Pulseworks LLC

MFG: CAMBER
NAME: MORPHIS SIMULATOR
TYPE: NON-KIDDIE

Morphis

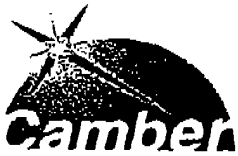
MOVIERIDE THEATER

OPERATORS' MANUAL

NOVEMBER 1997
REVISION 1.13

Camber ENTERTAINMENT

Contents



Revisions

Revision	Date	Details of changes
1.12	26 Sept 1997	
1.13	3 Nov 1997	Description of computer and interface added. Update to maintenance section.

Foreword

The Morphis™ Movieride Theater is designed to give many years of trouble-free service. In order to achieve this, it is essential that the maintenance schedules detailed in this manual are adhered to and recorded correctly. All maintenance and operating staff should be trained fully in their required tasks before putting the simulator into service.

For the safety of operators and passengers, the operating instructions should also be strictly followed.

WARNING

Safety checks must be completed at the start of each day of operation. Please refer to the Operations section in this manual for full procedures.

Warning notices must be displayed for the protection of passengers. Please refer to the Safety section of this manual.

DECLARATION OF CONFORMITY

We,

Camber Entertainment Systems,
Unit Two, Charlwood Court,
County Oak Way,
Crawley, Sussex RH11 7XA,
England

declare that the product

MORPHIS™ MOVIERIDE THEATER

Serial no: - - - - - - - - - - - - - - - - - - .

Date of Manufacture: - - - - - - - - - - - -

has been manufactured in conformity with the folowing standards and specifications:

(standards, specifications, etc)

and complies with the requirements of:

(directives...)

The technical file is held by/A certificate of adequacy was issued by/An EC type-examination certificate was issued by:

Date of issue: - - - - - - - - - - - - - - - - Place of issue: - - - - - - - - - - - - - -

Name: - - - - - - - - - - - - - - - - - - - Position: - - - - - - - - - - - - - - - - -

Signature - - - - - - - - - - - - - - - - -

Camber

DECLARATION OF CONFORMITY

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Certificate of Ownership

MORPHIS™ MOVIERIDE THEATER

ORIGINAL CERTIFICATE - PLEASE RETAIN IN FILE

Serial no: - - - - - - - - - - - - - - - - - - - Date of Manufacture: - - - - - - - - - -

System ia hereby accepted and warranty will commenceDate: - - - - - - - - - - - - - - - - -

Vendor signature - - - - - - - - - - - - - Date: - - - - - - - - - - - - - - - - - - -

Customer signature: - - - - - - - - - - - - Date: - - - - - - - - - - - - - - - - - - -

Owner - - - - - - - - - - - - - - - - - - New Owner - - - - - - - - - - - - - - -

Address: - - - - - - - - - - - - - - - - - Address: - - - - - - - - - - - - - - - - -

- -

- -

- -

In the event of the ownership of the Simulator changing, please complete the details above, and send a copy of the completed page to:

Camber Entertainment Systems,
Unit Two, Charlwood Court,
County Oak Way,
Crawley, Sussex RH11 7XA
England

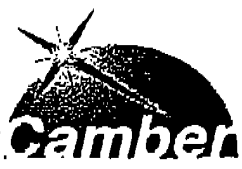
Tel: +44 (0) 1293 427920

Fax: +44 (0) 1293 427925

email: sales@camber.co.uk

Certificate of Ownership

PLEASE RETAIN THIS PAGE IN THE FILE FOR YOUR RECORDS



Certificate of Ownership

MORPHIS™ MOVIERIDE THEATER

DUPLICATE CERTIFICATE - PLEASE REMOVE AND SEND TO CAMBER ENTERTAINMENT FOR REGISTRATION OF OWNERSHIP

Serial no:- Date of Manufacture: - - - - - - - - - -

System is hereby accepted and warranty will commenceDate: - - - - - - - - - - - - - - - - -

Vendor signature - - - - - - - - - - - - - - Date: - - - - - - - - - - - - - - - - - -

Customer signature:- - - - - - - - - - - - Date: - - - - - - - - - - - - - - - - - -

Owner - - - - - - - - - - - - - - - - - - New Owner- - - - - - - - - - - - - - -

Address: - - - - - - - - - - - - - - - - - Address: - - - - - - - - - - - - - - - -

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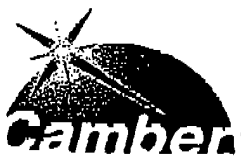

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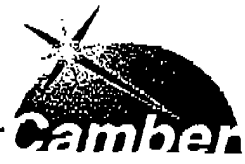

Compressor warranty

THE COMPRESSOR FITTED TO THE MORPHIS™ MOVIERIDE THEATER IS COVERED BY A 12-MONTH WARRANTY FROM THE MANUFACTURER, HYDROVANE.

TO REGISTER FOR THIS WARRANTY PLEASE COMPLETE THE DETAILS ON THIS PAGE AND SEND THE PAGE TO CAMBER ENTERTAINMENT AT THE ADDRESS BELOW.

Hydrovane Compressor

Part no:- . Serial number: - - - - - - - - - - - - -

Date of Morphis™ simulator acceptance: -

Commissioning Engineer's signature: -

Owner's signature: -

Owner - - - - - - - - - - - - - - - - - - -

Address: - - - - - - - - - - - - - - - - - -

- -

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Please complete the details above, and send a copy of the completed page to:

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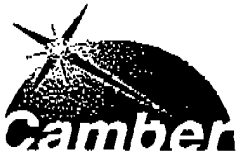

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Chapter 1 SAFETY

CAUTION

Any person required to work on this equipment must read this chapter. Never allow anyone to operate this equipment unless they are aware of the equipment's potential hazards and how the equipment works.

Camber Entertainment recommends that operators and maintenance personnel undertake the relevant approved training course before using and operating this equipment.

Table of Contents

1.1 Introduction to Safety

The Morphis Movie Ride Theater system is designed for safe and enjoyable operation. To ensure complete safety of operators, maintenance personnel, and passengers, this chapter informs the user of all the potential risks existing on the equipment and the design features and recommended methods of operation that should be used to minimise any risk.

The following possible hazards are described in this chapter:

- Mechanical Hazards: Mechanical parts are used in this equipment for supporting and moving the capsule. These parts could cause injuries to your hands, arms or body.
- High pressures: Pressurised fluids are used to transmit power to the motion base to move the capsule.
- Electrical Hazards: Hazardous voltages and current are used in this equipment. They could cause burns or death by electrocution.
- Chemical Hazards: Hydraulic oil is used within this equipment.
- Thermal Hazards: Portions of this equipment are very hot and can cause burns.

In the following subsections, we describe the hazards you may be exposed to and how the operator and maintenance personnel can prevent injury and protect themselves.

1.1.1 Safety Message Definitions

Safety messages appear in this manual and on the safety labels that are attached to the equipment.
These messages use "signal words" that identify the level of hazard and have the following definitions:

WARNING

This indicates the existence of a potential hazard which, if not avoided, may result in the injury or death of an operator, maintenance personnel, or any other person exposed to it.

CAUTION

This indicates the existence of a potential hazard which, if not avoided, may result in a minor or moderate injury of an operator, maintenance personnel, or any other person exposed to it, or it may result in damage to the equipment or other property.

1.1.2 Safety Labels

The table below lists the safety labels on this equipment. Periodically confirm that these labels are attached to the equipment and legible. If they are removed or illegible, contact the manufacturer for replacement labels.

Item	Description	Remarks
1	Disclaimer	Warning to passengers (see Foreword)
2	High Voltage	On Power Distribution box

1.1.3 Disclaimer

A disclaimer must be attached to the simulator as described in section 1.1.2 or in an alternative position in the installation but, in all circumstances, in a position which is in the clear, obvious and unobstructed view of all passengers before they enter the capsule. Operators should be instructed to draw passengers' attention to the notice.
The warning as a minimum should include the following text:

Warning

The Morphis Movie Ride Theater is a dynamic simulator ride that may include violent motion. You should not enter the capsule and experince the ride if you suffer from any disorder or condition that may be affected by a motion ride such as this. Such conditions are typically, but not limited to:

- Epilepsy
- Weakness or suffering of back pains
- Weakness or suffering of neck pains
- Pregnancy
- Tendency to suffer from motion sickness
- Tendency to suffer from claustrophobia
- Weak heart or fitted with a pacemaker
- Asthma
- Any other chronic illness

It is recommended that all passengers should conform to a minimum height of 1.07m (42") and a maximum weight of 110 kg (240 lb).

After leaving the motion ride, some passengers may experience a mild form of disorientation. It is recommended that passengers should not drive a car or operate machinery within one hour of experiencing the movie ride.

1.1.4 Safety Devices, Guards, Covers, etc.

The following safety devices, guards, covers, etc. are provided on this equipment. These are designed to protect users from hazards that may arise during operation and maintenance of the equipment.
You must be sure that these devices, guards, covers, etc. are working and in place during operation and maintenance.

- Hydraulic oil temperature sensors stop the power supply to the system when the hydraulic oil has overheated. In this event the motion base fail-safe system will operate.
- The System Interface Controller monitors the system for errors, and will stop operation if any fault is detected.
- Covers on the doors of electrical equipment cannot be opened without switching off the power isolator. This minimises the risk of electric shock.
- Covers over terminal blocks in the electrical enclosure prevent workers from being electrically shocked.
- Protective barriers are erected around the installation to prevent unauthorised access to the motion envelope of the capsule. This prevents injury from the motion base mechanism or capsule during operation.

1.1.5 Emergency Stop Buttons

This equipment is provided with emergency stop buttons (commonly referred to as the EStop).

When there is an emergency situation or any threat to the safety of the passengers such as fire, earthquake, or lightning or if you must immediately evacuate the premises, press any of these buttons to immediately stop the system from operating.

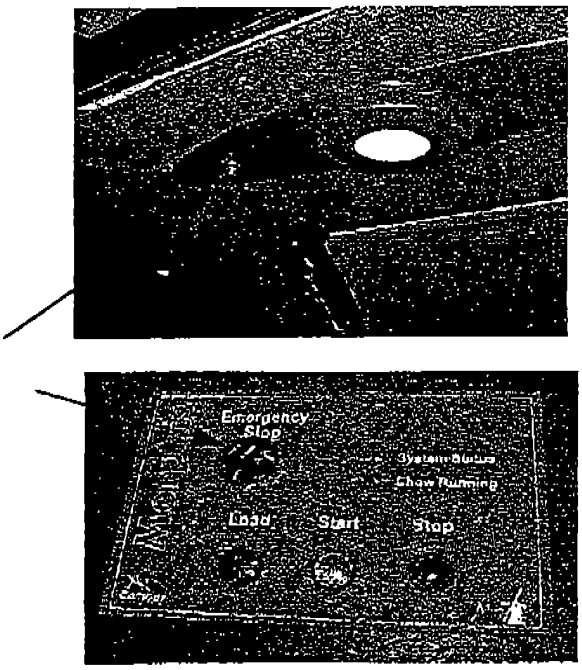


FIGURE 1.1 Emergency Stop Buttons

- Operation panel (on the top of the control console)
- Inside the capsule, above each row of seats

WARNING

When the EStop has been pressed the capsule may continue to move for a short period while it comes to rest. Be sure the equipment has stopped before approaching the capsule.

The locations of the EStops on your equipment may be other than in this figure if the system has been adapted for your site.

Press the EStop button once to disable the system.

Press it again and turn to release the button. The system will remain disabled until it is reset by the computer and controller.

1.2 Electrical Hazards

⚠ WARNING

High voltage and current are applied on some components of this equipment and may cause an electric shock, burns or electrocution.

The following areas pose the greatest risk of electric shock:

- Power distribution unit
- Control rack
- Hydraulic power pack
- Projector
- Compressor
- Air Chiller/Air Conditioning Unit

⚠ WARNING

To avoid the risk of electric shock and electrocution , do the following:

- Ensure that there is a qualified electrician present at all times when working on the electrical systems.
- Identify the location of the equipment power supply circuit breakers and the facility's power terminal block before starting your work.
- Shut off the equipment power supply, unless it is required for your work, by turning OFF the isolator and the circuit breakers.
- When performing maintenance inside the cabinet, always switch OFF the isolator.
- Before performing maintenance on electrical components, perform lockout/tagout procedure required by your employer: for example, turn off and lock out all power to electrical and

electronic equipment, and then put a tag on the disconnect that identifies the person responsible for the lockout, as well as his work location.

- Use only insulated (non-conductive) tools when working on electrical and electronic equipment.
- Remove all jewellery (watches, rings, bracelets, etc.) when working on electrical and electronic equipment.

1.3 Mechanical Hazards

Moving parts on this equipment pose a potential hazard. The motion base area poses the greatest area of concern:

- Erect a protective fence limiting entry to prevent collision with a panel that is open during maintenance.
- Be sure to know how moving parts operate before you start working.
- Do not enter the area within the enclosure while the simulator is in operation.
- NEVER enter the motion base area unless the power is switched OFF, and the capsule is suitably supported.

1.4 Thermal Hazards

Some areas of the equipment become very hot during operation. The following areas pose the greatest hazard for burns:

- Hydraulic power unit
- Air compressor

Beware of these hot areas when you are approaching the equipment.
Wait until hot areas cool before servicing.

1.5 Safety Precautions During Use

When working on this equipment, all normal safe working practices should be adopted. You should know the location of all emergency stop buttons and safety devices and know the meaning and location of all safety labels before you start working on this equipment. Wear proper work clothes (no loose clothing). Remove rings, watches, jewellery, neckties, and all loose items in your shirt pockets. Always report potential problems to your foreman. Make sure all safety labels are in place.

1.5.1 Precautions During Installation

- Only use approved parts to avoid malfunction of the equipment.
- Only connect the rated power supply to the system.
- Only use the appropriate air chiller connection duct.

1.5.2 Precautions Before Starting Operation

Start operating the equipment only after the following steps are confirmed. If there is any unconfirmed item, do not try to operate the equipment.

- Check the torque of the holding down bolts. See "Recommended Threaded Fastener Tightness Torques", section 5.2.3
- Check every pneumatic line, hydraulic line and cooling water piping for leaks.
- Confirm that all utilities supplies meet the requirement stated in the specification.

1.5.3 Precautions Before Turning off the Equipment

Before turning off the equipment, make sure that the following conditions are satisfied, so that there is no danger to passengers.

- The equipment is not performing automatic operation or is not in the middle of operation.
- The capsule has landed correctly.
- All passengers have left the capsule.

1.5.4 Precautions During Operation

- Ensure that no unauthorised persons approach the operating envelope of the capsule or motion base.
- All passengers must be seated, and children must be on their own seat.
- Do not allow passengers to stand during the ride.
- Do not allow passengers to exit before the machine has stopped, landed, and the doors are fully open.
- If the emergency stop has been pressed, ensure that all passengers are clear of the system before attempting to rectify the fault and restart the machine.

1.5.5 Precautions During Maintenance

Wear appropriate protective gear if necessary.

If working on the motion base system, ensure that the mechanism is properly supported at all times before entering the area under the capsule.

If working on the hydraulic system:

- Before closing open piping, replace the gasket and O-ring used on the joint with new and clean ones, and confirm the joint is securely tightened.
- After completing the job, purge the system and then execute a leakage check. Pay particular attention to safety when purging the system, when pressurised fluid may escape in an uncontrolled manner.
- Place all removed components and parts in a sealed vinyl bag for proper disposal.

For all work onthe electrical system, follow the guidelines in "Electrical Hazards", section 1.1.5

1.6 Chemical Hazards

1.6.1 Handling and Disposal of Contaminated Articles

Equipment operation and preventive maintenance may require users to handle and dispose of components contaminated with potentially harmful substances.

Follow all applicable national, state and local laws concerning the safe disposal of contaminated articles and contaminants. Also, follow equipment safety standards established at your facility.

The substances that are being disposed must be classified, grouped, and stored according to their category. The categories of the disposal articles must be displayed on easily recognizable locations on the containers or tanks.

Set up a tray when you collect waste liquid to prevent it from spilling on the floor or seeping into the ground.

Wear a protective, disposable garment when handling hydraulic oils. The garment must cover and protect any exposed skin, while allowing free body movement so that you can perform your work.

Wear a protective apron when working with chemicals. After using the apron, wash it thoroughly in water, wipe it off, and dry it completely using a dry disposable cloth.

Wear protective, disposable gloves that are impregnable and oil-resistant. Keep in mind that thinner gloves are more susceptible to holes, thereby exposing the user to chemical hazards. Check the gloves carefully for holes before use, and continue checking them while you wear them.

Use a hood or protective glasses to protect your face and eyes. If stronger protection is necessary, wear a pair of goggles or a face protective mask.

1.6.2 Materials Safety Data Sheet - Grease

PRODUCT AND COMPANY IDENTIFICATION

Trade Name ROCOL MTS 1000
Manufacturer/Supplier ROCOL Limited
Address ROCOL House,
Swillington, Leeds,
LS26 8BS ENGLAND.
Phone Number+44 (0) 113 2322700
Fax Number+44 (0) 113 2322760
Emergency Phone Number+44 (0) 113 2322600

2. COMPOSITION/INFORMATION ON THE COMPONENTS

Hazardous Components in Product for EC
No constituents need to be specified.

3. HAZARD IDENTIFICATION

Main Hazards	Not classified as hazardous.
Health Effects - Eyes	May cause slight transient irritation.
Health Effects -Skin	Repeated and/or prolonged contact may lead to dermatitis

4. FIRST AID MEASURES

First Aid - Eyes	Wash out eye with plenty of water. Obtain medical attention if soreness or redness persists.
First Aid -Skin	Wash skin with soap and water. If grease has been injected under the skin, seek medical advice immediately.
First Aid -Ingestion	Do not induce vomiting. Obtain medical attention

5. FIRE FIGHTING MEASURES

Extinguishing Media	Use foam, dry chemical or carbon dioxide. Do not use water jet.
Special Hazards of Product	This product may give rise to hazardous fumes in a fire
Protective Equipment for Fire-Fighting	Wear self contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Material can create slippery conditions underfoot.
Spillages	Transfer into suitable containers for recovery or disposal.

7 HANDLING AND STORAGE

Handling	When applying by grease gun, care must be taken not to inject this product under the skin.
Storage	Storage temperature should be controlled to between 1 and 40 °C

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Control Measures	No specific measures necessary
Hand Protection	Use a good quality barrier cream.
Eye Protection	No specific measures necessary.
Body Protection	Normal work wear.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Paste.
Colour	Blue - Black.
Odour	Odourless.
Flash Point (PMCC) (°C)	Exceeds 200°C.
Solubility in Water (kg/m3)	Insoluble.
Density (kg/m3)	1.0 (measured as kg/litre)
Auto-flammability (°C)	Above 200°C.

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Conditions to Avoid	No specific measures necessary.
Materials to Avoid	Strong oxidising agents.
Hazardous Decomposition Products	Combustion will generate; smoke, possibly thick and choking, resulting in zero visibility.

Combustion may also generate: oxides of sulphur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity	Low order of acute toxicity

12. ECOLOGICAL INFORMATION

Mobility	The product is insoluble in water. The product is poorly absorbed onto soils or sediments.
Persistence/Degradability	The product is expected to be resistant to biodegradation.
Bio-accumulation	Limited information indicates a potential to bio-accumulate.

13 DISPOSAL

Product Disposal	Incineration or landfill. Dispose of in accordance with all applicable local and national regulations.
Container Disposal	No specific measures necessary.

14. TRANSPORT INFORMATION

UN Class	Not classified.
ADR/RID -Class	Not classified
IMDG -Class	Not classified
IATA -Class	Not classified.

15. REGULATORY INFORMATION

Labelling Information	
R phrases	None.
S phrases	None.

16. OTHER INFORMATION

Product Use	For industrial use only. Lubricant.
MSDS first issued	16 December 1996
MSDS data revised	21 February 1997

17. NATIONAL LEGISLATION

EC Legislation EC Directive 91/ 55/EEC defining the laying down and detailed arrangements for the system of specific information relating to dangerous preparations.

EC Directive 88/379/EEC relating to the classification, packaging and labelling of dangerous preparations.

To the best of our knowledge, the information contained herein is accurate. Although certain hazards may be described we cannot predict that these are the only hazards, or combination of hazards, that may exist in a workplace. This MSDS, therefore, forms a component only of a risk assessment carried out by, or on behalf of, the user.

1.6.3 Material Safety Data Sheet - Hydraulic Oil

REACTIVITY AND THERMAL DECOMPOSITION DATA

Stability	Stable material.
Hazardous Polymerisation	Will not occur.
Known Dangerous Reactions	None known.
Reaction with Water	None.
Materials to Avoid	Strong oxidising agents.
Conditions to Avoid	Extreme temperatures.
Decomposition Temperature	> 100 degrees C.
Dangerous Decomposition Products	Significant concentrations of hazardous decomposition products are not expected.

SPILLAGE AND DISPOSAL INFORMATION

Steps to be Taken if oil is Released or Spilled	Soak liquid in absorbent material and collect solids in a container. Wash down floor area as spillages can be slippery.
Waste Disposal Methods	Incinerate or land dump at appropriate site in accordance with local regulations. Some used lubricating oils may be reclaimed by specialist contractors.
Disposal Restrictions	There may be local authority restrictions on mineral oil.
Environmental Advice	Avoid contamination of drains, sewers and water courses.
Biodegradability	No data.
Aquatic Toxicity	No data.
Chemical Oxygen Demand	No data.

TOXICOLOGICAL/OCCUPATIONAL HEALTH DATA

Oral LD50 (mg/kg bodyweight)	>5000 (rats, expected LD50)
Dermal LD50 (mg/kg bodyweight	>3000 (rabbits, expected LD50)
Inhalation LC50 (mg/litre)	No data
Occupational exposure limits	5 mg/m3 (oil mists)

Ingestion	Milk or water to drink may be beneficial, DO NOT INDUCE VOMITING. Main hazard is aspiration into the lungs during or following ingestion, children being more susceptible than adults. If this occurs (e.g. during vomiting) send to hospital immediately.
Notes for Doctors	Treat symptomatically. Aspiration may cause severe pneumonitis requiring antibiotic and corticosteroid therapy.

