

The background of the cover features a large, stylized flame graphic in shades of orange and yellow, overlaid with a black grid of hexagons. A large red arrow points from the left towards the center, containing the title text. The Pyroban logo is in the top right corner.

# PYROBAN<sup>®</sup>

## **Electric 3G featuring system6000™ Operator Manual**

TO BE HELD BY END USER

**Pyroban – your partner in Explosion Protection**

Thank you for choosing Pyroban to explosion protect your materials handling equipment. We have been converting industrial vehicles for use in hazardous areas for almost 50 years. We have the skills and expertise to protect all types of diesel and electric vehicles from the world's leading manufacturers.

Pyroban strive to be the first choice and trusted partner for explosion protection. We provide the right product and services to enable our customers and our people to succeed safely in their daily business.

**SHOREHAM, UK**

Our production and centre of excellence for industrial vehicle conversions that provide a full design, conversion and manufacturing facility.

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If Pyroban is not placing the equipment onto the market a declaration of conformity to the ATEX directive and a declaration of incorporation to the other applicable directives shall be issued.

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### Section 3

#### Relation to other documents

#### Legal requirement




The vehicle will be fitted with an identification marking label similar to that shown below. The label defines the conversion specification and vehicle details.

Refer to the label on the vehicle for specific details.

If in doubt, refer to the person in authority.

1. CE marking to show the truck meets the requirements for EU legislation. This will only be included on the label if Pyroban are the manufacturer of the truck. Otherwise refer to the OEM manual for the CE marking and declaration if they are the manufacture of the truck.

2. The Ex mark denotes the equipment is explosion protected.
3. Weight of the truck will only be applied to the label plate if Pyroban are the manufacturer of the truck.
4. The list of gases that can be detected can be found on the Pyroban website [www.Pyroban.com](http://www.Pyroban.com)
5. The address is only displayed on the label if Pyroban are considered as the manufacturer of the complete machine.

Build no: N° de construction: *		System: Système: *	
Bouw nr: Bau-Nr: *		System: Système: *	
 			
Manufacture date: Date de fabrication: Productiedatum: Herstellungsdatum:		Manufactured by: Fabriqué par: Gemaakt door: Hergestellt von:	
Serial no: Numéro de série: Serienummer: Seriennummer:		Mass: Masse: Gewicht: Gewicht:	
Vehicle Véhicule Voertuig Fahrzeug		Manufacture date: Date de fabrication: Productiedatum: Herstellungsdatum:	
Manufacturer/Type: Fabricant/Type: Fabrikant/Type: Hersteller/Typ:		ONLY FOR SPECIFIC FLAMMABLE GASES	
Serial no: Numéro de série: Serienummer: Seriennummer:		Type: Type: Type: Art:	
Manufacturer: Fabricant: Fabrikant: Hersteller:		Type: Type: Type: Art:	

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## Section 4

### Contents, list of images, icons and attachments

#### Symbols Used

The terms DANGER, WARNING, CAUTION, NOTE, ENVIRONMENT NOTE and CHANGE TO OEM MANUAL are used in these operating instruction for notes on particular hazards or for unusual information that needs to be highlighted.



#### **DANGER!**

**Means that failure to comply can cause risk to life and/or major damage to property.**



#### **WARNING!**

**Means failure to comply can cause risk of serious injury and/or major damage to property.**



#### **CAUTION!**

**Means that failure to comply can cause risk of material damage or destruction.**



#### **NOTE!**

Means that particular attention is drawn to combinations of technical factors which may not be evident even to a specialist.



#### **ENVIRONMENT NOTE**

The instructions listed here must be complied with as otherwise environmental damage may result.



#### **CHANGE TO OEM MANUAL**

This is to advise the user that the Pyroban conversion has altered or changed the way the part is used or serviced. This change will conflict with the OEM manual. This label also will appear on the component.

### Section 5 Introduction

Your converted Pyroban 3G vehicle is designed to deliver optimum safety whilst integrated with the original equipment manufacturers (OEM) machine.

Your equipment features a system6000™ gas detection system which protects vehicles operating in hazardous environments classified as Zone 2 in accordance with ATEX Directive 2014/34/EU.

The vehicle conversion is carried out in accordance with the latest requirements as specified within the European Standard EN1755:2015. Industrial Trucks - Safety requirements and verification - Supplementary requirements for operation in potentially explosive atmospheres.

system6000™ conversions cover all aspects of the vehicle/equipment components, functions, and modes of operation; employing appropriate protection concepts to each element in order to achieve ATEX Directive compliance.

To prevent ignition of the hazardous area, system6000™ will provide an audible and visual alarm followed by vehicle shut down in the event of high surface temperature or hazardous concentrations of flammable gas or vapour being detected. To ensure the integrity of system6000™, the control module carries out an automatic gas test and system calibration procedure each time system6000™ is started.

However, this level of protection will not be maintained unless the converted vehicle is operated and serviced in accordance with the vehicle manufacturers' instructions and the instructions defined in this manual.

It is important that this manual is read in conjunction with the original equipment manufacturers operating instruction.

### Description of Use

#### Indoor and Outdoor use

Ambient temperature limits:

**Refer to vehicle identification label**

Humidity limits:

**0% to 95% RH non-condensing**

Pressure limits:

**95kPa to 110kPa (712 to 825mmHg)**

Storage temperature limits:

**Refer to OEM manual**

Gases for which the equipment is certified:

**[www.pyroban.com/gas](http://www.pyroban.com/gas)**

Please refer to OEM manual for vehicle description and climatic condition limitations.



## Section 6

### General Safety prescriptions

#### Safety Points

Person in authority is the person taking full responsibility for safety procedures and supervision of safety for employees under their control.



#### **DANGER!**

If the Pyroban equipment fails to operate or if it shuts the vehicle down while operating, do not attempt to restart until permission has been granted by the person in authority. If it is suspected that flammable vapour has entered an enclosure, the vehicle should be moved in a safe manner to a non-hazardous area where the enclosure must be purged. Do not restart system6000™ until this procedure has been completed and permission granted by the person in authority.



