PYROBAN®

Diesel 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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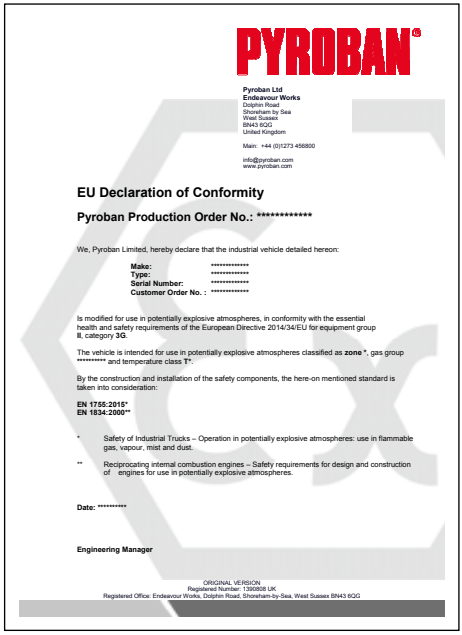
Section 2
Technical Specification and Certification

system6000™ is a flammable gas and over temperature shutdown system which is fitted to industrial vehicles to enable use in potentially explosive atmospheres.

The system may be fitted with either one or two flammable gas sensing heads which may be either pellistor or infrared type.

In addition a temperature input module is used to facilitate shutdown on up to 5 temperature channels.

The system disables the vehicle to prevent an ignition hazard occurring at gas concentration of 25% of the Lower Explosive Limit (LEL) or in the event of an over temperature condition.



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EU Declaration of Conformity

Pyroban Production Order No.: ************

We, Pyroban Limited, hereby declare that the industrial vehicle detailed hereon:

Make: ************
Type: ************
Serial Number: ************
Customer Order No. : ************

Is modified for use in potentially explosive atmospheres, in conformity with the essential health and safety requirements of the European Directive 2014/34/EU for equipment group **II**, category **3G**.

The vehicle is intended for use in potentially explosive atmospheres classified as **zone** *, gas group ********* and temperature class **T***.

By the construction and installation of the safety components, the here-on mentioned standard is taken into consideration:

EN 1755:2015*
EN 1834:2000**

* Safety of Industrial Trucks – Operation in potentially explosive atmospheres: use in flammable gas, vapour, mist and dust.

** Reciprocating internal combustion engines – Safety requirements for design and construction of engines for use in potentially explosive atmospheres.

Date: *********

Engineering Manager

ORIGINAL VERSION
Registered Number: 1360808 UK
Registered Office: Endeavour Works, Dolphin Road, Shoreham-by-Sea, West Sussex BN43 6QG

A flammable gas warning is given at 10% of the Lower Explosive Limit (LEL).

In most cases the vehicle will be placed on the market by the OEM. The EU Declaration of conformity and CE marking plate on the vehicle will be issued by the OEM and NOT Pyroban. Please refer to the OEM manual for guidance on CE conformity if OEM is placing the complete machine on the market.

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.

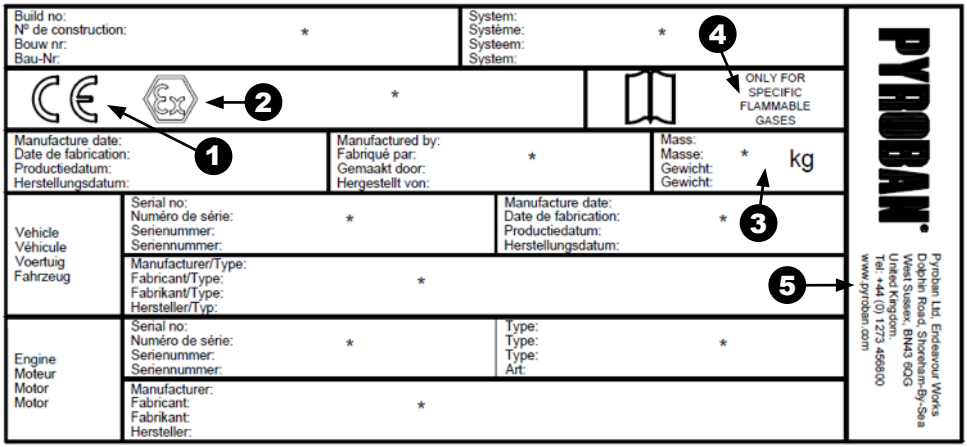
Section 3
Relation to other documents

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 marking 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. Refer to point 1.
4. The list of gases that can be detected can be found on the Pyroban website www.Pyroban.com
5. The address is only displayed on the label if Pyroban are considered as the manufacturer of the complete machine.



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 instructions 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 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

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 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.

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.

CAUTION!

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

Section 6
General Safety prescriptions continued

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!

