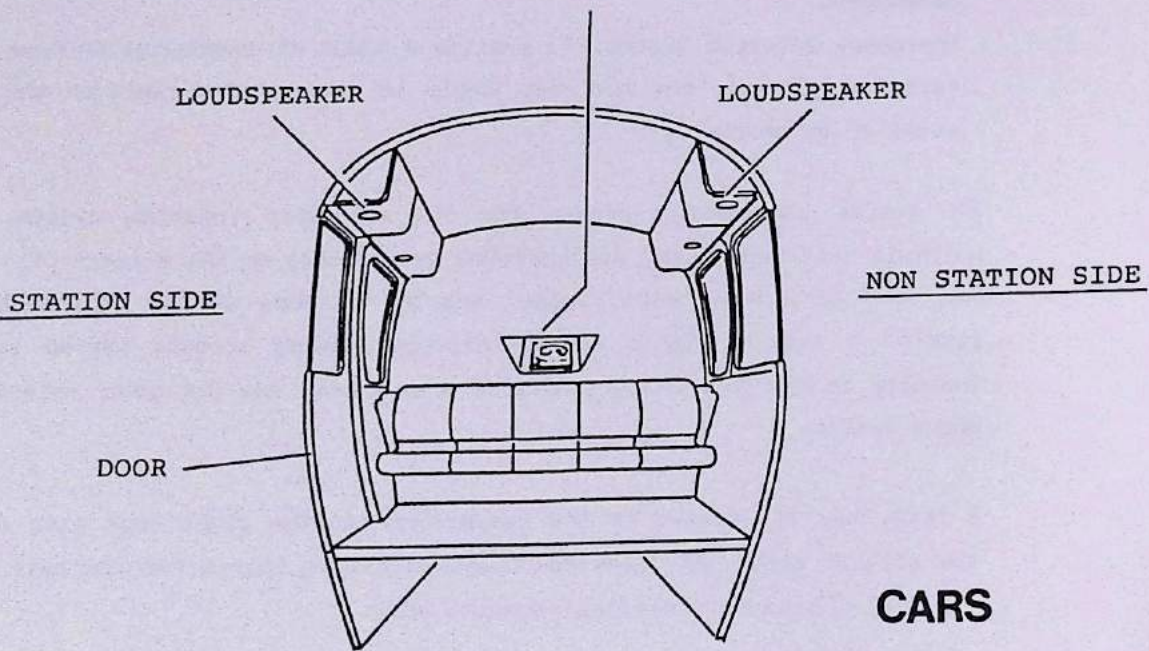


Fig. 1 Audio and Interphone System - General Arrangement



## (2) Audio and Interphone System Components

## (a) Transceiver

The monorail is equipped with a two-channel FM transceiver for external communication. One of the channels is used for normal communications, the other for emergencies. The components of this system are:

- two-channel FM transceiver
- antenna, roof mounted
- converter 24 VDC/12 VDC
- loudspeaker
- microphone
- relay box N2

1 The two-channel FM transceiver is fitted in the front cabin inside the hatrack above the right hand window. There is a hinged cover on the hatrack for access to the radio controls.

2 An antenna is mounted on the front cabin at the rear of the roof centerline. It is a ground plane antenna with a plastic base. The coaxial antenna cable is attached by a coaxial connector.

3 The 12 VDC power to the transceiver is supplied by a 24 VDC/12 VDC converter located in the front cabin's RH seatbox.

4 A loudspeaker is fitted to the radio mounting beneath the radio.

5 A pre-amplifier for adapting the microphone volume is installed in the relay box N2. For detailed information on the microphone refer to Section 1.

6 The relay box N2 is fitted in the compartment to the right hand side of the drivers seat. The relay box controls the switching of the microphone and the PA and tape system, as well as the caption indicators for the emergency intercom system.



## (b) Public Address (PA) System

The PA system on the monorail enables the driver to make announcements to the passengers. The system consists of the following components:

- microphone, with gooseneck extension
- mixer/amplifier XM 120
- loudspeaker system
- relay box N2
- rocker switch RADIO MIKE/XMIT on the drivers primary console
- push-button switch PA MIKE on the drivers primary console.

1 The microphone is of a dynamic, hypercardioid type fitted to a 42 cm long flexible gooseneck extension. It is connected through a 3 pin cannon plug to a socket beneath the transceiver in the front cabin. Access to the cannon connection is through the hatrack above the right hand window.

2 The mixer/amplifier with a power output of 120 Watt sinus modulates and amplifies the output signal from the microphone. It has sliding controls for setting the volume. An equalizer is installed with rotary controls on the front panel for setting treble, presence and bass. The mixer/amplifier is powered by an operating voltage of 24 VDC connected to the battery input and with the negative to the ground. The output side of the amplifier is provided with a broadband transformer for an output voltage of 70 Volts (typ.).

3 The loudspeaker system consists of 5 high-performance broadband loudspeakers in each car. Two loudspeakers are mounted on brackets above the hatrack on the non-station side, three loudspeakers above the hatrack on the station side. The loudspeakers are fitted with preliminary booster transformers to compensate for power loss due to long cable runs. The rear cabin is fitted with two loudspeakers inside the left hand and right hand ceiling trim panels. The front cabin has two loudspeakers inside the left hand and right hand ceiling trim panels. The loudspeakers in the front cabin



are connected to the 40 ohm monitor output with an attenuator per loudspeaker so that no feedback is generated by the microphone.

The loudspeakers are provided with soldered terminals and 2,8 mm DIN connectors. The loudspeakers are mounted to the hatrack so that the sound is emitted downwards. Foam plastic is fitted between the acoustic baffle and the cover to eliminate vibration noise and to improve the acoustic quality.

4 The relay box N2 contains relays that switch the microphone output from the transceiver (switch RADIO MIKE/XMIT) to the PA system (switch PA MIKE). The microphone is activated when and as long as switch XMIT or PA MIKE is pressed. Pressing the PA MIKE switch also suppresses tape output during the announcement without stopping the tape.

(c) Tape System

The tape system on the monorail enables the driver to play pre-recorded tapes to the passengers. The components of this system are:

- cartridge player
- inverter 24 VDC/110 VAC 60 Hz
- relay box N2
- rocker switch SOUND ON/SOUND OFF on the drivers secondary console
- push-button switch TAPE START on the drivers primary console.

All of these components, except the inverter, are installed in the compartment on the right hand side of the drivers seat. The inverter is installed under the RH forward passenger seat in the front cabin.

1 Endless mono tapes (NAB type AA) can be played on the processor-controlled ITC Delta I cassette tape recorder. Tape control is by means of acoustic signals recorded on a separate cue track. The maximum playing time of a cassette is approx. 10 minutes. After a 4 second pause, the tape automatically stops.



It can be restarted by the driver.

2 Microphone and tape recorder volume can be controlled separately on the amplifier (Refer Sect. 1).

3 The tape recorder requires 110 VAC therefore a 24 VDC/110 VAC inverter is provided. The rocker switch SOUND ON/SOUND OFF on the drivers secondary console, switches the inverter via the relay box and thus powers the tape recorder. At the end of a section of recording, the tape automatically runs forward until it encounters the next cue tone, it then stops and the TAPE START switch is lit up. Pressing the push-button switch TAPE START starts the tape.

(d) Emergency Intercom System

The emergency intercom system is a set of telephones with the main extension located on the rear wall to the left of the drivers seat in the front cabin. The system has one extension inside the emergency exit step on the front wall of cars 1 to 5, and one extension on the right hand side of the front wall next to the right window in the rear cabin. The front of the emergency exit steps on the front wall of cars 1 to 5 is closed off by a door, labelled EMERGENCY INTERCOM. This door is hinged at its bottom edge and held in the closed position by a pair of permanent magnets at the upper edge adjacent to the left and right corners. The door can be opened by inserting a finger into the finger hole in the center of the door near the upper edge and pulling outwards and downwards. The telephones in the front and rear cabins are not enclosed. The emergency intercom system is powered by 24 VDC.

The emergency intercom system consists of the following components:

- telephone handset
- telephone cradle
- telephone unit



- relay box N2
- caption indicators

1 The telephone handset is a conventional type with the earphone at one end and the microphone at the end to which the cable is attached. The telephone handset is connected to the telephone cradle by a length of coiled cable. The handset is held in place on the telephone cradle by a spring mechanism.

2 The telephone cradle, in addition to the spring mechanism for holding the handset, has two switches with plastic extensions. The switches are held open by the pressure of the handset on the plastic extensions when the handset is in place. They move to the spring-loaded closed position when the handset is lifted from the cradle. The telephone cradle in the front cabin is additionally fitted with a buzzer which sounds whenever any of the other handsets are removed from their respective cradles. The telephone cradle also contains the electronic circuits for the earphone, the microphone and for the two switches. The telephone unit in the front cabin has connections to +24 VDC and to GND for the entire emergency intercom system.

3 The telephone units have printed circuit boards containing terminal strips for the electrical connection of the extensions. The telephone units are located as follows:

- front cabin, in the compartment on the right hand side of the drivers seat on the outside wall.
- cars 1 to 5, in the right hand hatrack.
- rear cabin, beneath the fairing in the right hand front corner of the cabin.

4 The relay box N2 in the compartment on the right hand side of the drivers seat, contains relays that switch the lights in the respective caption indicators on the driver's console whenever any of the handsets is removed from its respective cradle.



## (3) Controls and Indicators

The controls that apply to the complete audio and interphone system are:

- the LAMP TEST switch (Fig. 2, 1); setting the switch applies a separate power supply to all caption indicators and switch lights to test for burned out filaments.
- CB20 (COMM SYSTEM) (Fig. 2, 7), which controls the 24 VDC power supply to the audio and interphone system.

## (a) Transceiver.

The controls and indicators for the transceiver are:

- RADIO MIKE/XMIT switch (Fig. 2,4); this is a three-position switch. Position RADIO MIKE is the off-position; the center position powers the radio; setting the switch to the XMIT position switches the microphone to the transceiver, upon release, the switch returns to the center position (press to talk).

---

NOTE

---

For controls and indicators on the transceiver refer to vendor documentation.

---

## (b) PA System

The controls and indicators for the PA system are:

- PA MIKE switch (Fig. 2, 3); pressing the switch activates the microphone (press to talk).



---

**NOTE**

---

For controls and indicators on the mixer/amplifier refer to vendor documentation.

---

**(c) Tape System**

The controls and indicators for the tape system are:

- SOUND ON/SOUND OFF switch (Fig. 2, 6); setting the switch to the SOUND ON position causes a relay in relay box N2 to close, switching 24 VDC to the 24 VDC/110 VAC inverter, and thus applying power to the tape recorder.
- TAPE START switch (Fig. 2, 2), after power is applied to the tape recorder, the tape advances until reaching the first cue tone, the tape then stops and the light in the switch lights up. Pressing the switch causes the tape to start forward until reaching the next cue tone.

---

**NOTE**

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For controls and indicators on the mixer/amplifier refer to vendor documentation.

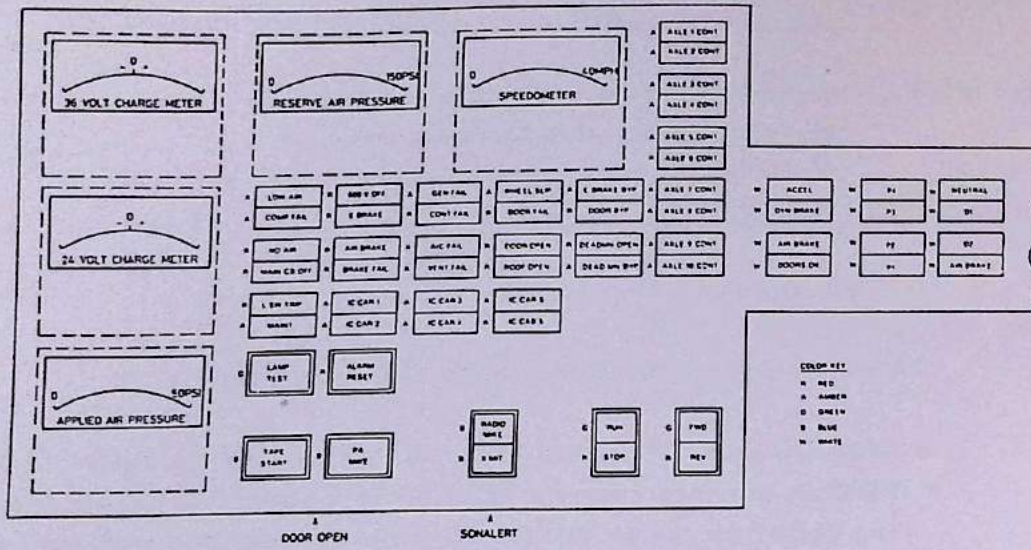
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**(d) Emergency Interphone System.**

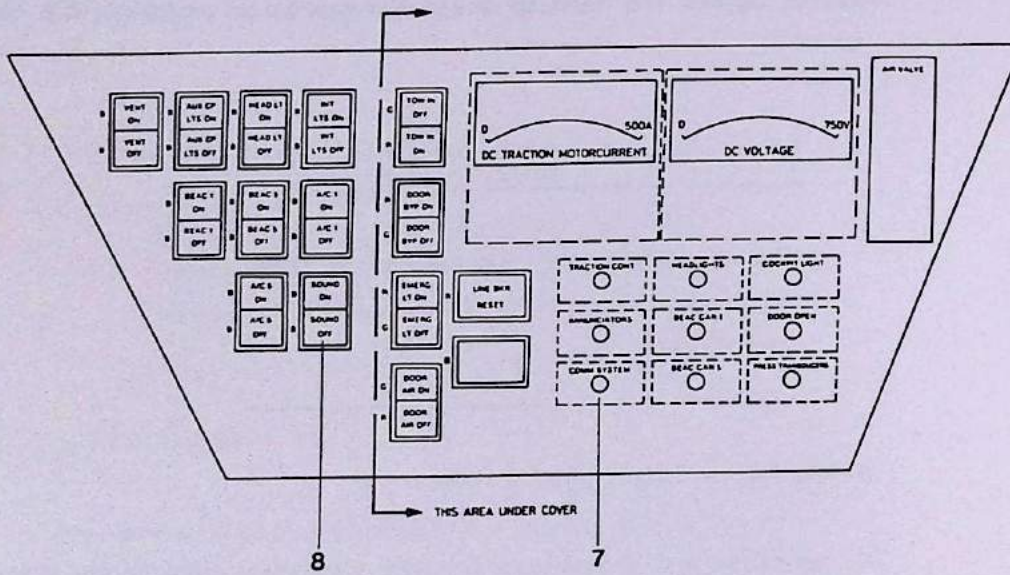
The controls and indicators for the emergency interphone system are:

- six amber caption indicators (Fig. 2, 5) labelled:  
IC CAR1, IC CAR2, IC CAR3, IC CAR 4, IC CAR5, IC CAB5; these caption indicators light up to indicate to the driver the source of a call on the emergency interphone system.





Primary panel



Secondary panel

Fig. 2 Drivers Panels



**B. Operation**

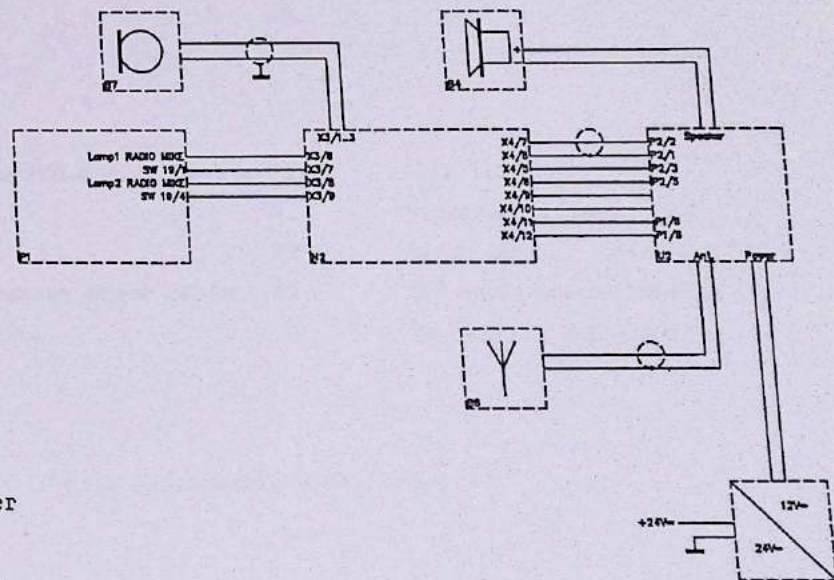
**(1) Transceiver**

The schematic of the transceiver is shown in Fig. 3.

(a) Power on. To switch power to the transceiver, set switch-RADIO MIKE/XMIT on the drivers primary console (Fig. 2) to the center position. This allows the radio to operate in the receive mode.

(b) Volume and frequency selection. For access to the transceiver, open the door in the right hand hatrack above the drivers seat. The transceiver is operated by switches on the transceiver front panel. For operation of the transceiver, refer to vendor documentation.

(c) Transmission. To transmit, set the RADIO MIKE/XMIT switch on the drivers primary console (Fig. 2, 4) to the XMIT position. Hold depressed for the duration of the transmission.



**Legend:**

- B4 Loudspeaker
- B6 Antenna
- B7 Microphone
- N2 Relay box
- P1 Drivers primary console
- U2 Transceiver

Fig. 3 Schematic - Transceiver system



## (2) PA System

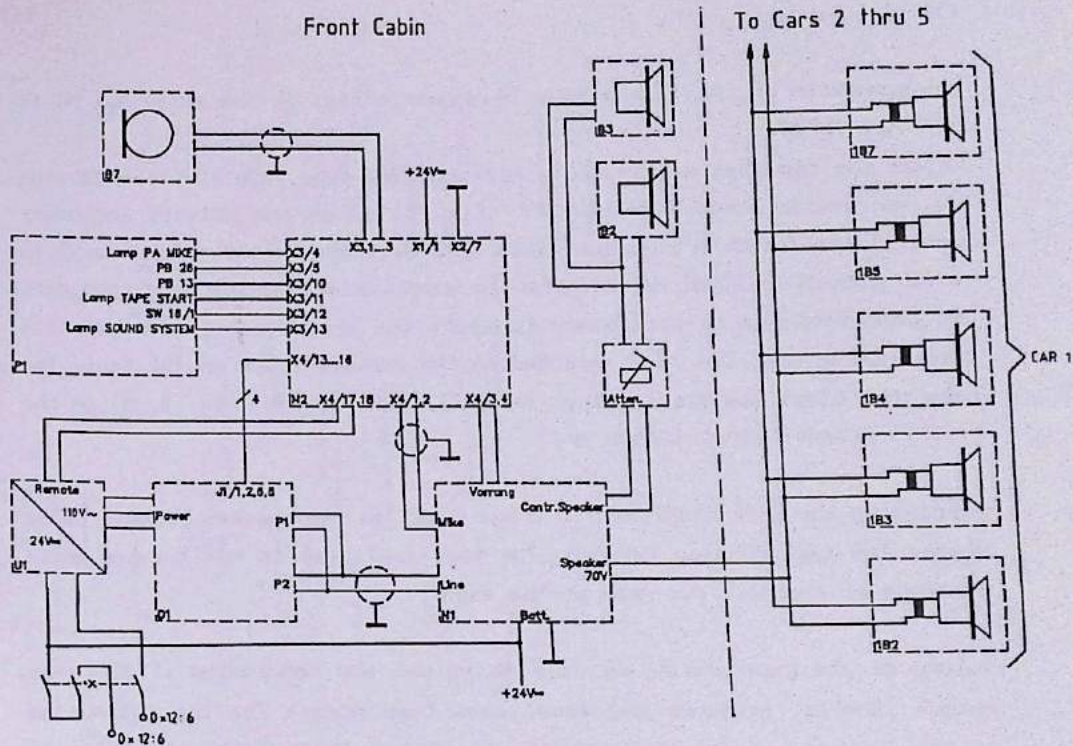
The schematic of the PA system is shown in Fig. 4.

Power to the PA system is switched with CB20 (COMM SYSTEM). For further details on the operation of the mixer/amplifier, refer to vendor documentation.

To use the PA system, depress the PA MIKE button (Fig. 2, 3) on the drivers primary panel and keep it depressed. This activates the microphone, while reducing the volume of the tape output from the mixer/amplifier. Releasing the PA MIKE button deactivates the microphone and returns the tape output to the normal volume level.

Volume of the microphone input, as well as volume and modulation of the PA system output (treble, presence and bass) have been preset for the optimum acoustic effect. If it is necessary to change these settings, refer to vendor documentation for the mixer/amplifier.





Legend:

- |                                    |    |                         |
|------------------------------------|----|-------------------------|
| 1B7, 1B5, Loudspeakers cars 1 to 5 | D1 | Tape recorder           |
| 1B4, 1B3                           | N1 | Mixer/amplifier         |
| 1B2                                | N2 | Relay box               |
| B2, B3 Loudspeakers front cabin    | P1 | Drivers primary console |
| B7 Microphone                      | U1 | 24 VDC/110 VAC inverter |

Fig. 4 Schematic - PA System



## (3) Tape System

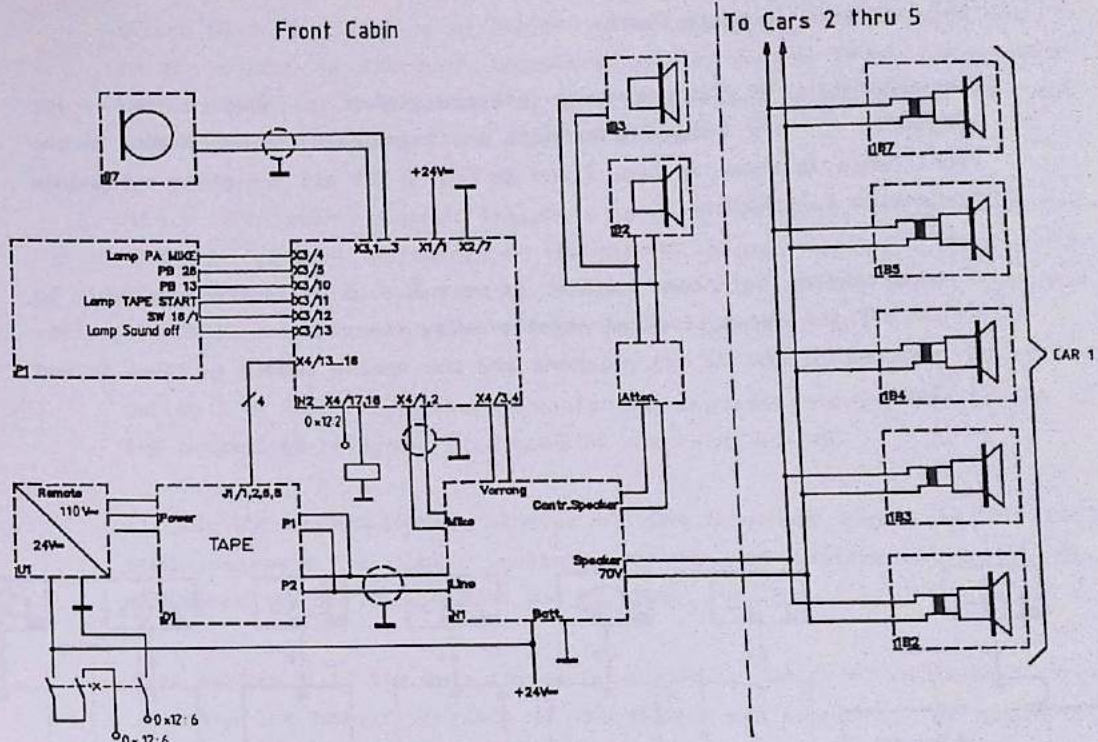
The schematic of the tape system is shown in Fig. 5. The relay box N2 is in Chap. 76-00.

To use the tape system, insert a pre-recorded tape into the tape recorder. Set switch SOUND ON/SOUND OFF (Fig. 2, 6) on the drivers secondary panel to the SOUND ON position. This sets switches in the relay box N2 to switch the 24 VDC/110 VAC inverter to supply power to the tape recorder. The tape recorder is programmed to start the tape running forward until reaching the next cue tone recorded on the control track on the tape. The tape then stops and the light in the TAPE START switch (Fig. 2, 2) on the drivers primary panel lights up.

Depressing the TAPE START SWITCH (Fig. 2, 2) on the drivers primary panel starts the tape running forward. The tape continues to run forward until it stops at the next cue mark on the tape.

Volume of the tape input, as well as volume and modulation of the tape output (treble, presence and bass) have been preset for the optimum acoustic effect. If it is necessary to change these settings, refer to vendor documentation for the mixer/amplifier.