#### **DANGER!**

If there is any doubt as to the satisfactory condition of the vehicle or Pyroban equipment the person in authority must be consulted and any faults rectified before the vehicle may be used in the hazardous area.



#### **WARNING!**

As the Pyroban ATEX declaration of conformity covers the entire vehicle, some components were assessed as safe for the application without modification. The person in authority must therefore ensure that these

components are replaced with the original manufacturers' components. If this is not possible then the person in authority must seek advice from Pyroban as to the suitability of an alternative replacement component.



#### **WARNING!**

Only suitably trained and competent personnel may carry out maintenance or repair work on the Pyroban equipment. All repair and maintenance must be in accordance with EN 60079-17 and EN 60079-19. Pyroban accepts no responsibility for work undertaken by non-Pyroban personnel.



#### **WARNING!**

All personnel are expected to employ safe working practices and observe their company safety policy and all relevant safety requirements, regulations and directives applicable to the country or locality in which the equipment is being used.



#### **WARNING!**

Products contain non-metallic parts, separately certified parts and electronics that are relied on for compliance. If the product is to be used within a chemically aggressive environment, contact Pyroban for verification that hazardous area compliance will not be compromised.

### Section 6

#### General Safety prescriptions continued



#### **WARNING!**

It is essential that the vehicle is maintained in accordance with the OEM instructions and schedule except where otherwise specified in this manual. Particular attention should be paid to the lubrication of all moving parts. Failure to do so could result in a mechanical ignition hazard.



#### **WARNING!**

If an audible noise or vibration is detected that could be indicative of bearing failure. Do not use the vehicle and contact the person in authority immediately.



#### **WARNING!**

Check for fluid leaks before vehicle start up. If a leak is detected do not use the vehicle and contact the person in authority immediately.



#### **WARNING!**

Check the levels of all lubricants before vehicle start up. If any are below the minimum recommended level do not use the vehicle and contact the person in authority immediately.



#### **WARNING!**

Ensure where applicable hydraulic activation cylinders are kept free from the build up of dust and debris.



#### **WARNING!**

Products contain Non-metallic parts, separately certified parts and electronics that are relied on for compliance. If the product is to be used with a chemically aggressive environment. Contact Pyroban for verification that the hazardous are a compliance will not be compromised.



#### **CAUTION!**

Read and understand all notices and labels on the equipment before operating the vehicle.



#### **CAUTION!**

After maintenance or repair work, the person in authority must inspect and approve the Pyroban equipment before the vehicle is returned to service.



#### **CAUTION!**

If braking performance is suspect or if a squealing sound is heard when the brakes are applied, do not use the vehicle and contact the person in authority immediately.

## Section 6

### General Safety prescriptions continued



#### **CAUTION!**

Do not remove connectors or plugs from system6000™ components when the battery is connected.



#### **CAUTION!**

Water or high-pressure jets must not be used to clean the system6000™ components or Pyroban enclosures.



#### **CAUTION!**

Operation of the Pyroban gas sensing head may be impaired by certain materials, necessitating more frequent replacement. Typical materials are silicone and chlorine vapours. Where such materials are present in the environment, the gas sensing head will not be covered by Pyroban warranty protection. Gas sensing heads must be protected when cleaning the vehicle or when using silicone based lubricants and sealants.



#### **CAUTION!**

The gas sensing head is installed into the vehicle to provide the best protection from environmental conditions, however damage may occur if exposed to severe weather conditions.



#### **CAUTION!**

The equipment must not be re-painted. If painting is required consult the person in authority.



#### **CAUTION!**

If any of the components that make up the Pyroban conversion are subject to direct impact, chemical spill or corrosion they must be checked by a qualified person before putting the equipment back into service.

### Section 6.1 Safety Warning



#### Safe Use

This equipment could present hazards if it is not operated according to this instruction handbook.

Instruction label will be in clear view for the operator.

system6000™ Instructions
**PYROBAN™**



**To enable vehicle**

- Ensure the Power LED is 'ON'
- Touch the Operator Key on the key receptor
- System checks 1, 2 and 3 are automatic
- Green  appears to show vehicle is ready for use
- Amber  indicates system fault → contact Customer Services Centre +44 (0)1273 456800


**Always disable vehicle after use**

- Ensure vehicle is at rest in a safe state
- Touch the Operator Key on the key receptor

**Automatic shutdown in flammable atmosphere**

- Warning: buzzer sounds & red  flashes
- Shutdown: buzzer sounds, red  on & vehicle disabled → contact supervisor

**Automatic over temperature shutdown**

- Buzzer sounds, red  on & vehicle disabled
- Red digit indicates temperature channel → contact supervisor

www.pyroban.com



#### DANGER

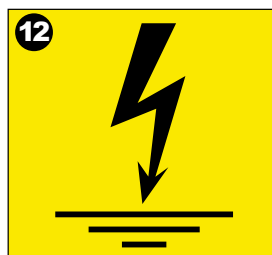
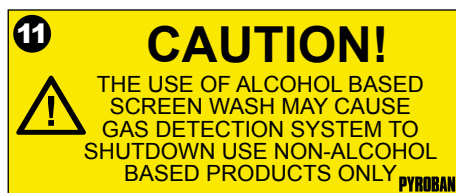
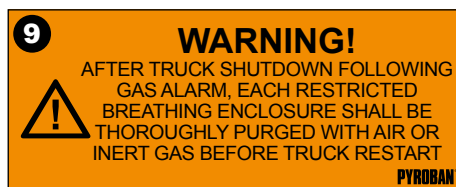
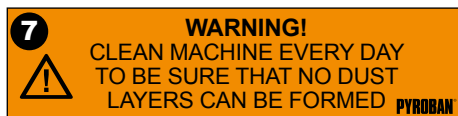
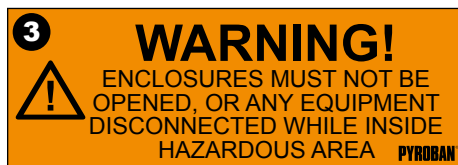
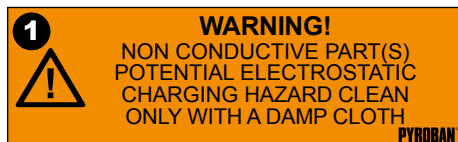
**The truck must only be used in the assigned areas that meet the requirements established on the conversion identification marking label. Any use of the equipment outside this may not be covered by sufficient explosion protection.**