EFFECTS OF OVER EXPOSURE

Eye Contact	May cause temporary irritation, smarting and discomfort. Permanent tissue damage is not expected.
Skin Contact	These products are generally non-irritant on incidental contact with the skin. However, excessive or prolonged skin contact with mineral oil products can give rise to oil blockages of hair follicles and skin pores, inflammation and slight irritation.
Inhalation	Harmful concentrations of vapour do not normally arise except where high temperatures or atomising systems are involved. Under such circumstances, inhalation in high enough concentrations may cause irritation of lungs and possible respiratory damage.
Ingestion	In the unlikely event of swallowing hydraulic oil, nausea, discomfort and irritation may result. Aspiration into the lungs (direct or during subsequent vomiting) can cause local irritation of lung tissue which may give rise to a chemically induced pneumonia - children are more susceptible than adults.
Carcinogenicity	No carcinogenic effects are normally associated with these types of products - they are manufactured from highly refined base stocks to minimise any risk, and in accordance with current petroleum industry, UKPIA, CUNCAWE and IARC guidance are not classified as carcinogenic materials.
Other chronic Toxic Effects	There are no reports of long-term adverse toxic effects in man attributable to the use of this type of product.

RECOMMENDED FIRST AID

Eye contact	Flush with plenty of clean water for at least 15 minutes. If irritation persists, obtain medical attention.
Skin Contact	Wash with soap, or approved skin cleanser, and water. Remove heavily contaminated clothing. Where skin rashes or other abnormalities occur as a result of excessive contact, medical advice should be obtained.
Inhalation	In the event of discomforting effects produced by over -exposure, remove to fresh air. If effects persist, obtain medical attention. (Note: whilst the recommended exposure limit for oil mists is 5 mg/m3, it is generally advisable to control exposures below 2 - 3 mg/m3 in order to minimise nuisance and discomfort complaints.)
Ingestion	Milk or water to drink may be beneficial, DO NOT INDUCE VOMITING. Main hazard is aspiration into the lungs during or following ingestion, children being more susceptible than adults. If this occurs (e.g. during vomiting) send to hospital immediately.
Notes for Doctors	Treat symptomatically. Aspiration may cause severe pneumonitis requiring antibiotic and corticosteroid therapy.

SPECIAL PROTECTION INFORMATION

Respiratory Protection	Not normally required.
Eye/Face Protection	Chemical eye goggles are suitable.
Hand Protection	PVC/Synthetic rubber gloves are usually suitable.
Body Protection	Normal clean industrial overalls are suitable.
Other Protection Information	May need local extraction if mists are generated.
Ventilation Type	General ventilation.
Additional Handling information	Avoid unnecessary skin contact. The use of suitable skin barrier cream can be beneficial. Observe good standards of personal hygiene. Keep exposure to oil mists and fumes to a minimum.

PACKAGING, LABELLING AND TRANSPORTATION CLASSIFICATIONS

UK/EEC Supply Classification	Not classified.
Risk Phrases	none
Safety Phrases	none
UN Classification/Shipping Name	Not Classified
UK 'PG' Packaged Goods Regulations	These products are not classified as being hazardous for transportation.

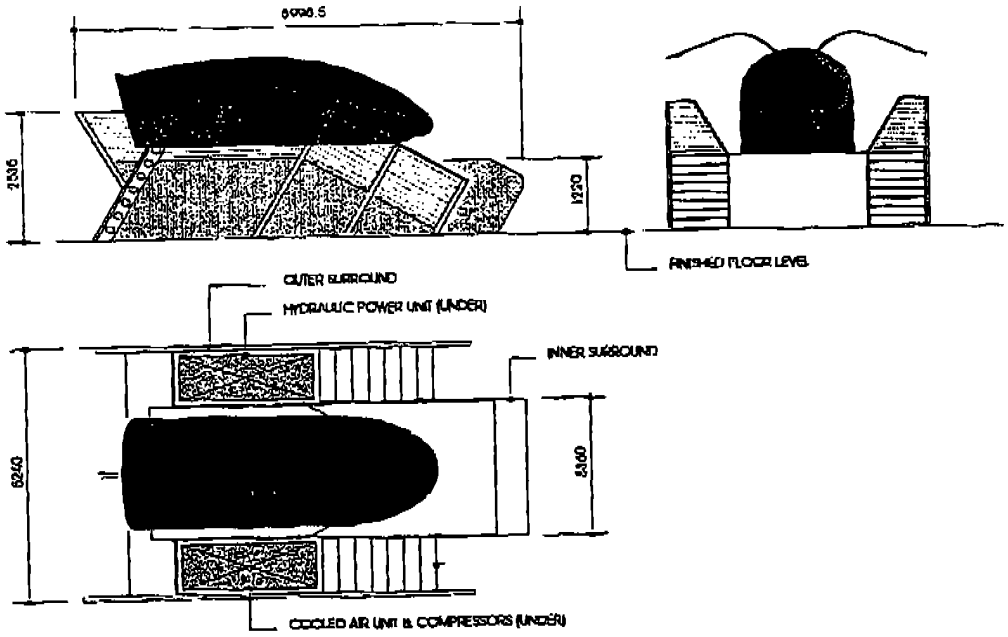
ADDITIONAL INFORMATION

Note: During some service conditions (for example, those involving high fluid temperatures or where thermal cracking occurs), mineral oil products may sometimes become contaminated or degraded during use and this may adversely effect the health characteristics.

Note: Information on this data sheet relates only to the product designated, and may not be valid when the product is used in combination with other materials or in any process. It is the responsibility of the user to decide whether the information is suitable and complete for the user's particular use. All physical data and characteristics are given to enable the user to design suitable control and other health and safety measures. They are presented as a guidance for this purpose only, and may NOT necessarily represent typical or specification values.

Chemical Hazards

Chapter 2 General Description



The Morphis™ MovieRide Theater is a dynamic motion system, using a computer to control motion, sound, and vision systems that create an artificial environment within the ride capsule.

The system is programmed to make a combination of movements of the capsule with synchronised images and sound effects, so that the passengers experience a motion sequence that is beyond their normal environment. This can be of the form of aircraft aerobatics, automobile racing, space flight, or fantasy adventure rides, depending upon which ride sequences are purchased with the system.

An hydraulic system provides the motive power for the movement of the capsule, which is mounted on a series of bearings to provide three degrees of freedom. This allow the capsule to experience accelerations in almost all directions, which simulate the full series of movements of the ride. The hydraulic power unit is sited beneath the access stairs, together with the pneumatic compressor.

Compressed air is used to power the door opening and closing mechanism.

The capsule is available in two alternative seating configurations, each in four rows. The simplest option has four bench seats, and can carry up to 20 passengers. Alternatively, the capsule can be fitted with 14 individual seats. If the individual seat option is chosen, then the seats can be fitted with seat belts as an option. For their safety during the ride, the passengers have access to an emergency stop button situated on the inside of the roof of the capsule above each row. The passenger environment is maintained by chilled air fed into ducts in the front of the capsule, supplied by a chiller unit situated within the stairs enclosure. An air conditioning unit is available as an option.

The system is controlled by a computer mounted within an electronics rack. The rack also contains a digital video system, an audio amplifier, and the system controller electronics, including a dot matrix display for operator messages. The digital video system is either a CRV video disk player or a dedicated MPEG player. Situated on the top of the rack are the operator controls.

Power to the system is supplied to one electrical distribution box which contains protection devices, motor contactors and the necessary electrical outputs for the sub-systems.

Chapter 3 Operations

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3.1 Daily Start-up procedure

1. Carry out the daily visual checks as detailed in Maintenance chapter 5.
2. Complete the power-up sequence as detailed in section 3.2, page 3- 3. If there are any failures during this sequence, then the fault should be remedied before putting the simulator into service.
3. Load the required ride sequence as detailed in section 3.4, page 3- 8
4. Start and run the simulator through five ride sequences to warm the system to its normal operating temperature, section 3.5, page 3- 11.

The system is now ready for normal use.

3.2 Power-up sequence

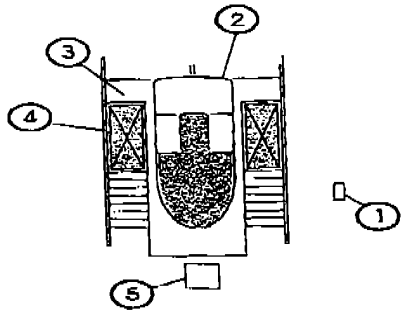


FIGURE 3.2 Basic power-up control locations

Item	Description	Remarks
1	Main Isolator	Location may vary depending upon the individual installation
2	Keyswitch	Under port rear of capsule
3	Compressor	Under starboard treadplate
4	Chiller	Under starboard treadplate
5	Control rack	

1. Switch ON the main power isolator (1).
2. Enter the rear of the motion base enclosure. Locate the keyswitch (2) situated under the port rear corner of the capsule. Open the switch cover and, using the key, turn the switch clockwise to position "1". Remove the key and replace the switch cover.
3. Press the air compressor START button (3). Allow the delivery pressure to reach 100 psi (6.8 bar), then drain the condensate.

⚠ CAUTION

Note: If the compressor fitted is a continuous-run unit, then there is a possibility that if it is stopped and started within a short time period that the motor will stall. Always allow at least four minutes between stopping and starting the unit to allow residual internal pressures to drain.

10. Wait five minutes to allow the compressor receiver pressure to reach 150 psi (10 bar).
11. Press "Reset" and all indicators on the System Interface Controller except "Oil pressure" should be green. The "Oil pressure" indicator goes green at the start of the ride, remains illuminated during the ride, and will extinguish at the end of the ride.

3.3 LCD display and controls

The LCD panel on the System Interface Controller has three touch buttons below it.

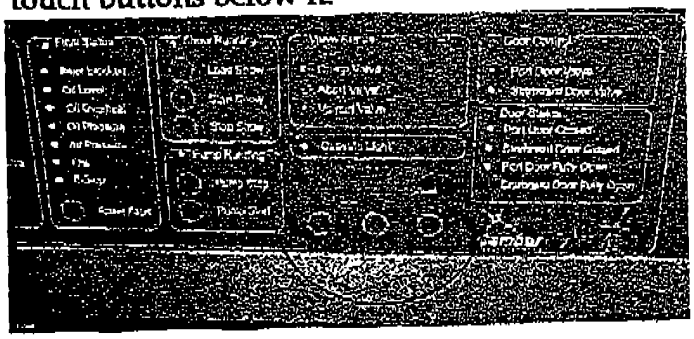
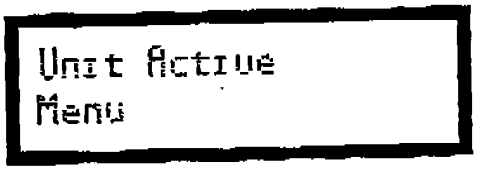


FIGURE 3.1 System Interface Controller

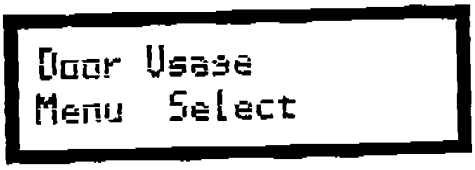
Each touch of the left button cycles through screens in the following sequence:

1. Start menu



2. Show menu

3. Door Usage menu



4. Start menu

For each menu screen selections can be made by using the centre and right-hand buttons. The Show menu is described in section 3.4, page 3- 8, the Door Usage menu is described below:

The default actions of the doors are Port - Exit,

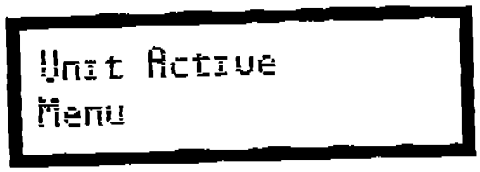
Starboard - Entry. If the configuration of the simulator requires these functions to be changed, this is achieved by using the Door Usage menu.
The following figures illustrate the general method of changing the options. Please note that not all available options are illustrated.

1. Press the Menu (left-hand) button to display the Door Usage menu.

2. Press the "Select" button to enter the function menu.

3. Press the "Select" button again to toggle between Port and Starboard doors
4. Press the "Change" button to toggle between all the available functions of the doors:

5. Press "Set" to confirm the change, or "Exit" to lose all changes. The display returns to the Start menu.



3.4 Changing the Experience

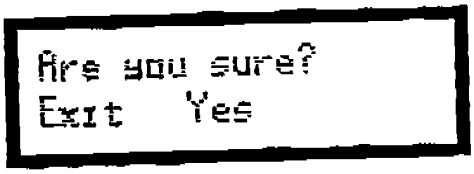
In order to change the experience the video software must match the software loaded on the ride computer. This procedure describes firstly the software selection, then the loading of the required videodisc as necessary (CRV systems only).

3.4.1 Software selection

1. Select the show menu

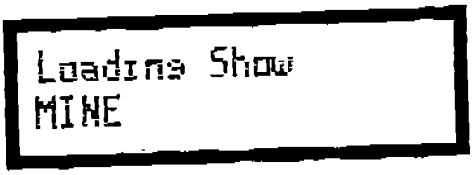
2. Press the "Next" button to toggle through the choices of experience

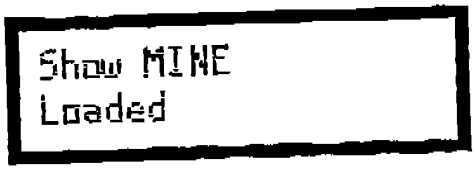
3. Select "Set" to load the current choice of experience



4. Select "Yes" to load the displayed experience or "Exit" to lose all changes and return to the starting menu as shown.

5. If the "Yes" button is selected, then the following sequence will be displayed on the screen





6. Press the "Reset Fault" button twice.

3.4.2 Video software (MPEG systems only)

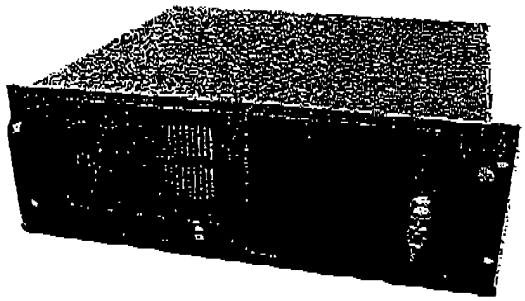


FIGURE 3.2 MPEG player

The systems fitted with MPEG players have no requirement for changing software as the rides are pre-loaded into the player. The chassis has an intenal autoload routine which starts when the control rack is powered up.

There is provision for loading new ride software supplied on CD, again with an automatic loading sequence. This software is loaded into the CD drive behind the hinged panel in the MPEG chassis.

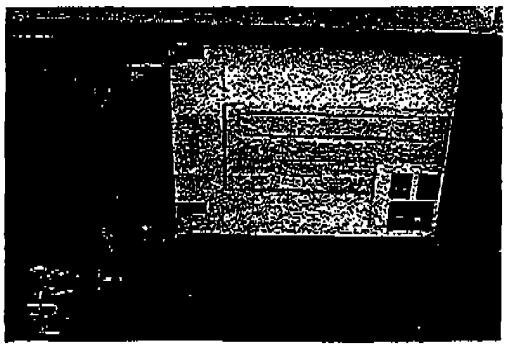


FIGURE 3.3 Software loading facility

3.4.3 Insert a videodisc (CRV systems only)

Caution: Do not turn on the power when inserting a videodisc.

1. Turn ON the POWER switch.
2. The player automatically begins cleaning the lens and blinks the STANDBY indicator. When the cleaning ends, the indicator goes off. Wait until the indicator goes off.
3. Insert the videodisc with the side to be played facing up. Do not force it in. The videodisc is automatically loaded and starts revolving. The STANDBY indicator lights up during loading of the videodisc.
4. When the disc is ready for playback, the STANDBY indicator goes off and the STILL/STEP indicator illuminates, indicating that the player is standing by at frame number 0.

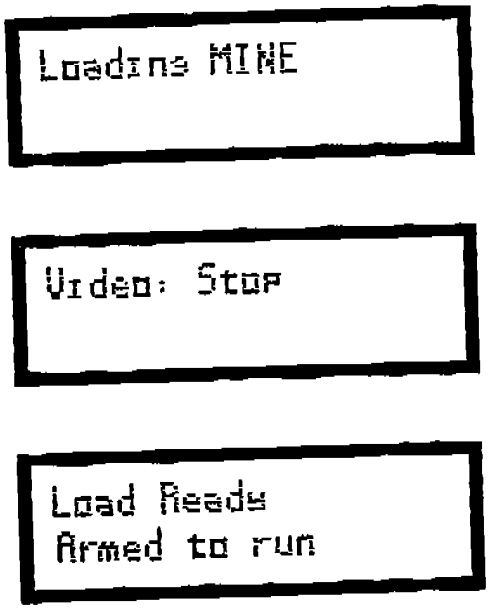
3.4.4 Removing the Videodisc (CRV systems only)

Caution: Do not turn off the power when removing a videodisc.

1. Press the EJECT button.
2. The STANDBY indicator lights up while this player is ejecting the videodisc. The videodisc stops revolving and is ejected.

3.5 Normal Run Sequence

1. On the top panel of the control rack, the "System Status" LED displays green, and the "Show Running" LED displays red. Press the "Load" button. The selected exit door will close, and the "Show Running" LED will flash red/amber. The LCD panel will display the following sequence:

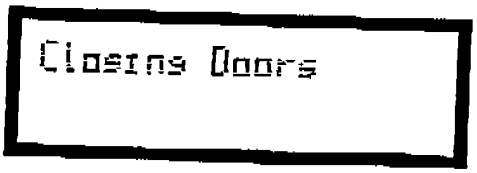


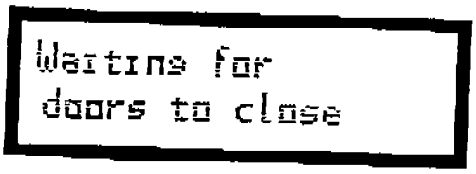
The "Show Running" LED will display steady amber if all operations have been completed successfully.

2. Allow the passengers to enter the capsule.

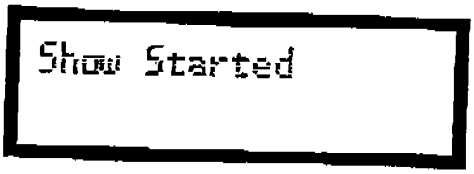
3. When all passengers have entered the capsule and are seated correctly, press the "Start" button. The entry door will close, the "Show Running" LED will flash amber/green, turning steady green when the entry door has closed.

The LCD panel will display as follows:

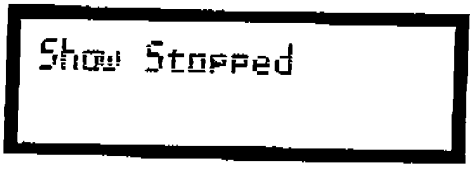




The ride will then commence and run through its normal motion sequence.



When the ride is complete, the LCD panel displays the following sequence:



The capsule settles and the selected exit door will open. Unload the passengers. The simulator is ready for another ride sequence. If the same experience is being used, restart the sequence from step one of this section. If another experience is required, use the procedure detailed in section 3.4.1, page 3-8.

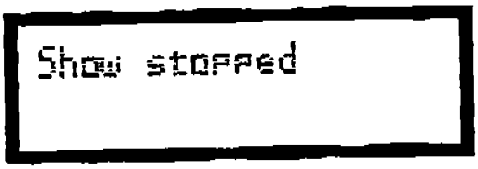
3.6 Safety Features

The simulator is fitted with two means of interrupting the ride in the event of an emergency. The control rack has a "Stop" button, and an "Emergency Stop" button. The function of the "Emergency Stop" button is repeated by buttons within the capsule above each seating row.

3.6.1 Stop Button

If the "Stop" button is pressed during a ride, then the following actions take place:

- The motion sequence is interrupted, and the capsule lands under control on its load platform.
- The video sequence stops.
- The exit door opens.
- The LCD panel shows the following message:



In order to re-commence normal operation, the standard "Load" and "Start" commands are used.

3.6.2 Emergency Stop

If one of the "Emergency Stop" buttons is pressed during a ride, then the following actions take place:

- The motion sequence is interrupted, and the capsule lands immediately under control on its load platform.
- Both doors open. In the event of power failure the doors are opened by the residual air pressure within the capsule air reservoir.
- The System Interface Controller panel shows "Fault" status.

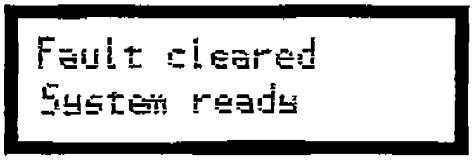
On no account should the simulator be used by the public until the fault has been rectified.

To recover from this situation:

1. Correct the fault that caused the emergency situation.

2. Reset the Emergency Stop button that has been pressed. The button must be reset by turning it clockwise and allowing the spring to reset.

3. Press "Reset Fault" on the System Interface Controller panel. The LCD panel shows the following message:



4. Press the "Load" button on the control rack. The exit door will close. The system will then be ready to start the loaded experience.

   If the fault is clear, load the passengers.

5. Press the "Start" button to resume a normal ride sequence.

3.7 Shutdown sequence

1. Ensure that the ride sequence has been completed. The LCD panel will display:

2. Press "Pump Stop" on the System Interface Controller panel.
3. Switch OFF the main power switch on the control rack.
4. Press the STOP button on the compressor control.
5. Drain the condensate from the trap.
6. Switch OFF the air-conditioning unit or the chiller, whichever is appropriate to the system configuration.
7. Use the keyswitch at the port rear of the capsule to release the residual air from the reservoir. Turn the key to position "1" to allow the doors to close. Turn the key to position "0" and remove the key.
8. Switch OFF the main power input at the isolator.