Legend:

1B7, 1B5, Loudspeakers cars 1 to 5	D1	Tape recorder
1B4, 1B3	N1	Mixer/amplifier
1B2	N2	Relay box
B2, B3 Loudspeakers front cabin	P1	Drivers primary console
B7 Microphone	U1	24 VDC/110 VAC inverter

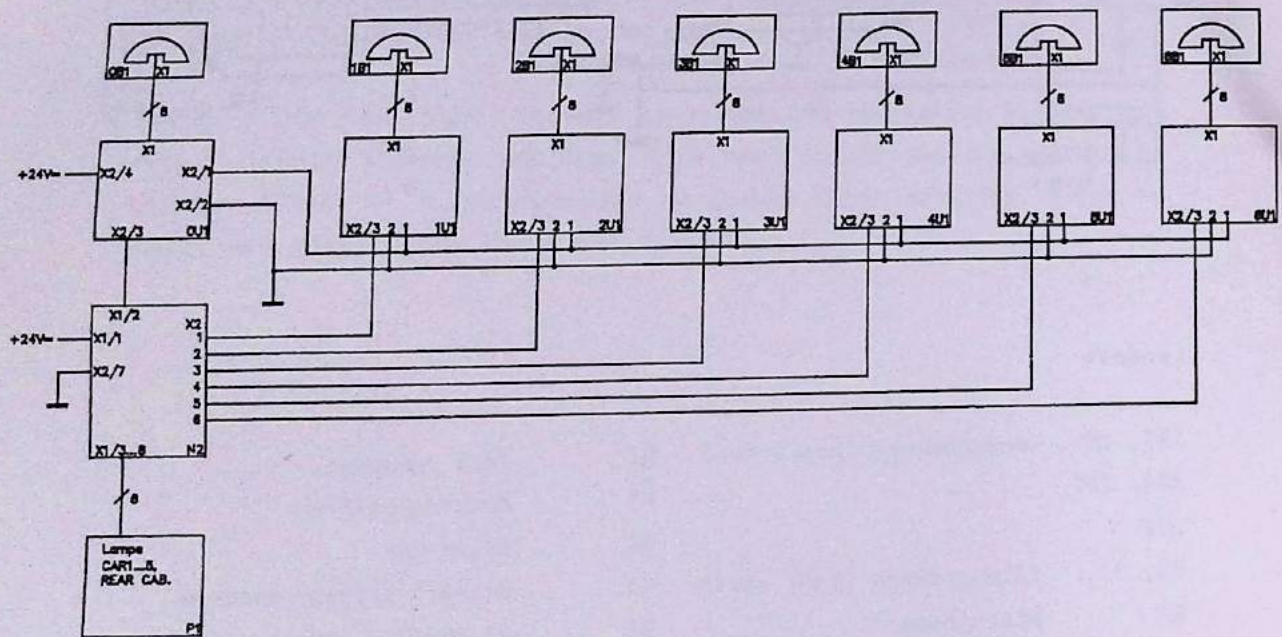
Fig. 5 Schematic - Tape System



(4) Emergency Intercom System

The schematic for the emergency intercom system is shown in Fig. 6. The schematic for the telephone handset and telephone cradle located in the front cabin is shown in Fig. 7 and in Fig. 8 for all the other telephones (extension telephones).

If an extension telephone handset in cars 1 to 5 or in the rear cabin is lifted off the respective telephone cradle, the plastic switch extensions of switches S1 and S2 are released and the spring loaded switches S1 and S2 close.



Legend:

- |     |                      |     |                          |
|-----|----------------------|-----|--------------------------|
| DB1 | Main telephone       | P1  | Drivers primary console  |
| nB1 | Extension telephones | OU1 | Main telephone unit      |
| N2  | Relay box N2         | nU1 | Extension telephone unit |

Fig. 6 Schematic - Emergency Intercom System



Switch S2 of each extension telephone is connected through relay box N2 to the buzzer in the main telephone cradle in the front cabin. When switch S2 on any extension telephone is closed, the buzzer in the main telephone cradle in the front cabin will sound.

Switch S2 of each extension telephone is also connected through relay box N2 to the caption indicators on the drivers primary console. When switch S2 on any extension telephone is closed, the light in the respective caption indicator on the driver primary panel will light up.

Switch 1 of each telephone connects the earphone and the microphone of the respective telephone to inputs of the relay box N2.

Lifting the main telephone handset off the telephone cradle in the front cabin releases the plastic switch extensions of switches S1 and S2 and the spring loaded switches S1 and S2 close.

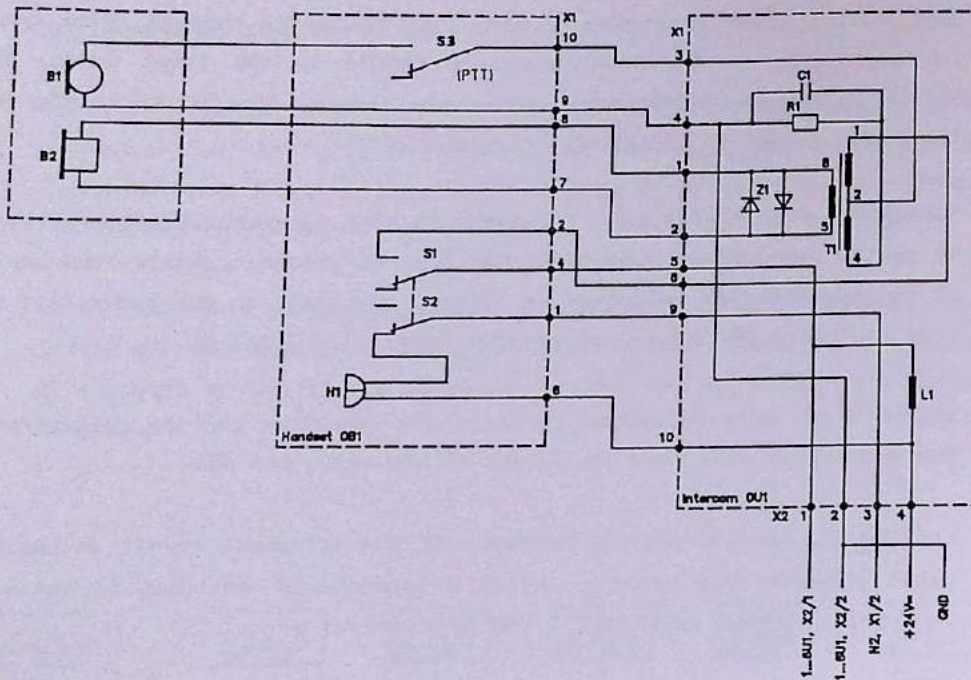
When switch S2 in the main telephone cradle in the front cabin is closed, it opens the buzzer circuit. If the buzzer was sounding, the sound will stop. The light in the caption indicator on the drivers primary panel remains lit until the extension telephone handset is replaced on its respective extension telephone cradle, and consequently switch S2 is opened.

When switch S1 in the main telephone cradle in the front cabin is closed, the circuit is completed from the front cabin to the extension telephone handset that has been lifted off its cradle.

Replacing the main telephone handset into its telephone cradle in the front cabin closes switch S2, closing the buzzer circuit, and opens switch S1, opening the earphone and microphone connection to relay box N2.

Replacing the respective extension telephone handset into its telephone cradle opens switch S1, opening the earphone and microphone connection to relay box N2, and opens switch S2, opening the buzzer circuit and causing the light in the caption indicator to go out.





Legend:

- |     |                  |     |                |
|-----|------------------|-----|----------------|
| B1  | Earphone         | H1  | Buzzer         |
| B2  | Microphone       | OU1 | Telephone unit |
| OB1 | Telephone cradle |     |                |

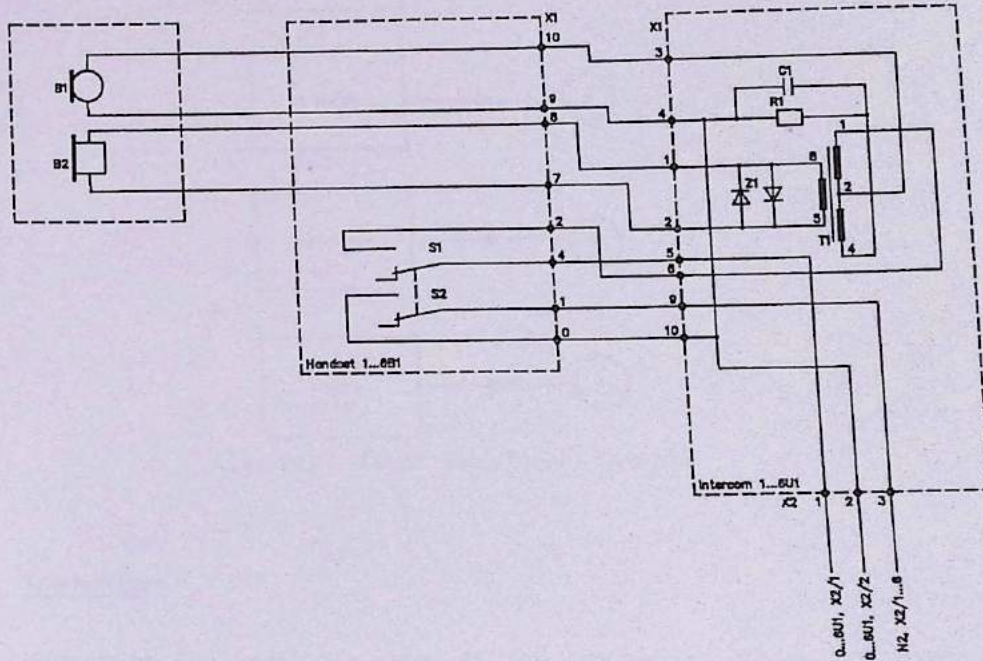
Fig. 7 Schematic - Telephone front cabin

If more than one extension telephone is picked up while the main telephone is still in its cradle, the buzzer will sound in the front cabin and the lights in the respective caption indicators for each one of these extension telephones will light.

If another extension telephone is picked up while the driver is already connected to one or more extension telephones, the light in the respective caption indicator for this extension on the drivers primary panel will also light, and all the connected extension telephones can communicate with each other.



The respective caption indicator on the drivers primary panel will go out for each extension telephone as they are replaced in their respective cradles. The last extension telephone to be replaced opens the buzzer circuit.



Legend:

- |    |            |         |                  |
|----|------------|---------|------------------|
| B1 | Earphone   | 1...6B1 | Telephone cradle |
| B2 | Microphone | 1...6U1 | Telephone unit   |

Fig. 8 Schematic - Telephone cars 1 to 5 and rear cabin



**2. Fault Isolation**

Procedures for fault isolation are shown in Figs. 201 to 205.

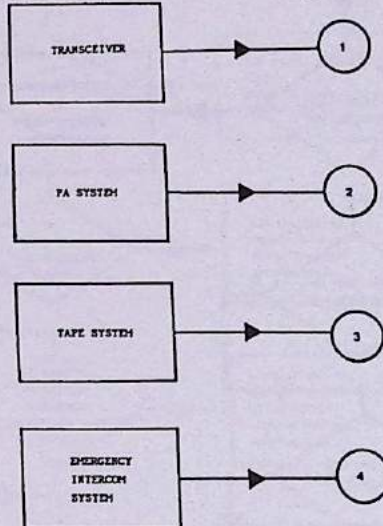


Fig. 201 Fault Isolation - Overall

**A. Transceiver**

Procedures for fault isolation of the transceiver system are shown in Fig. 202.

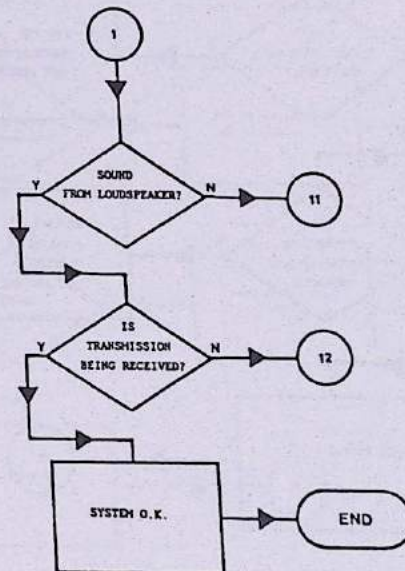


Fig. 202 Fault Isolation - Transceiver (Sheet 1 of 5)



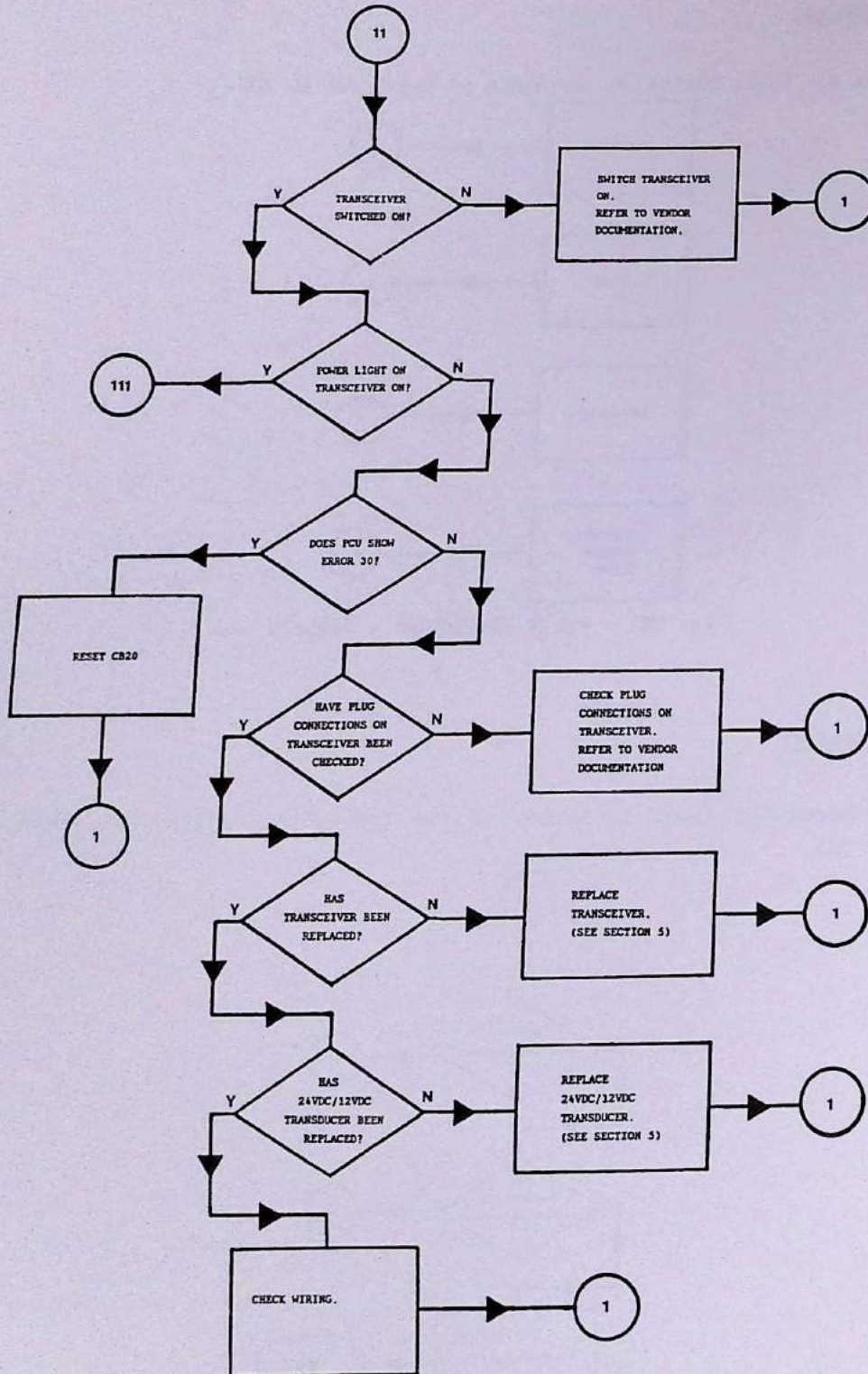


Fig. 202 Fault Isolation - Transceiver (Sheet 2 of 5)



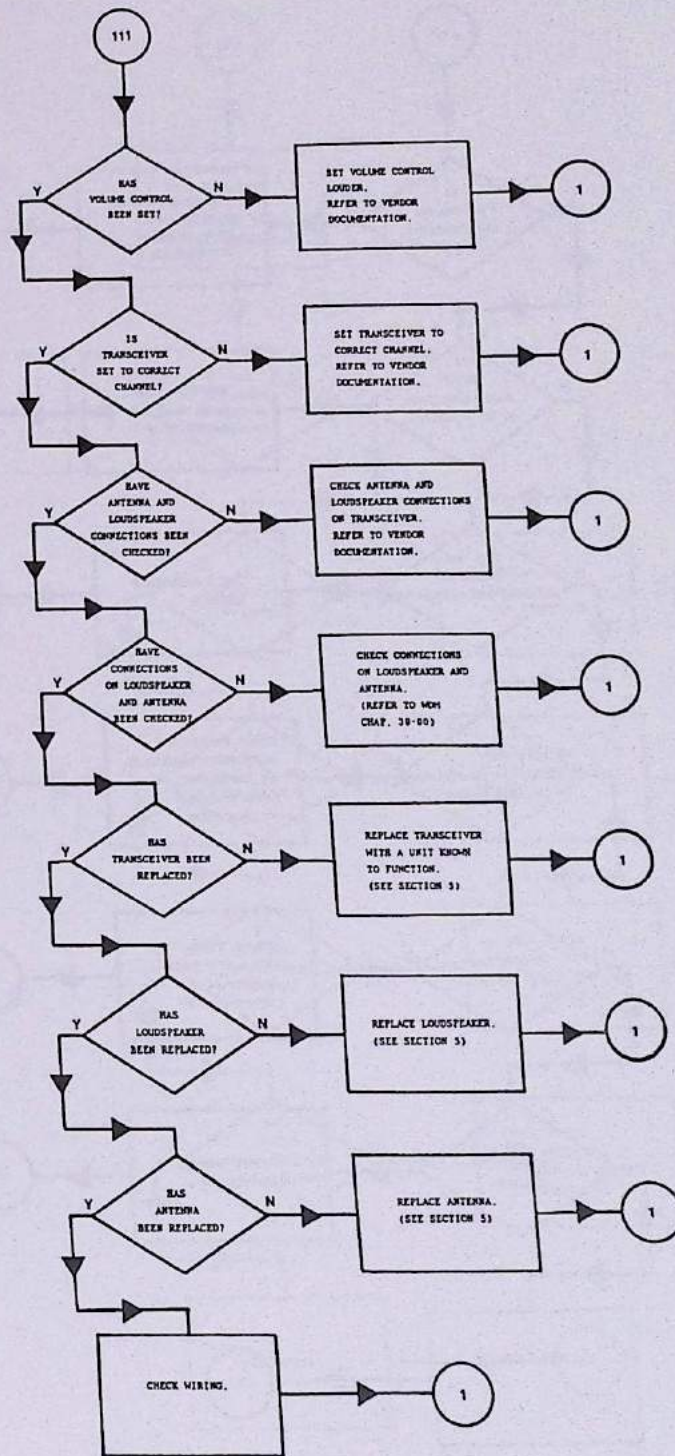


Fig. 202 Fault Isolation - Transceiver (Sheet 3 of 5)



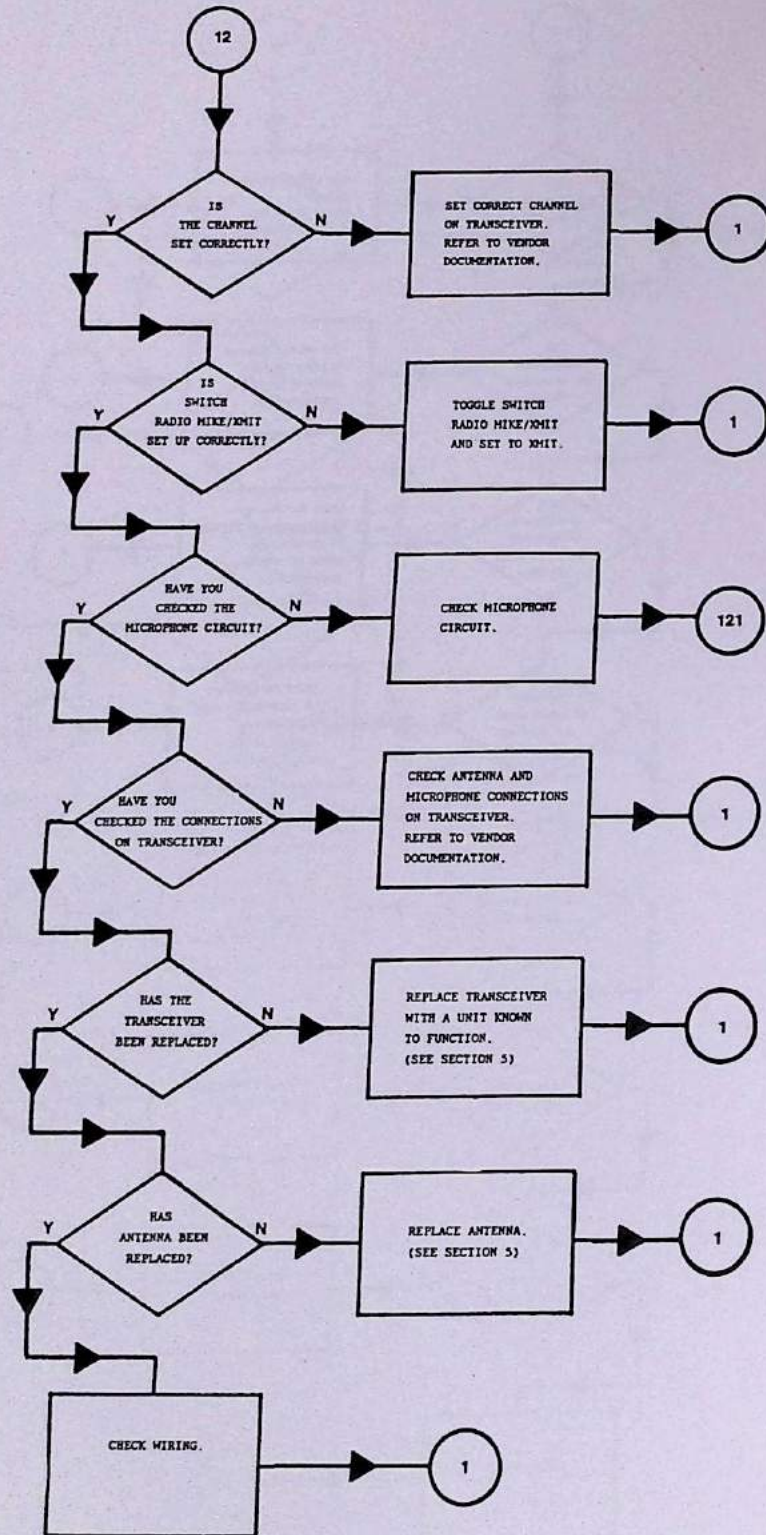


Fig. 202 Fault Isolation - Transceiver (Sheet 4 of 5)



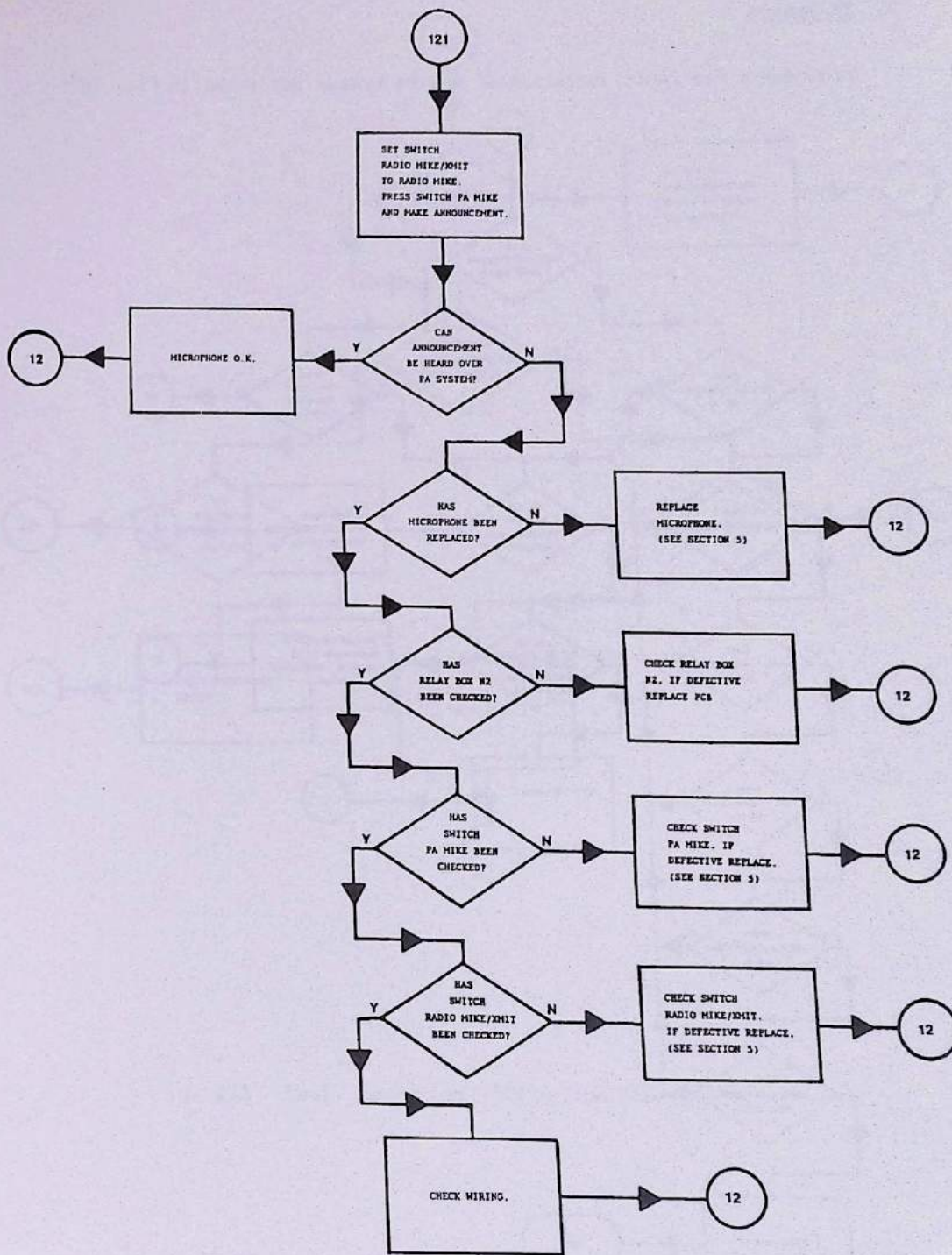


Fig. 202 Fault Isolation - Transceiver (Sheet 5 of 5)



B. PA System

Procedures for fault isolation of the PA system are shown in Fig. 203.