**Resale of the converted truck must also comply with the requirements established on the conversion certificate.**

**This equipment could present hazards if it is not operated according to the information given in this instruction handbook.**

## Section 6.1a

### Warning & Attention Labels



### 6.1a Safety Warning continued

REF	Label Text	Reason
1	<b>WARNING!</b> NON-CONDUCTIVE PART(S)- POTENTIAL ELECTROSTATIC CHARGING HAZARD - CLEAN ONLY WITH A DAMP CLOTH	To prevent the build up of static.
2	PYROBAN LOGO AND BOOK SYMBOL	This is advice to the user that the Pyroban conversion has altered or changed the way the part is used or serviced. This change will conflict with the OEM manual.
3	<b>WARNING!</b> ENCLOSURES MUST NOT BE OPENED, OR ANY EQUIPMENT DISCONNECTED WHILE INSIDE HAZARDOUS AREA	The equipment will not be protected from gas or dust in the hazardous area.
4	<b>WARNING!</b> REMOVE CABLE TIE FROM EARTH STRAP BEFORE PLACING TRUCK IN SERVICE / ENSURE STRAP IS IN CONTACT WITH THE FLOOR	Warning to ensure that the truck is grounded.
5	BOOK SYMBOL - <b>WARNING!</b> ON system6000™ ALARM STOP VEHICLE IMMEDIATELY	This will be because of an over temperature. Surface temperature above the T class of the truck is unsafe for use in the hazardous area.
6	<b>WARNING!</b> DO NOT SEPARATE WHEN ENERGISED	The equipment will not be protected from gas or dust in the hazardous area.
7	<b>WARNING!</b> CLEAN MACHINE EVERY DAY TO BE SURE THAT NO DUST LAYERS CAN BE FORMED	Dust layers above 5mm can affect the T-class of the truck.
8	<b>WARNING!</b> RESTRICTED BREATHING ENCLOSURES "nR" INSTALLED ON THIS TRUCK	After a safety shutdown caused by the gas detection system, the enclosure shall be purged with clean air or inert gas before the truck is restarted.
9	<b>WARNING!</b> AFTER TRUCK SHUTDOWN FOLLOWING GAS ALARM, EACH RESTRICTED BREATHING ENCLOSURE SHALL BE THOROUGHLY PURGED WITH AIR OR INERT GAS BEFORE THE TRUCK IS RESTARTED	After a safety shutdown caused by the gas detection system, the enclosure shall be purged with clean air or inert gas before the truck is restarted to remove any flammable gas or vapour.
10	<b>WARNING!</b> OPEN ONLY IN A NON HAZARDOUS AREA	The equipment will not be protected from gas or dust in the hazardous area.
11	<b>CAUTION!</b> THE USE OF ALCOHOL BASED SCREEN WASH MAY CAUSE GAS DETECTION SYSTEM TO SHUT DOWN, USE NON-ALCOHOL BASED PRODUCTS ONLY	Alcohol can be detected by the system6000™ resulting in shutdown.
12	CHASSIS TO GROUND POINT	The label is to indicate the chassis earthing points on the truck. There will be 2 points per machine located on opposite ends of the truck.

**6.1b**  
**system6000™ Safety Warning**

**Gas Shutdown!**



**Parking Brake ON warning**



**System failed to calibrate refer to handbook.**



For additional warning symbols you will need to check the OEM manual.

### Section 6.1c Function of Safety

**Explosions can take place in any location where the three elements of the fire triangle are present:**

1. An oxidizer - the oxygen in the atmosphere - is always present
  2. A gas or liquid fuel
  3. A source of ignition is always present
- Naked Flames
  - Hot Surfaces
  - Mechanically & electrically generated sparks
  - Electrostatic discharge sparks



### Function of the safety

- Keeping surface temperatures below the temperature class for the hazardous area. This is monitored by the system with temperature sensors placed at various locations on the equipment.
- Gas detection system that provides a warning at 10% LEL and shutdown of the equipment at 25% LEL.
- Earthing of electrostatic charge which is a potential ignition source.
- Fork cladding in stainless steel to protect from impact sparks.
- Sparking components such as relays and contactors are protected either by restricted breathing enclosures or sealing modifications.
- Identification of electro-static charge risks which are fitted with the appropriate warning labels.



## Section 6.1d system6000™ Safety Measures

### Operating Keys

system6000™ is supplied with two types of Dallas key, a green operator key and a red supervisor key. Only the green key should be given to the operator of the vehicle.

The red key must be kept in a safe place and under the control of the person in authority.

In the event of a gas shutdown or system failure, the operator must report it to the person in authority who should take appropriate action.



Function	Available with Operator key?	Available with Supervisor key?
Start up system6000™	<b>YES</b>	<b>NO</b>
Power down system6000™	<b>YES</b>	<b>NO</b>
Silence shutdown alarm	<b>YES</b>	<b>NO</b>
Reset system6000™ after over-temperature shutdown	<b>YES</b>	<b>NO</b>
Reset system6000™ after gas shutdown	<b>NO</b>	<b>YES</b>

## Section 6.1e - 6.1g Additional Safety Measures

### Footwear

Footwear to be worn by the operator shall comply with EN ISO 20344.

### 6.1f Protective Clothing

All protective clothing to be worn by the operator, including gloves to comply with EN 1149-5.

### 6.1g Requirements for conductive or dissipative floors



### **WARNING!**

**Trucks should only be operated in hazardous areas with dissipative floors.**



### **NOTE!**

Information on the requirements for conductive or dissipative floors can be found in CLC/TR 60079-32-1.