Chapter 4 System Description

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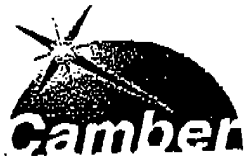


4.1 System Overview

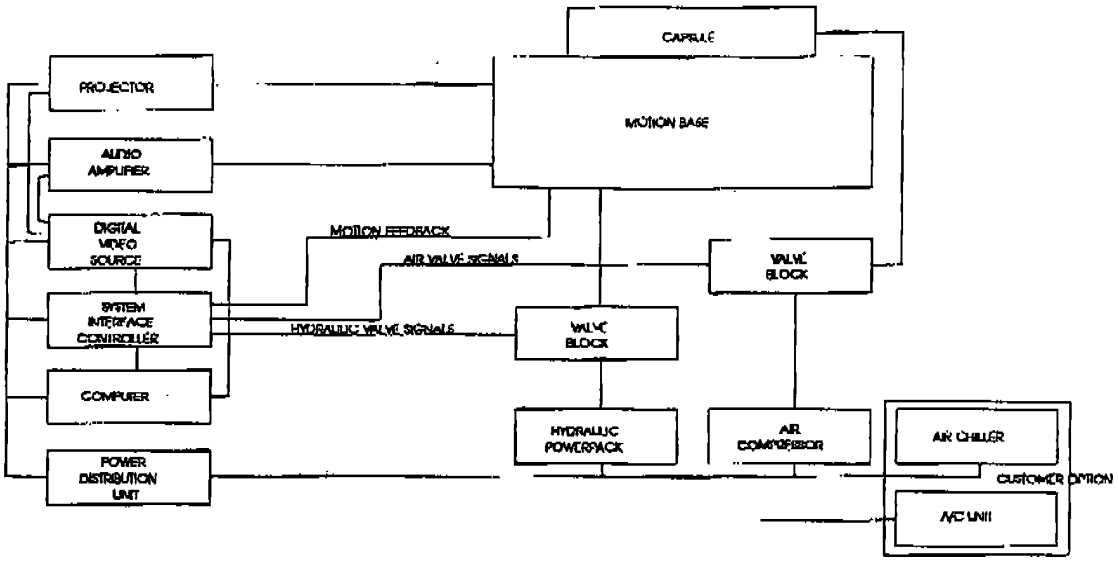


FIGURE 4.1 System Block Diagram

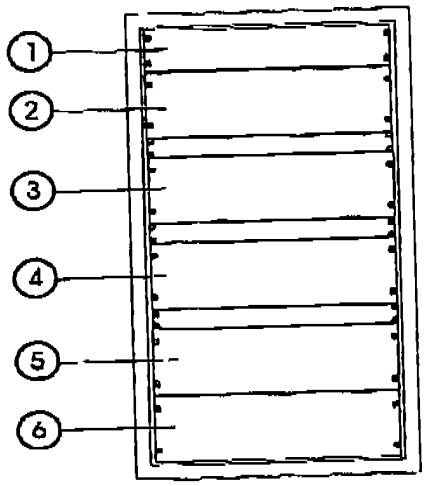
The main system blocks used by the Morphis™ MovieRide theatre system are as follows:

- Computer
- System Interface Controller
- Digital Video Source and Projector
- Audio Amplifier
- Power Distribution Unit
- Mechanical sub-systems - Pneumatic, Hydraulic, and motion base.

The Morphis ™ MovieRide theatre system is controlled by one main computer. This computer controls and synchronises all video and audio signals through direct serial connections, and movement of the motion base through the System Interface Controller (SIC). The input/output signals between the computer and SIC are conditioned by the SIC before communicating with the valves and transducers on the motion base.

4.2 Control Rack

The majority of the electronic sub-systems are mounted within a standard 19" electronic enclosure. The main control elements are mounted on the control rack as denoted in the diagram below:



Item	Description	Remarks
1	Power Switch panel	
2	Digital Video Source	CRV or MPEG unit
3	System Interface Controller	Incorporating operator touch screen
4	Computer	
5	Audio amplifier	
6	Blank Panel	

Also mounted on the top of the control rack is the basic operator control panel with Start, Load, standard Stop, and Emergency Stop buttons.

Each main control element is described in detail later in this chapter.

4.3 Power Distribution

WARNING

This system uses electrical supplies that can cause serious injury or death. Always isolate the power input before opening any enclosure.

4.3.1 Power Distribution - 50 Hz

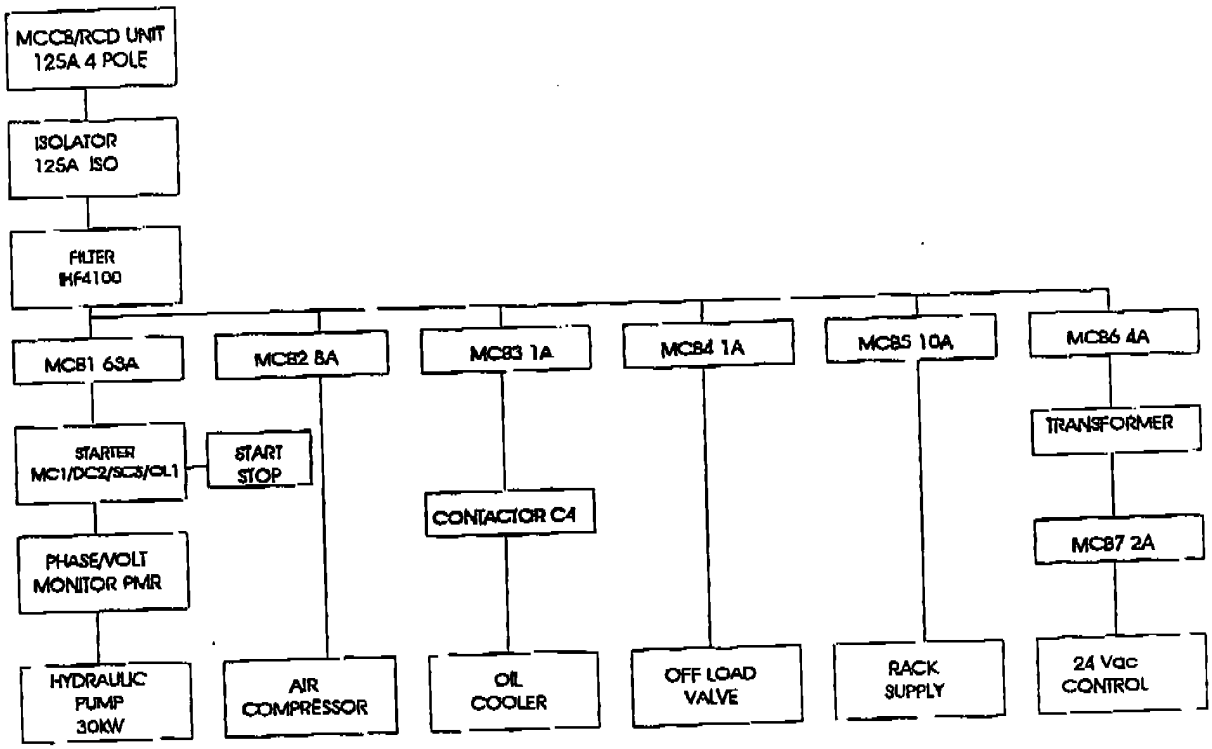


FIGURE 4.2 Power distribution block diagram - 50 Hz

The unit distributes and controls power to the following items:-

- Hydraulic Pump 415v three phase 30kw
- Air Compressor 415v three phase 2.2kw
- Oil Cooler 415v three phase 0.37kw
- Rack Supply 10A single phase

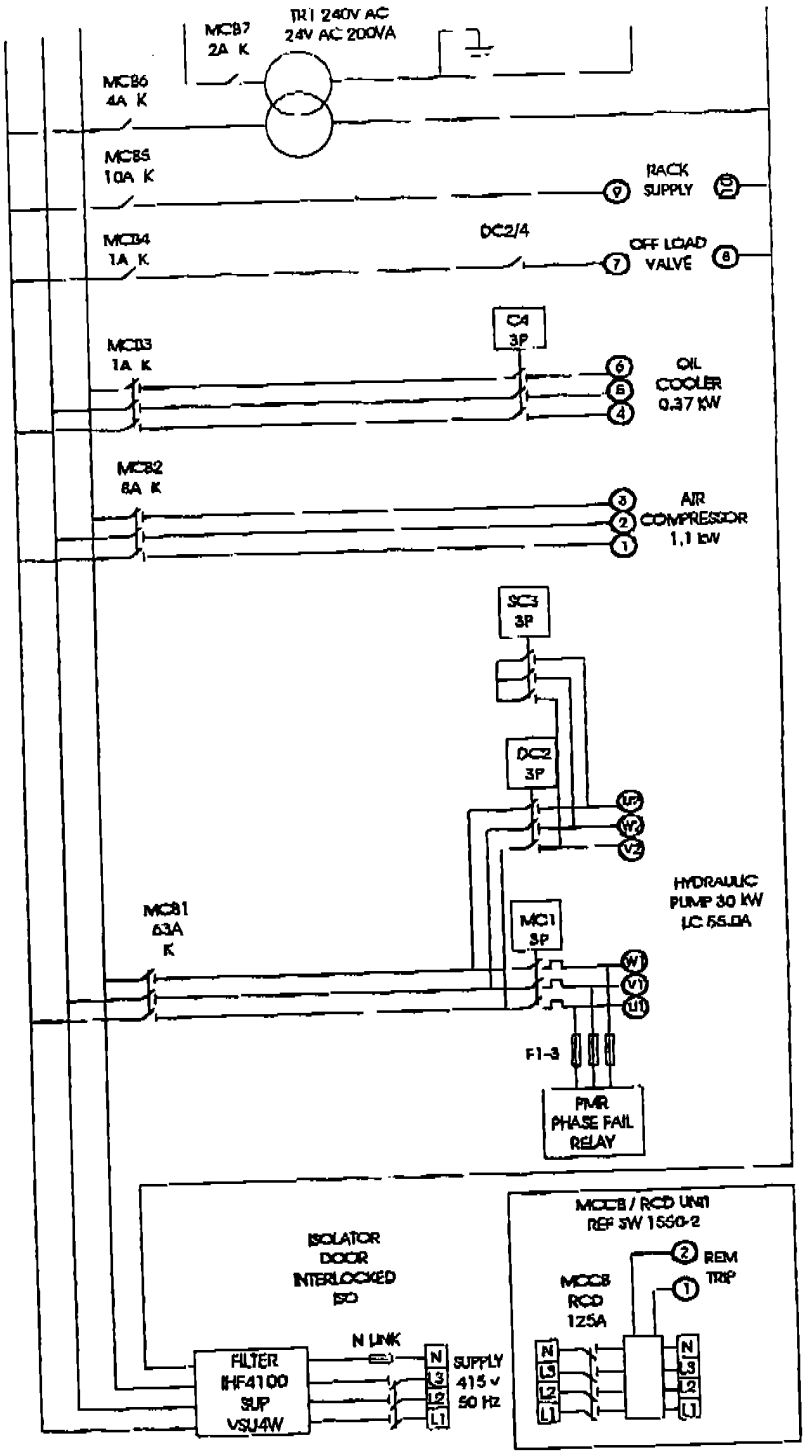


FIGURE 4.3 50 Hz Power Distribution - Sheet 1 of 2

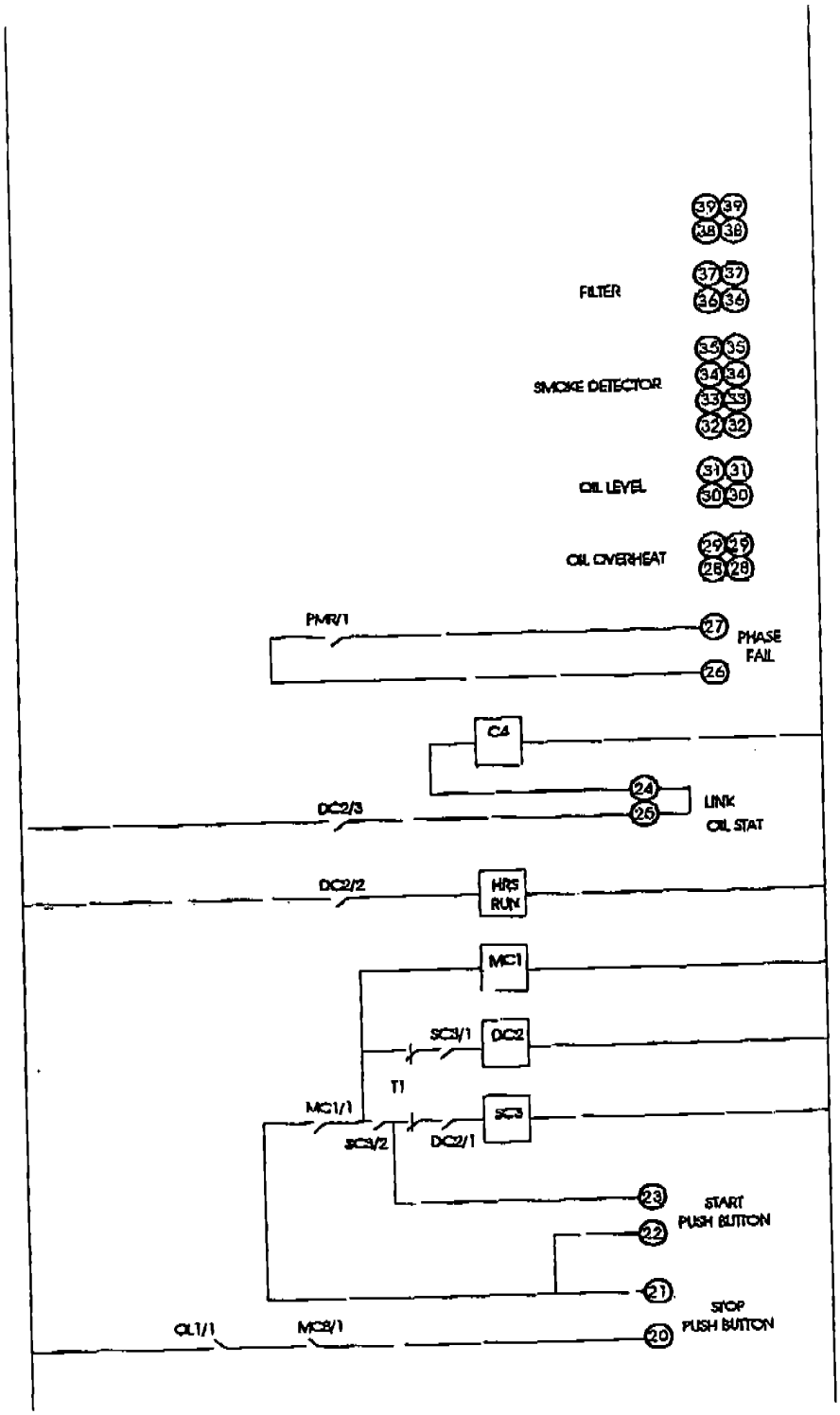


FIGURE 4.4 50 Hz Power Distribution - Sheet 2 of 2

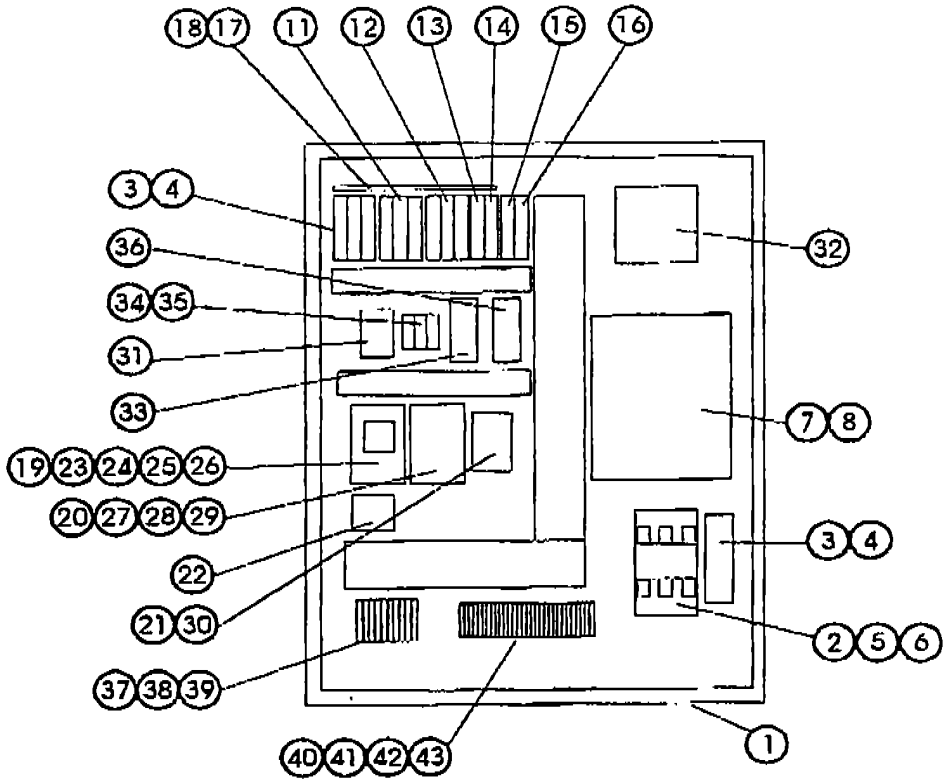


FIGURE 4.5 Power distribution components - 50 Hz

Item	Description	Remarks
1	Enclosure	Enclosure 800 x 600 x 250
2	ISO	Isolator 125A 3-pole
3	N LINK	Neutral Carrier 63A
4	N LINK	Neutral Link 63A
5	ISO	Door Interlocked Handle
6	ISO	Switch Operating Shaft 210mm
7	FILTER	Supply Filter
8	SUP	Suppressor
9	MCB1	MCB 3-pole 63A type K
10	MCB/1	MCB Aux contact
11	MCB2	MCB 3-pole 8A type K
12	MCB3	MCB 3-pole 1A type K
13	MCB4	MCB 1-pole 1A type K
14	MCB5	MCB 1-pole 10A type K
15	MCB6	MCB 1-pole 4A type K
16	MCB7	MCB 1-pole 2A type K

Item	Description	Remarks
17		MCB Busbar
18		MCB Busbar end cap
19	MC1	Main Contactor
20	DC2 24VAC	Delta Contactor
21	SC3 24VAC	Star Contactor
22	OL1	Thermal Overload Relay - set to 32 amps
23	T1	Star/Delta changeover timer - set to 1.5 seconds
24		Star/Delta Contactor interlock
25		Starter interconnections
26	MC1/1	Aux contact N/O
27	DC2/1	Aux contact N/C
28	DC2/2	Aux contact N/O
29	DC2/3	Aux contact N/O
30	SC3/1	Aux contact N/C
31	C4	Contactor
32	TR1	Transformer 230/240V - 24 AC 200 VA
33	PMR	Phase monitor relay - set to nominal value of 400V
34	F1,2,3	Fuse Carrier
35	F1,2,3	Cartridge fuse 1.6A 1.25" x 1/4" Type FF
36	HRS	Hours Run Meter
37	U1,2/V1,2/W1,2	10mm terminal - pump
38		10mm terminal end cap
39	E1	10mm earth terminal
40	1-39	4mm terminal
41		4mm terminal end cap
42	E2	4mm earth terminal
43		4mm terminal jumper
44	ENC MCCB& RCD	Polycarbonate Enclosure 380 x 190 mm
45	MCCB	MCCB 125A 4-pole 16kA
46	RCD	RCD Add-on block

The components are housed in a sheet steel enclosure 600mm x 800mm x 250mm deep, protected to IP55 and are compliant with CEI EN 60204-1. The finish colour is RAL7032. The incoming supply is connected to a mechanically door interlocked isolator rated at 25A AC1, 3 pole with a neutral link. The supply is then taken to the miniature circuit breakers (MCB's) which provide short circuit and over-current protection. The hydraulic pump is controlled by a star-delta starter (MC1 / DC2 / SC3) to reduce the starting current. A thermal overload (OL1) is fitted, rated at 58% to give over-current protection. An adjustable timer (T1) is fitted to control the star to delta changeover delay. A phase and voltage monitoring relay (PMR) is used to signal the rack

(terminals 26 / 27) of any abnormality of the supply to the pump motor. The air compressor supply (MCB2) is direct and uncontrolled, the oil cooler supply (MCB3) is interlocked to the hydraulic pump starter and oil thermostat by means of contactor C4. The off-load valve supply (MCB4) is interlocked to the hydraulic pump starter. The rack supply (MCB5) is direct and uncontrolled. The internal control voltage of 24vac is derived from the transformer TR1, the primary winding is protected by MCB6 and the secondary winding by MCB7. The hydraulic pump is controlled manually by means of external stop and start push buttons. If the overload relay (OL1) or the motor circuit breaker (MCB1) trips, the contacts OL1/1 and MCB1/1 will de-energise the starter. An "Hours Run" meter records the total time the hydraulic pump has run.