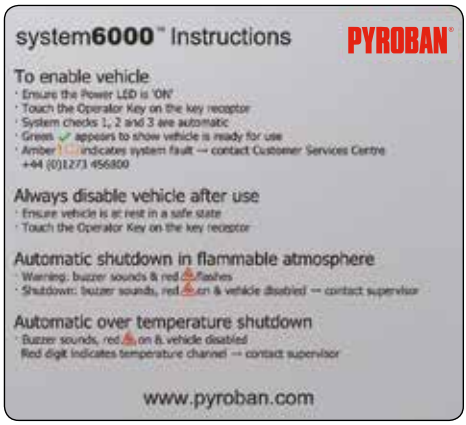
If any of the components that make up the Pyroban conversion are subject to direct impact, chemical spill or corrosion they must be checked by a qualified person before putting the equipment back into service.

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 of the operator.



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

1
WARNING!
NON CONDUCTIVE PART(S)
POTENTIAL ELECTROSTATIC
CHARGING HAZARD CLEAN
ONLY WITH A DAMP CLOTH
PYROBAN

2
PYROBAN®

3
CAUTION!
BATTERY ISOLATOR
DO NOT OPERATE
WITH ENGINE RUNNING
PYROBAN

4
CAUTION!
THE USE OF ALCOHOL BASED
SCREEN WASH MAY CAUSE
GAS DETECTION SYSTEM TO
SHUTDOWN USE NON-ALCOHOL
BASED PRODUCTS ONLY
PYROBAN

5
WARNING!
ENCLOSURES MUST NOT BE
OPENED, OR ANY EQUIPMENT
DISCONNECTED WHILE INSIDE
HAZARDOUS AREA
PYROBAN

6
WARNING!
REMOVE CABLE TIE FROM EARTH
STRAP BEFORE PLACING TRUCK
IN SERVICE
ENSURE STRAP IS IN
CONTACT WITH THE FLOOR
PYROBAN

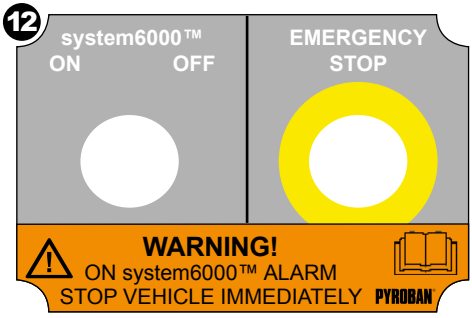
7
WARNING!
ON system6000™ ALARM
STOP VEHICLE IMMEDIATELY
PYROBAN

8
WARNING!
DO NOT SEPARATE
WHEN ENERGISED
PYROBAN

9
WARNING!
CLEAN MACHINE EVERY DAY TO
BE SURE THAT NO DUST LAYERS
CAN BE FORMED
PYROBAN

10
WARNING!
RESTRICTED BREATHING
ENCLOSURES “nR”
INSTALLED ON THIS TRUCK
PYROBAN

11
WARNING!
AFTER TRUCK SHUTDOWN FOLLOWING
GAS ALARM, EACH RESTRICTED
BREATHING ENCLOSURE SHALL BE
THOROUGHLY PURGED WITH AIR OR
INERT GAS BEFORE TRUCK RESTART
PYROBAN

12


13
WARNING!
ONLY OPEN IN A NON-
HAZARDOUS AREA
PYROBAN

14

6.1a
Safety Warning continued

REF	Label Text	Reason
1	**WARNING!** 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	**CAUTION!** BATTERY ISOLATOR DO NOT OPERATE WITH ENGINE RUNNING	Location and warning for the battery isolator.
4	**ATTENTION:** 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.
5	**CAUTION!** 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.
6	**WARNING!** 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.
7	BOOK SYMBOL - **WARNING!** 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.
8	**WARNING!** DO NOT SEPARATE WHEN ENERGISED	The equipment will not be protected from gas or dust in the hazardous area.
9	**WARNING!** 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.
10	**WARNING!** 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.
11	**WARNING!** 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.
12	system6000™ ON / OFF, EMERGENCY STOP, BOOK SYMBOL WARNING! ON system6000™ ALARM STOP VEHICLE IMMEDIATELY	To highlight the location of the system6000™ on/off switch and emergency stop button.
13	**WARNING!** OPEN ONLY IN A NON HAZARDOUS AREA	The equipment will not be protected from gas or dust in the hazardous area.
14	CHASSIS TO GROUND POINT	The label is to indicate the chassis eartthing points on the truck. There will be 2 points per machine located on opposite ends of the truck.