### Section 6.1h Additional Safety Information

#### Electro-static charging

Plastic parts which are subjected to a highly efficient charging mechanism such as frequent contact with the operator could be a possible dangerous electrostatic charging of non-conductive parts on the truck.

There is a danger of electrostatic charging of non-conductive parts of the vehicle for example: operator contact with flexible doors and strip curtains. If flexible doors have been fitted by Pyroban they will be dissipative to reduce electrostatic charging risks. Please contact Pyroban for repairs and maintenance.



#### **WARNING!**

**Some of these products can contain hatching markings that can reduce visibility when operating the truck. Always ensure that operator visibility is not compromised.**

## Section 6.1i

### Additional Safety Information

#### Earthing Straps & Dissipative Tyres

Check the condition of earthing straps and dissipative tyres. Earthing straps should be in full contact with the ground. The location for the earth straps are marked with label 12 to indicate the grounding points, typically in two different locations on the truck. Tyre treads should be free from metal particles and undamaged. Pneumatic tyres should be inflated to the manufactures advised pressure.



#### **WARNING!**

**As part of daily operation earthing straps and tyres should be checked for contamination. If the excessive contamination is suspected the conductivity should be checked by a suitably qualified person.**



**Earthing strap**



**Dissipative tyre**

### Section 7

#### Description of the product

#### Products for system operation

1. Vehicle enabled / System ok
2. Warning Shutdown Condition
3. Over-Temp Shutdown channel system failure number
4. Key receptor
5. Power On
6. Start-up and progress indicators
7. Parking brake ON warning
8. System Error



**Control Module**



1. system6000™ control module
2. Emergency stop

## Section 8

### Implementation, Installation, Adjustments

#### Pre-Start checks

1. Carry out any pre-start checks recommended by the vehicle manufacturer.
2. Check the general condition of the vehicle and Pyroban equipment as defined in the Routine Servicing section of this manual.
3. Ensure the battery isolator is switched on, then, by using the system6000™ supply switch confirm that the green Power Indicator on the Control Module is lit.



#### **DANGER**

**If there is any doubt as to the satisfactory condition of the vehicle or Pyroban equipment, the person in authority must be consulted and any faults rectified before the vehicle may be used in a hazardous area.**

### Section 9

#### Starting system6000™

Before the vehicle can be operated, system6000™ must be started.



Open the valve on the test gas cylinder and ensure the gauge shows there is gas in the cylinder. The gauge should read more than 20 bar.



Place the green Dallas key onto the key receptor on the Pyroban control module. A tone will be heard and all indicators on the control module will be illuminated simultaneously for a short period to confirm correct operation.



Progress of the start-up gas test is indicated by LED indicators 1, 2 and 3.

LED 1 flashes during the warm up period and is illuminated continuously once the warm up time has expired. The duration of warm up period varies according to the state of the system. The warm up period may be zero if the gas head has already been on for sufficient time.

The (P) is the control module determining the type of Gas head fitted.

(P) – Pellistor

(I) – Infrared

## Section 9

### Starting system6000™ continued



Following warm up test gas is injected for a number of seconds to check the response of the gas head(s). LED 2 flashes during test gas injection. On detection of a good response LED 2 is illuminated continuously.

Following test gas injection the system checks that the gas head is not blocked by timing the diffusion of gas out of the head. During the diffusion phase LED 3 flashes.



On successful conclusion of the start-up gas test the green tick is illuminated indicating that the truck is enabled.

In the event of a start-up gas test failure the 'book symbol' will flash and LED 2 or LED 3 will remain flashing to indicate the cause of failure.

This start-up sequence takes approximately 1 minute.

Then start the vehicle using the original vehicle key switch in the normal manner.

### Section 9.1a

#### Intended Use

##### OEM parameters

The truck is to be used for material handling. Ref to the OEM manual for details on the trucks application and optimum use.

##### Pyroban system6000™ parameters

The design parameters for the Pyroban conversion can be found on the Pyroban label plate. system6000™ is for use in a zone 2 area.

##### Temperature class

Flammable materials have an auto ignition temperature, this is the temperature that they will ignite without a spark by coming into contact with a hot surface. Trucks are built between T3 and T4.

T3 - 200°C

T4 - 135°C

##### Gas Groups

IIA and IIB are increasing order of sensitivity to ignition sources, so equipment designed for use in gas group IIB is also safe to use in the less-ignitable gas group IIA.

IIA – Test Gas Propane

IIB – Test Gas Ethylene

##### Category 3G

The Category defines the area in which the truck can operate. system6000™ is converted for category 3G which are zone 2 classified areas for gas.



## **Section 9.1b**

### **Service Operations**

Maintenance on the Pyroban conversion should be carried out by a Pyroban trained engineer with a current valid training certificate.



#### **WARNING!**

**All service and maintenance must be carried out in a non-hazardous area. For all OEM service and maintenance you will need to refer to the OEM manual.**

---

### Section 9.1c Shutdown and Reset



#### Gas Shutdown warning at 10% LEL

The fire triangle will flash alternately with the green tick. And the sounder will operate a slow beep.

Drive the vehicle out of the hazardous area.

Inform the person in authority.

When the gas level falls below the threshold, system6000™ returns to normal operation.

The red key will not be required after a 10% LEL gas warning.

DO NOT re-enter the hazardous area until authorised to do so.



#### Gas Shutdown 25% LEL

The fire triangle will flash and the sounder will operate with a fast beep.

Following a 25% LEL gas detection the vehicle must be brought to a controlled stop quickly before the shutdown warning times out.

Inform the person in authority.

Remove the vehicle from the hazardous area in a safe manner and purge all the restricted breathing enclosures. To restart the system the red key will be required which should be located with the person in authority.

The green key can be used to silence the sounder.

### Section 9.1c

#### Shutdown and Reset continued



#### Supervisor Reset Key

After a gas shutdown the area will need to be checked by the person in authority to ensure that the area is safe to continue operations.

Following a safe assessment of the area the supervisor can use the red key to re-set the system book to the sleep mode.

The user shall follow the normal start up procedure with the green key to enable the vehicle.