4.3.2 Power distribution - 60 Hz

The 60Hz system is almost identical to the 50 Hz system with the exception of the additional windings on transformer TR1 that is included to provide correct voltages to the off-load valve and the rack supply

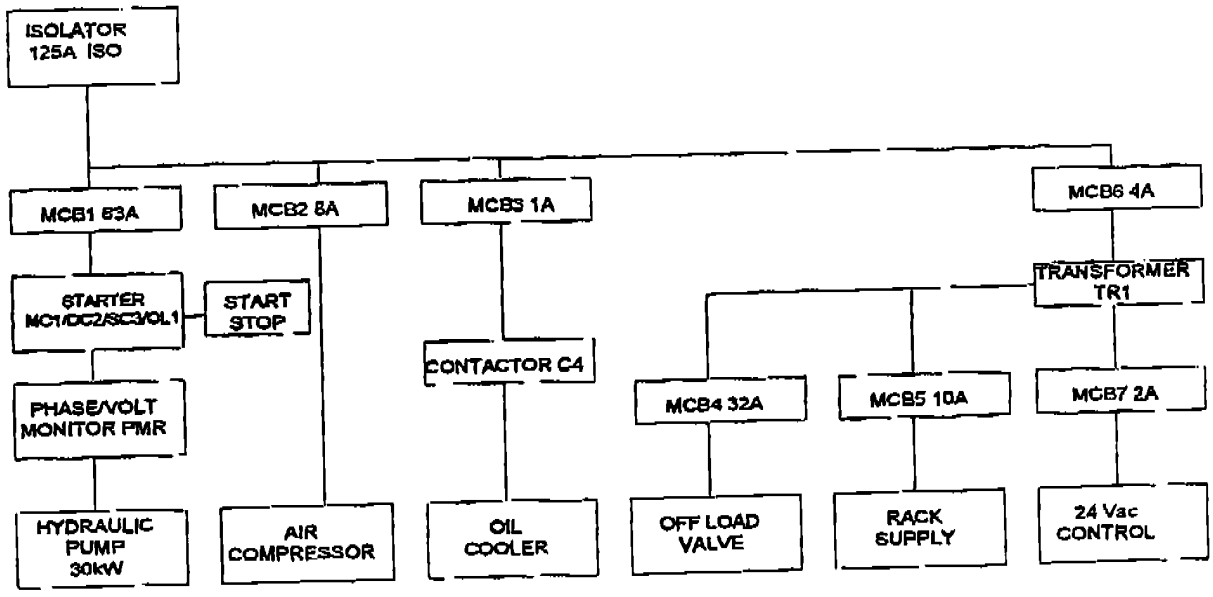


FIGURE 4.5 Electrical system block diagram - 60 Hz

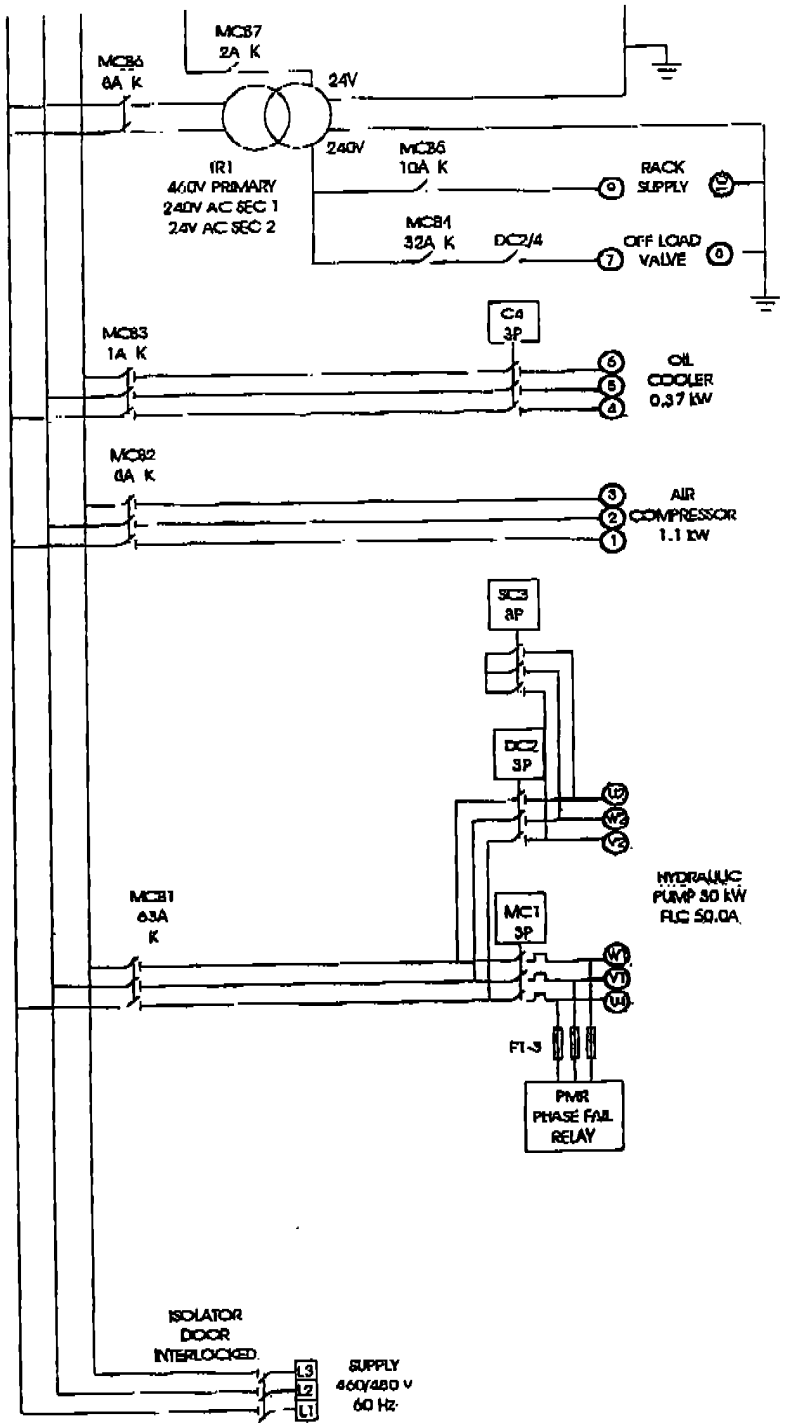


FIGURE 4.7 60 Hz Power Distribution - Sheet 1 of 2

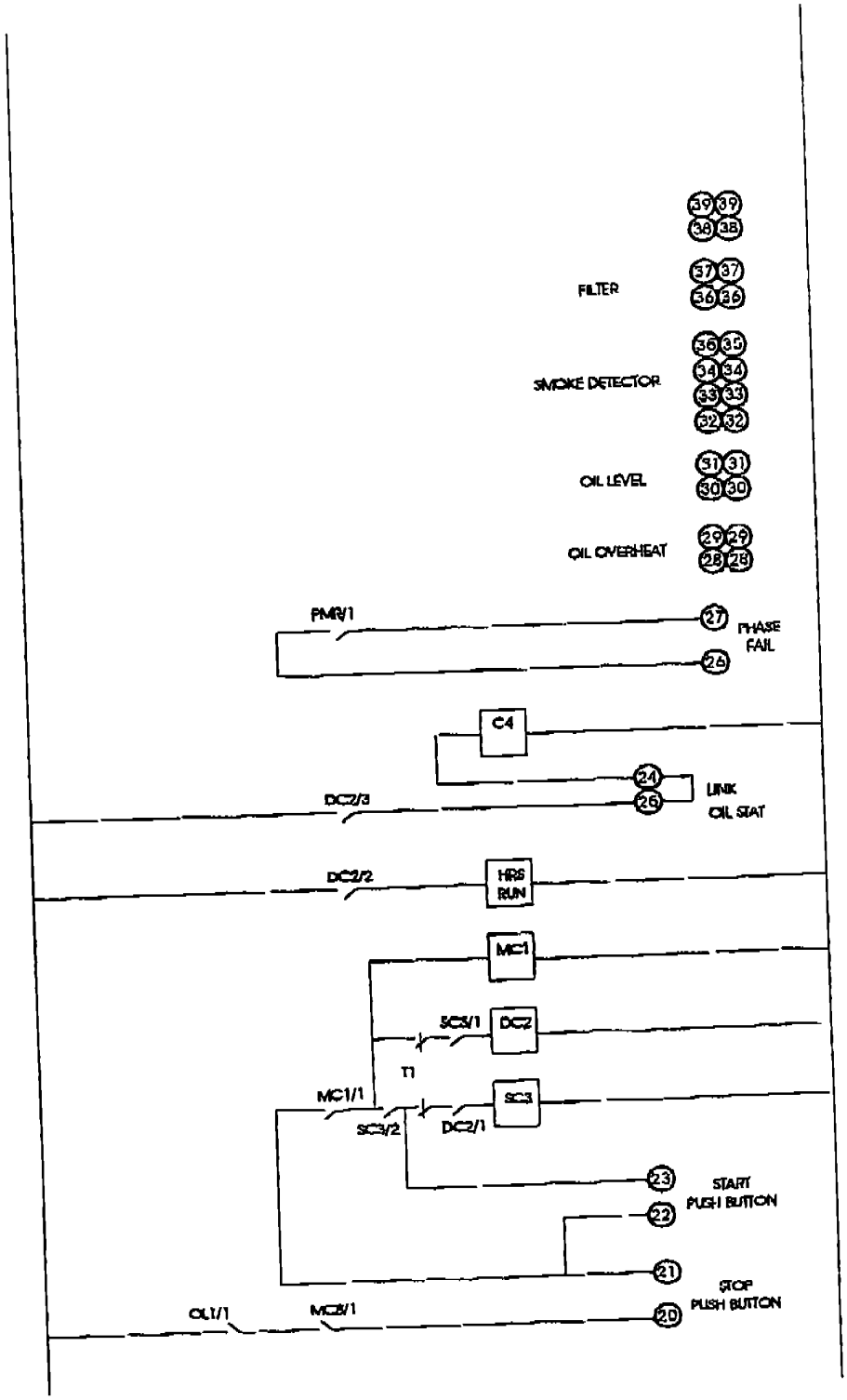


FIGURE 4.8 60 Hz Power Distribution - Sheet 2 of 2

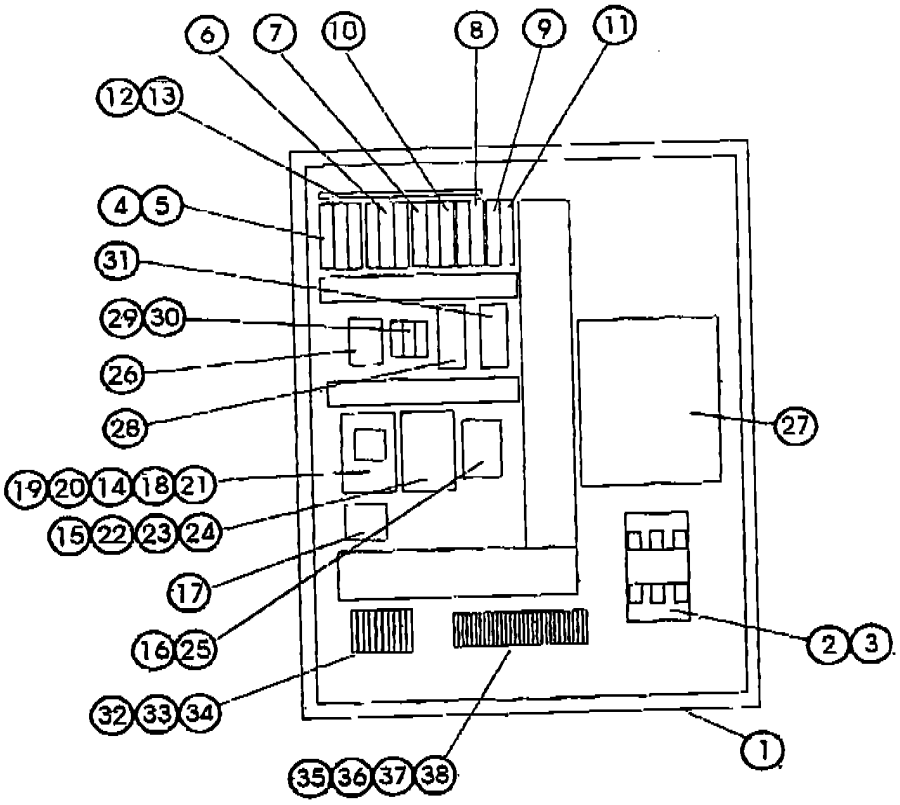


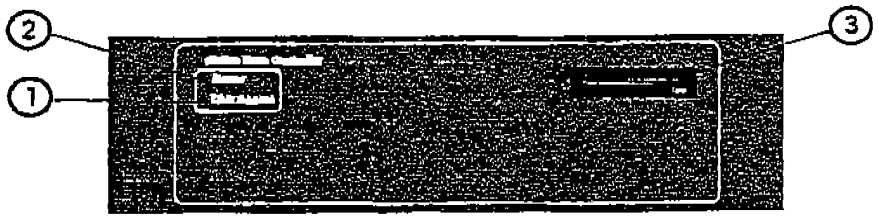
FIGURE 4.9 Power distribution components - 60 Hz

Item	Circuit ref./Part no.	Remarks
1	Enclosure	800 x 600 x 250
2	ISO	Isolator 125A 3-pole
3	ISO	Isolator shroud
4	MCB1	MCB 3-pole 63A type K
5	MCB/1	MCB Aux contact
6	MCB2	MCB 3-pole 8A type K
7	MCB3	MCB 3-pole 1A type K
8	MCB4	MCB 1-pole 32A type K
9	MCB5	MCB 1-pole 10A type K
10	MCB6	MCB 2-pole 8A type K
11	MCB7	MCB 1-pole 2A type K
12		MCB Busbar
13		MCB Busbar end cap
14	MC1	Main Contactor
15	DC2	Delta Contactor
16	SC3	Star Contactor

Item	Circuit ref/Part no.	Remarks
17	OL1	Thermal Overload Relay - set to 34.5 amps
18	T1	Star/Delta changeover timer - set to 1.5 seconds
19		Star/Delta Contactor interlock
20		Starter interconnections
21	MC1/1	Aux contact N/O
22	DC2/1	Aux contact N/C
23	DC2/2	Aux contact N/O
24	DC2/3	Aux contact N/O
25	SC3/1	Aux contact N/C
26	C4	Contactor
27	TR1	Transformer 460/480V - 240V/24V AC
28	PMR	Phase monitor relay - set to nominal value of 400V
29	F1,2,3	Fuse Carrier
30	F1,2,3	Cartridge fuse 1.6A 1.25" x 1/4" Type FF
31	HRS	Hours Run Meter
32	U1,2/V1,2/W1,2	10mm terminal - pump
33	W	10mm terminal end cap
34	E1	10mm earth terminal
35	1-39	4mm terminal
36		4mm terminal end cap
37	E2	4mm earth terminal
38		4mm terminal jumper

4.4 Computer

The main Control Computer is based on an IBM PC compatible Pentium motherboard, with the processor running at a clock rate of 150MHz or higher. This computer is normally not fitted with a keyboard or monitor, although it is possible for an SVGA monitor to be attached in order to view status information relating to the Morphis and the current ride. The interface is mostly graphical. Note that on replay machines neither the keyboard nor the mouse will give access to control or editing functions. The picture below shows the front panel of the computer:

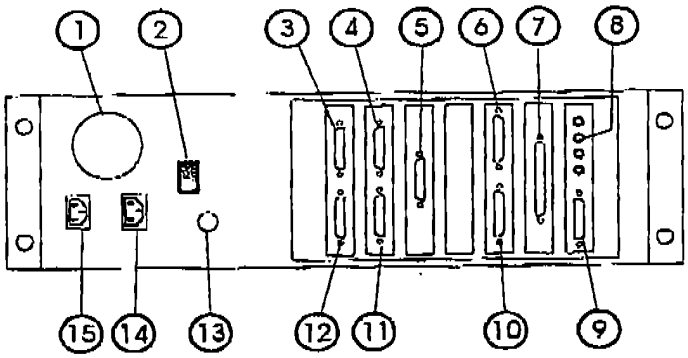


Item	Description	Remarks
1	Disk Access LED	Illuminates when disk is being accessed
2	Power LED	Illuminates when computer power is ON
3	Floppy disk drive	For 1.44 Mb diskette

FIGURE 4.10 Computer - Front Panel

The main features of the computer are as follows:

- Motherboard - IBM PC compatible
- Processor - Pentium 150MHz or faster
- Floppy disk drive - 1.44Mb, 3.5" standard IBM compatible
- Hard disk drive - 500Mb or larger
- Display adapter - SVGA, resolution 800x600, 256 colours
- Audio - Stereo, Sound blaster compatible
- Serial ports
- Analogue interface - 12 bit (4096 steps), 8 differential inputs, 8 single- ended outputs
- Protection - Internal software protection and show data encryption



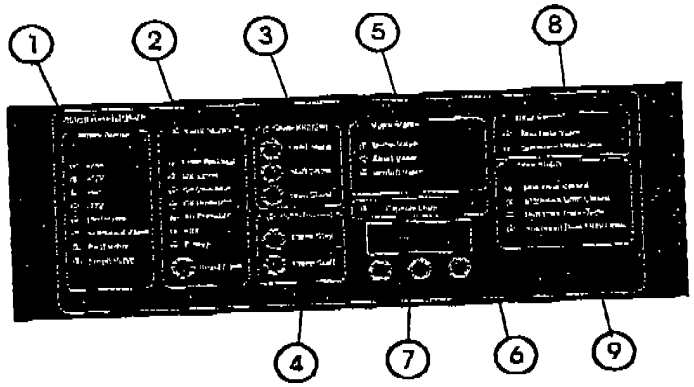
Item	Description	Remarks
1	Fan	
2	Power switch	Internal neon illuminates when power is ON
3	Serial port 1	9-pin male D-type. Mouse connector (if used)
4	Serial port 3	9-pin male D-type. To serially -controlled video source
5	15-way D-type	Display output, standard IBM PC compatible. Configured for SVGA monitor, 800x600 pixel resolution with 256 colours.
6	Not used	
7	Analogue interface	50 way male D-type connector. This connector is used to connect the motion base analogue control signals to and from the Safety Interface Controller
8	Audio interface	3.5mm stereo jack socket (line-out) to connect to an external amplifier.
9	Not used	
10	Not used	
11	Serial port 4	9-pin male D-type
12	Serial port 2	9-pin male D-type
13	Keyboard connector	5 pin female DIN standard IBM PC compatible
14.	Power through connector	IEC connector - 220/240VAC device, maximum 200W
15	Power inlet	IEC connector. Set for 220/240VAC 50Hz operation

FIGURE 4.11 Computer - rear panel

4.5 System Interface Controller

The Safety Interface Controller provides a number of different functions:

- It provides an autonomous safety function independent from the main Control Computer.
- It takes the incoming signals from the Morphis capsule, provides signal conditioning, and then feeds these signals to the Control Computer in an appropriate form.
- It takes signals from the Control Computer, provides signal conditioning and then feeds these signals to the Morphis capsule.
- It provides the basic operator interface.
- It displays operational status and fault information.
- It provides an interface between the Remote Operator Panels and the computer to allow remote control of the motion base.
- It provides the show control interface.



Item	Description	Remarks
1	Power status interface	
2	Fault status interface	
3	Show Running interface	
4	Pump running interface	
5	Valve control interface	
6	Capsule light interface	
7	LCD indicator and control interface	
8	Door Control interface	
9	Door status interface	

FIGURE 4.12 System Interface Controller - Front Panel

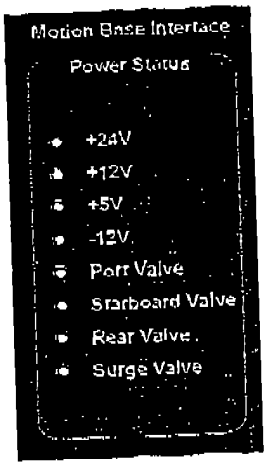
The colour of the indicators on the panels show the status of the corresponding items:

- Green indicates that the status is good – the motion base will only run when all indicators show green
- Yellow indicates a condition that makes the system non- optimal or a condition that is not a fault under the current circumstances. Examples are the "Filter Blocked" warning that will show yellow when it occurs – in this case it indicates that there is a problem which should be solved, but does not need the ride to be stopped immediately. Another example is the door status – if the starboard or port doors are not fully closed, but the ride is not running, then they will be shown as a yellow condition.
- Red indicates a fault condition that needs immediate action. One example is the oil-pressure warning indicator. A second example is when the doors open during a ride.

If an indicator is not lit, then there may also be a problem. An example of this could be that if one of the power supply indicators is not illuminated, then its power supply may not be working properly for some reason.

An LCD is used to display status information relating to the Morphis Motion Base system. Buttons are located below the display to allow shows to be selected and certain control parameters to be changed.

4.5.1 Power Status Interface



To the left is the power status display. This is used to indicate the status of the power supplies that are necessary for proper operation of the Morphis motion base and its control system. The 24 Volt supply is used to power the control relays and various other external devices.

The +12 and – 12 Volt supplies are used to supply power to the analogue interfaces, and also to the audio devices. The +5 Volt supply is used to provide power to the internal microcomputer and related components.

The power to the Port, Starboard, Rear and the optional Surge valves are applied sequentially after the Safety Interface Controller is switched on. This is done to avoid potential power surges in the control system.

4.5.2 Fault Status Interface

This panel displays the status of the system. The "Fault Status" LED should normally be green to show that the system is in good condition and ready to run. Under normal circumstances, this will only show red during start-up.

The individual sub-headings show the status of the individual potential primary problem sources – but note that there are other potential fault sources which need to be taken into consideration:

- Filter blocked - This indicates that there is a significant pressure drop across the main hydraulic oil filter, which should be changed. This fault will not cause the motion base to stop the current ride, but urgent action does need to be taken to rectify this condition.
- Oil Level - This indicator shows that the oil level is below an acceptable level for the ride to run. This condition will stop the ride from running.
- Oil Overheat - When the oil overheat indicator comes on, the current ride is abandoned, and no further rides can be run until the temperature of the oil has reduced to an acceptable level. This condition should be investigated before continuing to use the system.
- Oil Pressure - The oil pressure indicator comes on when there is inadequate pressure to run the motion base. This indicates a major fault, and the motion base will not run until this problem is cleared.
- Air Pressure - Low air pressure must be remedied immediately. If the ride is not running, then the doors cannot be operated properly, and will not necessarily open up to their full extent. When the ride is running, air pressure is needed by the door mechanism to keep the door closed, and by the four venturi suction cups which are used to force the door against the side of the cabin.
- Fire - This is a feedback signal from the internal and optional external fire detectors. Apart from the normal fault response, an internal buzzer inside the Safety Interface Controller will sound to indicate that a fire has been detected.
- E-Stop - The E-Stop indicator shows that one of the Emergency Stop buttons has been pressed. The cause must be investigated before resetting the switch.

- Reset Fault - This button is used to reset the fault condition. Note that the fault needs to be cleared before pressing this button will have an effect.

If there are multiple faults, then these indicators will show all the faults that are currently causing the problem. The primary fault, i.e. the fault that caused the problem in the first place, is also displayed on the LCD until the Reset Fault button is pressed.

Other possible sources for faults are:

- One or both of the doors opened during a ride – the feedback mechanism for this fault is sensitive to ensure that in case of any problems the ride cuts out as soon as possible.
- A communications failure between the Control Computer and the Safety Interface Controller.