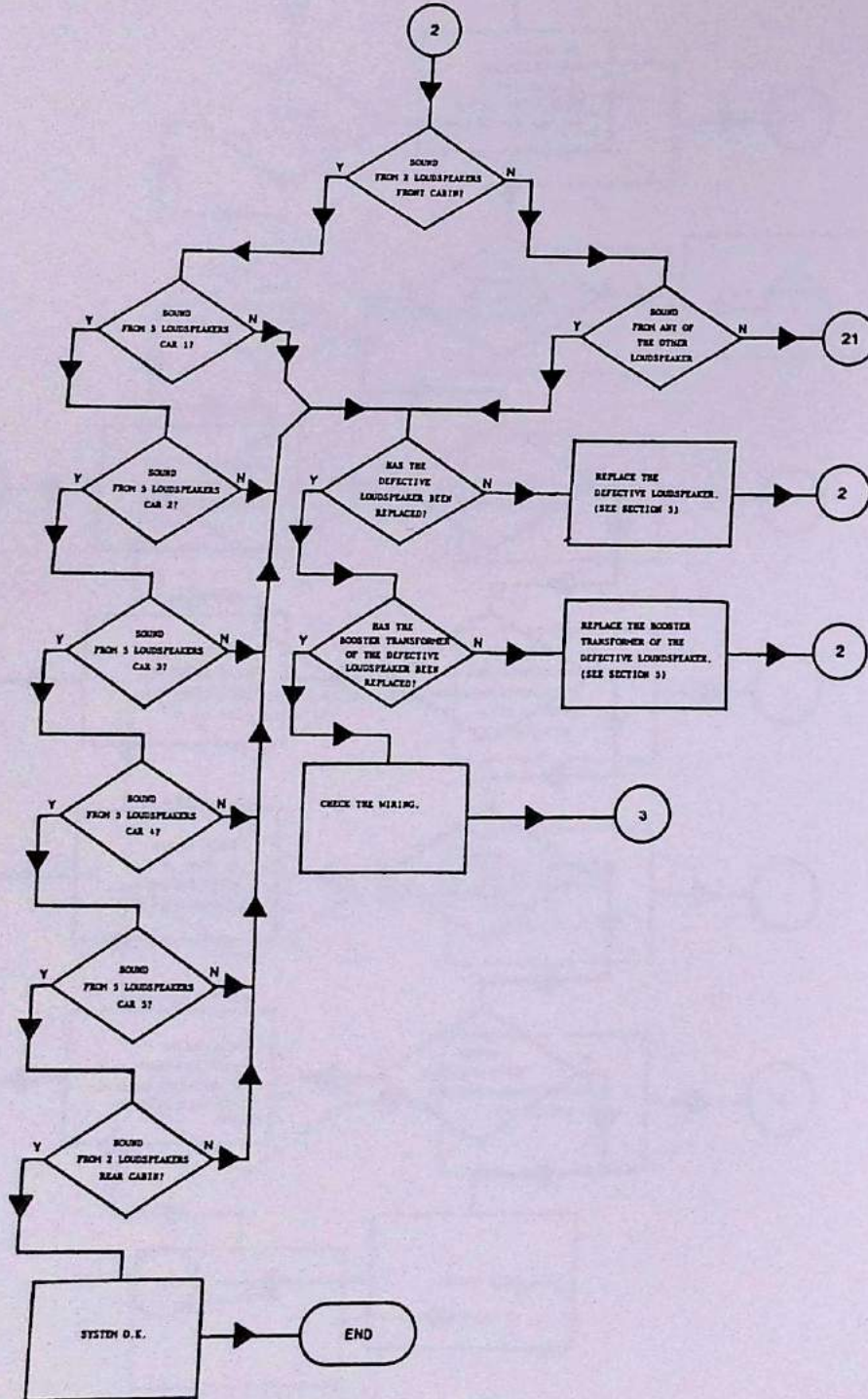


Fig. 203 Fault Isolation - PA System (Sheet 1 of 4)



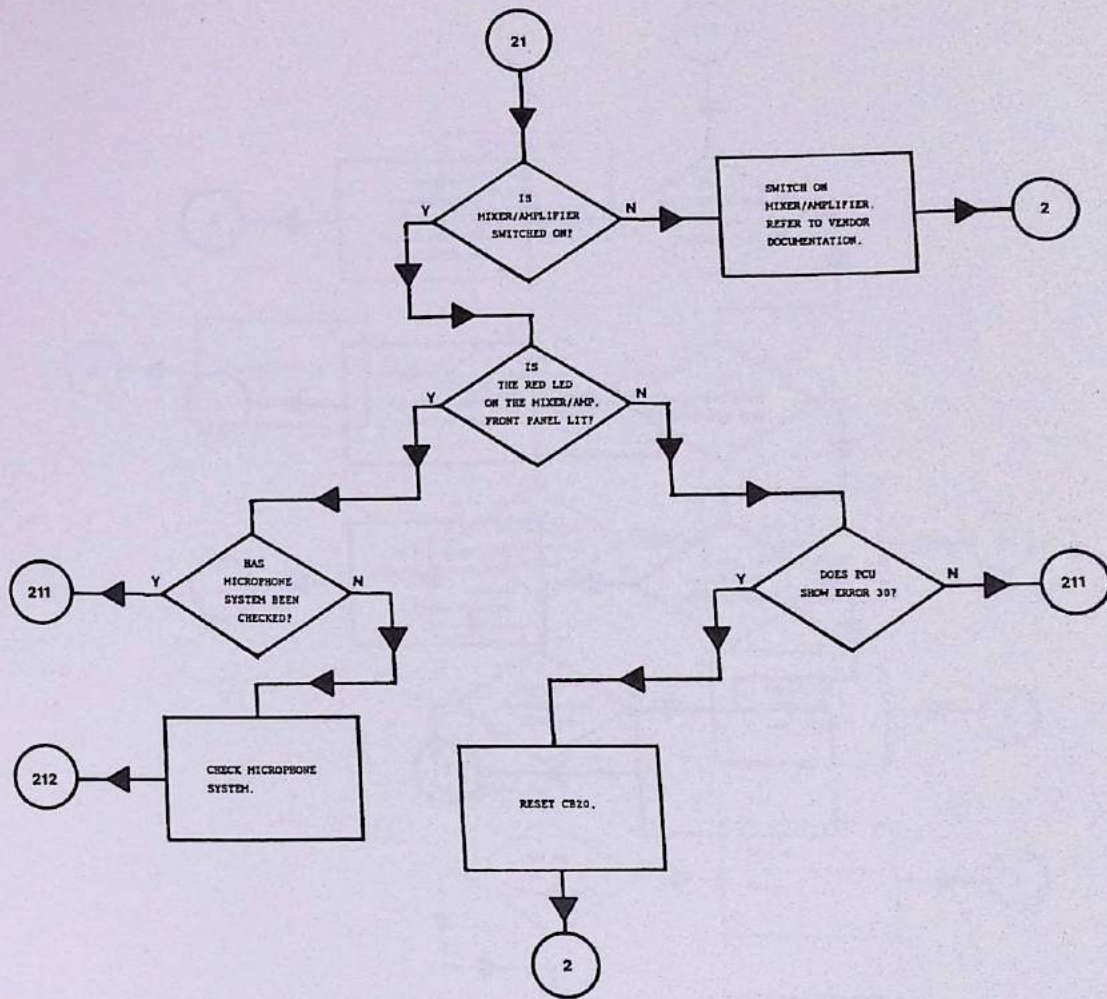


Fig. 203 Fault Isolation - PA System (Sheet 2 of 4)



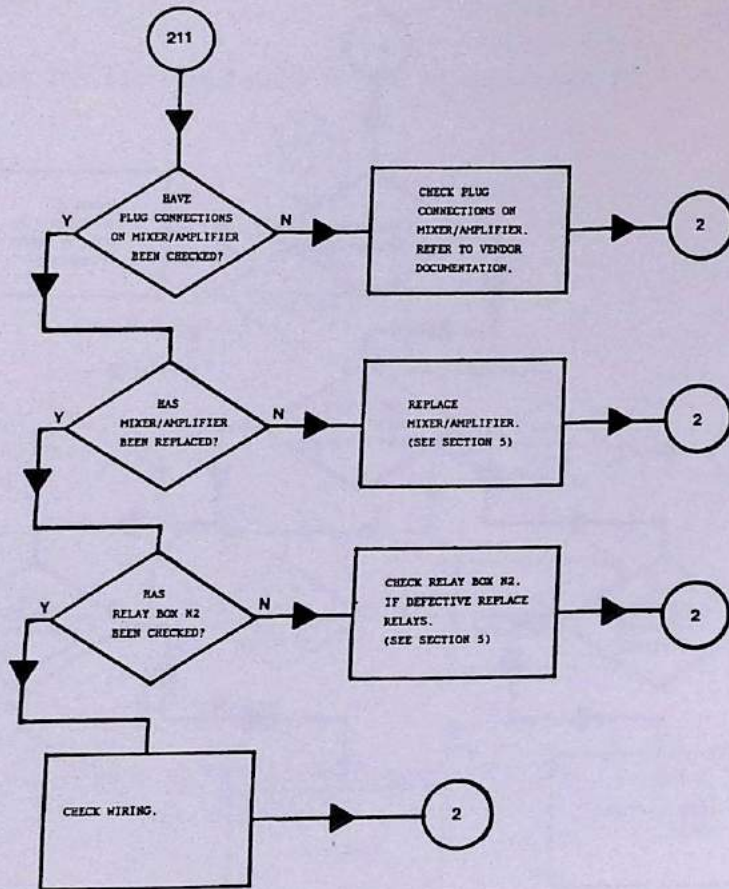


Fig. 203 Fault Isolation - PA System (Sheet 3 of 4)



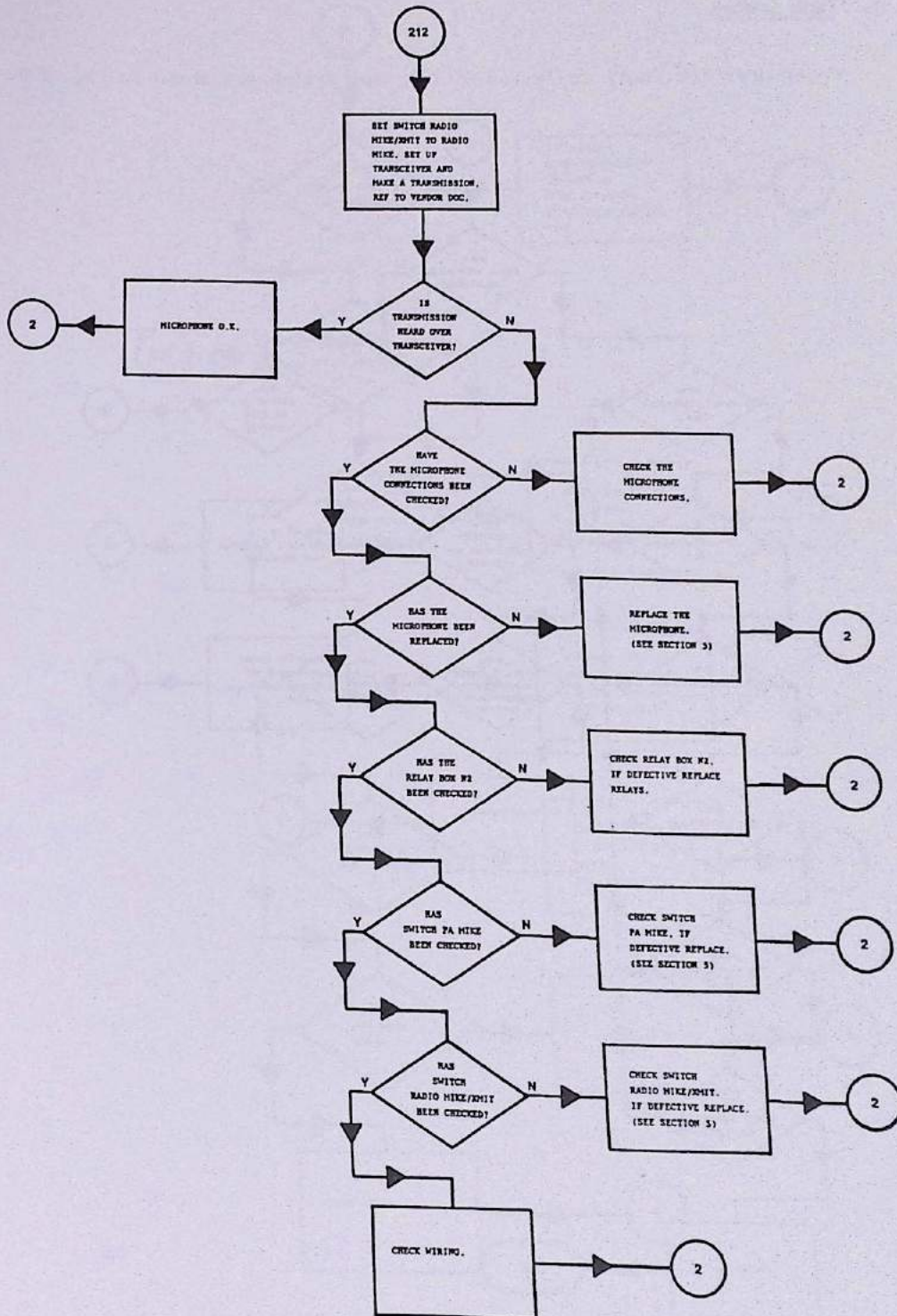


Fig. 203 Fault Isolation - PA System (Sheet 4 of 4)



C. Tape System

Procedures for fault isolation of the tape system are shown in Fig. 204.

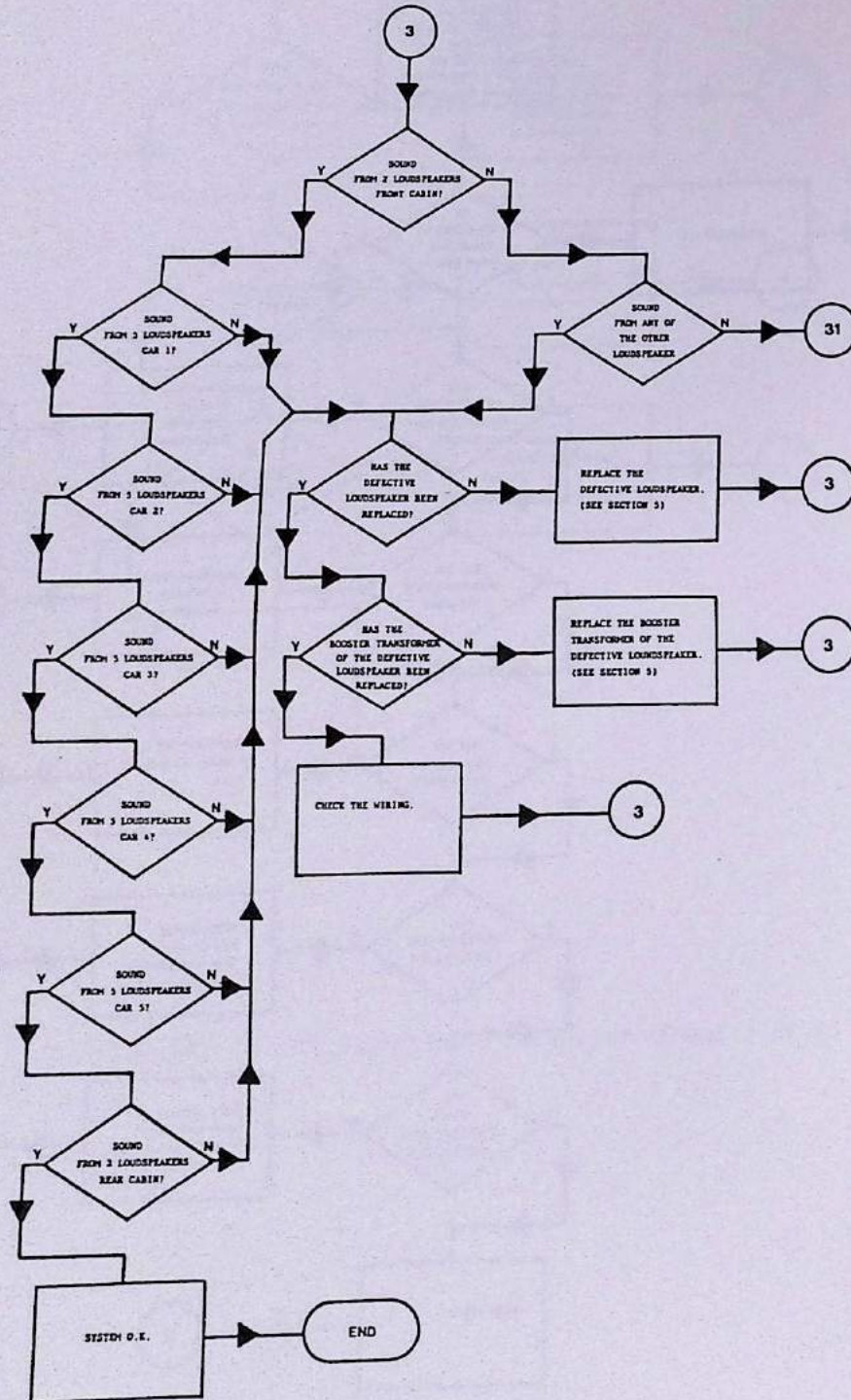


Fig. 204 Fault Isolation - Tape System (Sheet 1 of 5)



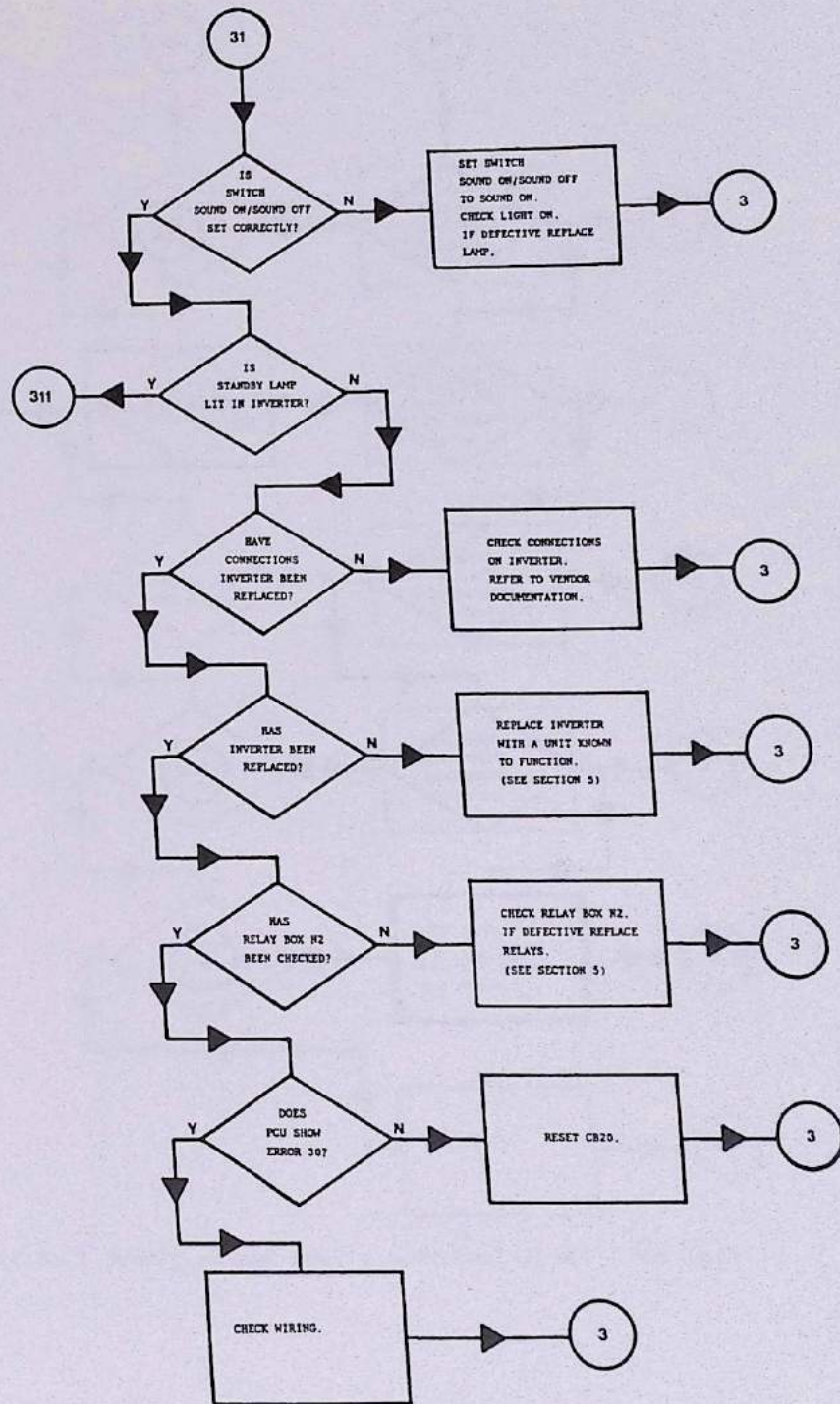


Fig. 204 Fault Isolation - Tape System (Sheet 2 of 5)



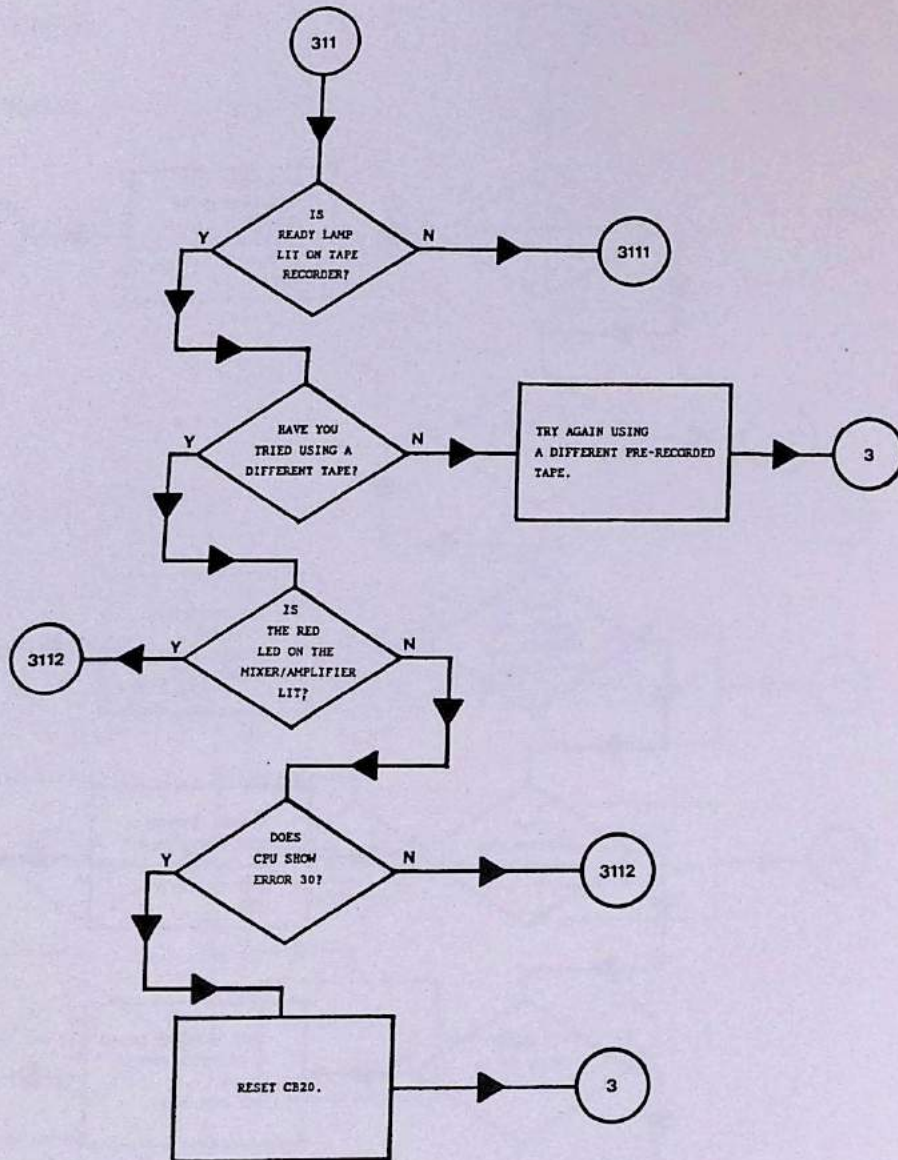


Fig. 204 Fault Isolation - Tape System (Sheet 3 of 5)



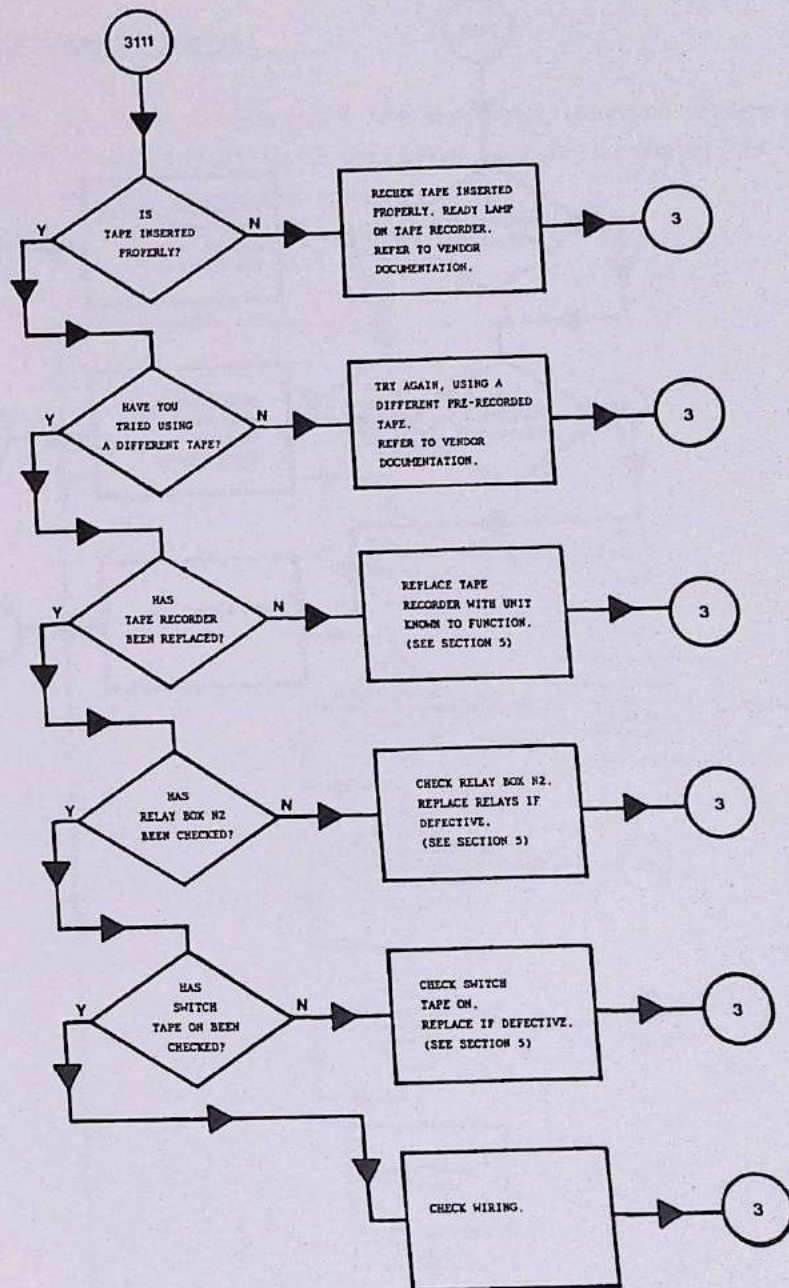


Fig. 204 Fault Isolation - Tape System (Sheet 4 of 5)



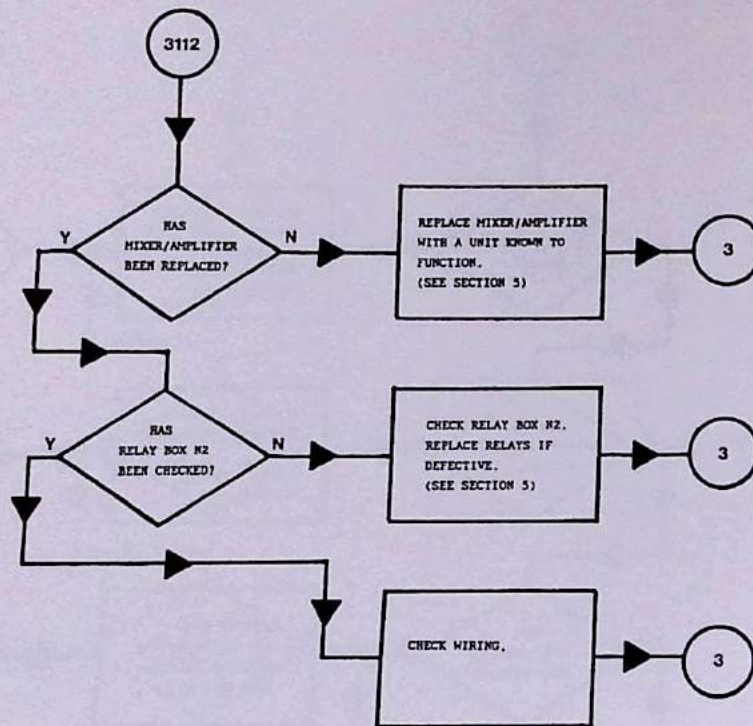


Fig. 204 Fault Isolation - Tape System (Sheet 5 of 5)



**D. Emergency Intercom System**

Procedures for fault isolation of the emergency intercom system are shown in Fig. 205. Fault isolation is initiated by lifting one of the extension telephones off its respective cradle.