#### Failed gas head output level test

The system will show failure on stage 2 LED illuminates with the book symbol.

Stage 2 is the gas injection to the gas head. Check gas in the bottle level for the calibration to be carried out.

This will need to be reported to the person in authority.

### Section 9.1c

#### Shutdown and Reset continued



#### Failed gas diffuser test

The system will show failure on stage 3 with the book symbol flashing simultaneously.

If the gas bottle is empty you will need to replace. Refer to the maintenance section for more information.

This will need to be reported to the person in authority.



#### Over Temperature warning

A temperature sensor has indicated the Temperature-class for the area of protection has been reached.

Bring the vehicle to a controlled stop.

Stage 3 and the fire triangle will flash to indicate this type of shutdown. The temperature sensor channel will be indicated under the fire triangle. Example shown is (2).

This will need to be reported to the person in authority.

## Section 9.1c

### Shutdown and Reset continued



#### Time out shutdown

The vehicle has been motionless for 50 minutes. In 10 minutes, system6000™ will shutdown to preserve battery power.

The sounder will operate with a beep every 5 seconds.

Place the green operator key onto the receptor on the control module to reset the timeout.



#### Power down system6000™

Place the green Dallas key onto the key receptor on the Pyroban control module. system6000™ and the vehicle will be disabled.

### Section 9.1d System Induced Shutdowns

system6000™ will activate vehicle shutdown if an over temperature or gas detection condition is detected. In normal operation the vehicle shutdown is activated immediately the condition is detected as the vehicle can be brought to a controlled stop without battery power.

However, in some vehicle types battery isolation prevents the operator bringing the vehicle to a controlled stop and therefore the vehicle may be fitted with a time delay before vehicle shutdown. This delay retains critical operator functions (steering, magnetic brake release etc.) for a period of up to 25 seconds, after which time full vehicle shutdown will be activated.

Typical vehicles fitted with this time delay are reach vehicles with 'fly-by-wire' steering and magnetic brake on traction motor, and counterbalance vehicles where additional safety devices are fitted (SAS) or electrically operated axle brake solenoids.

If such a delay is fitted, the vehicle will be labelled accordingly (see label below). When a shutdown condition is activated, the vehicle should be brought to a controlled stop BEFORE the vehicle is shut down.



#### Emergency Switch Off

To initiate an emergency stop, depress the emergency stop device fitted to the vehicle. This will be either the original vehicle's emergency stop button, a manual isolator fitted within the driver compartment.



#### CAUTION!

**The emergency stop or switch should not be used to facilitate a normal stop in operation.**



#### NOTE!

As for the original vehicle, activating the emergency stop causes immediate loss of power. There are no time delays built into this

function.

To restore the vehicle electrical system, release the emergency stop button.

With system6000™ operational, the vehicle may be turned off and restarted through the original vehicle key switch without switching off system6000™.

It is recommended that system6000™ is left switched on during the normal work cycle.



Replacement  
example 1



Replacement  
example 2



Replacement  
example 3



OEM  
example 1

## Sections 9.2 - 9.2c

### Information for Charging of the Battery and Battery Handling

#### 9.2



#### **DANGER!**

**Never recharge an Ex battery in a zoned area.**

#### 9.2a

#### **Battery Charging rooms**

Always use approved moving equipment when attempting to change batteries. When lifting and handling the Ex batteries use the correct approved lifting equipment and keep the battery in an upright position.

The original truck manufacture should supply the correct methods and procedures for handling of the battery.



#### **CAUTION!**

**The cable should not be extended without prior consultation with the charger manufacturer and supplier of your Ex battery.**

#### 9.2b

#### **Emission of Gasses**



#### **CAUTION!**

**When charging, proper provision must be made for venting of charging gases. These batteries will have low gas emissions, so some charging gases are involved.**

#### 9.2c

#### **Transport and storage**



#### **CAUTION!**

**When lifting and handling the Ex batteries use the correct approved lifting equipment and keep the batteries in an upright position.**



#### **NOTE!**

When batteries are taken out of service for a lengthy period they should be stored, disconnected from the truck, in the fully charged condition in a dry, frost-free room.

### Sections 9.2d + 9.2e

#### Information for Charging of the Battery and Battery Handling

##### 9.2d

##### Charging Equipment

There are 3 methods of protection for battery connectors.

1. IP rated connectors that have the correct ingress protection to meet the trucks certification. These connectors will also have an interlock system to avoid accidental disconnection.



2. OEM connectors fitted with a Pyroban designed interlock system. The interlock has to be fitted because the battery connectors have been deemed easily accessible.



3. OEM connectors fitted. The interlock does not have to be fitted because the battery connectors have been deemed not easily accessible.

##### 9.2e

##### General Battery Information

All Batteries will be certified for use in a hazardous area. The battery manufacture will be clearly labelled on the battery with a certification plate.



The Ex symbol should be visible on the battery.



#### **WARNING!**

**Never disconnect the battery in a zoned area. (Isolate circuits before disconnecting the battery outside a zoned area).**



#### **WARNING!**

**Never open the battery cover in a zoned area.**



#### **WARNING!**

**Never use the battery if damaged or bare cables are evident.**



#### **WARNING!**

**Never use the battery if the connector plugs are damaged.**



## Section 9.2f

### Information for Charging of the Battery and Battery Handling

#### Service

All service and maintenance must be completed by an approved Ex battery approved personnel.



#### **DANGER!**

**If frayed wires or worn insulation is noted take the battery out of service immediately and place in a safe area that is outside the zoned area. DO NOT ATTEMPT TO REPAIR an Ex battery.**

**Section 10**  
**Maintenance and Maintenance Schedule**

The hazardous area equipment covered by this manual possess features specifically designed to render it suitable for operation in such atmospheres. It is essential for reasons of safety in those areas that, throughout the life of this equipment, the integrity of those special features is preserved. The following sections provide details for safe operation.

It is important that this manual is read in conjunction with the original manuals provided by the vehicle manufacture. Where there is conflict in requirements this manual shall take precedence.