Section 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.
- Air inlet valve to stop engine if engine overspeed or flammable gas is detected.
- Exhaust gas cooling system to ensure the exhaust temperature does not exceed the Temperature-class
- 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 by restricted breathing enclosures.
- 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 blue operator key and a red supervisor key. Only the blue 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™	**YES**	**NO**
Power down system6000™	**YES**	**NO**
Silence shutdown alarm	**YES**	**NO**
Reset system6000™ after over-temperature shutdown	**YES**	**NO**
Reset system6000™ after gas shutdown	**NO**	**YES**

Sections 6.1e + 6.1g
Additional Safety Measures

6.1e
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

Electrostatic 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 no 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 14 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

Shutdown Valve lever

Control Module

1. System on / off switch
2. Emergency stop switch

Section 7
Description of the product continued

1. Shutdown valve lever
2. system6000™ control module, on/off switch and emergency stop

Section 8
Implementation, Installation, Adjustments

Pre-Start checks

1. Carry out any pre-start checks recommended by the vehicle manufacturer including coolant, fuel level and lubricant.
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.
4. Ensure the gear selector is in the NEUTRAL position. The engine starter motor will not operate unless NEUTRAL is selected.

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.

Ensure the emergency switch has not been applied and then turn the system6000™ on.

Place the blue Dallas key onto the key receptor of 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.

Section 9
Starting system6000™ continued

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

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.

Section 9
Starting system6000™ continued

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.

Ensure the hand brake is in neutral.

Before starting the engine you are required to open the air shutdown valve. Please read the instruction label above the inlet valve lever.

Ensure the air shutdown valve is placed in the start position. Push the lever to the START position.

The valve will not latch and needs to be held in the start position.

Section 9
Starting system6000™ continued

Hold the air inlet shutdown valve lever in the forward position and then start the vehicle using the original vehicle key switch in the normal manner. Once the engine has started wait 3 seconds before releasing the air inlet valve shutdown lever. This is to allow the engine oil pressure to hold the valve automatically in the open position.

Refer to the original vehicle operator manual for further guidance on operating the vehicle.

CHANGE TO OEM MANUAL
If applicable - The header tank will have been replaced and moved to the back part of the truck. Water levels can be checked against the fill line indicator.

The OEM filler point will no longer be the primary filling point.

Section 9.1a
Intended Use

OEM parameters

The truck is to be used for material handling. Refer 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. 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 as T3 or 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 is zone 2 classified areas for gas.

Section 9.1b
Service Operations

Any service or 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
Description of the Operation

Gas Shutdown warning at 10% LEL

The fire triangle will flash alternately with the green tick. 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 authorized 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 blue key can be used to silence the sounder.

Section 9.1c
Description of the Operation continued

Red 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 blue key to enable the vehicle.

Failed gas head output level test

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

Stage 2 is gas injection to the gas head. Check the contents of the bottle.

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

Section 9.1c
Description of the Operation continued

Failed gas diffuser test

The system with 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 shutdown

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
Description of the Operation 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 blue operator key onto the receptor on the control module to reset the timeout.

Power down system6000™

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

Isolate supply by turning the system6000™ supply switch to the off position.

Section 9.1d
Description of the Operation

System induced shutdowns

The vehicle shutdown is normally activated immediately if a shutdown condition is detected as the vehicle can be brought to a controlled stop without battery power.

However, the vehicle may be fitted with a time delay before vehicle shutdown. This delay retains critical operator functions (brakes, steering and systems of stability) 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 counterbalance vehicles where additional safety devices are fitted (systems of stability) or vacuum assisted braking.

If such a delay is fitted, the vehicle will be labelled accordingly (see label below). When a shutdown condition is detected, the vehicle should be brought to a controlled stop within 15 seconds BEFORE the vehicle will shut down.

WARNING!
ON system6000™ ALARM
STOP VEHICLE IMMEDIATELY
PYROBAN

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 or by pulling back on the inlet air shutdown valve lever (you will force the valve to shut off the air supply to the engine).

CAUTION!

The emergency stop, switch or shutdown lever 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, pull the emergency stop button to release it.

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.

Sections 9.2 - 9.2e

Information for Charging of the Battery and Battery Handling

9.2

WARNING!

The starting battery positive and negative terminals shall only be disconnected and connected in a non-hazardous area.

WARNING!

The starting batteries are user replaceable, and shall only be replaced with Pyroban certified components.

9.2a
Battery Charging

Battery charging is designed to take place in the hazardous area with the supplied on vehicle alternator.

CAUTION!

The cranking battery shall not be charged using a mains powered systems in the hazardous area.

9.2b
Gas Production

The battery enclosure is vented to prevent the build-up of hydrogen gas. This venting also aids in preventing heat build-up.

CAUTION!

Do not block or cover vents on the battery enclosure.

9.2c
Description of the Operation Charging Equipment

Not applicable as charging can only be carried out by a Pyroban certified alternator. All mains charging must be carried out in a non-hazardous area.