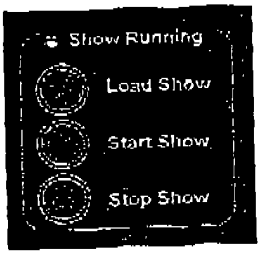
⚠ CAUTION

Any fault indication should be investigated - No faults should occur during normal operating conditions.

Do not attempt to bypass safety devices as serious injuries or equipment damage may occur.

4.5.3 Show Control Interface

Three buttons are available on this part of the panel to control the ride. These buttons are not used for normal operations as there is a remote Operators Panel which is the standard way of controlling the ride. These buttons act in parallel and allow the operator to test the system from the front panel of the safety interface unit.

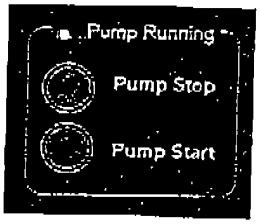


The "Show Running" indicator is used to show the current status of the motion base. If it is red, the system is "safe" and is not currently running. When the system is loading a show, it will alternately flash between red and yellow.

When the unit has loaded and is ready to run a show, this indicator will display yellow. At this point the show may be started using the local start button, or the start button mounted on the remote Operators Panel. The indicator will flash alternating between yellow and green to indicate that the unit is about to start running a show. After

the preparations are complete, and the doors are closed, the indicator will change to green to indicate that the system is live and the show is running.

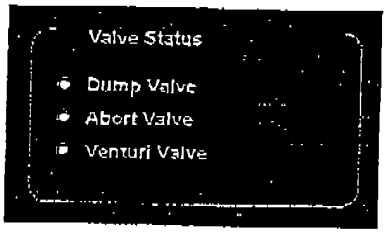
4.5.4 Pump Control Interface



The Pump Running indicator shows the current status of the hydraulic pump. It will show green if the pump is running. This indicator must show green before the system can be run and the system faults can be reset using the "Reset Fault" button described before. The hydraulic pump is controlled using the "pump start" and the "pump stop" switches. After the Safety Interface Controller is switched on, the operator has to press the "Pump Start" button to prepare the system.

4.5.5 Valve Status Interface

The Valve Status box shows the current status of each of the valves.



The Dump Valve is used to control the oil flow from the hydraulic pump. If this indicator is not lit, then the oil from the hydraulic reservoir is being pumped through the oil cooler back into the reservoir – no pressure is generated in the system.

The Abort Valve is a set of 3 valves (4 if the surge valve is fitted) which cause the individual hydraulic ram control valves to be bypassed.

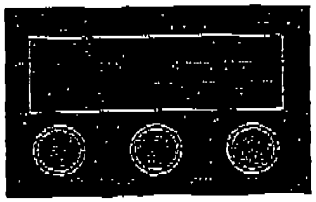
The Venturi valve functions to hold the doors shut after they are closed. There are four suction pads which hold the doors solidly against the body of the flight simulator during the show. This should show green during the time a show is running. In case of a fault condition, the venturi valves are held on for approximately 10 seconds after a fault occurs to allow for the Morphis to return to a "safe" condition before the doors are opened.

While the ride is not running, these indicators will not be illuminated. After the "run show" command is given the controller prepares the capsule: the doors are closed, and after they are sensed to be shut the venturi valve is switched on to keep the doors closed during the ride. The dump valve and abort valves are then activated to build up oil pressure within the system ready for the ride to start.

4.5.6 Capsule Light

The capsule light indicator is used to show the status of the lighting inside Morphis. It always shows the same level as the lighting in the capsule, and is not just an on/off indicator. The Morphis Safety Interface Controller is fitted with a dimmer that controls the internal lighting. The interior lights are controlled as part of the ride control, as one of the active channels. This means that at the beginning of the ride it is normally faded down, and at the end of the ride normally faded up – but this depends on how the shows are programmed and is not necessarily the case. It is also possible for the light to fade up or switch on during the ride itself to give visual effects. The capsule lights are always set to full "on" in the case of a fault condition.

4.5.7 LCD and control interface



The LCD display is used to show the system status. If a fault occurs, this LCD indicates the primary fault, i.e. the first fault which triggered the Morphis Safety Controller. As an example, if a door opens during a ride, the safety system will operate which will then cause further errors (such as a low oil pressure warning) to occur as a consequence. The display will continue to show the original error until the "Fault Reset" button is pressed.

The three buttons control some of the functionality of the Morphis. The leftmost button is the "menu selector", and the other two button functions are shown as necessary.

For more details of usage of the LCD panel please see "LCD display and controls" on page 3-4.

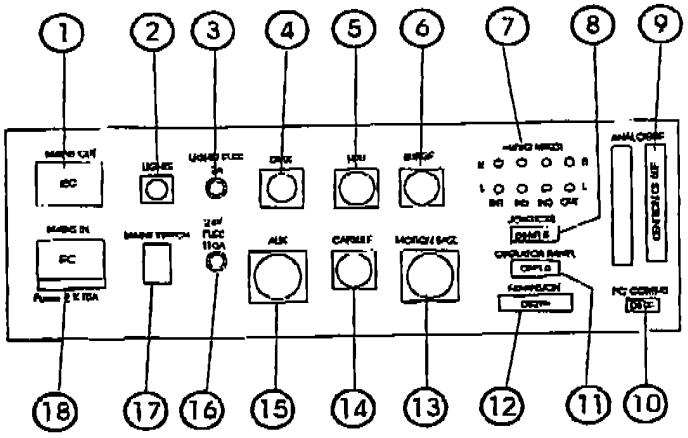
4.5.8 Door Status

Sensors are present at the top and bottom of the door travel to indicate when the doors are fully opened and fully closed. The indicators show green to indicate a closed or fully open condition. The door fully closed condition is shown as yellow to indicate a not-closed condition when this is acceptable, i.e. between rides. The indicators show red when a

door is not fully closed during a ride, at which point the ride will fail and the capsule is returned to its safe position.

4.5.9 Safety Interface Controller Rear panel

The rear panel of the Safety Interface Controller contains all the connections to the Morphis Motion Base.



Item #	Description	Remarks
1	Power through connector	IEC
2	Lights connector	4W
3	Lights fuse	T2A
4	DMX connector	XLR5
5	HPU connector	19-way
6	Surge valve connector	12-way
7	Audio mixer	
8	Joystick connector	DB15M
9	Analogue connector	Centronics 50-way female
10	PC serial link	DB9F
11	Operator panel connector	DB15F
12	Expansion connector	DB25F
13	Motion base connector	35-way
14	Capsule connector	23-way
15	Aux connector	28-way
16	24V PSU fuse	T10A
17	Power switch	
18	Power In connector	IEC, including 2 x T5A fuses

FIGURE 4.13 System Interface Controller - rear panel

4.6 Audio system

The audio system is illustrated in the block diagram below. Sound is originated from the sound track on the CRV laser disk player or MPEG player, which is fed to the input of the audio decoder and amplifier. The audio signal is decoded to give the passengers an authentic surround-sound experience, fed through an amplifier driving a six-speaker system in the capsule.

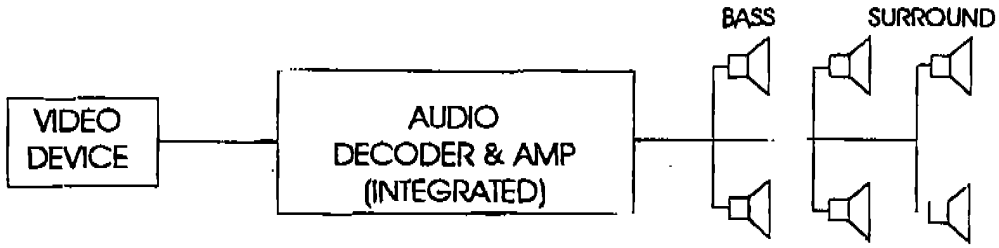


FIGURE 4.14 Audio Block diagram

4.6.1 The Audio Decoder/Amplifier

The audio decoder and amplifier is integrated into one unit. The unit is preset and normally requires only the controls on the front panel to be used.

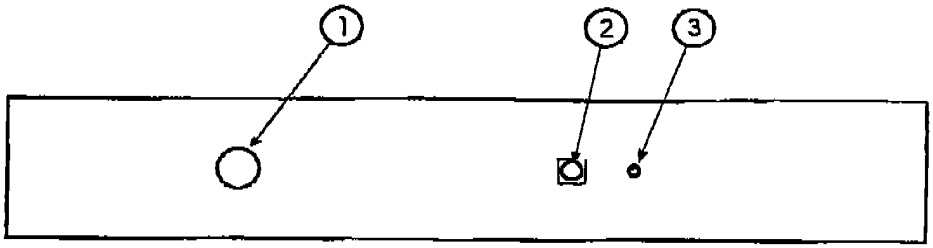


FIGURE 4.15 Audio Amplifier - front panel

Item	Description	Remarks
1	Volume Control	Preset during factory test
2	Power ON/OFF	
3	Power ON LED	

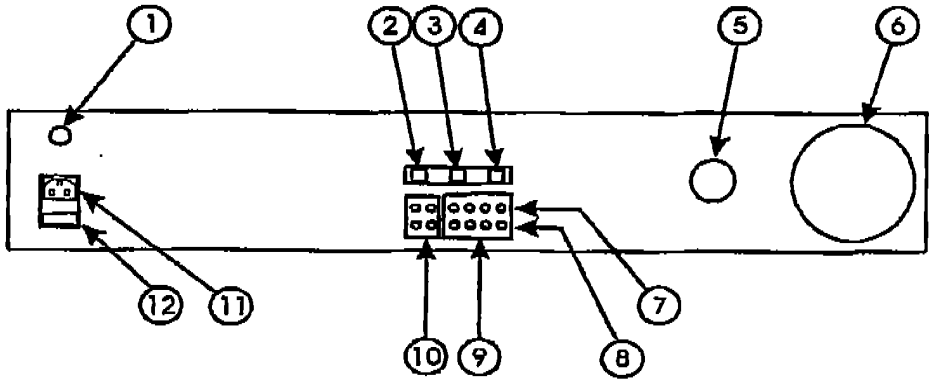


FIGURE 4.16 Audio Amplifier - rear panel

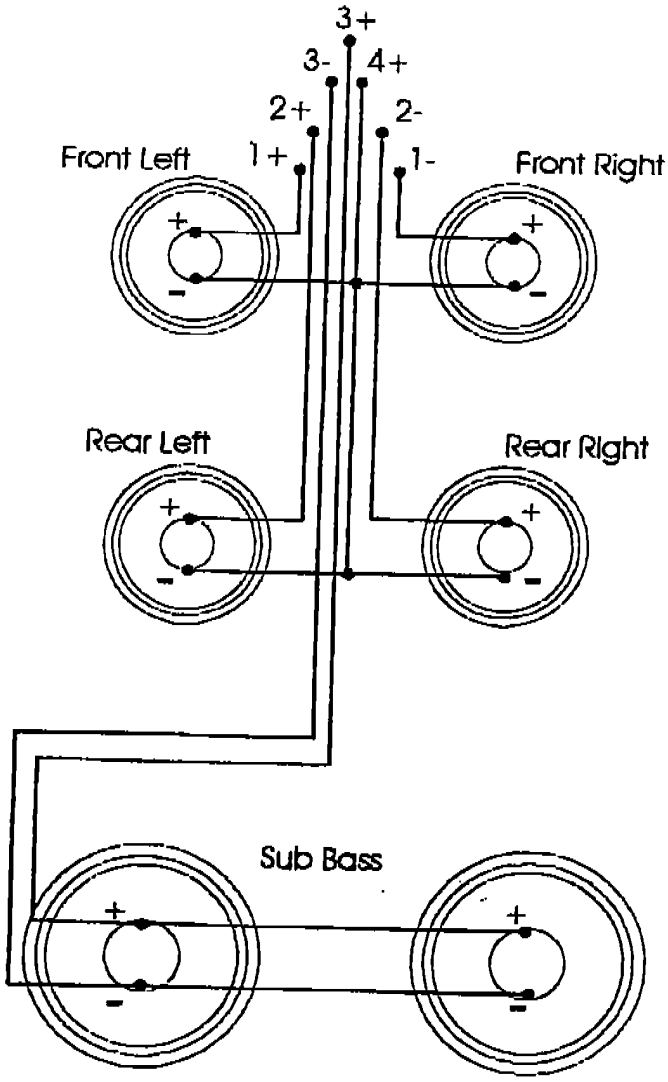
Item	Description	Remarks
1	Voltage Selector	240 or 120 V ac
2	B-Format selector	
3	uhj selector	Normally depressed for surround sound
4	Stereo enhance selector	
5	Speaker socket	
6	Vent	
7	Decoder outputs	
8	Audio inputs	
9	Four-channel in/out	B-format
	Two-channel in/out	UHJ / Stereo Enhance
11	Power input	
12	Fuse	20mm 6.3A (240 V) or 12.5A (120 V)

4.6.2 Speaker Loom

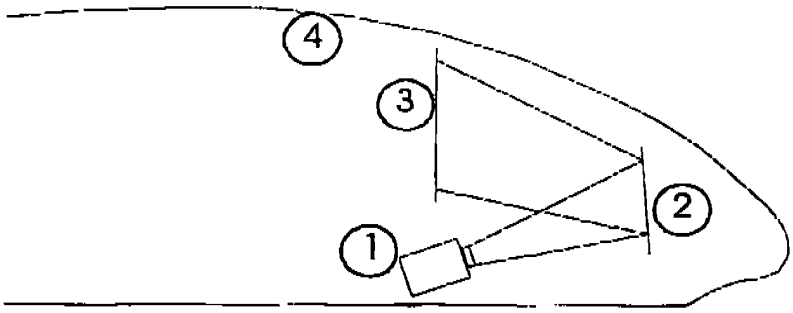
The speakers are connected to the decoder/amplifier by an 8-way Speakon™ plug which engages with a mating socket (item 5 on rear panel).

FIGURE 4.17 Speaker Plug

Pin	Colour	Speaker & Terminal
1+	Red	Front Left (+)
1-	Yellow	Front Right (+)
2+	Black	Rear Left (+)
2-	Blue	Rear Right (+)
3+	Green	Sub Bass (+)
3-	Brown	Sub Bass (-)
4+	White	High Frequency Common (-)
4-		No Connection


3+
3-
4+
2+
2-
1+
1-
Front Left
Front Right
Rear Left
Rear Right
Sub Bass
+
-

4.7 Visual projection system



Item	Description	Comments
1	Projector	Behind front bulkhead
2	Mirror	
3	Screen	
4	Capsule	

FIGURE 4.18 Visual Projection system

The visual projection system is based around a video device in the control rack controlled by the computer through a remote serial link. The video device can be either a CRV videodisc player or a PC-based MPEG player. The video output is connected via a flexible cable loom to a projector in the front of the capsule which projects via a mirror onto the back of the screen. All devices are preset on installation for remote operation and there should be no reason to adjust settings on either of these units. Control details are provided for reference only.

4.7.1 CRVdisc

The CRVdisc (videodisc) is a "write-once" laser videodisc that conforms to the CRVdisc system (the CRVdisc system includes the Laser Videodisc Player, Laser Videodisc Recorder and Laser Videodisc Processor). The videodisc contains recordings of both video and audio. The advantages of the videodisc are its capacity and durability. The capacity of the videodisc is up to 36250 frames per side, or 24 minutes of video and audio per side.

The CRVdisc incorporates the component recording system. The system records the colour intensity signals (Y) and the colour difference signals (R-Y/ B-Y) separately. It also incorporates time

compression recording and time expansion play formats. These formats produce high quality pictures.

4.7.2 CRVdisc player

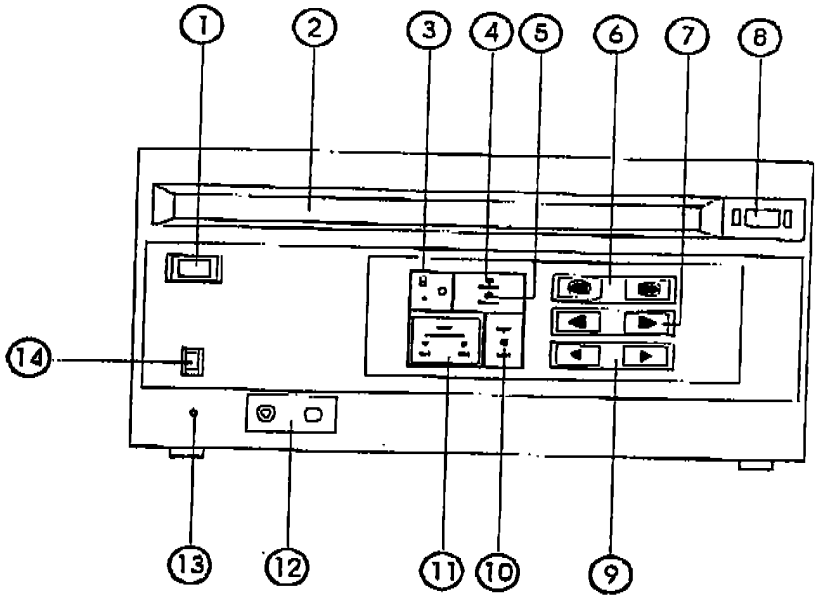
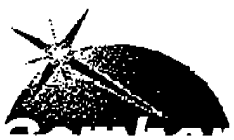


FIGURE 4.19 CRVdisc player Front Panel

Item	Description	Comments
1	POWER switch	Press to turn the power on, and press again to turn the power off
2	Disc compartment	Insert the videodisc into this aperture when power is on. The videodisc is automatically loaded.
3	REMOTE SENSOR and indicator	For use with the wireless RM-W7000 remote control unit (not supplied). The indicator lights up when the sensor receives the signal from the remote control unit.
4	NO DISC indicator	Lights up when there is no videodisc loaded into the player.
5	STANDBY indicator	Lights up while the player is loading or ejecting a videodisc. Also blinks while the player is cleaning the lens. (The player automatically begins cleaning the lens when power is switched on.)
6	SCAN buttons	Press one of these buttons to scan fast through picture frames. Press >>> to scan forward, and press <<< to scan backward. The system scans 30 times faster than the standard speed.

Item	Description	Comments
7	STILL/STEP buttons and indicator	Press either button once during playback to display a still picture. (The picture stands by for Step Play.) Then, press II> to move the pictures forward one by one, or press <II to move the pictures baskward one by one. To move the pictures continuously, keep the button pressed. The indicator lights up during a still picture display or Step Play.
8	EJECT button	Press to eject the videodisc.
9	PLAY button and indicator	Press to play back pictures at the standard speed. Press > to move forward, or press < to move backward. The indicator lights up while the player is operating.
10	MODE (video signal mode) indicator	The indicator lights up when the B&W mode is selected on the COLOUR/B&W selector on the rear panel.
11	AUDIO CHANNEL Indicators	For use with the RM-W7000 remote control unit or a computer. When using the remote control unit, press the AUDIO CH1 (or CH2) button to select the audio channel 1 (or 2). The corresponding AUDIO CHANNEL indicator lights up. Press the button again and the indicator goes off.
12	HEADPHONES jack (stereo phones Jack) and LEVEL control knob	Connect headphones to monitor the audio. Adjust the volume with the LEVEL control knob.
13	REMOTE COMMANDER Jack (special mini-jack)	Connector for the RM-W7000 remote control unit (not supplied). Power is supplied to the remote control unit from the player.
14	REMOTE/LOCAL selector and REMOTE indicator	Set to LOCAL when you operating the player from the front panel or from the RM-W7000 remote control unit (not supplied). Set to REMOTE when a computer is used to control the player. The REMOTE indicator lights up when the selector is set to REMOTE and the RS-232C DTR signal is ON.



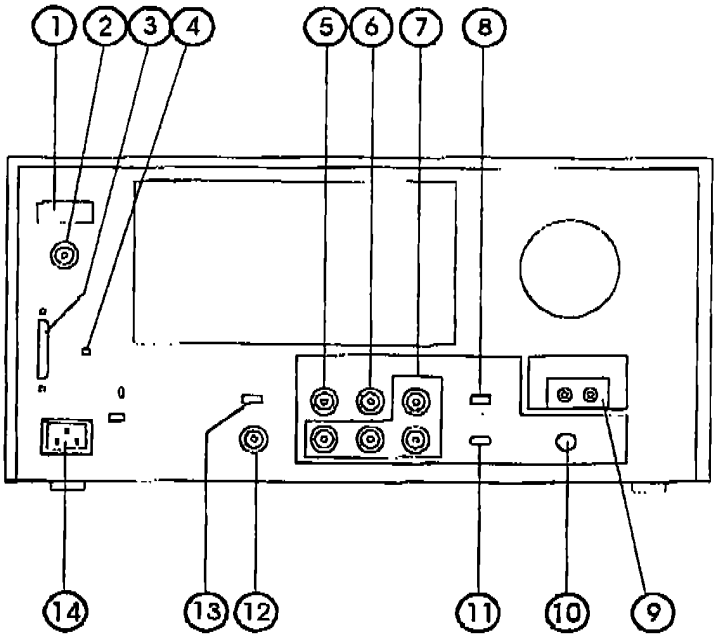


FIGURE 4.20 CRVdisc player rear panel

Item	Description	Comments
1	HOURS METER	Indicates the total numbers of hours that the player's power has been on. 1 increment of the scale means 1000 hours, and 10000 hours can be indicated.
2	DUB TRIG OUT Jack (BNC)	Connect to the DUB TRIG IN jack of the recorder when recording pictures onto another CRVdisc system.
3	RS-232C connector (25-pin)	Connect to a computer when controlling the player externally. For details, refer to the LDM-5000 interface manual (not supplied).
4	BAUD RATE selector	Set the baud rate of the RS-232C interface according to the computer used. The factory baud setting is 1200 bits per second (bps). The selector is preset during factory test and must not be adjusted.
5	COMPOSITE B&W output jack (BNC)	Outputs the composite video signal or B&W video signal according to the COLOUR/B&W selector (13).
6	MONITOR output jack (BNC)	Outputs the composite video signal or B&W video signal according to the COLOUR/B&W selector (13). The player always displays the index on the screen connected to this jack whenever the INDEX MODE switch is OFF.