## Section 10.1

### Service conditions



#### CAUTION!

If the Pyroban equipment fails to operate or if it shuts the vehicle down while operating, do not attempt to restart until permission has been granted by the person in authority. If it is suspected that flammable vapour has entered an enclosure, the vehicle should be moved in a safe manner to a non-hazardous area where the enclosure must be purged. Do not restart system6000™ until this procedure has been completed and permission granted by the person in authority.



#### CAUTION!

Only suitably trained and competent personnel may carry out maintenance or repair work on the Pyroban equipment. All repair and maintenance must be in accordance with IEC60079-17 and IEC60079-19. Pyroban accepts no responsibility for work undertaken by non-Pyroban personnel.



#### NOTE!

- Read and understand all notices and labels on the equipment before operating the vehicle.
- After maintenance or repair

work, the person in authority must inspect and approve the Pyroban equipment before the vehicle is returned to service.



#### CAUTION!

**Do not remove connectors or plugs from system6000™ components when the battery is connected. All connectors and plugs must be reconnected before connecting the battery.**

### Section 10.1a

#### Frequency of inspections and maintenance including daily operator checks

The type and frequency of inspection and maintenance for system6000™ is defined by EN60079-17. This says that throughout the life of this equipment the integrity of special features, that have been specially designed to render the equipment safe to use in hazardous areas, for the reasons of safety should be preserved. This will be through initial inspection, ongoing regular periodic inspections & maintenance thereafter.



#### NOTE!

Inspections must be carried out by suitably qualified persons whose training is defined in EN60079-17.

Maintenance can be conducted by suitably trained persons whose training can be provided by Pyroban.

Additionally checks must be carried out prior to using the truck. Each operator must conduct their own checks.

#### Task - In addition to original vehicle requirements.

(Details of each check point follows in the pages after this chart)

1. Forks – check cladding including underside for damage and wear. (Forks shall be clad in such a way that inspection for hair cracks on critical locations shall always be possible).
2. Tyres – check for damage, embedded foreign particles, pressure (where applicable).  
Castors, wheels and earth straps should be checked for contamination with regard to conductivity.
3. Test gas cylinder – check pressure. Replace if <20 bar.
4. system6000™ Control module – **warning**, electrostatic ignition hazard. Clean only with a damp cloth. DO NOT use solvents.
5. Traction battery – charge and maintain as per manufacturers instruction.
6. Brakes – check operation. Investigate any excessive noise or poor performance.
7. Conductivity – check earth strap is in contact with the ground.
8. Ancillaries – check that lights and beacons are intact with no broken lenses or guards.
9. Plastic surfaces - Seats, arm rests and plastic surfaces - **warning**, electrostatic ignition hazard.  
Clean only with a damp cloth. DO NOT use solvents.

## **Section 10.1a.1**

### **Checking fork cladding (and other load handling devices)**

Forks and other load handling devices (drum handlers etc.) are clad in 2.5mm thick stainless steel. During operation, the stainless steel cladding will be subject to wear and therefore needs to be routinely inspected to ensure the cladding remains intact and the thickness does not reduce to less than 1mm.

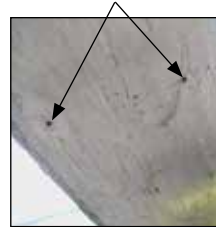
Wear indicators are provided on forks by 3mm diameter inspection holes. If the cladding is damaged or worn to the point where the red inserts are exposed or the thickness is less than 1mm, the vehicle should not be used in a hazardous area. The cladding must be repaired or replaced.



#### **WARNING!**

**Be aware of sharp edges that can be created from dragging forks on the ground. Use gloves when checking. Do not stand under elevated forks.**

#### **Wear Indicators (3mm diameter inspection holes)**



**Stainless Steel Clad Forks**



**The heel of the fork is left open to  
allow for periodic inspections**

### Section 10.1a.2

#### Checking tyres

Check the condition of conductive tyres. Tyres should be free from metal particles, undamaged, and if applicable inflated to the correct pressure.



#### NOTE!

Also as part of the daily operator checks the condition of castors, wheels, earth straps and fan belts should be checked for contamination with regard to conductivity. If excessive contamination is suspected the conductivity should be checked by a suitably qualified person.



### **Section 10.1a.3**

#### **Checking test gas cylinder content**

A replacement test gas cylinder should be ordered when the cylinder's pressure gauge registers 20 bar or less. It is advisable to hold a spare test gas cylinder to ensure uninterrupted operation. If the gas runs out you cannot start the vehicle.



**NOTE!**

To replace the cylinder:

1. Turn OFF the valve.
2. Slacken the retaining screw and remove the cylinder.
3. Unscrew the regulator from the test gas cylinder (left hand thread).
4. Check the seal for damage and replace if necessary.
5. Fit the regulator to the replacement cylinder (left hand thread).
6. Place the replacement cylinder into the mounting bracket and secure using the retaining screw.
7. Turn the valve ON and record the gauge pressure. To check for leaks, turn the valve OFF and after one hour, recheck the gauge pressure. No pressure drop should be observed.

The initial charge indicated on the test gas cylinder gauge should be in order of 150 bar pressure.



### Section 10.1a.4 Control module

The control module for system6000™ is mounted in easy view of the operator. It provides starting and stopping of the system. It will also provide status indication of system6000™ and gas detection levels. It is important that it is clean and legible.



#### CAUTION!

**Wiping the control module with a dry cloth could pose an electro-static risk therefore it is important to only wipe down with a damp cloth.**



#### NOTE!

Further details of the control module.

### Section 10.1a.5 Traction Battery

The battery will be Ex e certified from a third party supplier. The batteries are of “wet cell” construction and should be charged and maintained in accordance with the manufacturers’ instructions supplied with the battery.

The protective access cover must be in place and locked at all times when operating in a hazardous area.

Batteries must not be charged, disconnected or reconnected in a hazardous area.



**Typical Ex e Battery**  
(Note the specification and certification label on the lid)



### **Section 10.1a.6 Brake performance**

Brakes are potential ignition sources from either high temperature or sparks caused by metal to metal contact of the moving and stationary components.