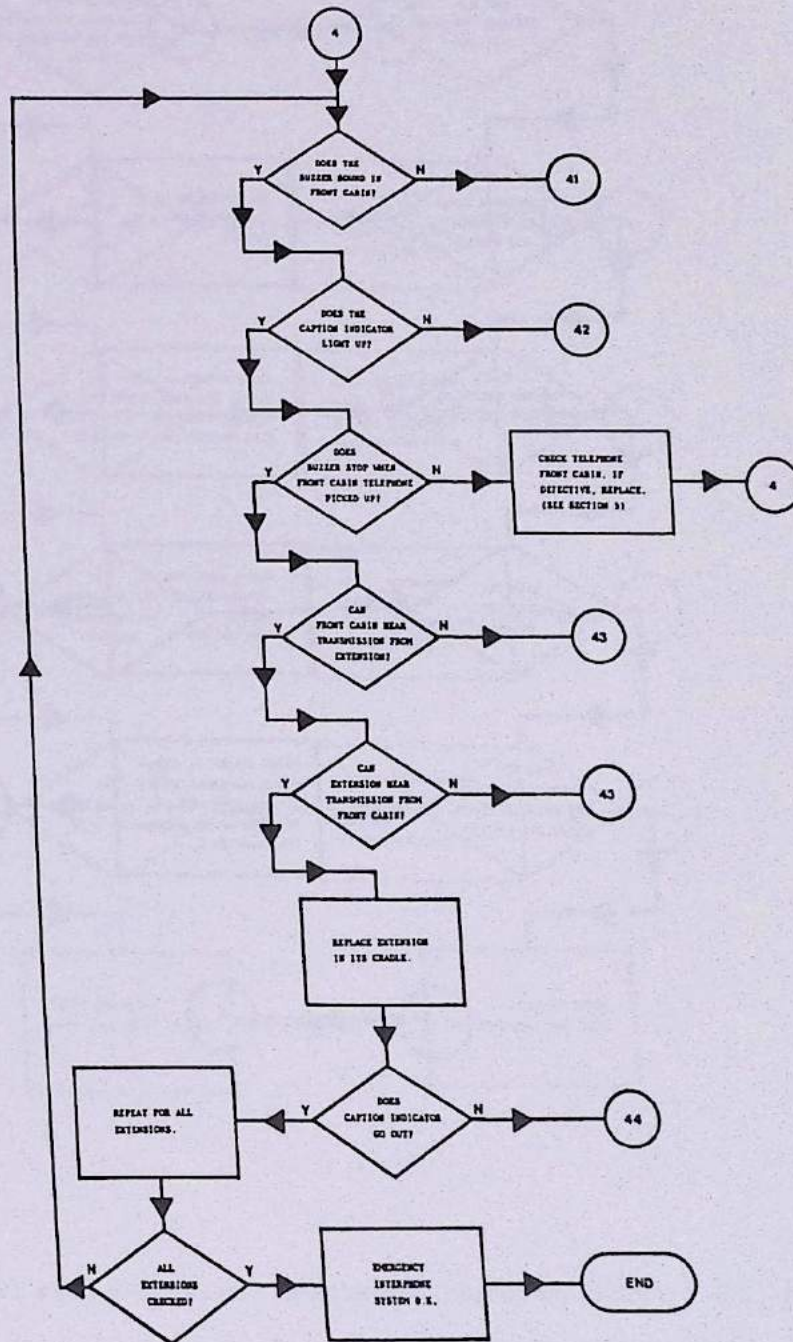


Fig. 205 Fault Isolation - Emergency Intercom System (Sheet 1 of 7)



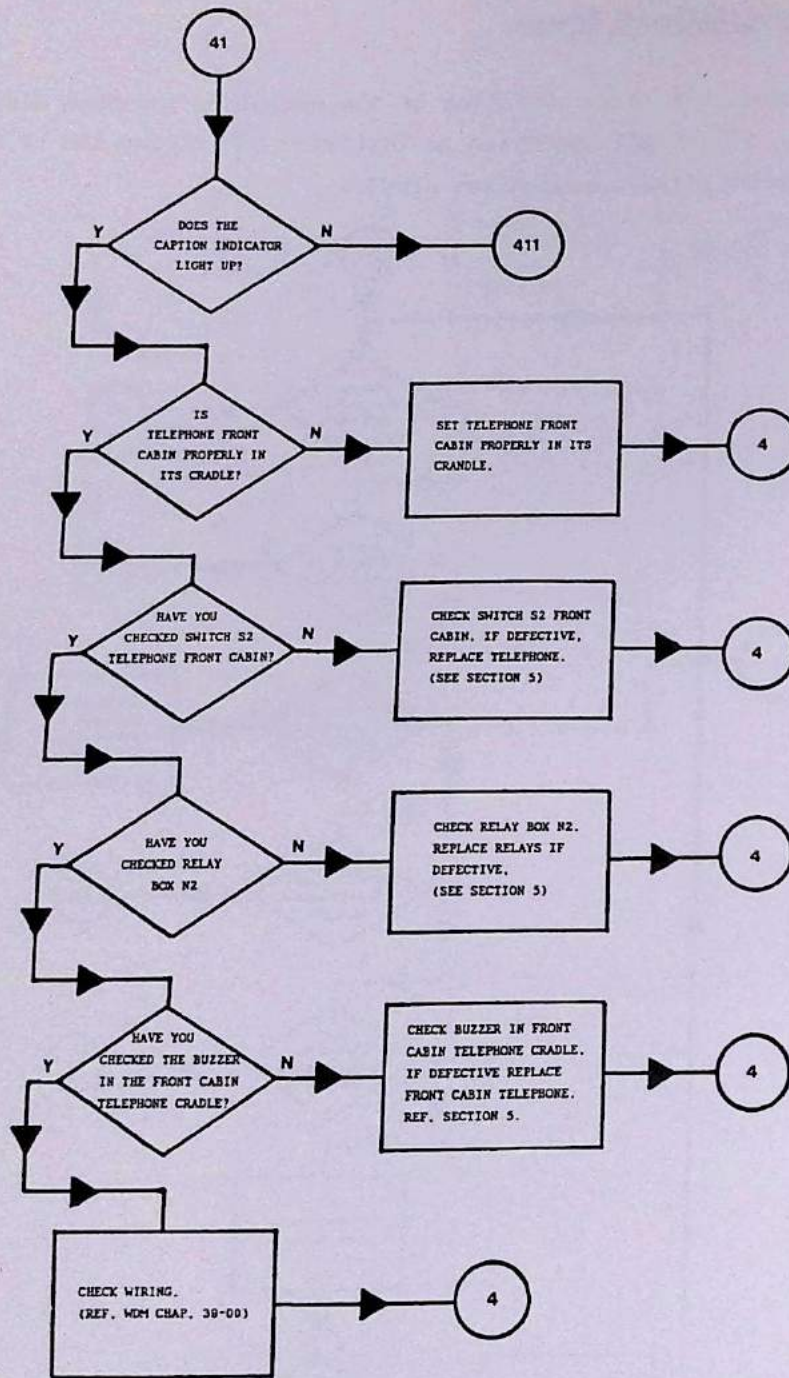


Fig. 205 Fault Isolation - Emergency Intercom System (Sheet 2 of 7)



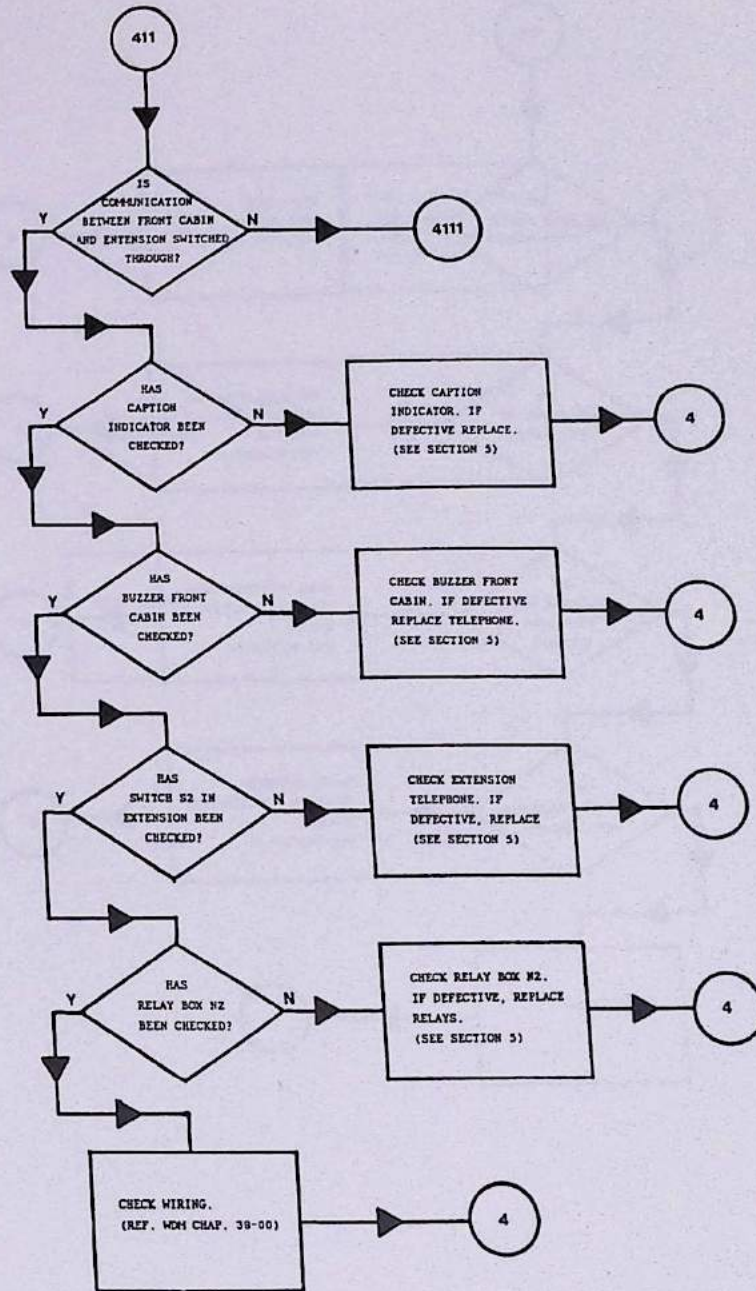


Fig. 205 Fault Isolation - Emergency Intercom System (Sheet 3 of 7)



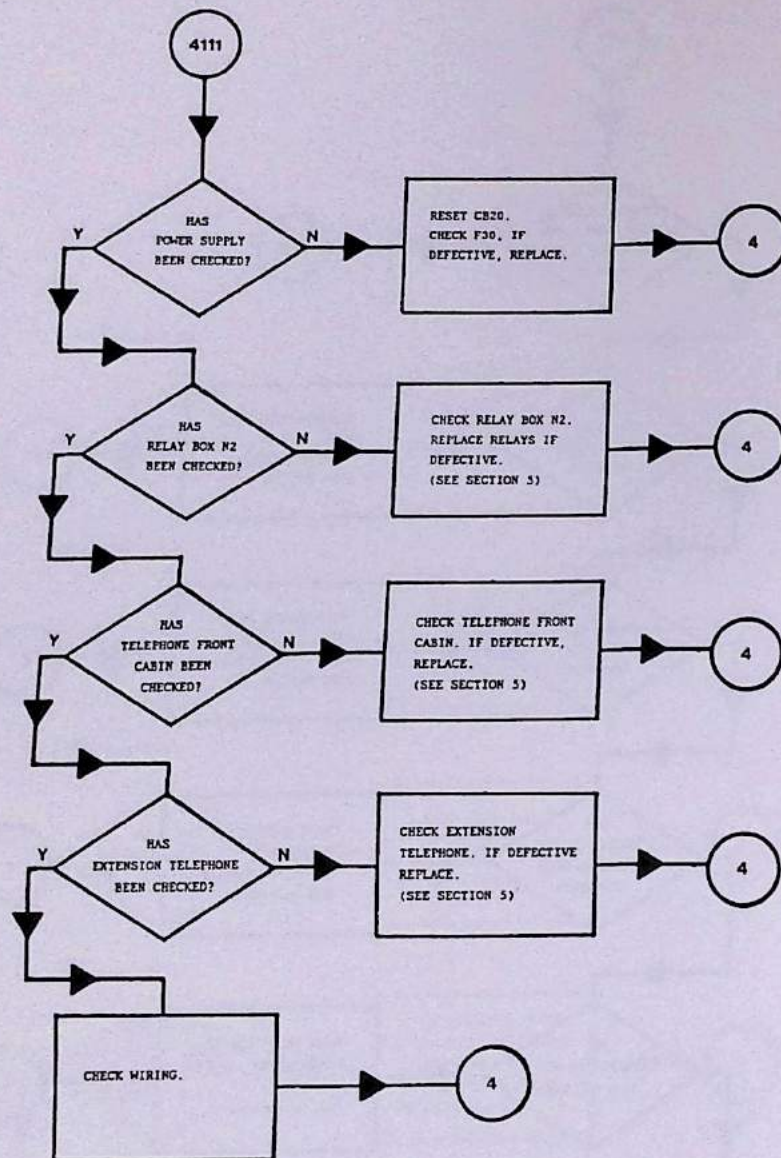


Fig. 205 Fault Isolation - Emergency Intercom System (Sheet 4 of 7)



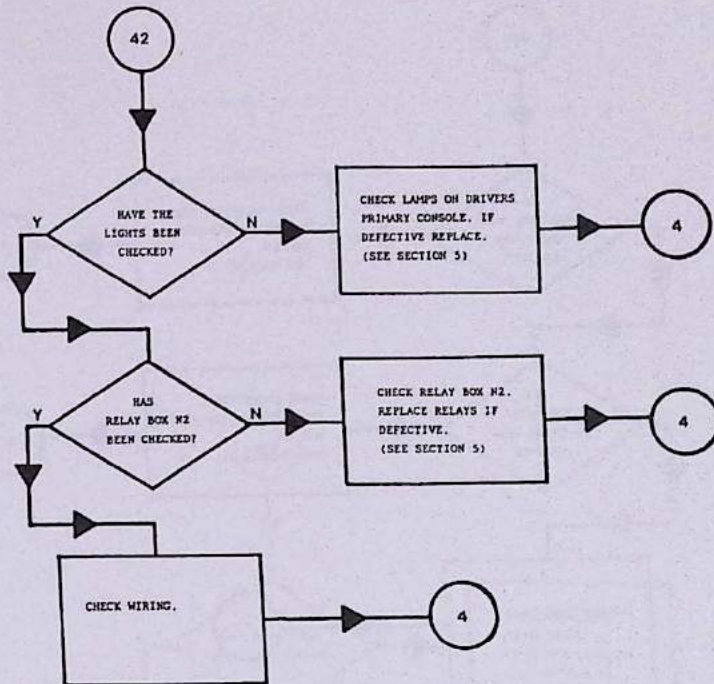


Fig. 205 Fault Isolation - Emergency Intercom System (Sheet 5 of 7)



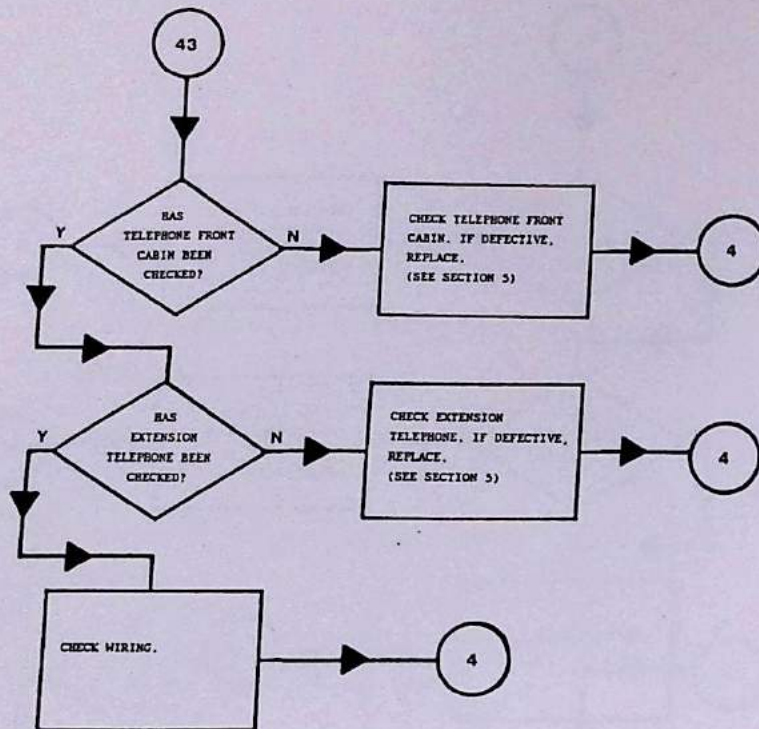


Fig. 205 Fault Isolation - Emergency Intercom System (Sheet 6 of 7)



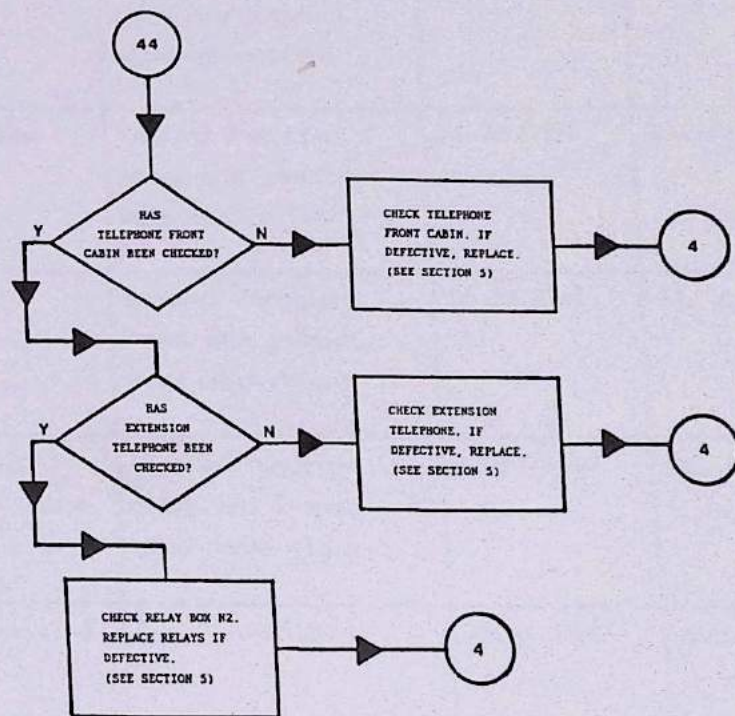


Fig. 205 Fault Isolation - Emergency Intercom System (Sheet 7 of 7)



**3. Maintenance Practices**

The maintenance schedule is shown in Table 301.

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
1	Interphone System Base Station	General function check and inspect wire connections	TI-39.0001	Quarterly
2	Interphone System Monorail	General function check and inspect wire connection	TI-39.0001	Quarterly
3	Loudspeakers B2, 3, 4, 5, 7	General function check and inspect wire connections	TI-39.0100	Six monthly
4	Loudspeakers B2, 3 front and rear cabin	General function check and inspect wire connections	TI-39.0101	Six monthly
5	Transformer cars 1-5	See TI-39.0100	TI-39.0101	Annual and on change
6	Transformer front and rear cabin	See TI-39.0101	TI-39.0103	Annual and on change
7	Mixer/Amplifier	General function check	TI-39.0200	Six monthly

Table 301 - Maintenance Practices (Sheet 1 of 2)



Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
8	Tape recorder	General function check	TI-39.0201	Six monthly
9	Transceiver	General function check	TI-39.0400	Daily
10	Antenna	SWR Test	TI-39.0401	Annual
11	DC/DC Converter	Inspect wire connections	TI-39.0402	Annual

Table 301 - Maintenance Practices (Sheet 2 of 2)



**4. Servicing**

The servicing schedule is shown in Table 401.

The items listed in Table 401 are shown against a recommended maximum elapsed time, it is not an instruction to wait out the time before servicing.

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
1	Interphone B1 Base station	Clean.	TI-39.0001	Annual
2	Interphone B1 Monorail	Clean.	TI-39.0001	Annual
3	Loudspeaker	Clean.	TI-39.0100	Annual
4	Loudspeaker B2, 3 front and rear cabins	Clean.	TI-39.0101	Annual
5	Mixer/Amplifier N1	Clean.	TI-39.0200	Annual
6	Cartridge recorder	Clean.	TI-39.0201	Annual
7	Inverter (DC/AC) U1	Clean.	TI-39.0203	Annual
8	Relay N2	Clean.	TI-39.0203	Annual
9	Cartridge	Clean, renew if necessary	TI-39.0204	Monthly and on change
10	Antenna B6	Clean.	TI-39.0401	Annual
11	Transformer (DC/DC)	Clean	TI-39.0402	Annual

Table 401 - Servicing



## 5. Removal/Installation

### A. Transceiver

#### (1) Removal

- (a) Electrical power supply. Disconnect. Trip CB20 (COMM SYSTEM).

Fig. 501

- (b) Microphone. Remove from hatrack.

1 Disconnect gooseneck extension (1) from Cannon plug adapter (2).

2 Using a small screwdriver to detach the locking screw at the side of the gooseneck extension, remove microphone and gooseneck extension.

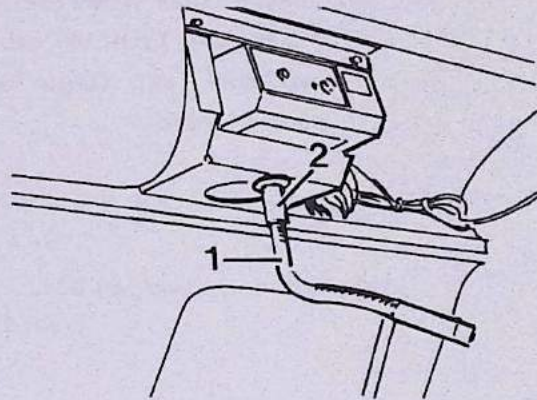


Fig. 501

- (c) Hatrack. Open. (Chap. 21-00).

- (d) Drivers auxiliary lamp. Disconnect.

#### (2) Procedure

- (a) Antenna lead. Disconnect from transceiver (ref. vendor documentation).
- (b) Plug connector. Disconnect from transceiver (ref. electrical drawing set).



Fig. 502

- (c) Transceiver. Remove. Remove screws (1), washers (2) and spring washers (3).

(3) Install

- (a) Install in the reverse sequence.

- (b) Ensure that the area is clean and free of debris and that all tools have been removed.

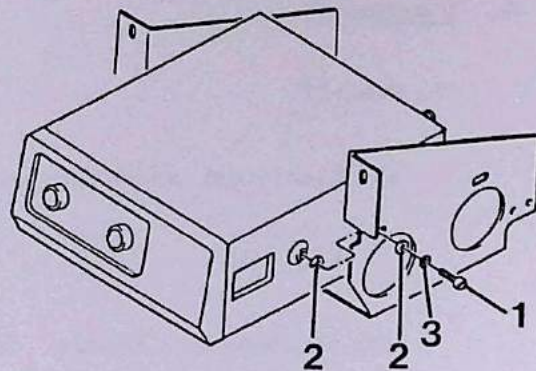


Fig. 502

(4) Completion

- (a) Test (see Section 6).