Item	Description	Comments
7	Component signal output jacks (BNC)	Outputs the RGB or colour difference (Y/R-Y/B-Y) signals according to the VIDEO OUT switch (11) G/Y: Outputs G (green) signal or Y (colour intensity) signal. R/R-Y: Outputs R (red) signal or R-Y (colour difference) signal. B/B-Y: Outputs B (blue) signal or B-Y (colour difference) signal. SYNC: Outputs sync signal.
8	INDEX MODE selector	Set to ON to display the index when the INDEX button on the remote control unit is pressed. Set to OFF to display the index only on the monitor connected to MONITOR output jack.
9	AUDIO OUT (audio signal output) jacks (RCA-pin)	Outputs audio signals. CH-1/L: Outputs Channel 1 (L Channel) audio. CH-2/R: Outputs Channel 2 (R Channel) audio.
10	Y/C OUT (Y/C output) jack (4-pin)	Outputs the Y/C (S) video signals.
11	VIDEO OUT switch	Select the video signals output from the component signal output jacks (7). Set to COMPONENT to select the colour difference signals. Set to RGB to select the RGB signals.
12	REF VIDEO (reference video) input jack (BNC)	Connect a reference video signal with chroma burst (VBS or SYNC). This jack terminates with 75 ohms. If the reference video signal without chroma burst is connected, the composite video signal will be colourless, as the sub-carrier frequency fluctuates.
13	COLOUR/B&W selector	Set to COLOUR when you play back pictures recorded in the colour mode. Set to B&W when you play back pictures recorded in the B&W mode.
14	AC IN (AC receptacle)	Connect the supplied AC power cord.

4.7.3 MPEG Player

The Digital Video Player is a PC MPEG based system. It is capable of producing PAL or NTSC outputs up to a resolution of 704 x 576 at 25 frames per second PAL or 704 x 480 at 30 frames per second NTSC. At 8mbps (considered broadcast quality) the system uses 60Mb per minute. (A CD ROM can hold 650Mb or 10 minutes and 50 seconds of video).

The MPEG Player is designed to play off the internal hard disk drive, using the CD ROM drive as a distribution mechanism. It delivers the video through the BNC connectors R G B and CVBS (composite for sync and external monitor), while the audio is via a 3.5mm audio jack.

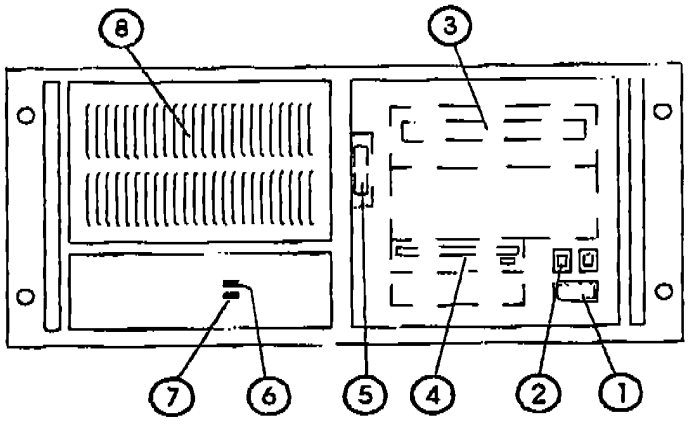


FIGURE 4.21 MPEG Player Front View

Item	Description	Comments
1	Power Switch	ON/OFF rocker switch
2	Reset Switch	Press to reboot unit
3	CD ROM drive	Press button to open/close
4	Floppy disk drive	Insert disk (press button to eject)
5	Fan filter release	Pull to the right to release
6	Power Led	Green normal use
7	HDD Led	Red/off HDD activity
8	Filter	Dust filter (clean when required)

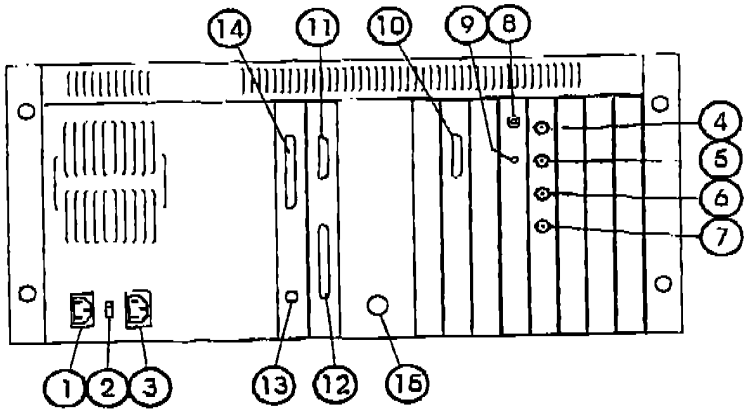


FIGURE 4.22 MPEG Player Rear View

Item	Description	Comments
1	Power in	Connect the AC Power cord
2	Power pass through	Connection for monitor power (Not used)
3	Voltage selector	(Not used)
4	Red BNC	Outputs red signal
5	Green BNC	Outputs green signal
6	Blue BNC	Outputs blue signal
7	CVBS BNC	Outputs SYNC/composite signal
8	SPDIF RCA	Outputs Dolby Digital (Not used)
9	Audio 3.5mm Jack	Outputs Stereo signal
10	SVGA	Monitor connection (Service item)
11	Com1 9pin RS232	Remote control connection
12	LPT1 25pin	Printer port (Not used)
13	Com2 25pin RS232	RS232 connection (Not used)
14	PS2 Mouse	Mouse connector (Service item)
15	Keyboard connector	Keyboard connector (Service item)

4.8 Hydraulic System

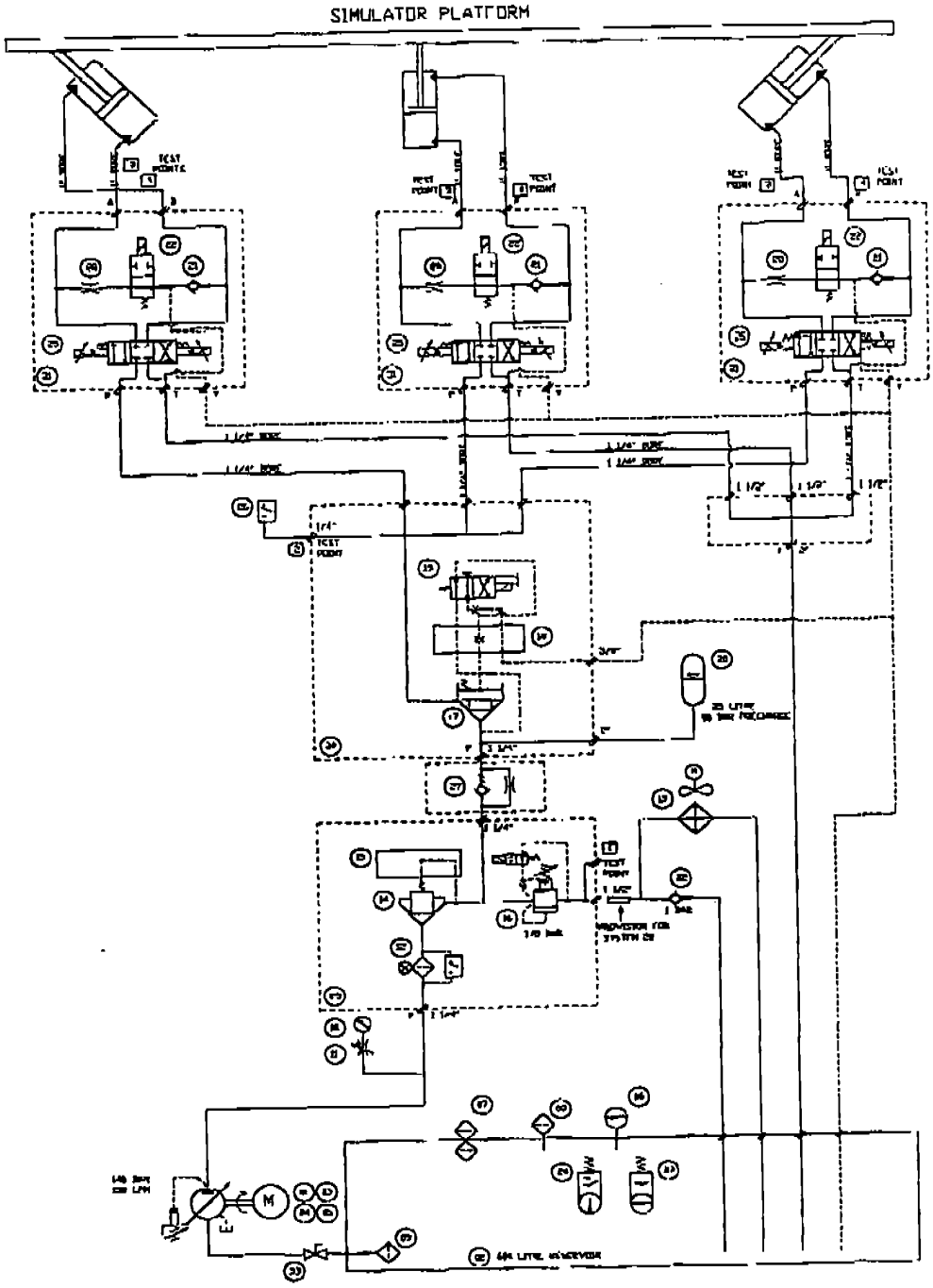


FIGURE 4.23 Hydraulic system block diagram

Item	Description	Comments
01	30 kW motor	
02	600 litre reservoir	
03	Piston Pump	
04	Bellhousing	
05	Coupling	
06	Oil level gauge	
07	Filler breather	
08	Air breather	Parfit element
09	Suction strainer	
10	Pressure gauge	0-250 bar
11	90 deg gauge isolator	
12	Filter	Manifold mounted
13	Cooler	Suitable for 50/60 Hz
14	Cartridge valve	
15	Cover plate	
16	Relief valve	
17	Cartridge valve	
18	Cover plate	
19	Directional control valve	
20	25 litre accumulator	90bar precharge
21	Cartridge check valve	
22	Cartridge valve	
23	Float level switch	
24	Thermostat	
25	Proportional control valve	
26	Pressure switch	
27	Check valve	
28	Orifice	
29	Outlet manifold	Camber specific
30	Accumulator manifold	
31	CETOP 7 Manifold	
32	Check valve	
33	Shut–off valve	

The 600 litre reservoir (Item 02) includes inspection covers on one side for maintenance purposes. The power unit includes an oil level gauge (Item 06), a filler breather (Item 07) and an air breather (Item 08). It also comprises two electrical switches, these being a thermostat (Item 24) and a single oil float level switch (Item 23). The variable piston pump (Item 03) draws oil from the reservoir through a suction strainer (Item

09). Incorporated in this suction line is a shut-off valve for maintenance purposes.

The pump delivers oil to the system with a flow of 150 L.P.M. at 140 Bar. A pressure gauge (Item 10), with isolator (Item 11) allows a constant view of the system pressure.

The first manifold (Item 29) includes the only filter on the system, this manifold mounted filter (Item 12) also has a visual and an electrical indicator to show the condition of the filter. Also on the manifold is a check valve cartridge (Item 15) and a solenoid-operated relief valve (Item 16), set at 170 Bar.

When this solenoid relief valve is de-energised, oil flows back to tank via a fan-assisted air cooler (Item 13). There is also a cooler bypass if the cooler becomes blocked, or the flow is too great. This bypass has a in-line check valve (Item 32) set at 3 bar.

For the simulator ride to operate, the relief valve must be energised. This will charge the accumulator (Item 20). The 25 Litre accumulator is mounted on the second manifold (Item 30) and has a nitrogen gas precharge of 90 Bar.

Fitted on the second manifold is the Hydraulic System Isolating Valve. This is made up of a cartridge valve (Item 17) with a cover plate (Item 18) and a directional control valve (Item 19).

To operate the simulator the directional control valve (Item 19) must be energised, this allows oil through a restrictive orifice and slowly opens the cartridge valve, allowing oil to pass through to the cylinder manifolds. This orifice achieves a "soft start" and prevents any sharp movements at the beginning of the ride.

A pressure switch will detect when there is pressure to the cylinder manifolds. This pressure switch (Item 26) is situated on the second manifold.

Each simulator has three identical cylinder manifolds (Item 31) which comprise of a proportional control valve (Item 25), a cartridge check valve (Item 21) and a solenoid operated cartridge valve (Item 22).

For the cylinders to operate the solenoid valve must be energised, otherwise the oil will drain back to tank. An orifice (Item 28) before this valve controls the rate at which the oil drains out of the

cylinders, and therefore prevents the simulator from falling sharply.

To shut down the ride in normal operation the cylinders are brought down to their park position using the proportional valves. The directional control valve (Item 19) is then de-energised and this closes the cartridge valve, shutting off the oil to the cylinder manifolds. The relief valve (Item 16) is de-energised allowing the oil to circulate through the cooler. Opening this valve also allows the oil in the accumulator to gently drain back to tank via the orifice in the check valve (Item 27). The Solenoid cartridge valve (Item 22) will be de-energised when at rest.

To lower the ride in an emergency condition the directional control valve (Item 19) closes (de-energise) and the pressurised oil in the accumulator rapidly shuts the cartridge valve (Item 17). Meanwhile the solenoid cartridge valve (Item 22) opens, lowering the cylinder by draining the oil back to tank. The power unit shuts down and the relief valve (Item 16) de-energises allowing all of the oil in the system to drain back to tank.

4.9 Pneumatic System

The pneumatic system provides the motive power to lift, close, and lock the two simulator doors. The operation of the doors is controlled by signal from the ride computer. The signals operate ISO 1 single solenoid valves (5), which in turn operate a double-acting cylinder (1) attached to the door. When the doors are closed they are held in position by two vacuum cups (19). The vacuum generator (20) is operated by solenoid valve SV2 (26).

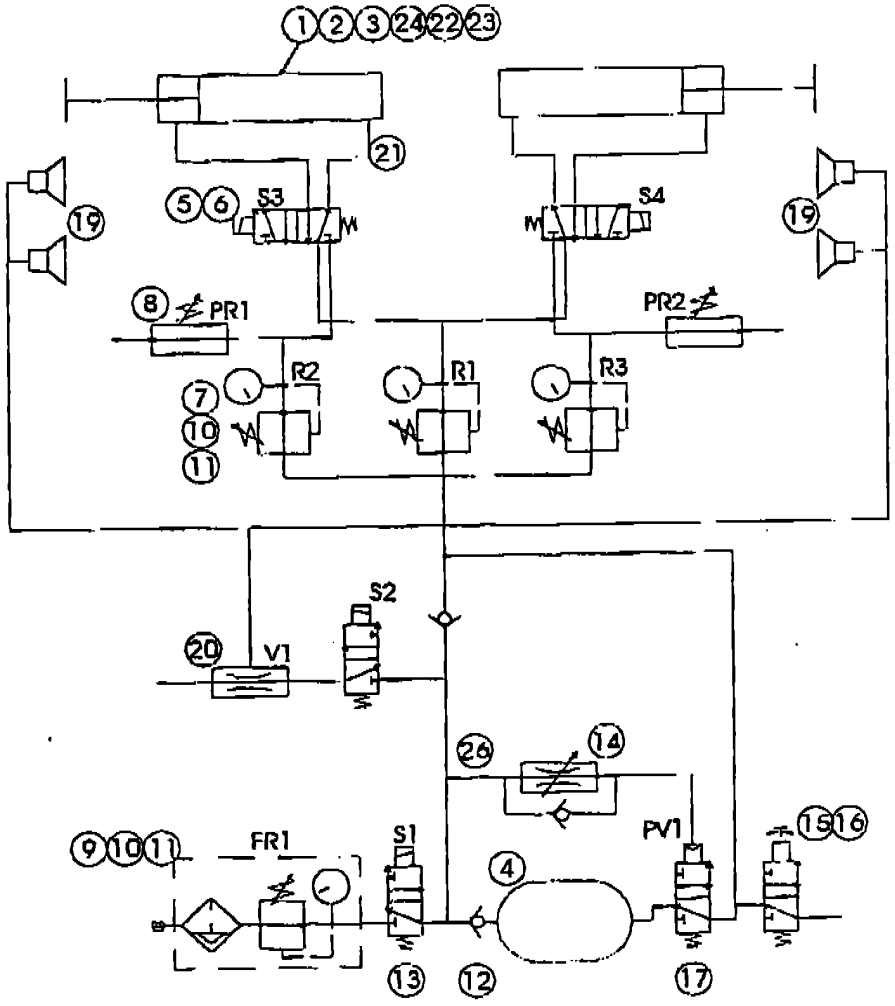


FIGURE 4.24 Pneumatic Circuit Diagram

Item	Description	Comment
1	Cylinder	63mm bore x 940mm stroke
2	Rear trunnion	
3	Spherical rod end mounting	
4	Reservoir	
5	ISO 1 valve	
6	ISO 1 sub base	
7	Regulator	
8	Pressure relief valve	
9	Filter-regulator	
10	Port block kit	
11	Wall mounting kit	
12	Non-return valve	
13	Dump valve	
14	Flow control	
15	Valve body	
16	Actuator	
17	Valve	
18		
19	Vacuum cup	
20	Vacuum generator	
21	Braided hose	5/16" ID
22	Hose adaptors	
23	M/F adaptor	
24	Pivot bracket	With swivel bearing
25	Valve	
26	Solenoid valve	

The air supply is provided from the compressor through a filter-regulator (9) and dump valve SV1 (13) to a reservoir (4). The valves are supplied from the reservoir through regulator R1. The reservoir provides a sufficient volume of air to enable the doors to be opened in an emergency.

In its normal rest state the valves are not actuated and the doors are in the open position. In order to close the doors, the cylinder control valves SV3 and SV4 are actuated. The normal exhaust ports of the valves are fed with low pressure air from a secondary regulator R2 or R3 (7) connected to pressure valves PR1 or PR2 (8). If the door encounters an obstruction during the closing cycle then the balancing pressure "stalls" the door until the obstruction is removed. When free to move, the door will then complete the closing cycle under control. If the

obstruction is not removed then the system controller will "time-out" and the doors will open automatically.

Chapter 5 Maintenance

Table of Contents

5.1 Recommended servicing schedules

In order to ensure optimum safety, performance, and maximum availability of the machine it is essential that preventive maintenance procedures are performed regularly by competent personnnel.

This section contains the master servicing schedule and the associated reference procedures that are required to maintain the Morphis motion simulator.

Some maintenance actions, noted in the text, require special tools or training, only available from Camber Entertainment or their authorised agents. Please note that there are several functional modules within the system that are not recommended for field repair and must be exchanged as a module.

All maintenance actions must be recorded in section 7 of this manual. These records must be completed and be available for inspection by Camber Entertainment or their authorised agents to ensure compliance with the warranty conditions.

The following tables detail the schedules of inspections and recommended maintenance actions to ensure the maximum availability of the simulator.

5.1.1 Power Distribution

Section	Description	Daily	Weekly	Month	6-month	12-month
5.3.1	Check security of all internal connections				■	
5.3.2	Check cabinet water seal				■	
5.3.3	Check condition of main isolator			■		
5.3.4	Check operation of RCB unit			■		

5.1.2 Hydraulic System

Section	Description	Daily	Weekly	Month	6-month	12-month
5.4.1	Inspect hoses and cylinders for leaks		■			
5.4.2	Check level of hydraulic oil	■				
5.4.3	Check oil for contamination					■
5.4.4	Check pressure filter condition indicator	■				
5.4.5	Change pressure filter element				■	
5.4.6	Check operation of hydraulic reservoir low-level float switch					■
5.4.7	Change hydraulic oil suction filter				■	
5.4.8	Clean oil cooler matrix surfaces				■	
5.4.9	Check motor rubber vibration mounts				■	
5.4.10	Check security of mounting bolts				■	

5.1.3 Pneumatic System

Section	Description	Daily	Weekly	Month	6-month	12-month
5.5.1	Visually inspect condition of external flexible pipe work		■			
5.5.2	Check the filter/regulator drain		■			
5.5.3	Drain compressor unit receiver	■				
5.5.4	Check on-board regulator (centre) for correct pressure (8 bar)			■		
5.5.4	Check on-board regulator (Left-hand) for correct pressure (4.5 bar)			■		
5.5.4	Check on-board regulator (Right-hand) for correct pressure (4.5 bar)			■		
5.5.5	Clean the compressor filter			■		
5.5.5	Change the compressor filter				■	
5.5.6	Change compressor pump oil					■
5.5.7	Clean the compressor pump matrix			■		
5.5.8	Check condition of receiver hose				■	
5.5.9	Check condition of the vacuum cups		■			
	Check operation of System Exhaust key switch		■			

5.1.4 Air Conditioning System

Section	Description	Daily	Weekly	Month	6-month	12-month
5.6.2	Empty water trap	■				
5.6.1	Clean/change air blower inlet filter element			■		
5.6.2	Clean condenser cooling surfaces			■		

5.1.5 Control Console

Section	Description	Daily	Weekly	Month	6-month	12-month
5.7.1	Check operation of Emergency Stop buttons	■				

5.1.6 Steps and Surround

Section	Description	Daily	Weekly	Month	6-month	12-month
5.8.1	Check security and condition of handrails		■			
5.8.2	Check gap between step and platform	■				
5.8.3	Check condition of access doors and locks		■			

5.1.7 Capsule

Section	Description	Daily	Weekly	Month	6-month	12-month
5.9.2	Check the operation of the Emergency stop switches			■		
5.9.3	Check the air conditioner/air chiller output	■				
5.9.4	Check the projector image alignments		■			
5.9.5	Clean the projector screen			■		
5.5.9	Check condition of the vacuum cups		■			
	Check tightness of capsule/motion base bolts			■		
	Check security of door cylinders		■			

5.1.8 Motion Base

Section	Description	Daily	Weekly	Month	6-month	12-month
5.1.2	Visually inspect all pipework, actuators, and fittings for leaks and security		■			
6A.1.2	Grease the Linear bearing assembly			■		
6A.1.3	Grease the Universal joint assembly			■		
6A.1.4	Grease fixed Pivot Bearing assemblies			■		
6A.1.5	Inspect all mechanical fixings and Pivot pin lock nuts for security		■			
6A.1.6	Check tightness of all anchor bolts (60Nm)					■
6A.1.7 - 6A.1.10	Check that all electrical connectors are secure				■	

5.2 Service Tooling requirements

5.2.1 Recommended Service tools

• Digital Multimeter	1
• VGA monitor & compact keyboard	1
• Electronic soldering station	1
• Screwdrivers - various engineers'	1 set
• Torque wrench 0-100 Nm	1
• Torch - rechargeable	1
• Combination pliers	1
• Side cutters	1
• Wire strippers	1
• Crimp tool	1
• Grease gun	11
• Insulation tape	1
• Screwdrivers - electrician's, insulated blades	1
• Allen keys (metric set)	1
• Allen key (imperial)	1
• Adjustable wrenches (large and small)	1 set
• Plastic screwdriver kit	1
• Current clamp	1
• First aid kit	1

5.2.2 Consumable Materials

- Rocol 1000 grease
- Hydraulic oil - mineral ISO 32

5.2.3 Recommended Threaded Fastener Tightness Torques

Size	Torque (Nm)	Torque (lb.ft)	Spanner size (mm)
M4	1.7	1.2	7
M6	9.5	7	10
M8	23	17	13
M10	44	34	17
M12	80	58	19
M16	200	145	24
M20	385	285	32

5.3 Power Distribution system

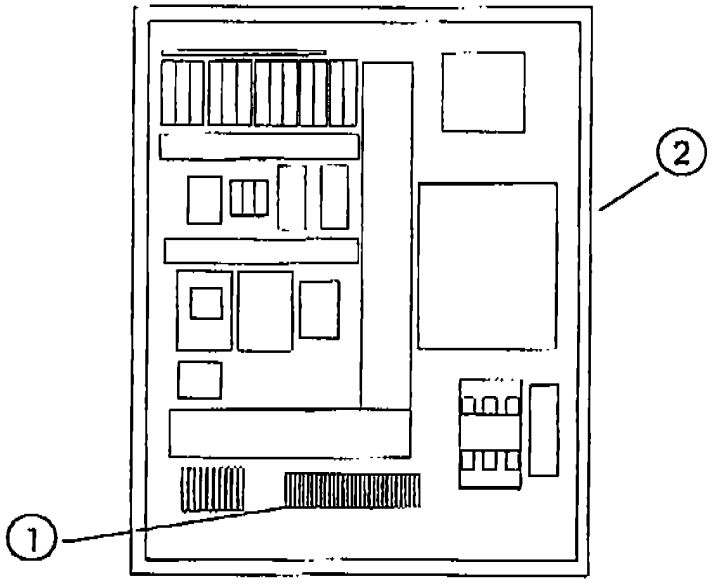


FIGURE 5.1 Power Distribution Enclosure

WARNING

Voltages exist inside the enclosure that can kill. Work inside the power distribution enclosure should always be carried out by competent trained personnel.