Brake assemblies must never be allowed to wear to the extent that metal contact between moving and stationary components occurs. In addition, allowing brakes to bind could raise the brake drum temperature above the maximum surface temperature. Therefore if brake performance deteriorates or a squealing noise heard when operated the truck should be stopped and the brakes should be checked.

### **Section 10.1a.7 Vehicle conductivity to earth**

Earth straps are fitted using a dual eyelet system which allows the strap to be lowered should the strap become worn.

The straps are fitted with an M8 bolt and washer drilled and tapped into the chassis. This position will be marked. The position cannot be changed without consulting Pyroban.



**Example of a 350mm conductive strap**



**NOTE!**

To ensure sufficient contact with the ground each strap is cut to a length that allows 50mm to be pressed against the floor.



**50mm contact  
with the ground**



**Strap attached  
to the chassis**

The straps can be easily wiped clean with a cloth to remove any dirt or grease. They have been proven to be resistant to most harmful substances.

### Section 10.1a.8 Ancillaries

Ancillary equipment such as lights will have been assessed or modified to ensure they will not present an ignition source. It is therefore essential that any broken lights, beacons etc. are reported immediately and the truck isolated until confirmed safe to use.



## Section 10.1a.9

### Plastic surfaces

To prevent the build-up of static electricity plastic materials also require consideration. Parts in frequent contact with moving bodies (seats, arm rests, cab sides. etc.) require all plastic materials to be electrically conductive or anti-static. Therefore seats and arm rests are either checked for anti-static properties or covered in an anti-static material.



Dashboards, canopies, bonnets, roof guards, finger guards (stacker vehicles) etc. if approved by Pyroban do not require additional measures as they have proven to meet the requirements of the ATEX Directive.



#### NOTE!

Approved plastics will be fitted with a label such as the one shown below:



#### WARNING!

NON CONDUCTIVE PART(S)  
POTENTIAL ELECTROSTATIC  
CHARGING HAZARD CLEAN  
ONLY WITH A DAMP CLOTH

**PYROBAN**

### Sections 10.1b - 10.1i

#### 10.1b

#### Maintenance of the electrical and gas detection systems

Maintenance aspects for the electrical system and gas detection system shall be included in the periodic maintenance that shall be carried out by the contract service provider. The maintenance person must be suitably qualified to maintain Pyroban equipment.

#### 10.1c

#### In the event of a gas shutdown

In the event that system6000™ shuts the vehicle down because it has detected a gas the truck must not be restarted. The incident must be reported to the person in authority. The vehicle must NOT be restarted until the restricted breathing enclosures have been checked and purged with clean air. Failure to do this may result in an explosion.

#### 10.1d

#### Calibration of gas sensing heads

The gas sensing head(s) fitted to this vehicle undergo a calibration routine every time that system6000™ is initiated. This means that there is no need for periodic calibration by a third party

#### 10.1e

#### Gas detection verification

The function of the gas sensing head(s) is verified each time that system6000™ is initiated. This means that there is no requirement to have this checked and confirmed by a third party.

#### 10.1f

#### Maintenance of restricted breathing enclosures

Maintenance of restricted breathing enclosures - Maintenance and routine testing of restricted breathing enclosures shall be included in the periodic maintenance that shall be carried out by the contract service provider. The maintenance person must be suitably qualified to maintain Pyroban equipment.

#### 10.1g

#### Maintenance of insulation resistance monitoring

The insulation resistance monitoring system shall be included in the periodic maintenance that shall be carried out by the contract service provider. The maintenance person must be suitably qualified to maintain Pyroban equipment.

#### 10.1h

#### Clearance between rotating and stationary parts

Clearance between rotating and stationary parts shall be included in the periodic maintenance that shall be carried out by the contract service provider. The maintenance person must be suitably qualified to maintain Pyroban equipment.

#### 10.1i

#### Maintaining a good path to earth

As part of the daily operator checks the condition of the castors, wheels, earth straps and fan belts should be checked for contamination with regard to conductivity. If excessive contamination is suspected the conductivity should be checked by a suitably qualified person.

## **Sections 10.1j - 10.1o**

### **10.1j**

#### **Maintaining seat and non-metallic covers**

Seat and non-metallic covers bonding and surface resistance shall be included in the periodic maintenance that shall be carried out by the contract service provider. The maintenance person must be suitably qualified to maintain Pyroban equipment.

### **10.1k**

#### **Maintenance of safety monitoring and shut down systems**

Correct functioning of safety monitoring and shutdown systems shall be included in the periodic maintenance that shall be carried out by the contract service provider. The maintenance person must be suitably qualified to maintain Pyroban equipment.

### **10.1l**

#### **Consumable items**

During each system start up, system6000™ conducts a forced gas test to verify the integrity and operation of the gas sensing system. The test procedure is fully automated and consumes minimum test gas. In a leak free installation, the test gas cylinder will last many hundreds of starts.

The cylinder is fitted with a pressure gauge to indicate bottle contents. A replacement test gas cylinder should be ordered when the cylinder's pressure gauge registers 20 bar or less.

It is advisable to hold a spare test gas cylinder to ensure uninterrupted operation. If the gas runs out you cannot start the vehicle.

### **10.1m**

#### **Maintenance of fasteners**

Correct tightness of fasteners and the correct maximum gap of flameproof joints shall be included in the periodic maintenance that shall be carried out by the contract service provider. The maintenance person must be suitably qualified to maintain Pyroban equipment.

### **10.1n**

#### **Maintenance of brakes**

Brakes are potential ignition sources from either high temperature or sparks caused by metal to metal contact of the moving and stationary components.

Brake assemblies must never be allowed to wear to the extent that metal contact between moving and stationary components occurs. In addition, allowing brakes to bind could raise the brake drum temperature above the Temperature Class. Therefore if brake performance deteriorates or a squealing noise heard when operated the truck should be stopped and the brakes should be checked.