**B. Antenna rod**

---

**CAUTION**

---

TO PREVENT DAMAGE TO EQUIPMENT, USE THE SPECIAL TOOL (K66301) PROVIDED WITH THE ANTENNA.

---

(1) Removal

- (a) Disconnect antenna lead from transceiver (ref. vendor documentation).

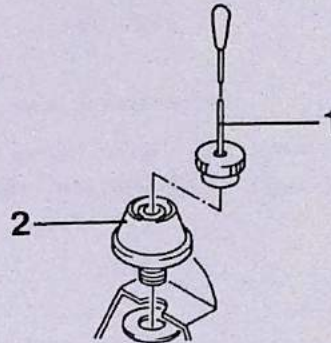


(2) Procedure

Fig. 503

(a) Antenna rod. Remove from plastic base.

1 Unscrew fitting (1) at the top of the plastic base (2) using special tool K66301.



2 Remove antenna rod from plastic base.

Fig. 503

(3) Installation

(a) Ensure that the antenna connections are free of dirt, grease and corrosion.

(b) Fit antenna rod to antenna base.

(c) Tighten antenna rod using special tool K66301.

(d) Ensure that the area is clean and free of debris and that all tools have been removed.

(4) Completion

(a) Test (see Section 6).

C. Antenna base

(1) Removal

(a) Disconnect antenna lead from transceiver (ref. vendor documentation).

(b) Antenna rod. Remove from antenna base (see Section 5).



## (2) Procedure

Fig. 504

## (a) Antenna base. Remove

1 Unscrew elbow connector  
(1) from antenna base  
(2).

2 Disconnect coaxial cable  
(3).

3 Remove nut (4), spring  
washer (5) and washer  
(6).

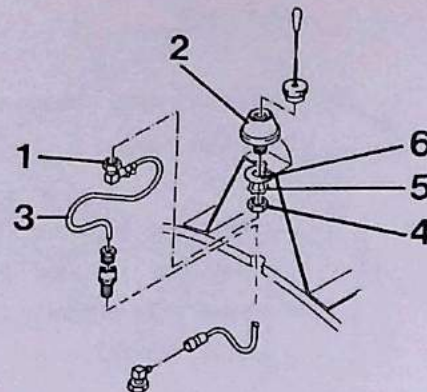


Fig. 504

## (3) Installation

(a) Install in the reverse sequence.

(b) Ensure that antenna connections are free of dirt, grease and corrosion.

(c) Ensure that area is clean and free of debris and that all tools have been removed.

**D. Antenna lead**

## (1) Removal

(a) Disconnect antenna lead from transceiver (ref. vendor documentation).



## (2) Procedure

- (a) Antenna lead. Remove from antenna base
- (b) Antenna lead. Remove from roof. Remove union (1), nut (2), washer (3) and adapter (4). Remove HF connector (5) from elbow connector (6).

## (3) Installation

- (a) Install in the reverse sequence.
- (b) Ensure that antenna connections are free of dirt, grease and corrosion.
- (c) Ensure that area is clean and free of debris and that all tools have been removed.

## (4) Completion

- (a) Test (see Section 6).

**E. Converter 24 VDC/12 VDC**

## (1) Removal

- (a) Electrical power supply. Disconnect. Trip CB20 (COMM SYSTEM).
- (b) Front seat, RH. Remove (Chap. 21-00).



## (2) Procedure

Fig. 505

(a) Leads. Disconnect.

(b) Converter. Remove.

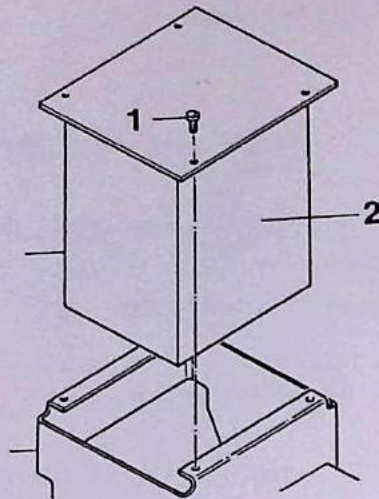
1 Remove four holding  
screws (1).2 Remove converter (2).

Fig. 505

## (3) Installation

(a) Install in the reverse se-  
quence.(b) Ensure that the area is clean and free of debris and that all  
tools have been removed.

## (4) Completion

(a) Test (see Section 6).

**F. Loudspeaker (transceiver)**

## (1) Removal

(a) Electrical power supply. Disconnect. Trip CB20 (COMM SYSTEM).

(b) Microphone and gooseneck extension. Remove (see Section 5.A).

(c) Hatrack. Remove (Chap. 21-00).

(d) Transceiver. Remove (see Section 5.A).



(2) Procedure

Fig. 506

(a) Loudspeaker. Remove from hatrack.

1 Remove screws (1), washers, spring washers and nuts securing loudspeaker to transceiver mounting.

2 Remove loudspeaker.

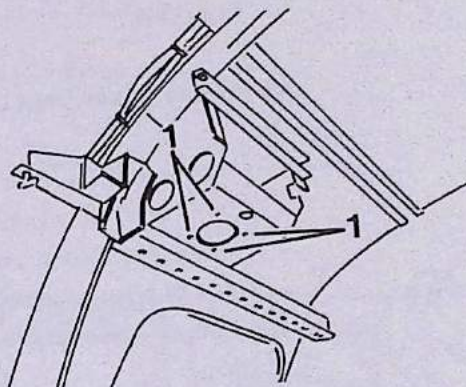


Fig. 506

(3) Installation

(a) Install in the reverse sequence.

(b) Ensure that the area is clean and free of debris and that all tools have been removed.

(4) Completion

(a) Test (see Section 6).

G. Mixer/Amplifier

(1) Removal

Fig. 507

(a) Electrical power supply. Disconnect Trip CB20 (COMM SYSTEM).

(b) Trim panel (1).  
Remove from drivers right hand side compartment

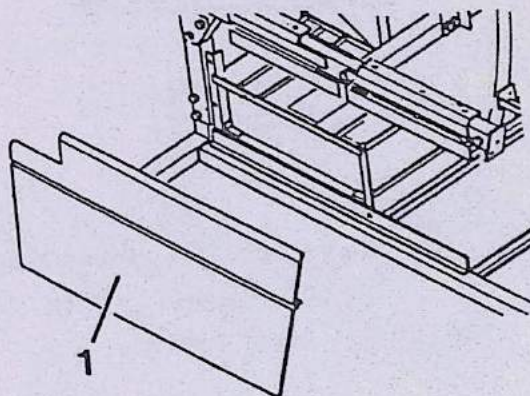


Fig. 507



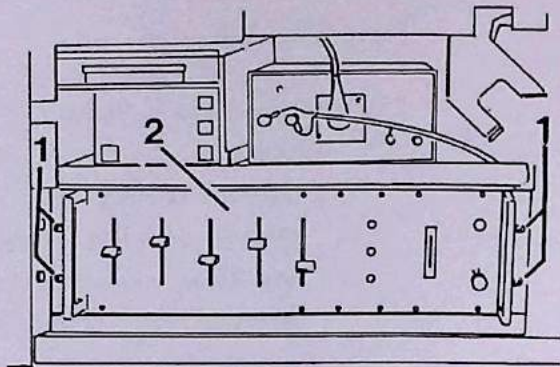
## (2) Procedure

Fig. 508

(a) Remove mixer/amplifier.

1 Remove the four screws  
(1) on the mixer ampli-  
fier (2) front panel.

2 Slide mixer amplifier (2)  
out of its rack mounting.



(b) Remove leads at rear of Fig. 508  
mixer amplifier.

## (3) Installation

(a) Install in the reverse sequence.

(b) Ensure that work area is clean and free of debris and that all  
tools have been removed.

## (4) Completion

(a) Test (see Section 6)

**H. Inverter 24 VDC/110 VAC**

## (1) Removal

Fig. 509

(a) Electrical power supply.  
Disconnect. Trip CB20  
(COMM SYSTEM).

(b) Trim panel (1).

Remove from drivers right  
hand side compartment

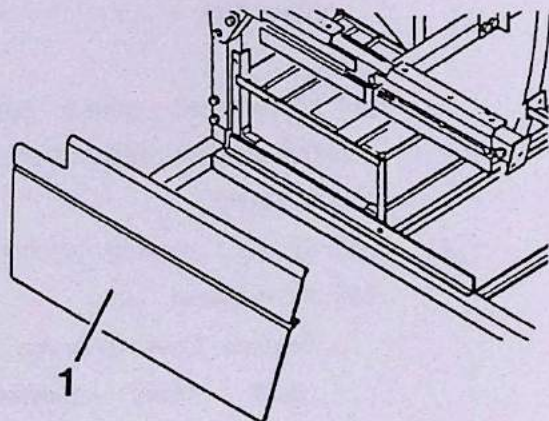


Fig. 508



(2) Procedure

NOTE

The inverter sits on channels above the mixer/amplifier.

Fig. 510

- (a) Inverter (1). Remove.  
1 Note the position of and disconnect the cables.

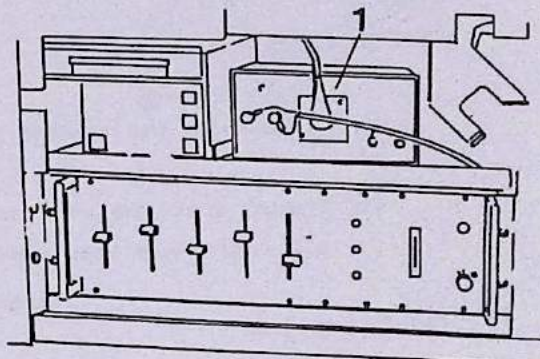


Fig. 510

(3) Installation

- (a) Install in the reverse sequence.
- (b) Ensure that the area is clean and free of debris and that all tools have been removed.

(4) Completion

- (a) Test (see section 6).

**J. Tape Recorder**

(1) Removal

Fig. 511

- (a) Electrical power supply. Disconnect. Trip CB20 (COMM SYSTEM).
- (b) Trim panel (1).  
Remove from drivers right hand side compartment

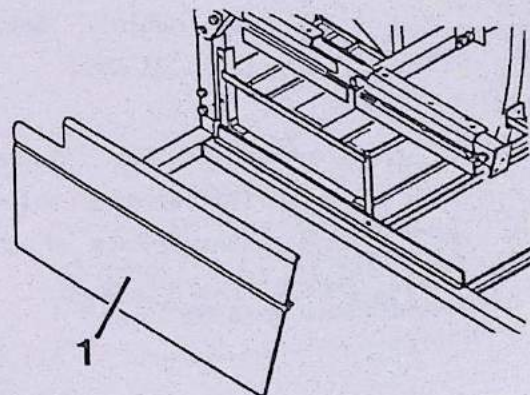


Fig. 511



## (2) Procedure

(a) Disconnect all electrical connection at the rear of the tape recorder.

(b) Lift tape recorder out of the locating holes in the mounting tray.

(c) Tape recorder. Remove.

## (3) Installation

(a) Install in the reverse sequence.

(b) Ensure that the work area is clean and free of debris and that all tools have been removed.

## (4) Completion

(a) Test (see Section 6).

**K. Loudspeaker (PA System)**

## (1) Removal

Fig. 512

(a) Respective hatrack (or side ceiling trim in front or rear cabin). Remove (ref. Chap. 21-00).

(b) Loudspeaker (1). Disconnect from terminal block (2). (Make a note of the connections).

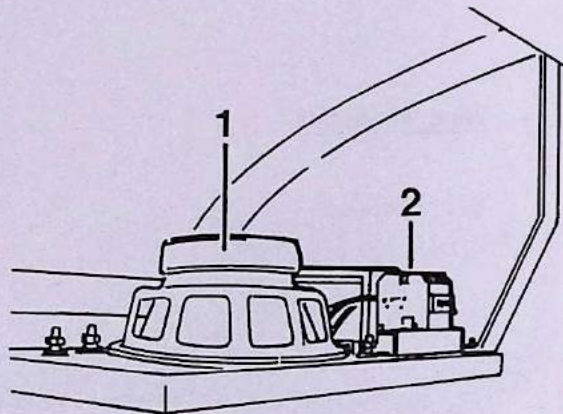


Fig. 512



(2) Procedure

Fig. 513

(a) Remove loudspeaker.

1 Remove nuts (1), spring washers (2), washers (3) and bolts (4) securing loudspeaker (5) to its mounting (6).

2 Loudspeaker. Remove

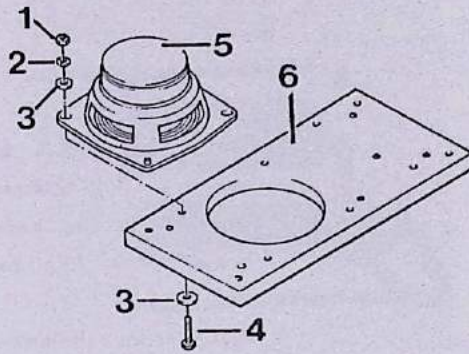


Fig. 513

(3) Installation

(a) Install in the reverse sequence.

(b) Ensure that the work area is clean and free of debris and that all tools have been removed.

(4) Completion

(a) Test (see Section 6).

**L. Booster Transformer**

(1) Removal

Fig. 514

(a) Respective hatrack (or side ceiling trim in front or rear cabin). Remove (ref. Chap. 21-00).

(b) Transformer (1). Disconnect from terminal block (2) (Make a note of the connections).

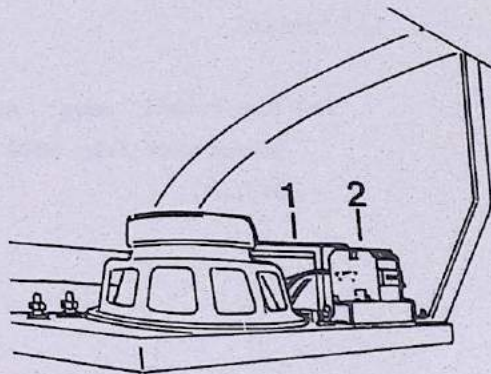


Fig. 514



## (2) Procedure

Fig. 515

## (a) Remove transformer.

1 Remove nuts (1), spring washers (2), washers (3) and bolts (4) securing transformer (5) to its mounting (6).

2 Transformer. Remove.

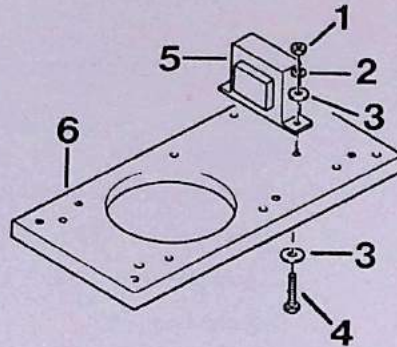


Fig. 515

## (3) Installation

(a) Install in the reverse sequence.

(b) Ensure that the work area is clean and free of debris and that all tools have been removed.

## (4) Completion

(a) Test (see Section 6).

**M. Emergency Intercom System**

## (1) Removal

(a) Electrical power supply.  
Disconnect Trip CB20 (COMM SYSTEM).



## (2) Procedure

Fig. 516

## (a) Telephone. Remove.

- 1 Remove the four screws (1) holding the cradle (2) to the base (3).
- 2 Remove electrical connections from telephone base.
- 3 Remove the screws holding the base.

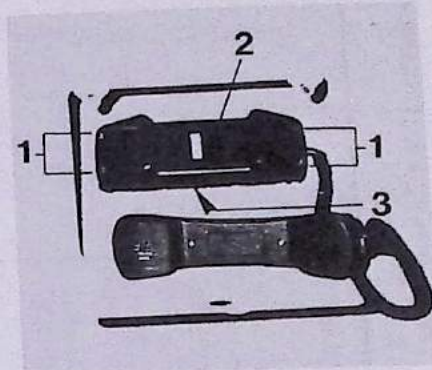


Fig. 516

## (3) Installation

## (a) Install in the reverse sequence.

- (b) Ensure that the work area is clean and free of debris and that all tools have been removed.

## (4) Completion

- (a) Test (see Section 6).



6. Adjustment/Test

A. Adjustment

(1) Transceiver

NOTE

If there is difficulty with the reception, the problem could lie with antenna mismatching.

For test configuration see Fig. 601.

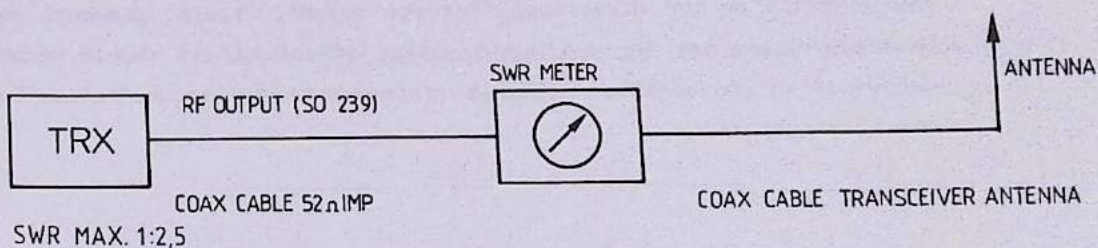


Fig. 601

WARNING

DURING SWR MEASUREMENTS, PERSONNEL MUST MAINTAIN A DISTANCE OF MORE THAN 5 FEET FROM THE ANTENNA. METAL OBJECTS MUST ALSO BE REMOVED FROM THIS AREA PRIOR TO STARTING MEASUREMENTS.

Matching for new antenna.

Fig. 602

1. Remove rubber cab from antenna rod.
2. Shorten antenna rod approx. 1/4".
3. Replace rubber cap on antenna rod.
4. Measure SWR.
5. Repeat items 1 to 4 until a SWR of max. 1:2,5 is reached.

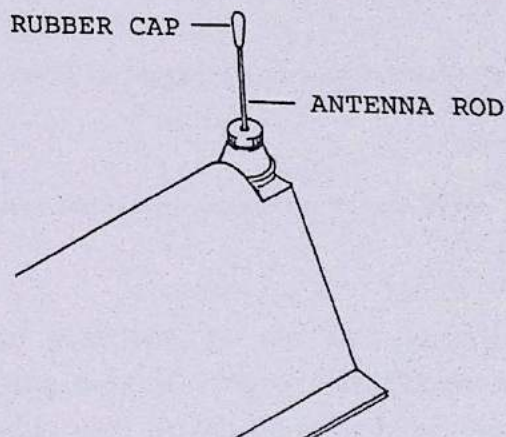


Fig. 602



(2) PA System

The controls on the mixer/amplifier for volume, treble, presence and bass have been set for optimum acoustic effect. If it should become necessary to change these settings, refer to vendor documentation for the mixer/amplifier.

(3) Tape System

The controls on the mixer/amplifier for volume, treble, presence and bass have been set for optimum acoustic effect. If it should become necessary to change these settings, refer to vendor documentation for the mixer/amplifier.

(4) Emergency Intercom System

Refer to vendor documentation and Part B, Test Procedure.



**B. Test**

## (1) Functional Test

## (a) Transceiver

1 Functional test the microphone volume adjuster (gain) as follows:

1. Apply symmetrical AF signal (1 kHz sine/-50 dB) to X3/1...3 (X3/1 = -, X3/2 = shield, X3/3 = +).
2. Apply test probe to plus pole of capacitor C2, the signal measured must be distortion-free.

---

**NOTE**

---

The volume depends on the position of potentiometer R6 and amounts to  
- 10 dB max. (for an input volume of  
- 50 dB). The volume must be matched to the input sensitivity of the transceiver.

---

2 Perform a functional test of the transceiver as follows:

1. Check CB20 COMM SYSTEM on drivers secondary panel is in.
2. Set switch RADIO MIKE/XMIT on drivers primary console to the middle position.
3. Set desired channel and receiver volume on transceiver front panel.
4. Depress switch RADIO MIKE/XMIT to the XMIT position and attempt to contact the base station (or any other station on the frequency set), keep switch depressed for the entire transmission.



5. Release switch RADIO MIKE/XMIT to change to receive mode.

(b) PA System

Perform a functional check of the PA system as follows:

---

NOTE

---

This check is best combined with a functional check of the tape system and of the emergency intercom system.

---

- 1 Check CB20 COMM SYSTEM on the drivers secondary panel is in.
- 2 Depress switch PA MIKE on the drivers primary panel and make an announcement, keep switch depressed for the entire transmission.
- 3 Check whether the announcement can be heard over each of the loudspeakers in each car and in the rear cabin, and that the volume of the transmission overrides that of the tape.

---

NOTE

---

The person doing the check can report the results over the emergency intercom system.

---

(c) Tape System

Perform a functional check of the tape system as follows:



---

**NOTE**

---

This check is best combined with a functional check of the tape system and of the emergency intercom system.

---

- 1 Check CB20 COMM SYSTEM on the drivers secondary panel is in.
- 2 Set switch SOUND ON/SOUND OFF on the drivers secondary panel to the SOUND ON position.
- 3 Check that lamp TAPE START on the drivers primary panel lights.
- 4 Depress switch TAPE START on the drivers primary panel.
- 5 Check whether the tape transmission can be heard over each of the loudspeakers in each car and in the rear cabin, and that the volume of the tape transmission decreases so that the PA transmission can be heard, and then increases again to the original level.

---

**NOTE**

---

The person doing the check can report the results over the emergency intercom system.

---

**(d) Emergency Intercom System**

Perform a functional check of the emergency intercom system as follows:

- 1 Lift handset of the emergency intercom off telephone cradle in car 1.



2 The buzzer in the cradle of the telephone in the front cabin must sound and lamp IC CAR1 on the drivers primary panel must light

1. Check the buzzer sounds.

---

NOTE

---

If it does not sound, apply a 24 VDC to terminals 1 and 6 of the telephone cradle in the front cabin. The buzzer should sound when the handset is put down. If it does sound, replace buzzer. If malfunction continues, check the handsets of both extensions, and if necessary, the relay box N2.

---

3 Lift the handset in the front cabin off its cradle. The buzzer should stop; the caption indicator will remain lit until both handsets have been replaced in their cradles.

---

NOTE

---

If the buzzer does not stop, check the function of the switches in the telephone cradle in the front cabin.

---

4 Do a functional check of the intercom system.

1. Install a complete new extension (handset with cradle) if malfunction continues.

5 Repeat steps a to d for the remaining extensions in cars 2 to 5 and in the rear cabin.



## (e) Relay box N2

Perform the functional check of the relay box N2 for emergency intercom control as follows:

1 Apply supply voltage to X1/1 (+24 V) and X2/7 (GND).

2 Functional check the buzzer control as follows:

1. Connect a 24 V lamp between X1/1 and X1/2.

2. Individually connect terminals X2/1 to 6 to GND. The lamp must light in each case.

3 Functional check of the relays for control of the emergency intercom caption indicators.

1. Detach 24 V lamp from terminals X1/1 and X1/2 and connect one lead to ground (X2/7).

2. Apply the open lamp connection to terminal X1/3. The lamp should not light.

3. Connect terminal X2/1 to GND. Relay K1 becomes active and the lamp lights.

4. Repeat step 2 for terminals X1/4 to 8.

5. Repeat step 4 respectively for terminals X2/2 to 6.

## (f) Control relays for console switches

1 Functional check of relay for switch PA MIKE.

1. Connect terminal X3/5 to +24 VDC. Relay K7 is energized.

2. Check if +24 VDC is now available at X3/4.

3. The following connections are switched: X3/1 to X4/1, X3/3 to X4/2, and X4/3 to X4/4.



4. Disconnect +24 VDC from terminal X3/5.

5. Items 2 and 3 should no longer apply. Check relay K7 is de-energized.

2 Functional check of relay for switch RADIO MIKE/XMIT.

1. Connect terminal X3/7 to +24 VDC. Relay K8 is energized.

2. Check if + 24 VDC is now available at X3/6.

3. The following connections are switched: X4/5 to X4/6, and the plus pole of capacitor C2 to X4/7.

4. Disconnect + 24 VDC from terminal X3/7.

5. Items 2 and 3 should no longer apply. Check relay K8 is de-energized.

6. Connect X3/9 to +24 VDC. Relay K9 becomes energized.

7. Check if +24 VDC is now available at X3/8.

8. The following connections are switched: X4/9 to X4/10, and X4/11 to X4/12.

9. Disconnect +24 VDC from terminal X3/9.

10. Items 7 and 8 should no longer apply. Relay K9 is de-energized.

3 Functional check of relay for switch TAPE START.

1. Apply +24 VDC to terminal X3/10. Check relay K10 is energized

2. Connection between X4/13 and X4/14 is switched.



3. Disconnect +24 VDC from terminal X3/10.
4. Item 2 should no longer apply. Relay K10 is de-energized.

---

NOTE

---

The following test requires A +5 VDC power supply.

---

4 Functional check of the tape recorder feedback relay.

1. Connect +5 V to terminal X4/15, and X4/16 to GND. Check relay K11 is energized.
2. Check +24 VDC is available at X3/11.
3. Disconnect +5 VDC from X4/15.
4. Item 2 should no longer apply. Check relay K11 is de-energized.

5 Functional check of the relay for switch SOUND ON/SOUND OFF.

1. Connect +24 VDC to X3/12. Check relay K12 is energized.
2. Check +24 VDC is available at X3/14.
3. Connection is switched between X4/17 and X4/18.
4. Disconnect +24 VDC from X3/12.
5. Items 2 and 3 should no longer apply. Check relay K12 is de-energized.
6. Check +24 VDC is available at X3/13.



## (2) Test Procedures - Emergency Intercom / Audio System

## (a) Intercom emergency call

---

NOTE

---

The test follows the description in ATP 6.4. and requires no measuring equipment.

---

1 Procedure:

1. Pick up the receiver in car 1. The driver's handset sounds a buzzer and the CAR 1 indicator lamp in the driver's console lights up.
2. Pick up the receiver of the master unit. The alarm stops, the indicator lamp remains lit.
3. Sound volume and quality must permit a clear audible conversation conducted in normal speech.
4. Put down the receiver in car 1. The indicator lamp in the driver's console goes off.
5. Put down the receiver of the master unit.
6. Repeat the test in cars 2 to 5 and in the rear cabin.