5.3.1 Check security of internal connections

Check the security of all connections in the connector strip (1). Ensure that there are no loose wires or degradation of any insulation. Check the security of the main power distribution cable terminals.

5.3.2 Check cabinet water seal

The enclosure is protected to IP55. In order to maintain this protection, the door seal (2) must be undamaged. Clean the seal and the sealing surface. Look for any signs of surface degradation of the seal material, or any cracks or tears in the sealing surface. Replace the seal if necessary.

5.3.3 Check condition of main Isolator

The main isolator must prevent the enclosure door from opening when it is switched on. Ensure that this locking mechanism is undamaged and working correctly. Check the tightness of the connections to the isolator.

5.3.4 Check operation of RCD unit

The RCD unit has a self-test function. This is used as follows:

1. With the system operating normally, ensure that there are no passengers in the capsule or in the surrounding area.
2. Press the RCD test button. The power input should switch OFF.
3. Switch OFF the compressor, chiller, and control rack.
4. Switch OFF the main isolator and reset the RCD unit.
5. Switch ON the main isolator.
6. Complete the standard power-up sequence. Command the system to complete a full ride sequence to ensure that all systems are fully operational.

5.4 Hydraulic System

WARNING

A SYSTEM FITTED WITH AN ACCUMULATOR CAN STILL OPERATE WHEN THE PRIME MOVER IS SWITCHED OFF. THE FLUID MUST THEREFORE BE EVACUATED FROM THE ACCUMULATOR BEFORE ANY REPAIRS OR MAINTENANCE OPERATIONS ARE UNDERTAKEN

5.4.1 Inspect hoses and cylinders for leaks

FIGURE 5.2 Motion Base Hydraulics

Visually inspect for leaks. With unit running, i.e. electric motor, confirm the air cooler fan (Item 13) is rotating and that the temperature is normal. Check the noise level, and for the presence of any unusual noises. Inspect all pipework and hoses underneath the simulator.

Tubing should be checked at regular intervals for leaks and clip damage. Any leaks discovered in the tube couplings must be sealed at once. It is also important to make sure that the tube clamps are completely intact. Defective clamps may cause vibrations in the tubing, which may lead to tube failure or leaks in the tube couplings.

Pipework should be checked for damage, mountings should be checked, ensuring that the

pipe is secure and producing little vibration. All fittings should be inspected for leaks.

5.4.2 Check level of the hydraulic oil

FIGURE 5.3 Oil Level Inspection Port

Visually inspect the oil level (Item 06). If fluid losses are observed, the cause must be traced and rectified. Always top up with the fluid specified by Camber Entertainment.

5.4.3 Check oil for contamination

A self seal coupling and a small hose is needed for this operation, as well as 2 containers, one used for the sample oil, the other used for oil to be put back into the tank. The power unit needs to be running, but "off-load", i.e. the relief valve (Item 16) de-energised.

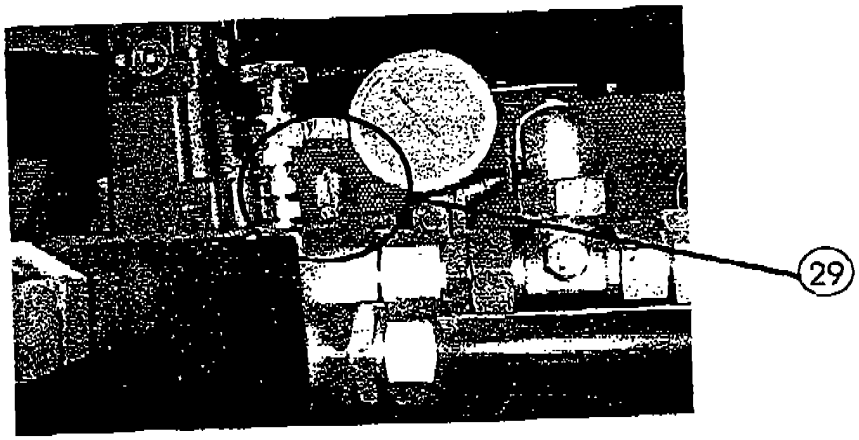


FIGURE 5.4 Hydraulic oil test point

1. Hold the end of the hose in the first container and slowly wind in the coupling on to the test point 1, in manifold (Item 29).
2. When the first container is half full, swap to the second.
3. Continue collecting the sample until the second container is nearly full, then unwind the coupling.
4. Seal the second container and send away for analysis. It should meet the specification of ISO 16/13.
5. Pour the first sample container back into the tank via the filler breather.

If there is difficulty in identifying a suitable laboratory to carry out this analysis then please contact Camber Entertainment or its local agent for assistance.

5.4.4 Check the pressure filter condition indicator

The filter elements in the unit should be changed for the first time after commissioning. Subsequent changes are to be made at intervals determined according to service conditions. About 500 hours is a common interval. In the event of alterations or repairs, the elements must be replaced after a further 50 hour's service. During normal operation if a filter indicator shows that the by-pass is in operation a warning light will illuminate and the power unit will not operate. The element should be replaced immediately.

The air and filler breathers (Items 8 & 7 respectively) should also be changed at the same time as a change of the manifold mounted filter's (Item 12) element. The filler breather and the suction strainer (Item 09)

should also be replaced whenever the oil is changed to prevent contamination of the new fluid.

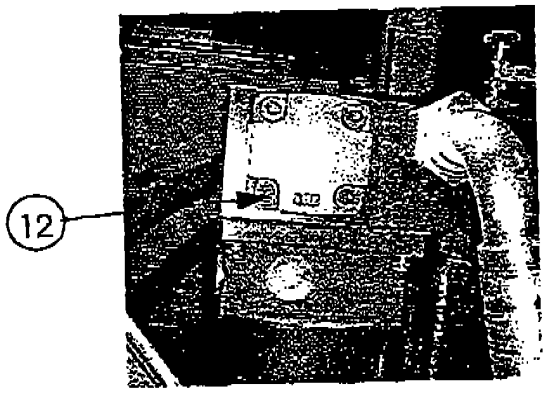


FIGURE 5.5 Pressure Filter Condition Indicator

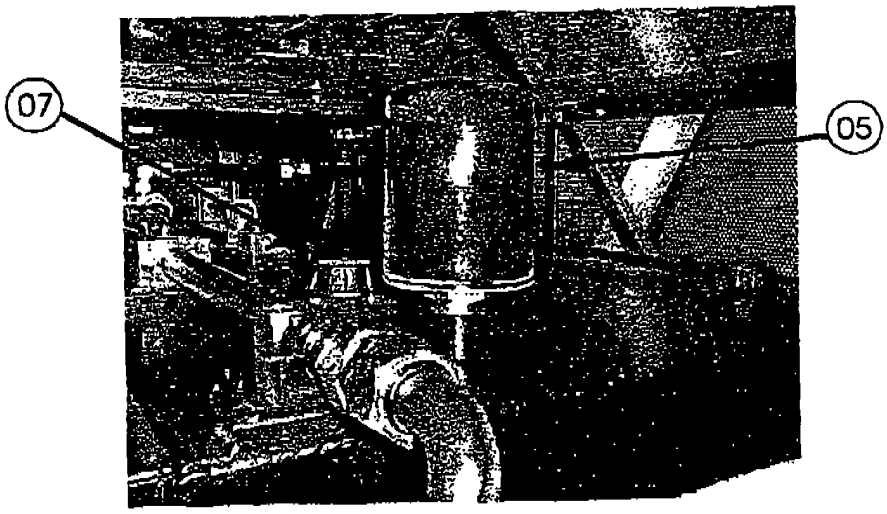
1. With unit running, inspect the bypass indicator on the filter head (Item 12). - If the indicator is green then the condition if the filter is good. If the filter is indicating amber or red then the unit may stop running at any time due to the electrical cut-off on the filter; change the filter as described in section 5.4.5 .

5.4.5 Change Pressure Filter Element and breathers.

FIGURE 5.6 Pressure filter and breathers

1. Ensure that the hydraulic system is switched off and that the pipework is de-pressurised.
2. With a suitable spanner unscrew the bowl from the filter head, (Item 12) revealing the element.
3. Grasp the element and pull downwards with a slight twisting movement to remove.
4. Discard the used element and check the head and bowl for damage.
5. Clean inside the bowl with a cleaning agent - do not use cloth or paper towels.
6. Check that the appropriate seal is fitted to the element, lubricate with oil and replace the element in the filter head.
7. Check the condition of the head to bowl seal, replace if necessary, lubricate and refit the bowl to the head.

8. Unscrew and discard the air breather (Item 05). Replace with a new item.



9. Remove the filler breather (Item 07) using a suitable screwdriver and discard it. Replace with a new unit.
10. Switch ON the system and inspect the filters for leaks.

5.4.6 Check operation of hydraulic reservoir low-level float switch

The hydraulic reservoir is fitted with a switch to indicate that the fluid level is adequate. The switch is situated on the top of the tank as shown below, Figure 5.7.

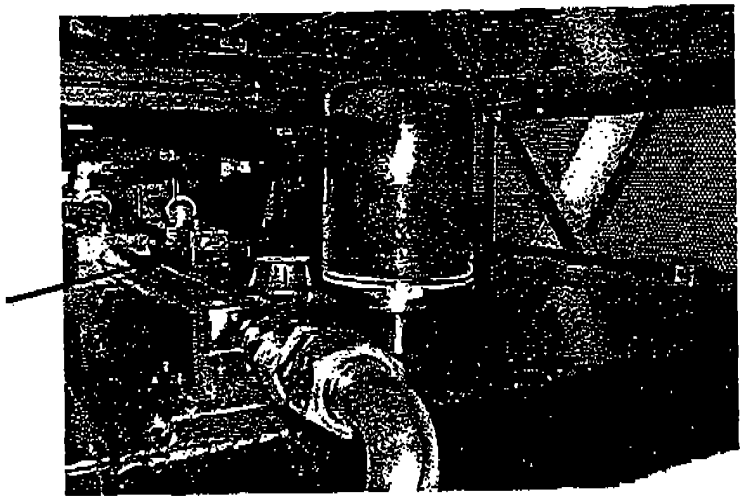


FIGURE 5.7 Hydraulic reservoir float switch

The protection circuit can be tested in two ways: by a partial test of the control circuit or a full test that includes the switch.

To perform a test of the control circuit, simply disconnect the float switch when the power-pack is running. The motor will stop and an error indicator will illuminate on the operator control panel.

To test the switch itself, it is necessary to remove the switch from the reservoir.

1. Switch off the power-pack.
2. Disconnect and remove the float switch.
3. Reconnect the float switch and either manually lift the float, or invert the switch to operate the switch.
4. Switch on the power-pack.
5. Manually move the float of the switch until the motor of the power-pack stops as above.
6. If the motor does not stop, then check the operation of the circuit by disconnecting the switch. If the motor stops then the switch is faulty and must be replaced. If the motor does not stop then the protection circuits are faulty and must be rectified.
7. Ensure that the power-pack is switched off.
8. Disconnect and replace the float switch.
9. Reconnect the switch, restart the pump and resume normal operation.

5.4.7 Change hydraulic oil suction filter

The suction filter (Item 9 on the hydraulic circuit diagram, Figure 4.23) can be accessed via the inspection covers. It should be changed when there is a overhaul of the system and the oil is changed. Overhauls are commonly carried out at intervals of 1-5 years, subject to yearly oil sample analysis.

Cleanliness must be observed during overhauls.

5.4.8 Clean oil cooler cooling surfaces

The air cooler must be checked to ensure its fan is running properly. The cooler is running normally if the expelled air feels warm. The matrix should be checked for damaged and cleaned if clogged.

5.4.9 Check motor rubber anti-vibration mounts

The power-pack is fitted with rubber anti-vibration mountings which require inspection at regular intervals.

5.4.10 Check security of anchor bolts

The hydraulic power-pack is secured to the concrete slab by four chemical anchors which should be torque checked every six months.

5.5 Pneumatic system

WARNING

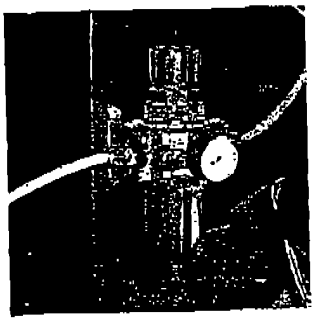
STOP THE COMPRESSOR AND ISOLATE FROM MAINS ELECTRICAL SUPPLY. LOCK THE ISOLATOR IN THE OFF POSITION. FIT A SAFETY NOTICE TO THE ISOLATOR ADVISING THAT WORK IS BEING CARRIED OUT ON THE COMPRESSOR.

CLOSE THE AIR OUTLET VALVE TO ISOLATE THE COMPRESSOR FROM THE AIR-LINE SYSTEM. FIT A SAFETY NOTICE TO THE VALVE ADVISING THAT IT IS NOT TO BE OPENED.

5.5.1 Visual Inspection

Make a visual check of the compressor, receiver, electrical control box and the interconnecting pipework. Watch for signs of leakage and wear, especially on flexible braided hose. Ensure that the components are mounted securely and are not subject to abrasive contact with any mechanical parts.

5.5.2 Check the filter/regulator drain



The regulator is normally set to 8 bar. Drain the filter bowl as appropriate.

FIGURE 5.8 Filter/Regulator Drain

5.5.3 Drain the compressor unit receiver

1. Wait for air-end vent down cycle to finish.
2. Position a suitable container beneath the condensate drain valve.

WARNING

THE AIR RECEIVER IS PRESSURISED, TAKE GREAT CARE WHEN CARRYING OUT THE NEXT OPERATION. DO NOT ALLOW ANY COMPRESSED AIR JETS TO MAKE CONTACT WITH YOUR BODY.

3. Carefully open the drain valve and allow the pressure to fall slowly to zero. Collect all condensate drained from receiver.

Note: Condensate may contain traces of oil and must be disposed of in an approved manner.

4. Close the drain valve and open air outlet valve.
5. Switch on the compressor and ensure that there are no air leaks.

CAUTION

Note: if the compressor fitted is a continuous-run unit, then there is a possibility that if it is stopped and started within a short time period that the motor will stall. Always allow at least four minutes between stopping and starting the unit to allow residual internal pressures to drain.

5.5.4 On-board regulators

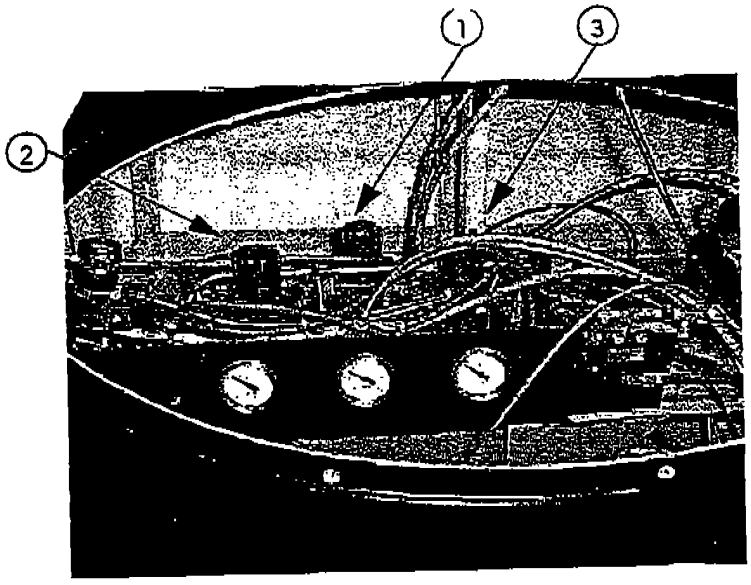


FIGURE 5.9 Regulator Panel

Set the regulators to the pressures as shown in the table below:

Item	Description	Function	Pressure
1	Centre Regulator	Supplies the air pressure for the door cylinders	8 bar
2	Left Regulator	Cushioning pressure for left-hand door closing	4.5 bar
3	Right Regulator	Cushioning pressure for right-hand door closing	4.5 bar

5.5.5 Clean the compressor air filter

The air filter is located beneath the filter cover (A). The cover (A) slides over the adapter and pipe (B).

1. Wait until air-end vent down cycle is complete.
2. Open the test valve to vent pressure from the receiver and associated pipework.
3. Check that air-end pressure gauge reads zero.

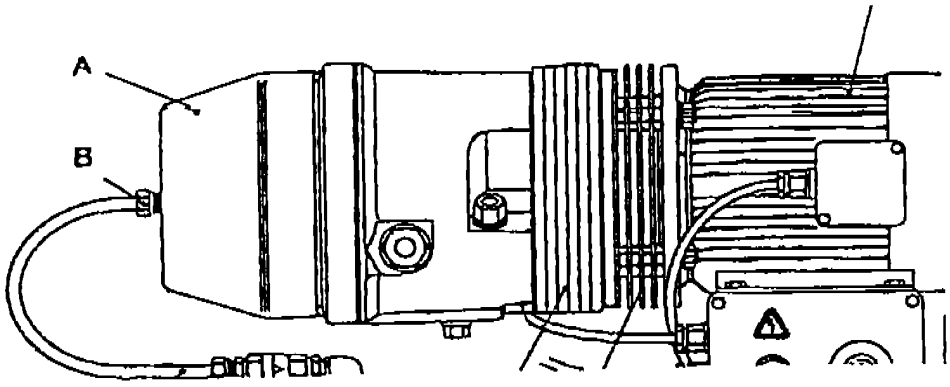


FIGURE 5.10 Compressor filter unit

WARNING

DO NOT PROCEED UNTIL GAUGE READS ZERO

Note: PURS compressors. If pressure gauge does not fall to zero then the non-return valve may be faulty.

4. Remove pipe (B).

WARNING

IF ANY AIR ESCAPES BEFORE OUTLET PIPE OR VALVE ARE FULLY REMOVED STOP! AIR-LINE IS PRESSURISED! DO NOT REMOVE UNTIL ALL PRESSURE IS LOST. DO NOT ALLOW ANY COMPRESSED AIR JETS TO MAKE CONTACT WITH YOUR BODY

5. Firmly pull the cover (A) to remove from the separator casing.
6. Unclip the air filter (D) and the filter support (E).
7. Clean the separator casing and the inside of the cover.
8. Vacuum clean or blow dust out of the filter using low pressure, clean dry air. Renew the filter if it cannot be cleaned satisfactorily.

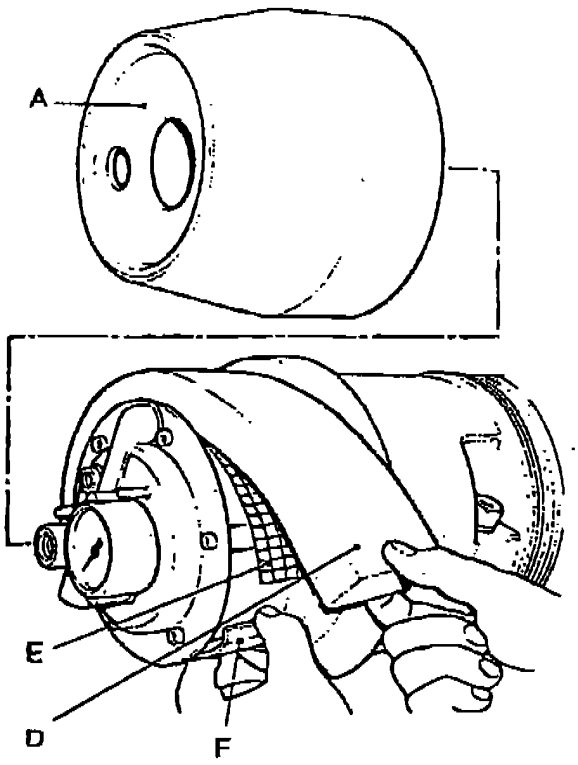


FIGURE 5.11 Compressor Air Filter

9. Relocate the filter support (E), refit the air filter (D) and secure both ends using spring clip (F).
10. Refit the cover (A).
11. Test run the compressor and ensure that there are no air leaks.