### **10.1o**

#### **Maintenance of the cladding of forks and other load handling devices**

Forks and other load handling devices (drum handlers etc.) are clad in 2.5mm thick stainless steel. During operation, the stainless steel cladding will be subject to wear and therefore needs to be routinely inspected to ensure the cladding remains intact and the thickness does not reduce to less than 1mm.

**Sections 10.1p + 10.1r****10.1p****Maintenance of enclosures**

Maintenance of enclosures shall be included in the periodic maintenance that shall be carried out by the contract service provider. The maintenance person must be suitably qualified to maintain Pyroban equipment.

**10.1q****Markings and warning labels**

Verification of the integrity of markings and warning labels relevant to the protection concepts shall be included in the periodic maintenance that shall be carried out by the contract service provider. The maintenance person must be suitably qualified to maintain Pyroban equipment.

This will also be checked during the yearly inspection which could result in a non-compliance if not present and legible.

## **Section 11**

### **Storage and Transport**

For information on transportation and storage refer to the original equipment manufacturers handbook. It is recommended that the battery should be isolated during extended periods of time when the equipment will not be used.



#### **CAUTION!**

**During long term storage the gas sensing head should be removed and safely stored to prevent impairment of the products performance.**

## **Section 12**

### **Faults and Repairing**

Due to the nature of the protection for this vehicle any faults must be reported to the person in authority before commencing work activities.

All repairs must be carried out by suitably trained personnel as defined in EN60079-17.

## **Section 13**

### **Dismantle, Environment**

To avoid damage to the environment do not dispose of used engine oil, batteries, filters etc. yourself. Dispose of such waste products in accordance with the laws of your country, or an authorised waste treatment agency.

Oil, gas, chemicals, batteries, tyres and other flammable materials must be stored in a safe location to prevent these materials from harming the environment. Refer to the OEM manual for the procedure of their disposal.

Forklifts are built with parts that contain recyclable metals and plastics. Make sure that those materials are appropriately recycled.



## **Section 14**

### **Glossary**

#### **Accessories**

An optional part that may be fitted to the machine either by OEM or aftermarket.

#### **Antistatic**

Preventing the build-up of static electricity or reducing its effects.

#### **ATEX Directive**

European legislation governing the classification of work areas and work equipment in potentially explosive atmospheres.

#### **Attachments**

An accessory attached to the vehicle. E.g barrel handler, side shift or cage.

#### **Bonding**

Electrical bonding is the practice of intentionally electrically connecting all exposed metal items not designed to carry electricity on the machine.

#### **Calibrate**

Measurements to test and adjust the accuracy of a measuring instrument or process.

#### **CE Marking**

Symbol used on equipment label and conformity certificates indicating that the equipment meets all relevant legislation requirements.

#### **Cladding**

Replacing forks or attachments with non-sparking material.

#### **Conductive**

Transmitting or able to transmit energy, particularly heat or electricity.

#### **Control Module**

Human Interface and central processor for the safety control system6000™

#### **Conversion**

Modification process to truck. The change in a fork truck from a standard industrial unit to a hazardous area suitable machine.

#### **Dallas Key**

Specialised key to operate the equipment.

#### **EU Declaration of Conformity**

Legal document required for machine issued by company placing the equipment on the market

#### **Dissipative**

In terms of electrostatic charge, a medium resistance material classification as to how quickly electricity moves through a material.

#### **Earthing**

Electrical connection to the ground intended to carry current safely away from a circuit in the event of a fault, or a wire that makes such a connection.

#### **EN1755:2015**

Industrial Trucks - Safety requirements and verification - Supplementary requirements for operation in potentially explosive atmospheres. European technical standard.

#### **Explosive Atmosphere**

Vapour, dust, fibres, or flyings which, after ignition, permits self-sustaining propagation.

#### **Explosive Protection Level**

Equipment marking – defining equipment category, gas group and temperature class for the machine.

#### **Fire Triangle**

Illustration of the three elements required for combustion; fuel, air & ignition. Used to define methods of protection.

## Section 15

### Glossary continued

#### Flammable Atmospheres

Mixture with air, under atmospheric conditions, of flammable substances in the form of gas,

#### Flammable Gas

Gas that at ambient temperature and pressure forms a flammable mixture with air at a concentration of 12 percent (or less) by volume.

#### Gas Group

Is a defined group of Gases that each have different explosive properties.

#### Gas Sensing Head

Gas detection device for the system6000™ to pick up flammable gas within its vicinity.

#### Gas Shutdown

A condition triggered by system6000™ after of detection of a flammable gas to 25% LEL.

#### Hazardous Area

Hazardous areas are those places, commonly on industrial sites, where a potentially flammable atmosphere may exist.

#### Ignition Hazard

Something that has the potential to become an active ignition source if a flammable atmosphere were present. Examples hot surface temperature or sparking component.

#### Inert Gas

An inert gas is a gas which does not undergo chemical reactions under a set of given conditions. Air can be used when purging enclosure following a gas shutdown.

#### Lower Explosive Limit (LEL)

The lowest concentration (percentage) of a gas or a vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

#### OEM

Original Equipment Manufacturer

#### OEM Manual

Original Equipment Manufacturer Manual

#### Pellistor

Is a solid-state device used to detect gases which are either combustible or which have a significant difference in thermal conductivity to that of air.

#### Person In Authority

Person providing technical management, having adequate knowledge in the field of explosion protection, having familiarity with the local conditions, having familiarity with the installation and who has overall responsibility and control of the inspection systems for the equipment within hazardous areas.

#### Purge

To replace air within an enclosure in case of risk of flammable gas may have entered enclosure.

#### Surface Resistance

Refers to the resistance experienced by the leakage of current along the surface of coat/insulating material. It also can be defined as the electrical resistance that exists between two parallel electrodes in contact through the surface.

#### Temperature Class

A classification for flammable gases for their ignition from hot surfaces.

#### Zoned Areas

The zone defines how likely it is that a hazardous concentration will be present in any given geographical location. The zones are a result of a formal area classification exercise.

Notes

Notes



**Enabling people to  
work safely  
every day**

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