## (b) Audio system - Tests

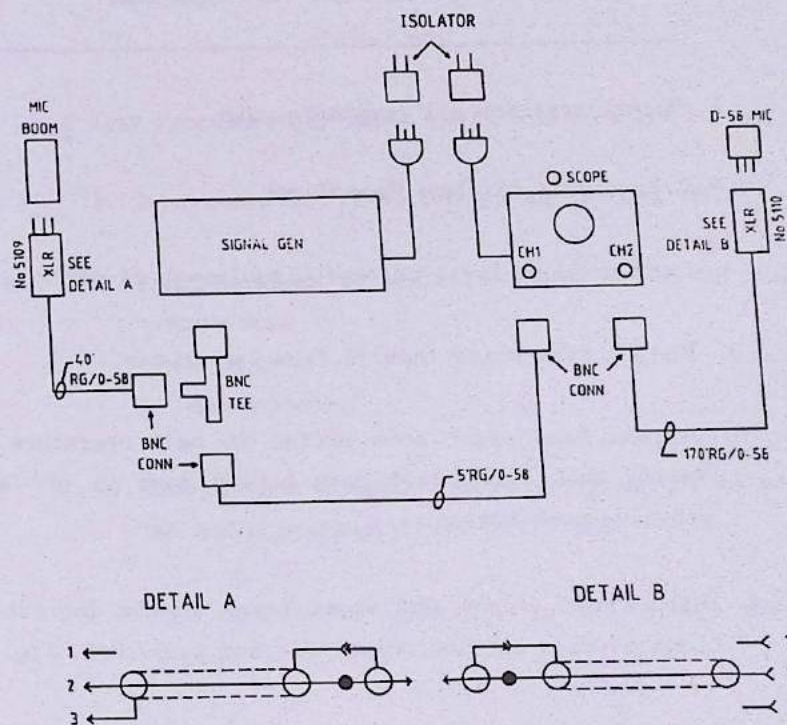
1 Measuring equipment:

1. Endless tapes NAB type AA:
  - Pink noise
  - Zero noise, 500 Hz, 1 KHz tone
  - Zero noise, 500 Hz, 8 KHz tone.



2. Bruel and Kjaer #1405 pink noise generator.
3. Bruel and Kjaer #2230 sound level meter.
4. Bruel and Kjaer #1625 octave filter set.
5. Bruel and Kjaer #2317 portable level recorder.
6. Function generator, Simpson Model 420 or equivalent.
7. Oscilloscope, Hitachi 417ACHIV212 or equivalent.
8. Ivey spectrum analyser #1EC179.

2 Test set-up:



FIRST, VERIFY THAT INPUT SIGNAL TO M/C BOOM AND OUTPUT SIGNAL FROM AMPLIFIER ARE IN PHASE.  
THEN VERIFY THAT EACH SPEAKER IS IN PHASE WITH INPUT SIGNAL (29 PLACES.).

Fig. 603 Test Set-up (Schematic)



3 Test Procedure for Speaker Phasing

1. Connect function generator to microphone, input of pre-amp and set generator output at 450 HZ, 100MV P-P per MOR-172.
2. Depress and hold PA mike pushbutton.
3. At every speaker in the car record the indicated phase relationship by noting the time base shift between channel 1 and 2.

---

NOTE

---

Proper phase angle is 180 degrees. Any speaker noted as 0 degrees out of phase shall fail this test.

---

4. Repeat test for all remaining cars.

4 Test Procedure for Tape Reproducer

1. Connect sound level recording equipment as per Fig. 604.
2. Install pink noise tape in tape reproducer.
3. Depress tape start push button on main operators console. Verify that tape start push button lamp is off after depressing push button.
4. Measure and record the sound level at the indicated locations in each car including nose and tail. Ref. Fig. 605.



## NOTE

The sound level required is 75 dB with undistorted peaks of 10 dB (less than 3%) above this level. A uniform frequency response is required over 200-8000 HZ  $\pm$  5 dB, through out the seating area of the train.

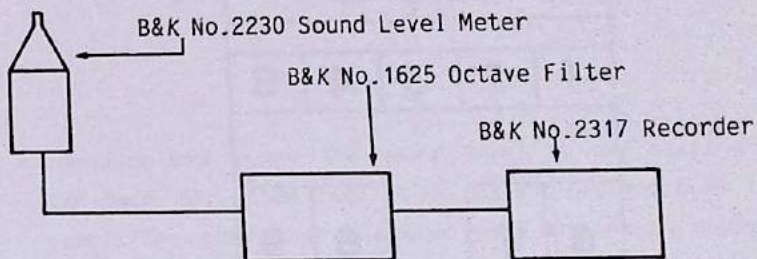
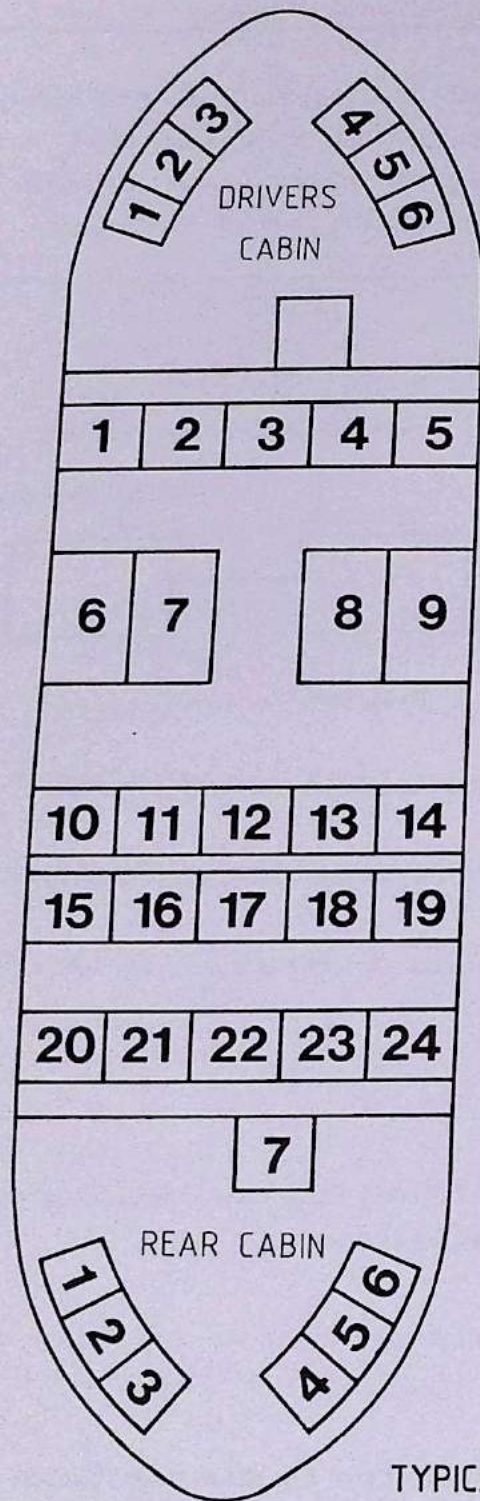


Fig. 604

5 Test Procedure for Sound Level Measurement

1. Turn sound On/Off switch to the ON position.
2. Confirm power on indicators are ON for the following audio components:
  - Inverter
  - Tape Repeater
3. Connect B & K #1405 Pink noise generator to microphone input at audio pre-amplifier.
4. Set pink noise generator to 1/3 octave band random noise input.
5. Depress and maintain PA Mike push button on main operators console.
6. Connect sound level recording equipment as per Fig. 606.





TYPICAL SEATING ALL CARS

Fig. 605



7. Set octave filter at 1/3 octave position

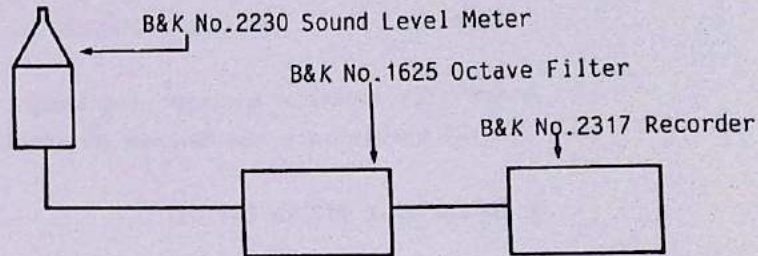


Fig. 606

8. Measure and record the sound level at one seating location in each car. (See Fig. 605). Adjust as required the power amplifier gain and equalizer pots to obtain desired sound level.

---

NOTE

The sound level required is 75 dB with undistorted peaks of 10 dB (less than 3%) above this level. A uniform frequency response is required over 200-8000 HZ,  $\pm 5$  dB, throughout the seating area of the train.

---

9. Turn Sound ON/OFF switch to the OFF Position and confirm that Power On indicators are OFF for the following equipment:
- Inverter
  - Tape Repeater

6 Test Procedure for Audio System Hum, Noise and Distortion

---

CAUTION:

WEAR PROTECTIVE HEARING PLUGS.

---



**1. Hum & Noise Test:**

- a Install zero noise 1 KHz tone endless tape in tape reproducer.
- b Set IVEY spectrum analyser for sample and hold measurements at D3 sample rate and maximum dB sensitivity scale.
- c Locate seat #12 in Car 01.
- d Depress tape start push button on main console.
- e Locate front panel of audio power amplifier.
- f Place microphone of IVEY spectrum analyser at approximate ear level in stationary holder.
- g Adjust audio output for maximum amplitude on dB scale of IVEY analyser and record results:
  - Record 1 KHz dB Level. ----dB
- h Remove 1 KHz tape from reproducer.
- j Insert zero noise tape in reproducer and restart.
- k Record dB level of any hum above 40 dB down from maximum dB level determined in step 7 at each 1/3 octave point over the entire frequency range of 31.5 Hz to 16 KHz. Record results in table para (3) (a).

**2. Distortion**

- a Install a zero noise 500 Hz, 1 KHz, 8000 Hz tone endless tape in tape reproducer and record the audio sound level in dB at each 1/3 octave point over the entire frequency range of 31.5 Hz to 16 KHz. Use table (3) (b) to record results. The acceptable roll off for each of the test frequencies should be 40 dB per octave. The test results shall not exhibit any noise above 40 dB down from maximum amplitude of any center frequency beyond the roll off skirts of the test frequencies.



## (3) Test and Measuring Record

(a) FREQ.	HUM NOISE dB LEVEL
31.5 Hz	
40 Hz	
50 Hz	
63 Hz	
80 Hz	
100 Hz	
125 Hz	
160 Hz	
200 Hz	
250 Hz	
315 Hz	
400 Hz	
500 Hz	
630 Hz	
800 Hz	
1 KHz	
1.25 KHz	
1.6 KHz	
2 KHz	
2.5 KHz	
3.15 KHz	
4 KHz	
5 KHz	
6.3 KHz	
8 KHz	
10 K	
12.5 KHz	
16 KHz	



## (b) Distortion Results

(b) FREQUENCY	TAPE 1 500 HZ <u>dB LEVEL</u>	TAPE 2 1000 HZ <u>dB LEVEL</u>	TAPE 3 8000 HZ <u>dB LEVEL</u>
31.5 Hz			
40 Hz			
50 Hz			
63 Hz			
80 Hz			
100 Hz			
125 Hz			
160 Hz			
200 Hz			
250 Hz			
315 Hz			
400 Hz			
500 Hz			
630 Hz			
800 Hz			
1 KHz			
1.25 KHz			
1.6 KHz			
2 KHz			
3.15 KHz			
4 KHz			
5 KHz			
6.3 KHz			
8 KHz			
10 KHz			
12.5 KHz			
16 KHz			



**7. Cleaning/Painting****A. Cleaning**

Equipment requiring cleaning is listed in Table 701. To clean the equipment, wipe with a damp cloth.

Equipment requiring cleaning	Equipment not requiring cleaning
Transceiver	Antenna
	Step-down transformer
	Loudspeaker
Microphone c/w gooseneck extension	
	Relay box N2
Mixer/amplifier	
Inverter 24 VDC/110 VAC	
Tape recorder	
Emergency intercom handsets and cradles	
	Loudspeakers
	Booster transformers

Table 701 - Cleaning

**B. Painting**

For localized painting refer to Chap. 11-00.



**MBB**

Transportation  
Technology Division

# CHAPTER 47-00 DRIVER'S STATION

Jan. 88



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## CHAPTER 47

## DRIVERS STATION

1. Description and OperationA. Description (Fig. 1)

## (1) General

The drivers station is located in the front cabin of the Mk V monorail. It is located in the right hand side of the cabin and consists of:

- a drivers console
- a power lever
- a drivers seat.

## (2) Drivers Console

The console is the housing for the communication equipment, the electrical equipment, plus the indicators, gages and controls for the driver to operate the monorail. These indicators and gages are installed on control panels (Refer Chap. 75) mounted on the top face of the console.

The console is constructed from mild steel box section secured to the cabin's structure with bolts and washers. The box section is shimmed as necessary to maintain the correct construction heights for the fitment of the console covers. The console framework has side panels, trim covers and an upper cover which is slotted for the speed control power lever.

## (3) Power Lever

The lever is to the right hand side of the driver and is located in a slot on the upper cover of the console. A hand grip assembly is fitted to the top of the lever. The handgrip is constructed from moulded plastic and has two press to action micro switches. A removable cover on the handgrip exposes two Allen bolts which secures the handgrip to a stub lever. The stub lever is connected to a rear half lever and a front half lever. The rear and front half levers are attached to the power lever housing. The front half lever complete with a pivot lever is secured to a control cable. The control cable assembly



has an outer casing, and an inner cable with eye-ends. The power lever is attached to the console structure with hexagon headed bolts. The control cable assembly goes through an adaptor at the base of the power lever housing, and the outer casing of the cable assembly is secured to the monorail's structure with bolts and clamps. A gaiter covers the inner cable's movement at the output end of the cable. The purpose of the gaiter is to keep dust and dirt from entering the cable assembly and causing excessive wear. A spring loaded piston and pressure plate assembly are fitted at the output end of the power lever assembly. The purpose of the piston assembly is to retain the power lever to its selected position on the pressure plate. The pressure plate is secured to the power selector system (Refer to R & S manual).

#### (4) Drivers Seat

Four Allen headed bolts secure the driver's seat to the cabin floor. The seat has a modular constructed metal chassis with each modular section being adjustable to the posture at the driver. The three adjustments are:

- back adjustment lever located at the LH base of the lumbar support
- slope adjustment levers located at LH side of the seat
- depth adjustment lever located under the front of the seat.

The seat and lumbar support are padded to give the driver a comfortable working seat.

## B. Operation

When the driver at the monorail moves the power lever from the train halt "power off" position to the train move "power on" position, the power lever pivots on a clevis pin through the lever housing. This pivoting action moves the pivot lever and consequently a movement of the output end of the control cable takes place. The output end of the control cable moves the power selector lever. The power lever and pressure plate are held to the position selected by a spring loaded forkend acting on a pulley which seats in detents on the pressure plate. To enable the driver to observe a control the monorail from a safe comfortable working position, a modular constructed seat is provide. The seat can be adjusted for height, depth and reclining postures with the operation of three control levers. The raising of a lever on the base of the lumbar support lets the driver adjust his back (lumbar) support to an upright or reclined angle.



Two levers on the side of the seat, when depressed let the driver raise or lower the seat in an angled mode to suit the driver's height. A lever located under the seat lets the driver adjust the seat in a forward/aft direction.

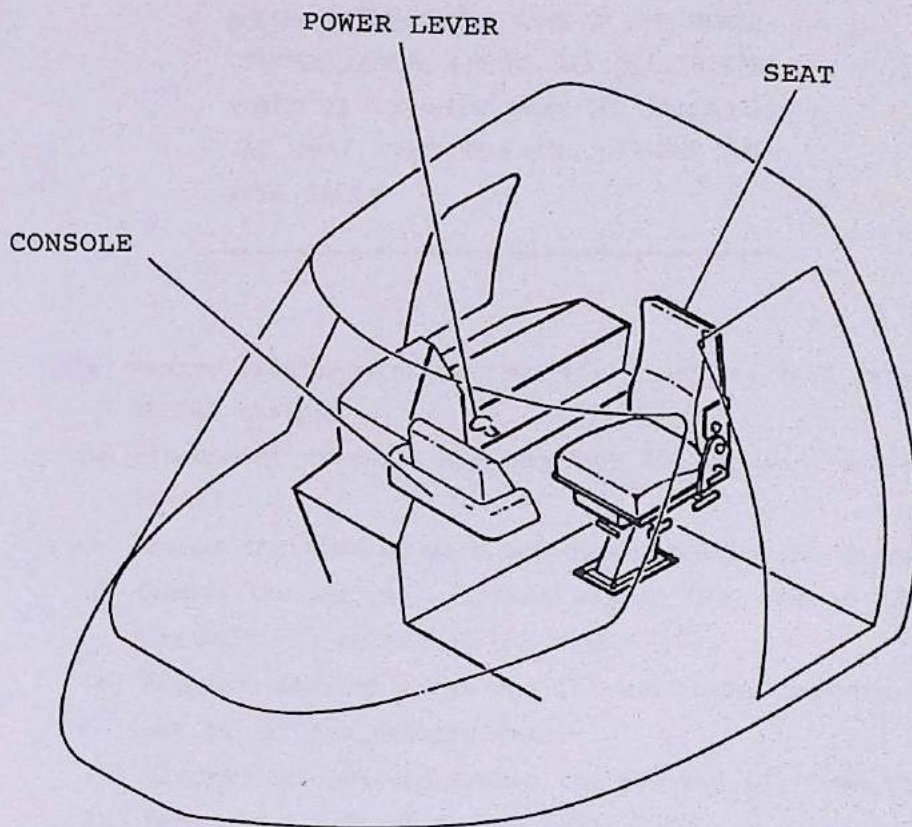


Fig. 1 Driver's Station - General Arrangement



**5. Removal / Installation****A. Power Lever Control Cable**

- (1) Removal  
Fig. 501

---

**WARNING**

---

BEFORE COMMENCING WORK ON THE POWER CONTROL LEVER, ENSURE ALL ELECTRICAL POWER IS ISOLATED FROM THE MONORAIL AND THAT ALL RELEVANT SYSTEMS ARE MADE SAFE.

---

- (a) Remove side trim panel from side console. Pull carefully off the VELCRO strips.
- (b) Disconnect flexible ducting from the driver's air outlet. (Chap. 29-00)
- (c) Remove the side console top cover. Remove the screws.
- (d) Remove the nut (1), spring washer (2), washer (3) and withdraw the bolt (5) retaining the washer (4).
- (e) Withdraw the cable eye end (7) and thrust washers (6) taking care not to let the washers fall.
- (f) Slacken nut (8) and remove the eye end (7) from the cable.
- (g) Remove nut (10). Withdraw cable (20).
- (h) Remove cotter pin (11), washer (12) and clevis pin (13) securing the control cable eye end (14) to the power selector lever (15). Discard the cotter pin.
- (j) Slacken nut (16) and remove eye-end (14) from the cable.
- (k) Remove rubber gaiter (17).
- (l) Remove nut (18).
- (m) Remove all clamps attaching the cable to the chassis and remove the cable.



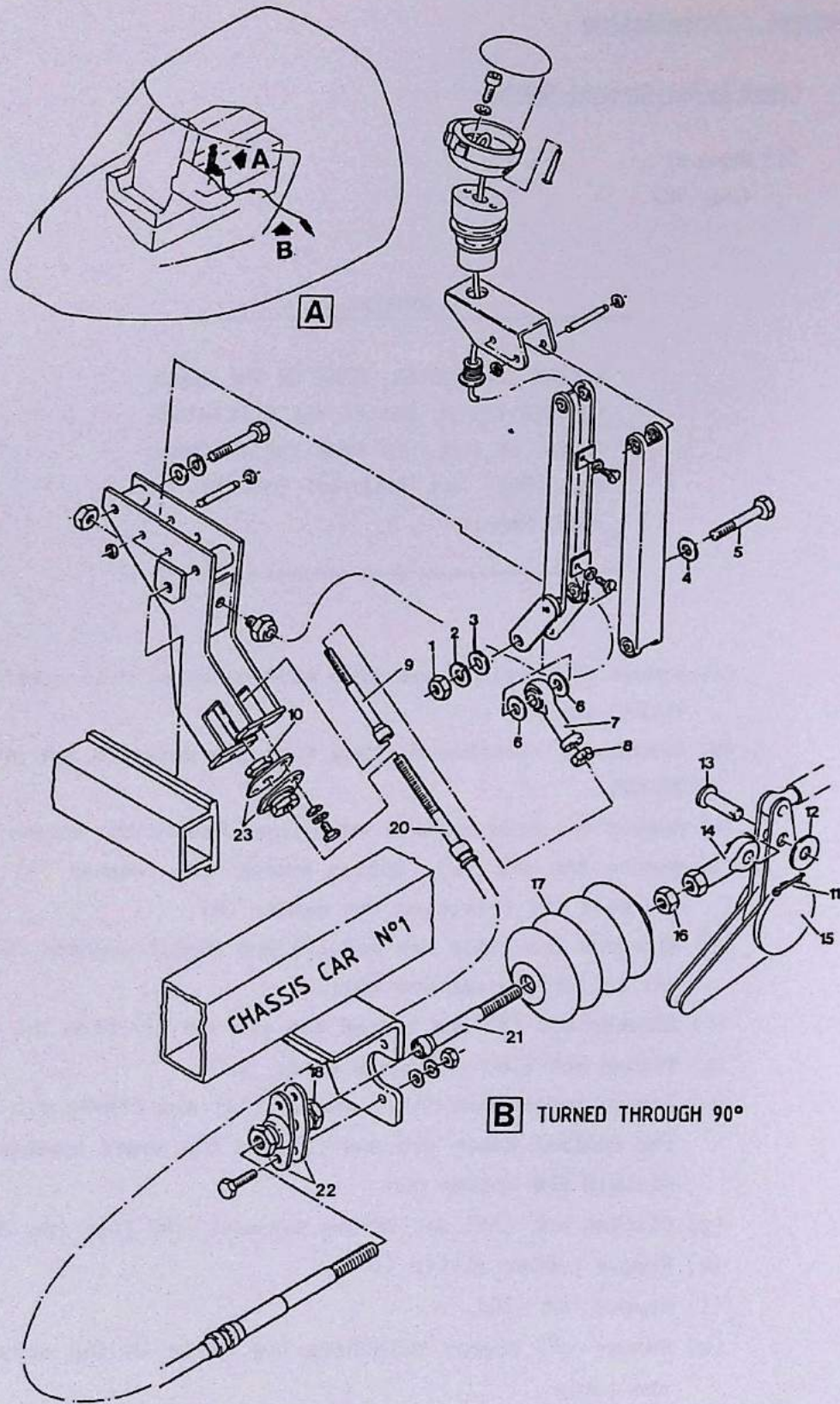


Fig. 501



## (2) Install

- (a) Examine all components for serviceability and freedom from damage.
- (b) Examine the rubber gaiter (17) for freedom from cracks.
- (c) Make sure the inner cable is free from obstruction within the cable casing and that there is freedom from bends.
- (d) Insert cable through swivel joint (22) and secure with nut (18).
- (e) Install gaiter (17) to cable, and fit eye-end (14). Do not tighten nut (16).
- (f) Fit clevis pin (13) and secure with washer (12) and make safe with new cotter pin (11).
- (g) Secure cable to chassis with clamps.
- (h) Insert cable (20) through swivel joint (23) and secure with nut (10).
- (j) Fit nut (8) and eye-end (7) to adaptor (9). Do not tighten nut.
- (k) Fit eye-end (7) to pivot lever ensuring thrust washers (6) are in position. Secure with bolt (5), washers (3, 4), spring washer (2) and nut (1). Adjust. (Sect. 6A)
- (l) Adjust the cable. (See Sect. 6A)
- (m) Ensure the cable eye-ends are locked with nuts (8) and (16).
- (n) Ensure work area is clean and free from debris and all tools are removed.



**6. Adjustment/Test****A. Adjustment**

Refer to R & S engineering test instruction (TI 113) for correct procedures.

**7. Cleaning / Painting****A. Cleaning**

The console structure can be cleaned using a detergent free cleaning agent and wiped dry with a clean, dry, lint free cloth. The covers, trim panels and control panels can be cleaned using a damp cloth and a mild solution of detergent free cleaning agent. Wipe dry with a clean lint free cloth.

**B. Painting**

For paint repairs to the console structure, Refer to Chap. 11-00.

**8. Repairs**

There are no detailed repairs to the console structure because of its various mild steel section. Repair is either by replacement or localized welding of any damaged section.

However if a localized repair is necessary the damaged section should be removed and repaired in the workshop and not in situ on the monorail.

---

**CAUTION**

---

WELDING IN THE AREA OF ELECTRICAL  
EQUIPMENT OR SOFT FURNISHINGS CAN  
CAUSE PERMANENT DAMAGE.

---



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Technology Division

**CHAPTER 75-00  
CONTROL PANEL**

Jan. 88



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## CHAPTER 75

## CONTROL PANEL

1. Description and OperationA. Description (Fig. 1)

## (1) General

This chapter describes the control panel and its structure. It does not describe the individual functions of the caption indicators or gages. For detailed information regarding the operation of each component on the control panel, reference must be made to the system they serve, but description of the type of switches, circuit breakers and instrument gages is contained in Chapter 76.

Installed on the drivers console, is a primary and secondary control panel. The purpose of these control panels is to house the control and indication gages for the electrical systems.

## (2) Primary Control Panel

The primary control panel is located on the front facia of the drivers console. The panel is rectangular in shape with an anti-vibration strip, 1,5 mm (0.040 in.) thick fitted between the contact surfaces of the control panel and the facia of the console. There are five rectangular cut-outs in the panel facia to accomodate instrument gages. There are also oblong cut-outs in the control panel to accomodate twenty five caption indicators and seven rocker switches. The control panel is secured to the console with latches and spring loaded ball catches. The ball catches are attached to adjustable brackets. This allows adjustment of the control panel's facia plate which is fitted flush with the facia on the console.

## (3) Secondary Control Panel

The secondary control panel is located on the angled side facia of the drivers console. The panel is rectangular in shape with both ends angled from the base to a wider top edge. An anti-vibration strip is fitted to the panel between its contact surfaces and the console. There are two rectangular cut-outs in the panel facia to accommodate instrument gages. There are also oblong cut-outs in the control panel



to accommodate switches and circuit breakers. A slot in the fascia plate of the panel is for the control handle of the air valve. A hinged cover is fitted on the right hand half of the secondary control panel. The purpose of the cover is to cover the circuit breakers and switches not used in normal operations.