9.2d
General Battery Information

The cranking batteries have been assessed as Group II, Category 3G equipment, safe for use in a Zone 2 hazardous area. All of these batteries are to be used as cranking batteries for use in diesel fork lift trucks converted under diesel system6000™.

9.2e
Service

The starting battery shall be maintained in accordance with EN 60079-17.

CAUTION!

The starting battery is sealed and does not require electrolyte maintenance.

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!

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!

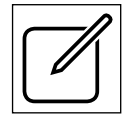
- Read and understand all notices and labels on the equipment before operating the vehicle.
- After maintenance or repair work, the person in authority must inspect and approve the Pyroban equipment before the vehicle is returned to service.

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.

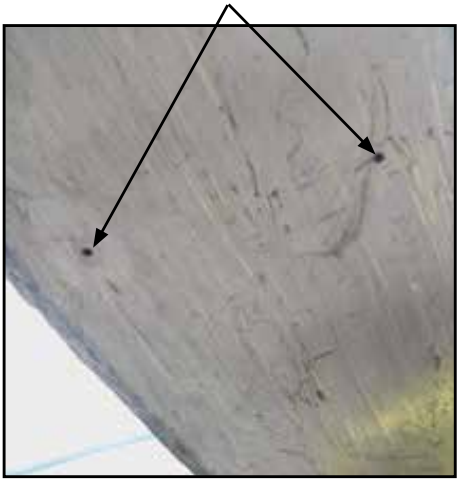
Task - In addition to original vehicle requirements. (Details of each check point follows in the pages after this chart)
1. Forks – check cladding including underside for damage and wear. (Forks shall be clad in such a way that inspection for hair cracks on critical locations shall always be possible).
2. Tyres – check for damage, embedded foreign particles, pressure (where applicable). Castors, wheels, earth straps and fan belts should be checked for contamination with regard to conductivity.
3. Test gas cylinder – check pressure. Replace if <20 bar.
4. Control module – **warning**, electrostatic ignition hazard. Clean only with a damp cloth. DO NOT use solvents.
5. Radiator – check coolant level. Top up as necessary. Check radiator core for damage or blockage. Clean as required.
6. Brakes – check operation. Investigate any excessive noise or poor performance.
7. 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 thickness is less than 1mm, the vehicle should not be used in a hazardous area. The cladding must be repaired or replaced.

Wear Indicators
(3mm diameter inspection holes)



Stainless Steel Clad Forks

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.

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 can be found in section 7.

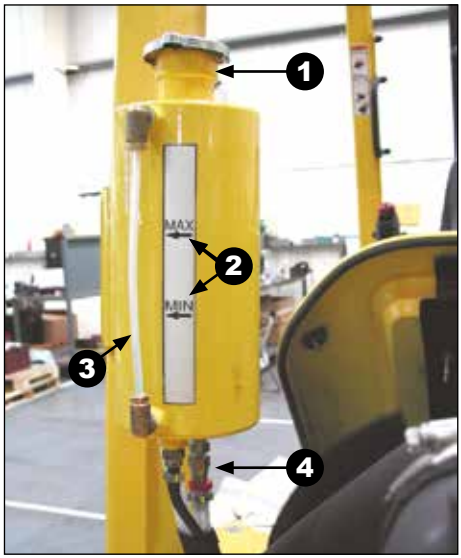
Section 10.1a.5
Topping up the coolant

As part of the system6000™ conversion, the original coolant system will be modified to provide additional coolant capacity. An extra capacity expansion tank will be fitted to the vehicle. The level of coolant must be maintained to prevent coolant over-temperature shutdown. The coolant level should be checked every day.

A visual coolant level feature is fitted to the expansion tank to facilitate level checking.

WARNING!

The pressure cap must not be removed if the engine is hot.
Serious personal injury may result from hot coolant.



1. Pressurising cap & overflow
2. Coolant level MIN / MAX
3. Coolant level indicator tube
4. Cooler & radiator vent hoses

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 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.

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 covered in an electrically conductive vinyl or cloth.

Dashboards, canopies, seat backs, 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 as 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 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 aspects of the internal combustion engine

Maintenance aspects for the internal combustion engine 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
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.

10.1r
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 authorized 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.

Air Inlet Shutdown Valve
Safety device fitted to the inlet of a diesel engine which will shut air supply off to the engine. Will be activated automatically when air flow increases, high temperature shut-off and manually from the operator.

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 a 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
Illustrates the three elements a fire needs to ignite: heat, fuel, and an oxidizing agent (usually oxygen).

Section 14
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.

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. The inert gas system is used to prevent the atmosphere with system6000™ test gas calibration from coming into the explosive range.

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

Overspeed
Condition where an internal combustion engine is forced to run beyond it design running speed. Ingestion of air and flammable gas can lead to engine overspeed.

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

Enabling people to work safely every day

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