5.5.6 Change Compressor Pump Oil

1. Switch OFF the compressor and isolate it from mains electrical supply.

WARNING

LOCK THE ISOLATOR IN THE OFF POSITION. FIT A SAFETY NOTICE TO THE ISOLATOR ADVISING THAT WORK IS BEING CARRIED OUT ON THE COMPRESSOR.

CLOSE THE AIR OUTLET VALVE TO ISOLATE THE COMPRESSOR FROM THE AIR-LINE SYSTEM. FIT A SAFETY NOTICE TO THE VALVE ADVISING THAT IT IS NOT TO BE OPENED.

2. Wait until the air-end vent down cycle is complete.
3. Check that the air-end pressure gauge reads zero.

Note: PURS compressors. If pressure gauge does not fall to zero then the non-return valve may be faulty.

4. Drain the air receiver following procedure 5.5.3 . Do not reopen air-outlet valve.

WARNING

DO NOT PROCEED UNTIL GAUGE READS ZERO

5. Carefully unscrew the oil filler plug (A), Figure 5.12.

WARNING

IF ANY AIR OR OIL ESCAPES BEFORE THE PLUG IS FULLY REMOVED THEN STOP - THE COMPRESSOR AIR-END IS PRESSURISED. DO NOT REMOVE THE PLUG UNTIL ALL PRESSURE IS LOST. DO NOT ALLOW ANY COMPRESSED AIR JETS TO MAKE CONTACT WITH YOUR BODY.

6. Remove the drain plug (D) and allow the oil to drain into a suitable container.

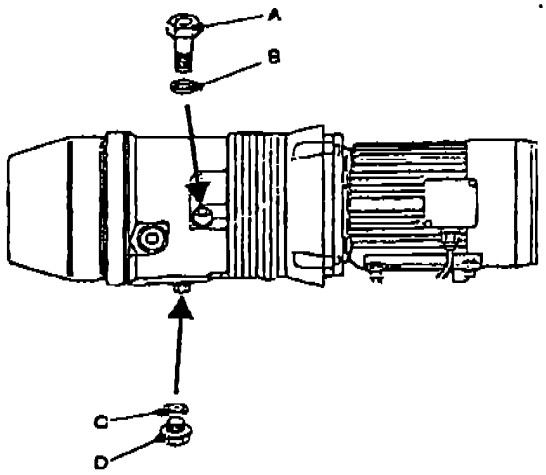


FIGURE 5.12 Drain and Filler plugs

7. Seal the container and dispose of the oil in an approved manner.
8. Inspect the bonded seal of the drain plug (C) and replace if necessary.
9. Clean the sealing face and replace the drain plug with seal (C, D). Tighten to a torque of 25 Nm.
10. Fill to overflow with an approved oil (e.g. Fluid Force 2000)
11. Examine the filler plug bonded seal (B). If it is not damaged then refit the seal to the filler plug (A). If it is damaged them it must be replaced.
12. Refit the seal and filler plug, tighten the plug to 25 Nm.
13. Test run the compressor and ensure that there are no air or oil leaks.
14. Remove safety notices.

5.5.7 Clean the Compressor pump matrix

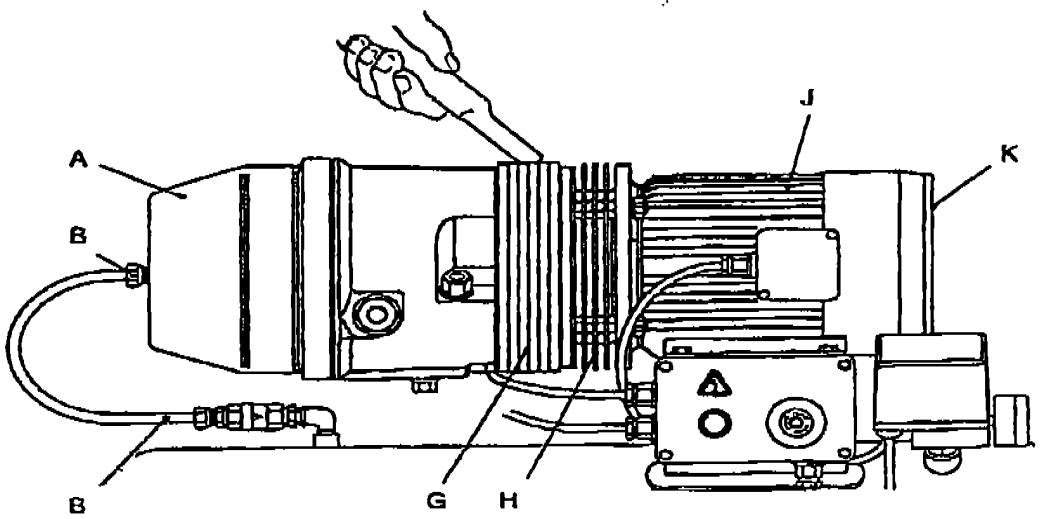


FIGURE 5.13 Compressor Pump Matrix

1. Close the air-outlet valves.
2. Switch off the compressor at the main isolator.
3. Carefully vacuum clean the oil cooler matrix (G) and guard rings (H).
4. Vacuum clean or blow dust from the motor (J) and motor grill (K), using low pressure, clean dry air.
5. Open the air-outlet valves.

6. Turn the main electrical supply on. Test run the compressor.

CAUTION

Note: if the compressor fitted is a continuous-run unit, then there is a possibility that if it is stopped and started within a short time period that the motor will stall. Always allow at least four minutes between stopping and starting the unit to allow residual internal pressures to drain.

5.5.8 Check condition of the receiver hose

Visually inspect the hose connecting the air compressor and the air receiver. Watch for any deterioration of the hose material which could lead to leaks. Check the security of the end connections to the receiver and compressor.

5.5.9 Check the condition of the vacuum cups

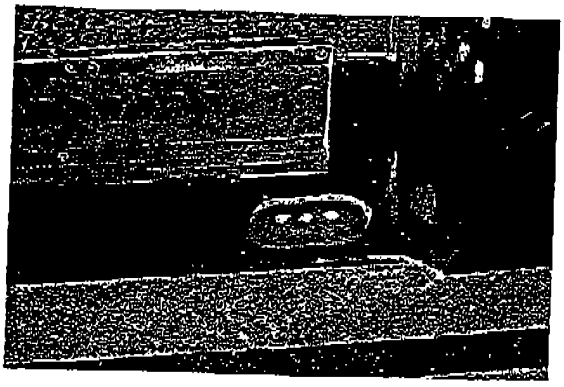


FIGURE 5.14 Vacuum Cups

Each door is held shut during the ride by two vacuum cups fitted to the capsule at the bottom of each door aperture. Ensure that the surface of each cup is clean, undamaged, and free from debris.

5.6 Chilled air system

5.6.1 Cleaning and Changing the Blower Inlet Filter Element

Remove the air filter and check whether it is clogged with dust. If it is dirty then clean it using a vacuum cleaner. Rinse it in a tray of cold or lukewarm water.
If the filter is extremely dirty then wash it in a neutral detergent. Ensure that the filter is rinsed well in clean water.
Dry the filter naturally before re-installing it and running the system.

5.6.2 Cleaning the Condenser cooling surfaces

Check the evaporator and condenser for dirt and clogging. If they are dirty or clogged, wash them with a high-pressure washer.

There is a water trap fitted to collect condensate. Note that the 50 Hz model is also fitted with a level sense switch that will inhibit operation of the chiller if the trap water level is high. Enure that the water trap is empty before operating the chiller.

The trap should be emptied daily:

1. Switch OFF the chiller.
2. Remove and drain the condensate tray.
3. Switch ON the chiller.

5.7 Control Console

5.7.1 Check the operation of the Emergency Stop

The Emergency Stop switch is situated on the Operator panel on the top of the control rack.

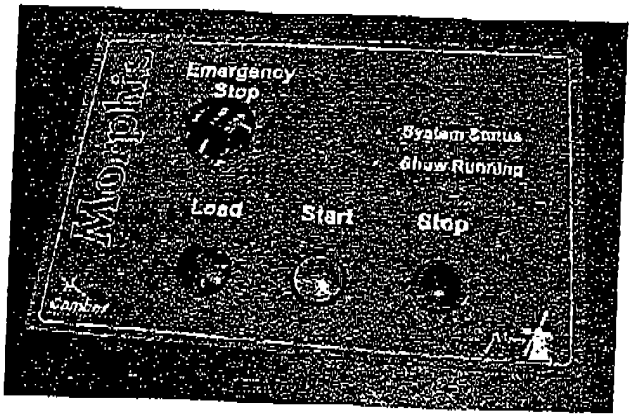


FIGURE 5.15 Emergency Stop switch

Please refer to the emergency stop testing procedure contained within the Operations section of this manual.

5.8 Steps and Surround

5.8.1 Check the handrails

Visually check the security and condition of the handrails on each side of the simulator enclosure. Check that all supports are secure and that there are no sharp edges that can cause injury to passengers.

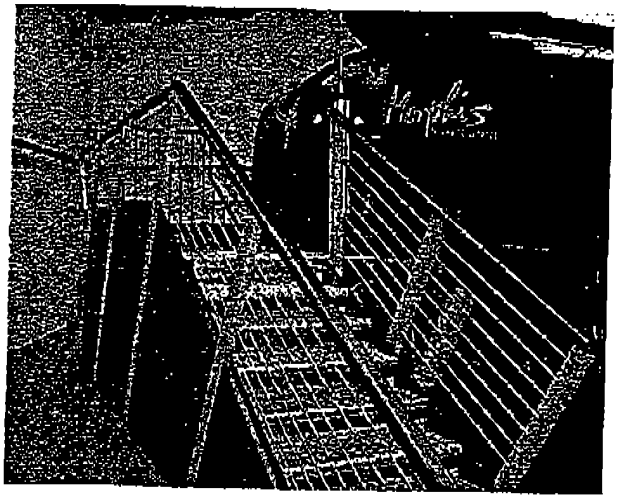


FIGURE 5.16 Enclosure Handrails

5.8.2 Check gap between step and platform

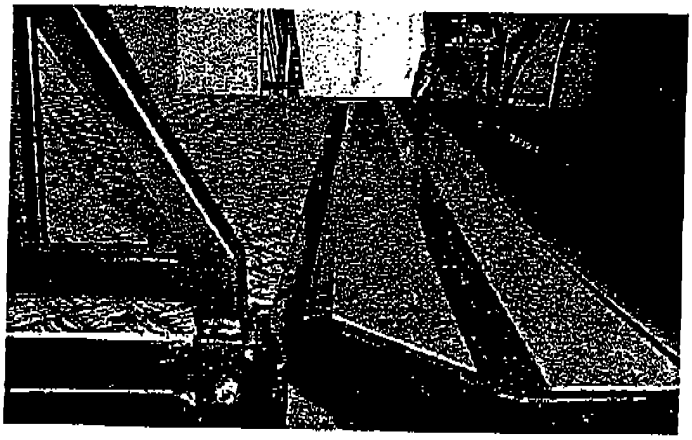


FIGURE 5.17 Capsule/Treadplate gap

The gap between the capsule step and the platform should be equal (nominally 20mm) on each side of the capsule. This dimension is preset during installation.

WARNING

If the dimension is unequal then do not use the simulator. Contact Camber Entertainment Systems for advice.

5.8.3 Check condition of access doors and locks

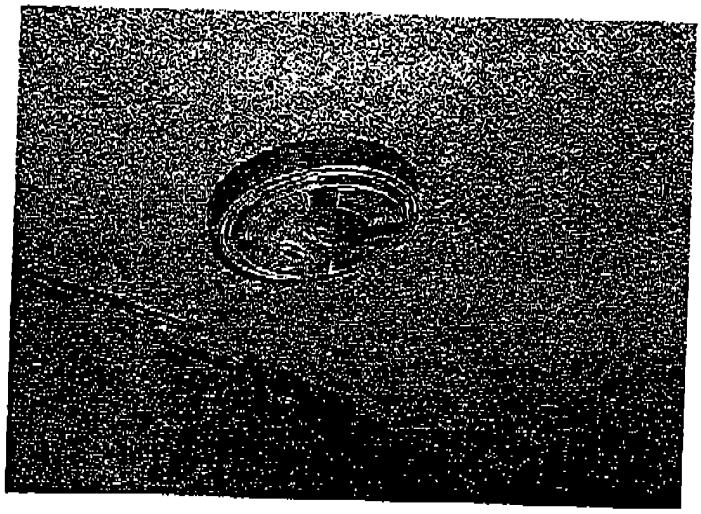
The enclosure doors should be examined for wear and damage. Any sharp edges should be removed or repaired to prevent injury. All locks should operate correctly. Repair as necessary.

WARNING

Do not operate the system if the enclosure doors cannot be secured against unauthorised entry.

5.9 Capsule

5.9.1 Check operation of the smoke detector



1. Check that the LED operating light flashes approximately every 45 seconds.
2. Press and hold the test button until the alarm sounds.

Note: It may be necessary to press the test button for up to 20 seconds for an alarm to sound.

An alarm is indicated by a loud pulsating sound. An alarm may continue to sound for up to 3 seconds after the button is released. Pressing the test button activates the relay after 12 seconds.

Note: The electronic test button provides a comprehensive test of the functionality of the unit. DO NOT ATTEMPT to test using a naked flame as this in itself could pose a potential fire hazard.

3. Determine that the smoke alarm triggers the alarm circuit in the system controller.

Note: Pressing the test button activates the relay after 12 seconds and it may take up to 5 seconds for the system controller alarm circuit to receive the alarm signal.

4. Vacuum clean the unit every six months to help keep the unit working effectively.

FALSE ALARMS

Abnormal air conditions may cause the highly sensitive smoke alarm to give a "false" alarm. DO NOT DISCONNECT THE POWER SUPPLY.

If no fire is apparent, ventilate the room.

WARNING: IF THERE IS ANY QUESTION AS TO THE CAUSE OF AN ALARM, ALWAYS ASSUME THAT THIS IS DUE TO AN ACTUAL FIRE AND FOLLOW YOUR EMERGENCY PLANS. DO NOT ASSUME THAT THE ALARM IS A NUISANCE ALARM.

DUST CAN LEAD TO EXCESS SENSITIVITY. VACUUM CLEAN AS RECOMMENDED ABOVE.

DO NOT PAINT THE UNIT

5.9.2 Check the operation of the Emergency Stop switches

Please refer to the startup checks in the Operations section of this manual

5.9.3 Check the air conditioning/air chiller output

The air supply is directed into the capsule through two flexible pipes. There are two points of entry to the capsule. Check that the airflow is present and sufficient to maintain the desired temperature in the capsule. Check also that the flexible pipes are not damaged.

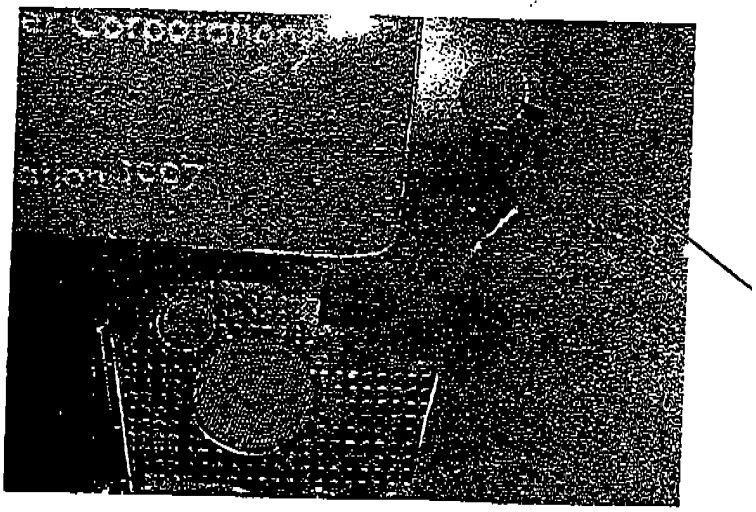


FIGURE 5.18 Cold air entry point

5.9.4 Check the projector image alignments

Please refer to the Barco manual as supplied.

5.9.5 Clean the Projector Screen

1. If the screen is only slightly dusty, remove the dust with a feather duster or similar. A vacuum cleaner can be used, provided that the mouthpiece of the nozzle is protected by bristles which are firm enough to protect the screen from the nozzle but not too stiff so that they scratch the surface. The brush must be moved in the direction of the grooves, i.e. up and down on the front (lenticular profile) and on the back in circular movements from the centre (Fresnel profile).

   If the dirt on the screen cannot be removed by vacuuming,e.g. stains from fingers, then the screen should be cleaned with normal window cleaner containing ammonia (NOT alcohol). The whole screen must be treated otherwise a difference will appear between treated and untreated areas.

CAUTION

Never use cleaning agents with solvents as these may destroy the screen. Also, never rub hard or persistently on the screen in order to remove stains, as this will cause deformations in the surface which will appear as stains. If the cleaning agent requires dilution, use only lime-free water.

2. Moisten a paint pad (not a brush) with the cleaning agent until the pad is lightly moistened. Moving the pad in the direction of the profile as described above, apply the cleaning agent to the screen.
3. When the liquid has been distributed and worked well into the grooves, the screen must be wiped dry. Use a dry paint pad, and wipe in the direction of the profile until the screen is dry. If the pad becomes too wet, then dry it or replace it before continuing. It is important that the screen is completely dry after treatment.
4. Repeat the treatment if required.
5. In order to dry the screen completely, a hair dryer can be used. Use a low heat setting, and maintain a separation distance between the screen and the dryer such that the screen does not overheat. Special caution is advised with black stripe screens that may deform and buckle at high temperatures.

Chapter 6 Maintenance Records

Table of Contents

All maintenance records must be recorded on the following forms to provide an accurate account of the machine history. The majority of the records are routine inspections, any non-scheduled actions should be recorded on the appropriate section.

6.1 DAILY AND WEEKLY CHECKSHEET

System Serial Number- - - - - - - - - - - Date week commencing - - - - - - - -

6.1.1 DAILY CHECKS

Ref	Description	M	T	W	T	F	S	S
5.4.2	Check level of hydraulic oil							
5.4.4	Check pressure filter condition indicator							
5.5.3	Drain compressor unit receiver							
5.7.1	Check operation of Emergency Stop							
5.8.2	Check gap between step and platform							
5.9.3	Check the air conditioner/air chiller output							

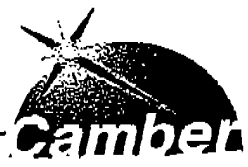
6.1.2 WEEKLY CHECKS

Ref	Description	Date	Sig
5.4.1	Inspect hoses and cylinders for leaks		
5.5.1	Visually inspect condition of external flexible pipe work		
5.5.2	Check the filter/regulator drain		
5.5.9	Check condition of the vacuum cups		
-	Check operation of System Exhaust key switch		
5.8.1	Check security and condition of handrails		
5.8.3	Check condition of access doors and locks		
5.9.4	Check the projector image alignments		
-	Check security of door cylinders		
-	Check security of lighting strips (Floor/roof panel)		
5.1.2	Visually inspect all pipework, actuators, and fittings for leaks and security		
5A.1.5	Inspect all mechanical fixings and Pivot pin lock nuts for security		

6.1.3 Notes

Date	Comments	Signature

Date	Comments	Signature



6.2 MONTHLY MAINTENANCE

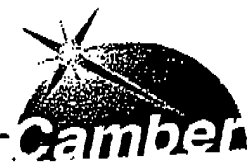
System Serial Number- - - - - - - - - - - - Service Year commencing - - - - - - -

Ref.	Description	1	2	3	4	5	6	7	8	9	10	11	12
5.3.3	Check condition of main isolator												
5.3.4	Check operation of RCB unit												
5.5.4	Check on-board regulators for correct pressure												
5.5.5	Clean the compressor filter												
5.5.7	Clean the compressor pump matrix												
5.6.1	Change/clean air blower inlet filter element												
5.9.2	Check the operation of the Emergency stop switches												
5.9.5	Clean the projector screen												
-	Check tightness of capsule/ motion base bolts												
5A.1.2	Grease the Linear bearing assembly												
5A.1.3	Grease the Universal joint assembly												
5A.1.4	Grease fixed Pivot Bearing assemblies												

6.2.1 Notes

Date	Comments	Signature

Date	Comments	Signature



6.3 PERIODIC MAINTENANCE

System Serial Number- - - - - - - - - - - Service Year commencing - - - - - - -

6.3.1 6-Monthly Maintenance

Ref	Description	Date	Sig	Date	Sig
5.3.1	Check security of all internal connections				
5.3.2	Check cabinet water seal				
5.4.5	Change pressure filter element				
5.4.8	Clean oil cooler matrix surfaces				
5.4.9	Check motor rubber vibration mounts				
5.4.10	Check security of mounting bolts				
5.5.5	Change the compressor filter				
5.5.8	Check condition of receiver hose				
5A.1.7 - 5A.1.10	Check that all electrical connectors are secure				

6.3.2 Annual Maintenance

Ref	Description	Date	Sig
5.4.3	Check oil for contamination		
5.4.6	Check operation of hydraulic reservoir low-level float switch		
5.4.7	Change hydraulic oil suction filter		
5.5.6	Change compressor pump oil		
5A.1.6	Check tightness of all anchor bolts (60Nm)		

6.3.3 Notes

Date	Comments	Signature

Date	Comments	Signature