**B. Operation**

Not applicable (N/A)



Fig. 1 Control Panels - General Arrangement.



## 5. Removal / Installation

### A. Primary Control Panel

#### (1) Removal

Fig. 501

---

#### WARNING

BEFORE DOING ANY OF THE FOLLOWING MAINTENANCE PROCEDURES, ENSURE THAT ALL ELECTRICAL SYSTEMS ARE MADE SAFE AND ALL PRESSURIZED SYSTEMS ARE BLED OFF.

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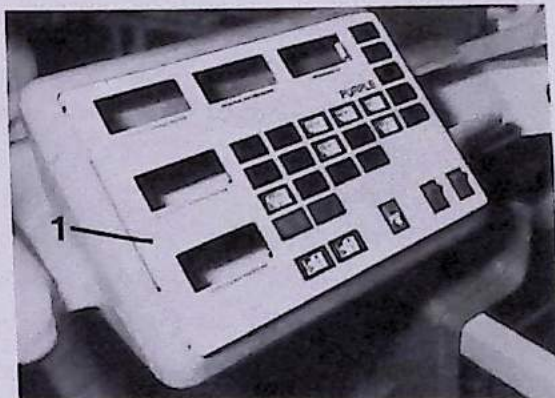


Fig. 501

- (a) Using a suitable tool, lift the primary control panel (1) from the drivers console.

---

#### NOTE

The panel is retained in the console with four spring-loaded ball catches.

---

- (b) Disconnect the electrical connections to all switches and indicator lights (Chap. 76-00).
- (c) Disconnect the electrical gages. (Chap. 76-00)
- (d) Remove the panel.
- (2) Install
- (a) Examine all components for serviceability and freedom from damage.
- (b) Install the electrical gages. (Chap. 76-00)
- (c) Install the switches and indicator lights (Chap. 76-00).
- (d) Connect all electrical connections (Chap. 76-00).
- (e) Fit the equipped control panel to the console.



- (f) Ensure the work area is clean and free from debris and all tools are removed.
- (g) Do a lamp test (Chap. 76-00).
- (h) Do a functional test of the doors (Chap. 22-00).
- (j) Do a functional test of the air conditioning (Chap. 29-00).
- (k) Do a functional test of the communications (Chap. 39-00).
- (l) Do a functional test of the electrical system (Chap. 76-00).

**B. Secondary Control Panel**

- (1) Removal

Fig. 502

---

**WARNING**

BEFORE DOING ANY OF THE FOLLOWING MAINTENANCE PROCEDURES, ENSURE THAT ALL ELECTRICAL SYSTEMS ARE MADE SAFE AND ALL PRESSURIZED PNEUMATIC SYSTEMS ARE BLED OFF.

---

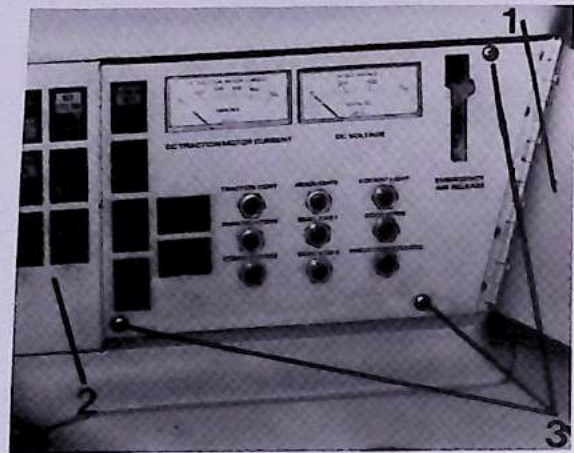


Fig. 502

- (a) Open hinged cover (1) and remove screws (3). Using a suitable tool, lift the secondary control panel (2) from the drivers console.

---

**NOTE**

The panel is retained in the console with spring-loaded ball catches.

---

- (b) Disconnect the electrical connections to all circuit breakers, switches and indicator lights (Chap. 76-00).
- (c) Disconnect the electrical gages (Chap. 76-00).



- (d) Remove the panel.
- (2) Install
  - (a) Examine all components for serviceability and freedom from damage.
  - (b) Install the electrical gages (Chap. 76-00).
  - (c) Install the circuit breakers, switches and indicator lights (Chap. 76-00).
  - (d) Connect all electrical connections (Chap. 76-00).
  - (e) Ensure the work area is clean and free from debris and all tools are removed.
  - (f) Do a lamp test (Chap. 76-00).
  - (g) Do a functional test of the doors (Chap. 22-00).
  - (h) Do a functional test of the air conditioning (Chap. 29-00).
  - (i) Do a functional test of the communications (Chap. 39-00).
  - (k) Do a functional test of the electrical system (Chap. 76-00).
  - (l) Install the secondary control panel (2) in position and secure with screws (3).

#### C. Side Panel Top Cover

- (1) Removal
  - (a) Remove the five screws fastening the top cover.
  - (b) Reach in under the cover and disconnect the driver's fresh air outlet. (Chap. 29-00)
  - (c) Remove the cover.
- (2) Install
  - (a) Install in the reverse sequence.

#### D. Side Panel Side Cover

- (1) Removal/Installation
  - (a) The cover is held in position with Velcro tape. Exercise care when removing the panel.



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# CHAPTER 76-00 ELECTRICS

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## CHAPTER 76

## ELECTRICS

1. Description and OperationA. Description(1) General

The Mk V monorail has two electrical distribution centers and a programmable control unit (PCU) installed beneath car 3. The centers take DC voltages and distribute them through a main switch, circuit breakers and relays to the electrical cables installed between cars 1 to 5. The PCU takes a DC voltage to control and fault diagnose the electrical systems. The drivers control and indication of the electrical operated systems is shown on drivers control panels installed in the front cabin. The maintenance indication is shown on the PCU modules.

(a) Primary Control Panel (Fig. 1)1 Instrument Gages

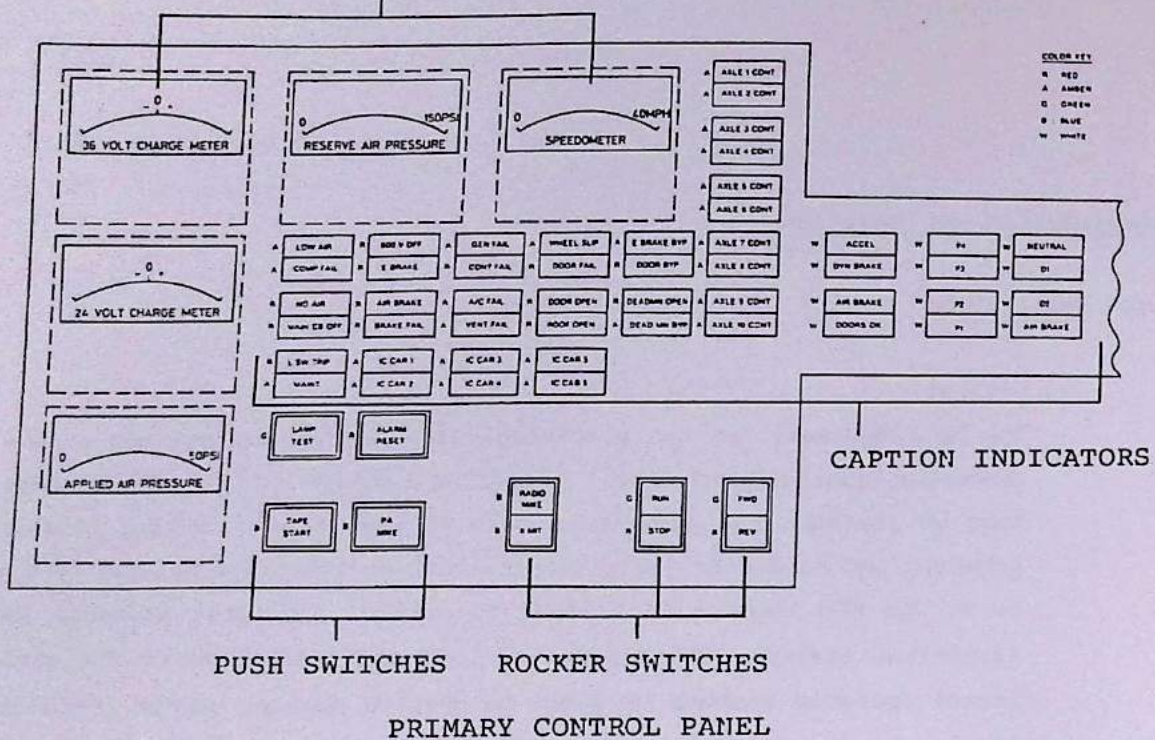
There are five gages fitted to the primary control panel. These gages are:

- a speedometer, range 0-40 mph
- a reserve pressure gage, range 0-150 psi
- a charge voltmeter, 36 volt
- a charge voltmeter, 24 volt
- a applied air pressure gage, range 0-50 psi.

Each gage is retained in the control panel with two clamping plates. Each clamping plate is secured with a mushroom headed screw that secures the plate to a hexagon internally threaded spacer. A countersunk screw secures the spacer to the control panels facia plate. Thus the instrument is clamped between the facia plate and the clamping plate.

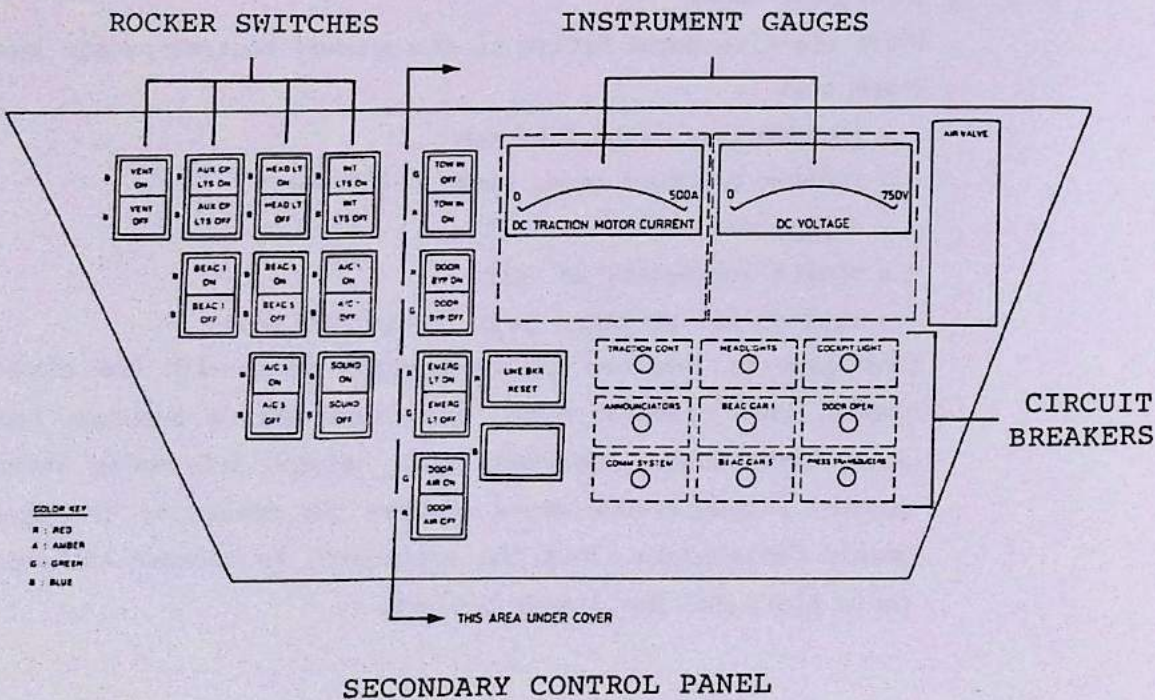


INSTRUMENT GAUGES



PUSH SWITCHES      ROCKER SWITCHES

PRIMARY CONTROL PANEL



SECONDARY CONTROL PANEL

Fig. 1 Control Panel - General Arrangement



## 2 Caption Indicators

There are five amber/red caption indicators ten amber/amber caption indicators and six white caption indicators installed on the primary control panel. Each caption indicator is fitted from the front of the control panel facia plate and it is retained to the facia plate with plastic moulded legs that contract as the indicator is pushed through the oblong cut-out. The legs expand once the caption indicator is pushed into position. The case of each caption indicator has a dividing center wall that separates each case into two separate compartments. Two filament bulbs are fitted in each compartment. The bulbs are connected to connections at the base of the case.

Connection legs protruding from the back of the holder allow electrical plugs to be fitted to the caption indicator. Installed to the front of each case is a colored plastic caption plate. The colors of the caption plates fitted to the control panel are:

- red, warnings
- amber, caution
- white, system ok

The six white caption indicators, are similar in construction to the amber/amber and amber/red indicators. The white indicators are described here as part of the primary control panel, but they are not part of the control panel's main facia plate. The control panel's main facia plate is removable (as previously described), but the facia plate that retains the six white caption indicators remains in position on the console.

## 3 Rocker Switches

Three rocker switches and four pushswitches are fitted to the control panel. Each switch is fitted from the control panel front and secured to the control panel facia plate with two plastic moulded legs. The legs contract as the switch is pushed through the oblong cut-out and then expand when the switch is located. Each switch has a filament bulb that connects with the contacts inside the switch. The rocker switch faces have a center pivot which allows the switch to be depressed by a rocking action. The rocker face is made of colored plastic.



(b) Secondary Control Panel (Fig. 1)

There are oblong cut-outs in the secondary control panel to accommodate nine blue and four red/green rocker switches, two press switches and nine circuit breakers.

1 Instrument Gages

There are two gages fitted to the control panel, the gages are:

- a voltmeter, (0-750 Vdc)
- an ammeter, (dc traction motorcurrent 0-500 A).

Each gage is retained in the control panel with two angled bracket clamps. Each bracket clamp is secured with a mushroom headed screw that secures the bracket to an internal threaded spacer. A countersunk screw secures the spacer to the control panel's fascia plate. Consequently the instrument is clamped between the fascia plate and the bracket clamps.

2 Rocker Switches and Pushswitches

Thirteen rocker switches and two pushswitches are installed on the control panel. Each switch is fitted from the control panel front and secured in position with two plastic moulded legs that contract as the switch is pushed through the oblong cut-out. The legs expand when the switch is located. Each switch has a filament bulb that connects to contacts inside the switch. A colored plastic face plate on the switches, is back-lighted with the filament bulb. When the pushswitch is pressed a toggle is actioned and makes the electrical contacts. On the rocker switches, the face has a center pivot which allows the switch to be depressed with a rocking action. The rocker face of nine switches is blue and of four switches is red/green.

3 Circuit Breakers

There are nine circuit breakers installed on the secondary control panel. The circuit breakers are of different amperage ratings and protect their individual systems against over-loading. Each circuit breaker is attached to the panels fascia plate with a nut and washer.

(c) Distribution Centers

There are two electrical distribution centers located under car 3. The centers are of rectangular construction with glass panels in the front doors. The centers contain the main switches, PCV and terminal boards which distribute the electrical power to the monorails door control system.



(d) Programmable Control Unit (PCU)

1 The PCU is of compact modular design. Each system component is a detachable module that can be replaced in less than 5 minutes. The PCU has the following:

- 884A Controller Module
- P800 Power Supply Module
- J802 Holdup Power Supply Module
- 800 Series I/O Modules
- Module Housing
- Interconnecting Housing Cables (Power and Signal).

2 Controller Module

The 884A Controller Module is the center of the 884 Programmable Control System. All logic solving and supervisory control functions are performed by the controller module. It has two printed circuit boards:

- a CPU board
- a communications board (Doubus/Modbus).

These two boards are enclosed in a housing that measures 3.60 inches wide by 8.15 inches deep by 9.25 inches high. The controller module installs into the slot immediately to the right of the power supply and into the second slot from the left in the primary module housing. It connects to the housing's backplane connectors. The power supply module, I/O modules, and controller option modules share the housing with the controller module.

3 Power Supply Module

The P800 Power Supply Module provides power for the controller and I/O modules. The power supply performs in environments with temperature and humidity extremes, steady shock and vibration and high frequency electromagnetic fields.

The DC power source connects to the terminals on the power supply module's terminal block. The terminal block has a safety cover that protects against shock.

The power supply module is installed in the housing's left slot next to the controller. It connects to the housing's backplane.

The power supply module measures 3.6 inches wide by 9.25 inches high x 8.15 inches deep.

4 Holdup Power Supply Module

The J802 power holdup module provides sufficient internal



storage to prevent 884 memory loss under conditions of DC source brownout, dropout or shortout. It also provides for optional remote ON/OFF switch capability without sacrificing P802 ON/OFF switch functionality.

The J802 consists of the following major functional elements:

- A blocking diode
- A bank of energy storage capacitors
- A threshold sensing circuit
- A P802 Control Switch

The J802 module is installed in the PCU to the right of the controller module 884A and in the third slot from the left in the primary module housing. The module's steady state current rating is limited to 10 amps maximum passing from the DC in terminals to the DC out terminals. The threshold of the turn ON switch is activated when the DC in (+) to the DC (-) in terminal is in the range of 21.3 to 21.8 VDC.

#### 5 Series I/O System

The 884 Programmable Controller System interfaces with equipment by way of the 800 Series input and output (I/O) modules. The input modules receive data from equipment, and send this data to the controller module. The controller module uses the program logic to process the data and send instructions to specific output modules. The output modules send instructions to the equipment being controlled. All communications between the controller and I/O modules occurs by way of the Ourbus communications network. The Ourbus coordinates, validates, and checks all I/O communications. These processes are initiated by the program logic.

Each I/O module electrically connects to the module housing by way of the bull pin, card edge, and terminal block connectors. The I/O modules are physically secured to the housing by two captive screws.

The equipment being controlled connects to the terminal block connector located on the housing. The I/O module connectors physically mate with these terminal blocks.

The I/O modules have the following status and diagnostic indicators:

- STATUS - these indicators reflect the state (ON or OFF) of



each point. Each status indicator has an associated I/O point number.

- ACTIVE - indicates the module is communicating properly with the controller.
- FUSE - indicates the fuse is blown (output modules only).

#### 6 Module Housings

The module housings contain all the system components. The housings provide electrical connections between system components, system grounding, and electromagnetic and radio frequency interference shielding. The module housing contain three combinations of power supply, I/O (Ourbus), Systembus and bull pin connectors. These connectors are located on the housing backplane.

#### 7 Interconnecting Housing Cables (Power and signal)

The module housings interconnect by way of a 37 pin flat bus signal cable and a 15-pin power cable. Each cable has a male and female connector. The power cable has a grounding lug. The cables connect to the power and bus ports on the primary housing's lower flange, and the secondary housing's upper and lower flange. The cable's input connectors (power and bus) mate with the ports on upper flange of the secondary housings. The cable's output connectors mate with the connector ports on the lower flange of the primary and secondary housings.

### B. Operation

#### (1) General (Fig. 2)

For the operation of the electrically operated systems refer to the individual chapters and to the electrical schematics on figure 2. For more detailed electrical system information refer to the drawing set.

#### (2) PCU operation (Fig. 3)

Power is supplied to the PCU through a power supply module, controller module, I/O modules, power holdup supply module, power and signal cables, and P190 programmer. These modules electrically and physically connect to the housings. The prime 24 VDC voltage source is applied to the input terminals of the J802.

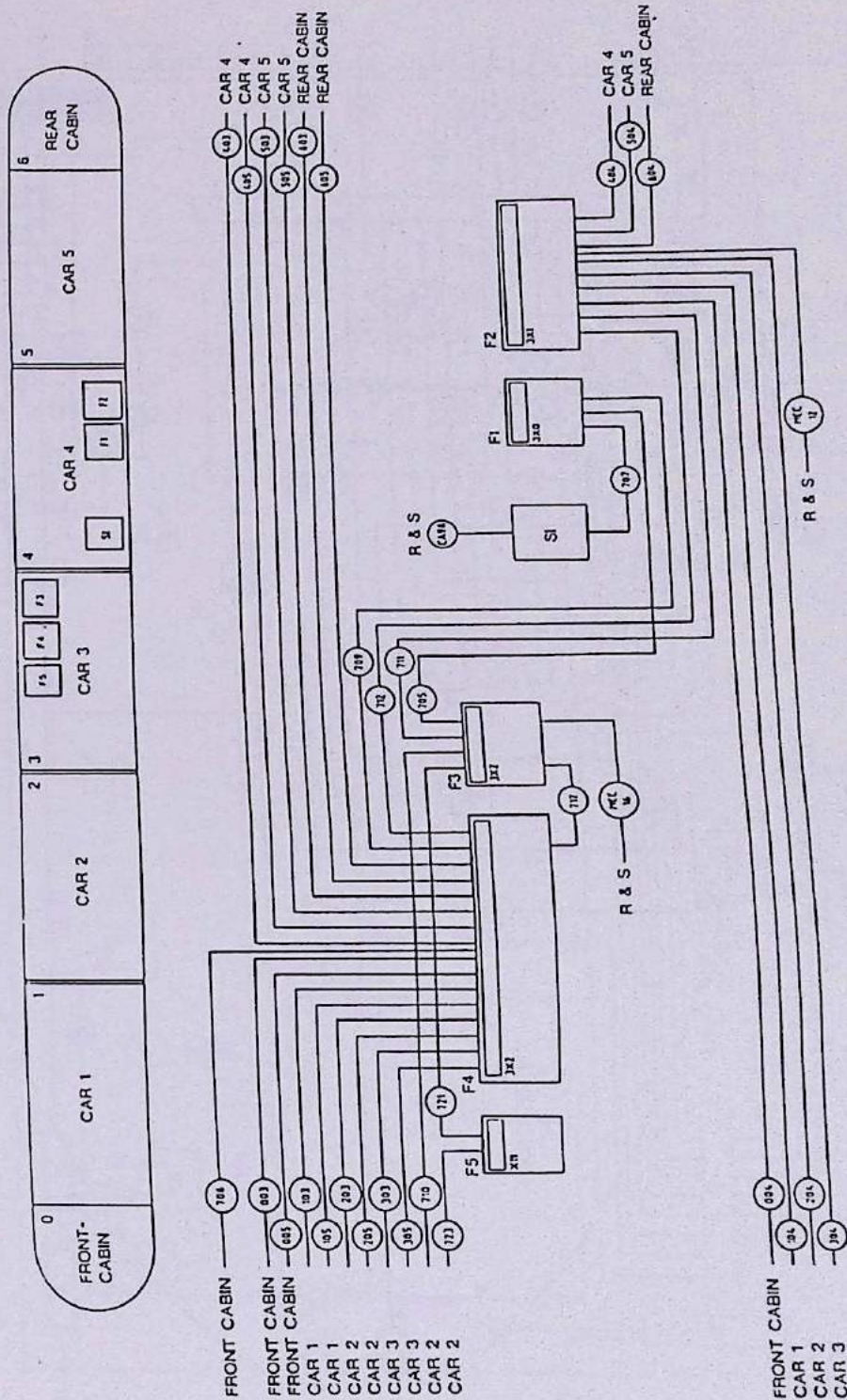


The threshold circuit of the J802 module senses the DC source input voltage. When the voltage is above the nominal 21.5 volt threshold, the P802 control switch transistor is turned ON. The turn-on of the control switch transistor activates the P802 status circuitry which brings the P802/884 system up to a running condition.

If the threshold sense circuitry detects that the DC source is below the nominal 21.5 volt level, the control switch transistor is turned OFF, thus de-activating the P802 status circuitry. This action causes the initiation of a P802 POK/RESET sequence. Energy storage capacitors built into the module, allow for any small negative peaks in the supply voltage. These capacitors safeguard against unscheduled shutdowns of the PCU due to small voltage drops. The energy storage capacitors also ensure that a graceful system shutdown occurs.

All housings interconnect by way of power and signal cables. The 884 PC is programmed with the P190 programmer. User logic is entered into the 884 PC and edited by way of the P190 programmer. For detailed operation of the PCU, reference should be made to the vendors handbook. For details of the wiring, refer to the drawing set.





NOTE: FOR KEY TO FIGS. 2  
REFER TO THE DRAWING SET

Fig. 2 Electrical Schematic - General (Sheet 1 of 4)



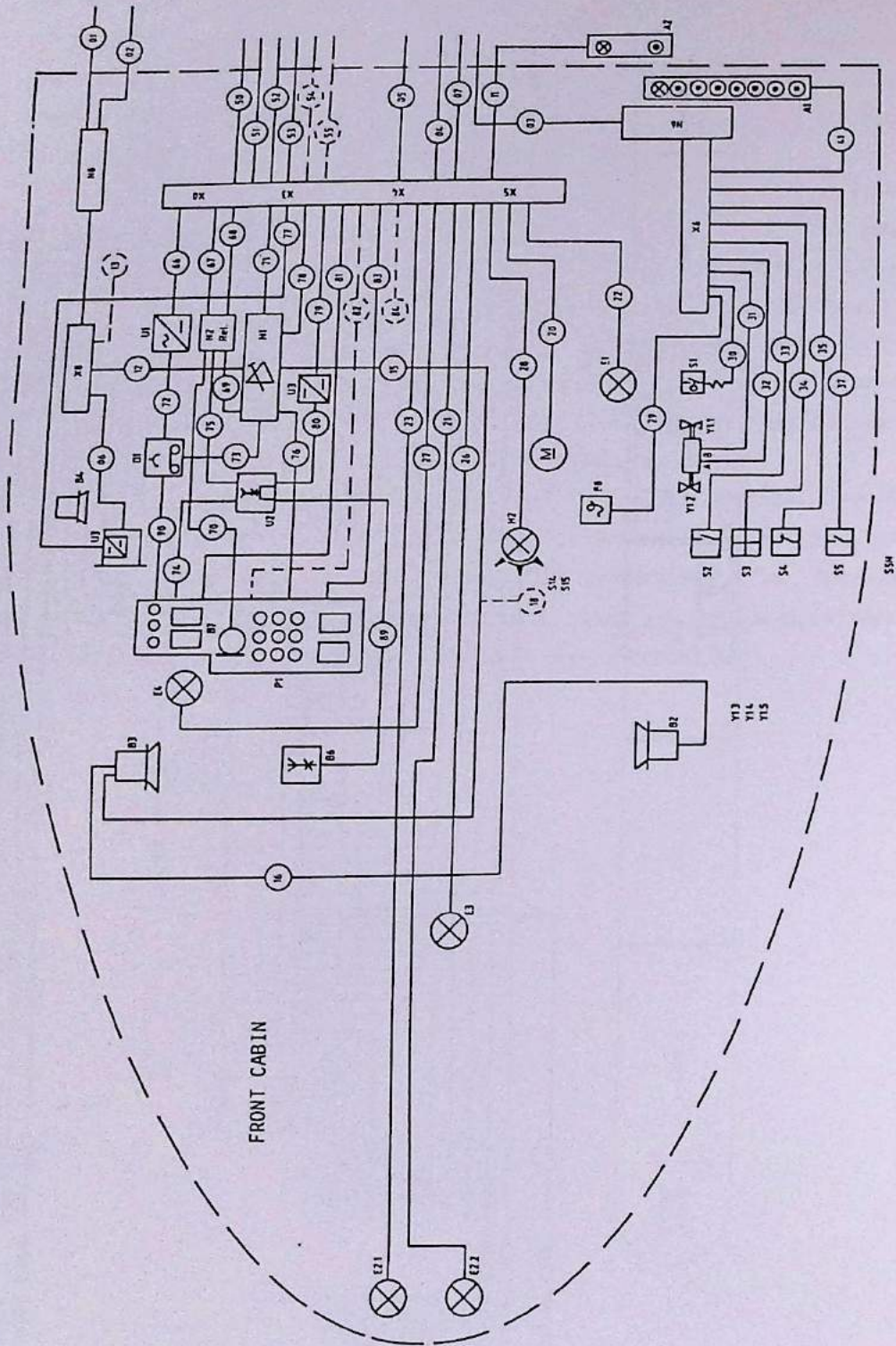


Fig. 2 Electrical Schematic - General (Sheet 2 of 4)



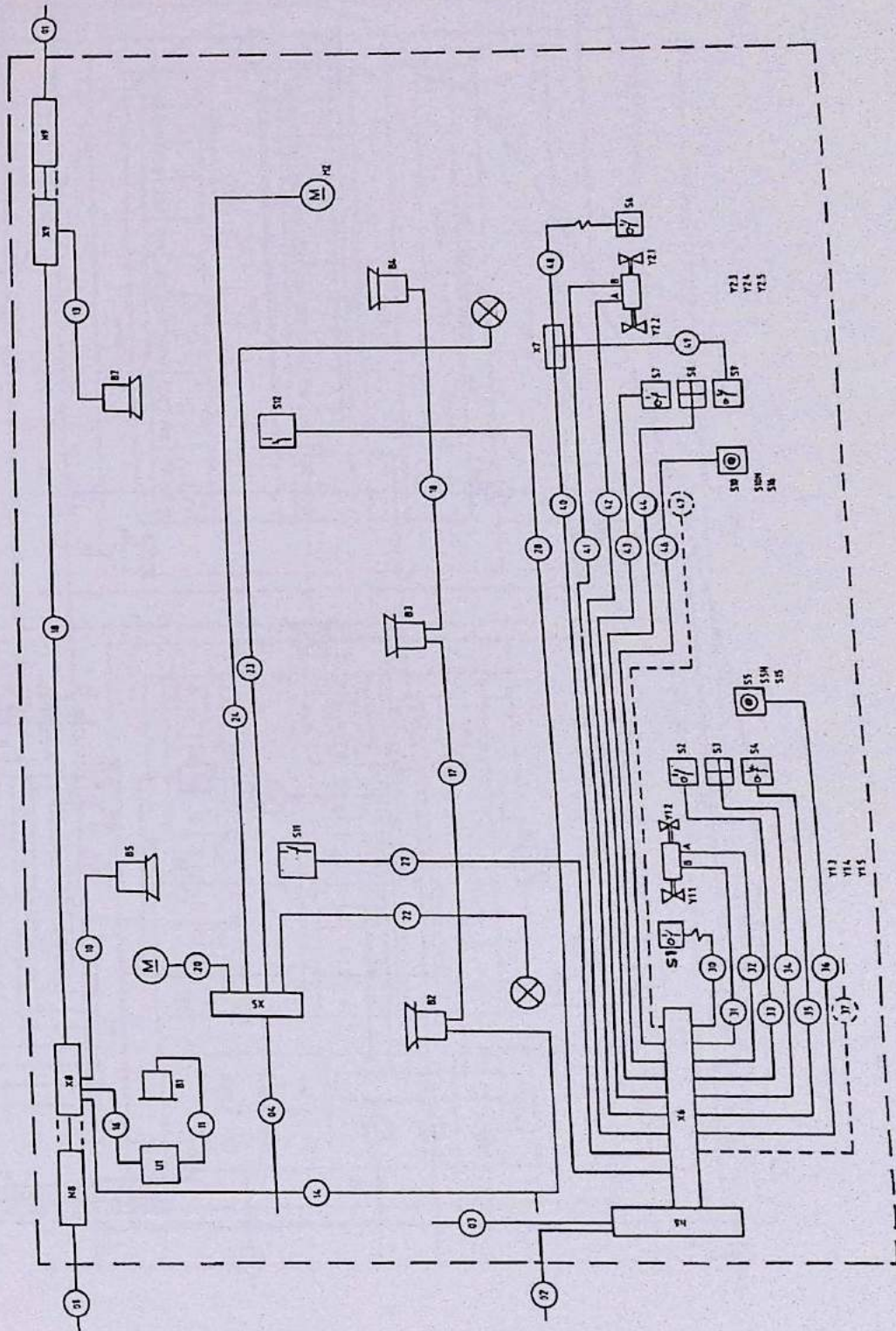


Fig. 2 Electrical Schematic - General (Sheet 3 of 4)



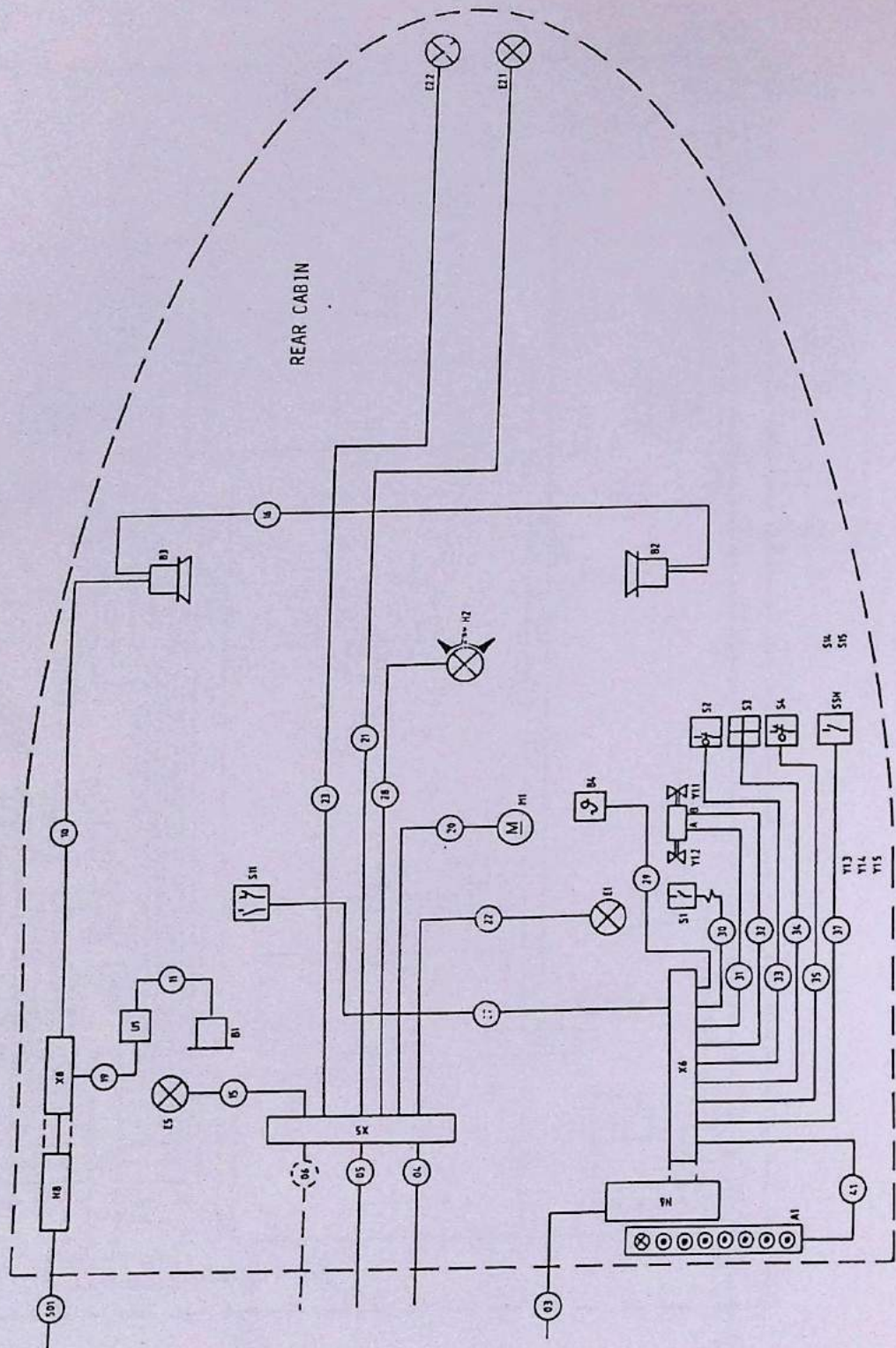


Fig. 2 Electrical Schematic - General (Sheet 4 of 4)



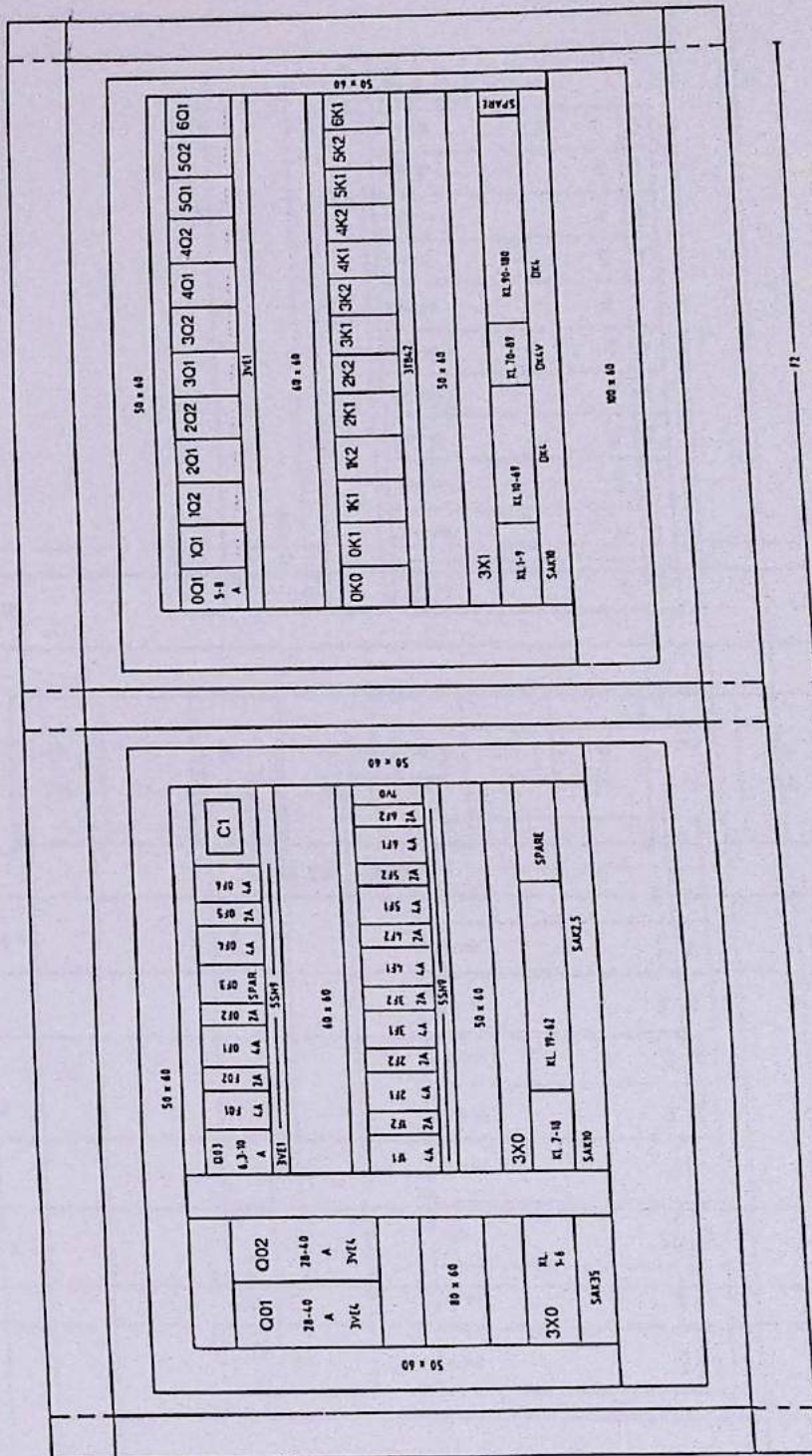


Fig. 3 PCU Modules (Sheet 1 of 3)



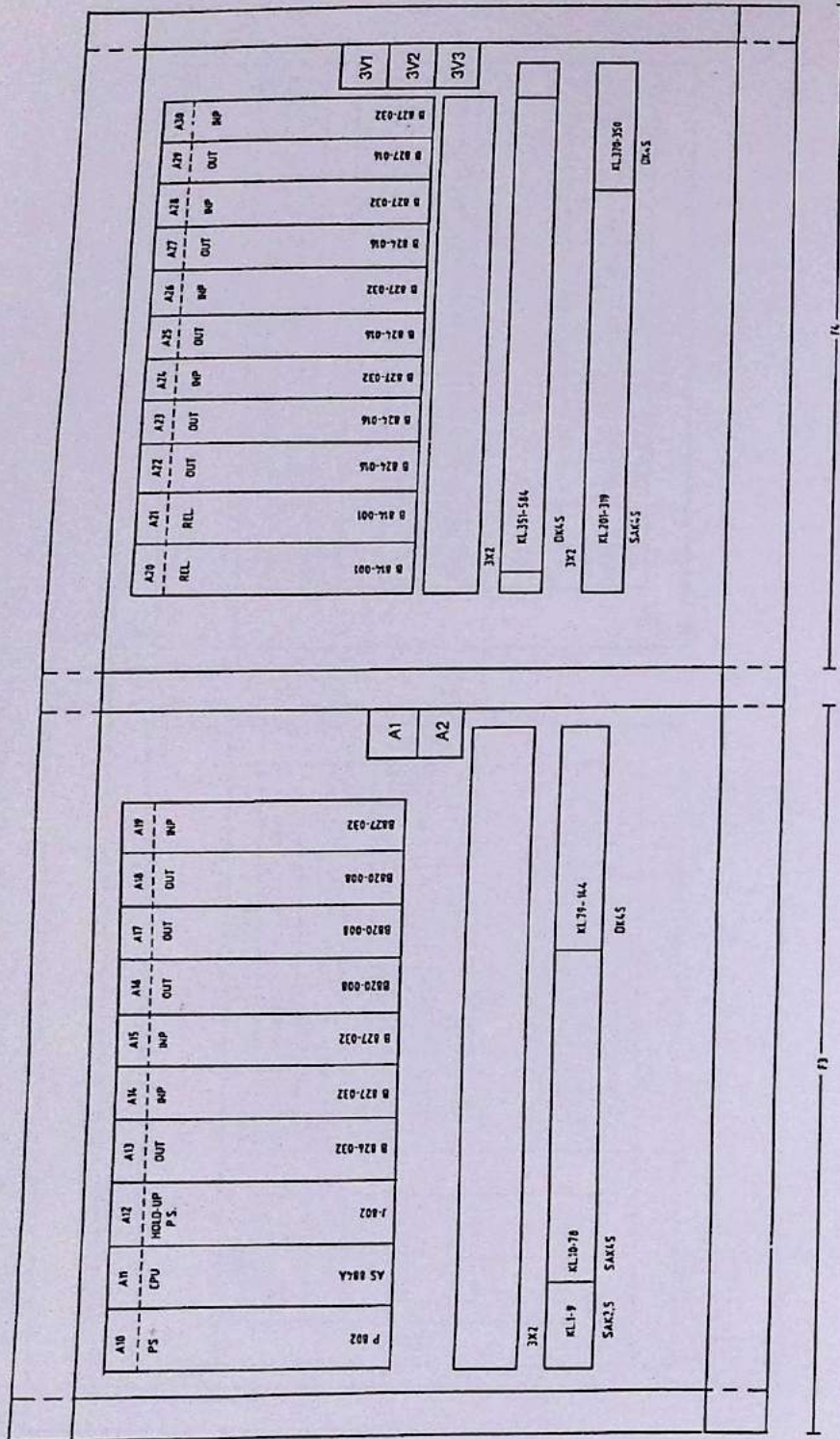
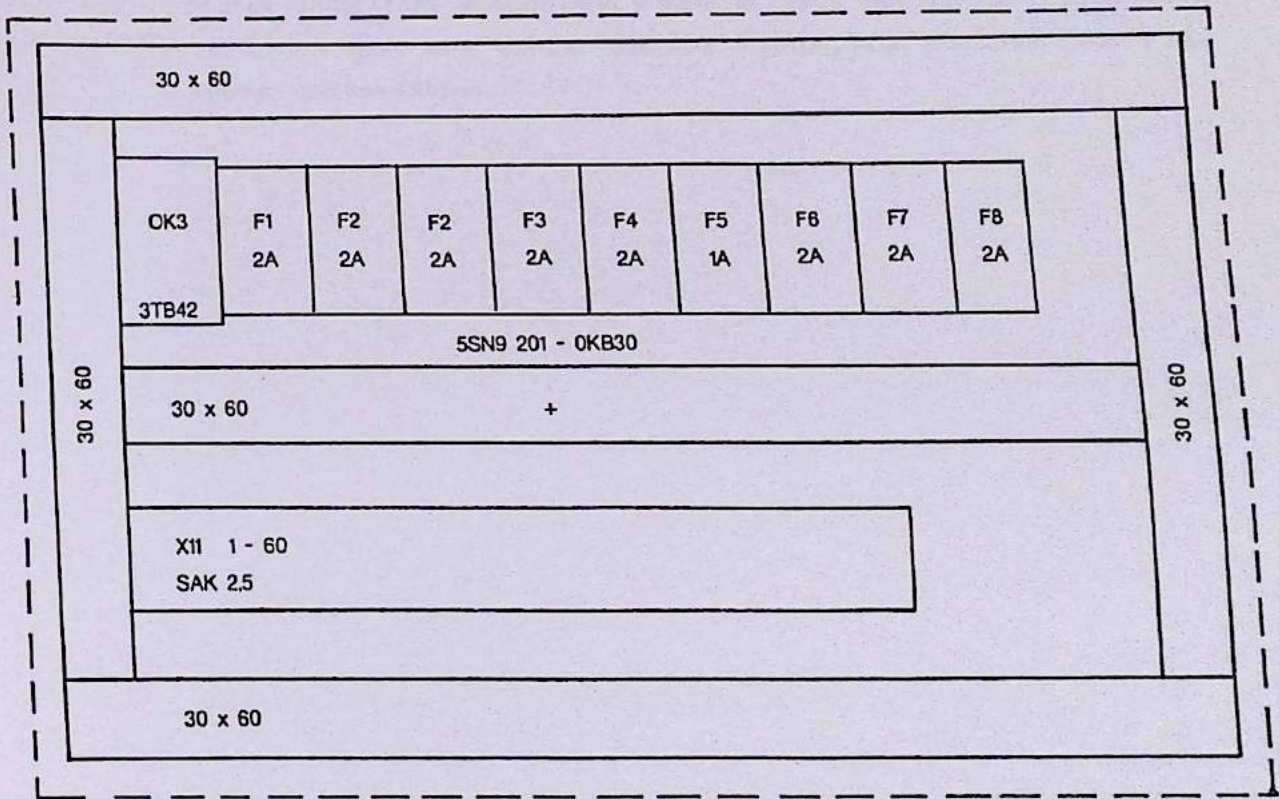


Fig. 3 PCU Modules (Sheet 2 of 3)





A E 1039

Fig. 3 PCU Modules (Sheet 3 of 3)



## 2. Fault Isolation

### A. General

The fault isolation procedures are given to enable the mechanic to quickly trouble shoot the cause of system/component failure.

#### (1) Failure Diagnosis System

A failure diagnosis system (FDS) for failure management is on the front face of the PCU case (Refer to vendor documentation).

#### (2) PCU Status Indicators

Status indicators are on the front of each module. The indicators light to show the status in the appropriate circuit (Refer to vendor documentation).



**3. Maintenance Practices**

The maintenance schedule is shown in Table 301.

Table 301 Maintenance Practices

Item	Description	Required Maintenance	Test and Inspection Instruction	Maintenance Interval
1	Pushswitch bodies	General check and freedom from cracks	TI-76.0001	Annual
2	Pushswitches	General function check	TI-76.0002	Annual
3	Caption indicator bodies and lens	General function check and freedom from cracks.	TI-76.0003	Annual
4	Rockerswitch bodies	General function check and freedom from cracks.	TI-76.0004	Annual
5	Rockerswitches	General function check	TI-76.0005	Annual
6	Filament lamps	General function check	TI-76.0006	On replacement
7	Instrument gages: 0-5 V, MA 2 0-5 V, MA 0-100 MV, AMI 0-100 MVI, AM 3 0-50 MV, AM 5 0-1 MA, S 1 0-1 MA, VM 1	General function check	TI-76.0010 TI-76.0011 TI-76.0012 TI-76.0013 TI-76.0014 TI-76.0015 TI-76.0016	Annual Annual Annual Annual Annual Annual Annual



8	Warning buzzer	General function check	TI-76.0020	Monthly
9	Circuit breakers	General function check	TI-76-0021	Annual
10	Control module 3,5 km	General function check	TI-76.0914	Annual
11	Power supply module	General function check	TI-76.0915	Annual
12	8 pt. Relay-module	General function check	TI-76.0916	Annual
13	16 pt. 24Vdc Output module	General function check	TI-76.0917	Annual
14	32 pt. 24Vdc Input module	General function check	TI-76.0918	Annual
15	19" Module housing	General function check	TI-76.0919	Annual
16	27" Module housing	General function check	TI-76.0920	Annual
17	Cable power	General function check	TI-76.0921	Annual
18	Cable signal	General function check	TI-76.0922	Annual
19	Led-display	General function check	TI-76.0923	Annual



20	Terminal 2,5	General function check	TI-76.0924	Annual
21	Terminal 4	General function check	TI-76.0925	Annual
22	Terminal 4	General function check	TI-76-0926	Annual
23	Terminal 4	General function check	TI-76.927	Annual
24	Power switch	General function check	TI-76.0900	Annual
25	Aux. current switch	General function check	TI-76.0901	Annual
26	Power switch	General function check	TI-76.0902	Annual
27	Circuit breaker	General function check	TI-76.0903	Annual
28	Circuit breaker	General function check	TI-76.0904	Annual
29	Terminal 35	General function check	TI-76.0905	Annual
30	Terminal 10	General function check	TI-76.0906	Annual
31	Terminal 2,5	General function check	TI-76.0907	Annual



32	Power switch	General function check	TI-76.0908	Annual
33	Motor contactor	General function check	TI-76.0909	Annual
34	Suppr: Diode	General function check	TI-76.0910	Annual
35	Terminal 10	General function check	TI-76.0911	Annual
36	Terminal 4	General function check	TI-76.0912	Annual
37	Terminal 4	General function check	TI-76.0913	Annual
38	Terminal SAK 4 PA Terminal EK 4 PA Terminal SAK 2,6 PA Terminal EK 4 2,5 PA Terminal SAK 45 PA	General security check	TI-76.0300	Annual
39	Terminal Box N11	General security check and leak test	TI-76.0207	Bi-Annual
40	Terminal Box	General security check	TI-76.0208	Bi-Annual
41	Terminal Box N1	General security check and leak test	TI-76.0200 (Nose & Tail)	Bi-Annual
42	Terminal Box N6	General security check and leak test	TI-76.0201 (Nose & Tail)	Bi-Annual



43	Terminal Box N8	General security check and leak test	TI-76.0202 (Nose & Tail)	Bi-Annual
44	Terminal Box N5	General security check and leak test	TI-76.0203 (Car 1-5)	Bi-Annual
45	Terminal Box N6	General security check and leak test	TI-76.0205	Bi-Annual
46	Terminal Box N8, N9	General security check and leak test	TI-76.0205	Bi-Annual
47	Terminal Box N10	General security check	TI-76.0206	Bi-Annual
48	Sensitive edge switch S1, S6	General function test	TI-76.0500	Monthly
49	Limit switch, door closed S2, S7	General function test	TI-76.0501	Quarterly and on change
50	Limit switch, door latch S3, S8	General function test	TI-76.0502	Monthly and on change
51	Limit switch sens. edge S4, S9	General function test	TI-76.0503	Quarterly and on change
52	Control valve Y 1.1-1.2/Y2.1-2.2	General function test	TI-76.0504	Annual and on change
53	All other switches	General function test	TI-76	Quarterly and on change

Table 301 - Maintenance Practices



**4. Servicing**

The servicing schedule is shown in Table 401.

Item	Description	Required Service	Service Instruction	Maintenance Level
1	Sensitive edge switch S1, S6	Renew	T1-76-0500	5 yearly

Table 401 - Servicing



**5. Removal / Installation**

Not applicable (N/A).

**6. Adjustment/Test****A. Adjustment**

Refer to Vendor documentation.

**B. Test**

- 1) Lamp indications-functional test (Refer to Vendor documentation)
  - (a) Ensure electrical power is available to the systems.
  - (b) On primary control panel, press LAMP TEST pushswitch and observe all caption indicators illuminate. If necessary replace filament bulbs.

**7. Cleaning/Painting**

Not applicable (N/A).