

PYROBAN[®]

**HOW TO REMOVE
“PLATE TYPE”
EXHAUST FLAME
ARRESTORS
FROM ATEX
CATEGORY 3G
ENGINES**

WHITE PAPER

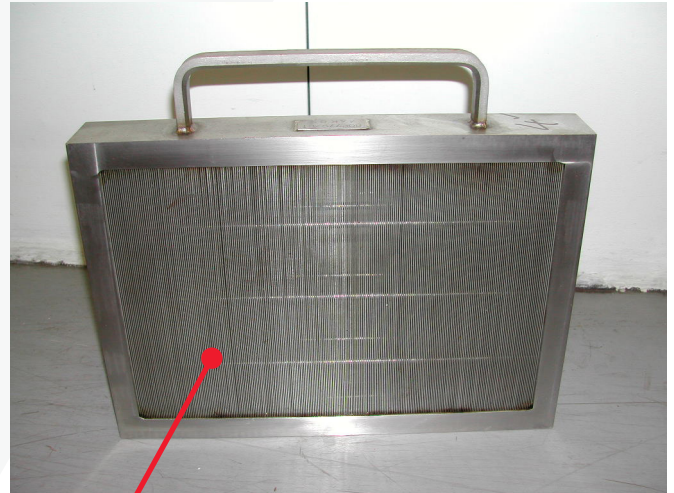
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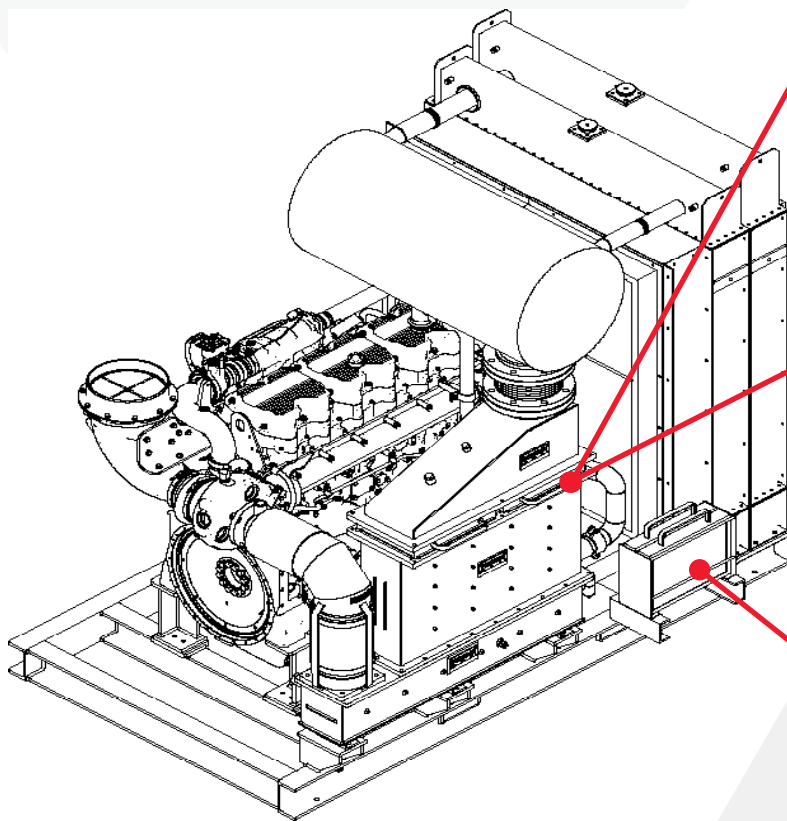
EXHAUST FLAME ARRESTORS

Exhaust flame arrestors are a critical component part of the explosion proof system found on diesel engines used in Zone 2 hazardous areas. They make the engine flameproof.

“Plate type” flame arrestors* have been the industry standard for decades.



Typical “plate type” exhaust flame arrestor



Exhaust flame arrestors

- Allow the engine exhaust gases to pass through small passages
- Stop a flame in the event of hydrocarbon gas ingestion. The heat of the flame is absorbed and the flame cannot survive or propagate

Dummy flame arrestors

- Dummy flame arrestors are for safe area operation

Example of a typical explosion proof engine which features air inlet shut-off valve, air inlet flame arrestor, water-cooled turbocharger and exhaust manifold, thermal control and treatment, exhaust gas heat exchanger, exhaust flame arrestor, spark arrestor and more.

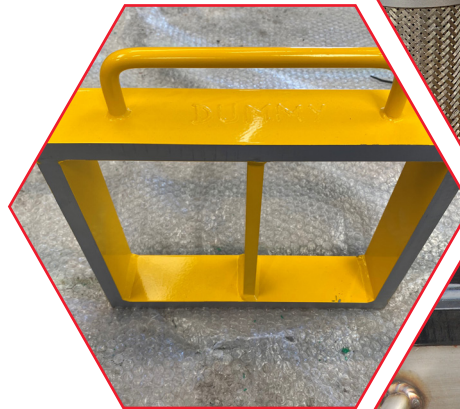
The potential ignition sources on an unprotected diesel engine include electrical, mechanical or static sparks, overspeed or flame transmission from inlet or exhaust, and hot surfaces.

** Sometimes called exhaust flame traps*

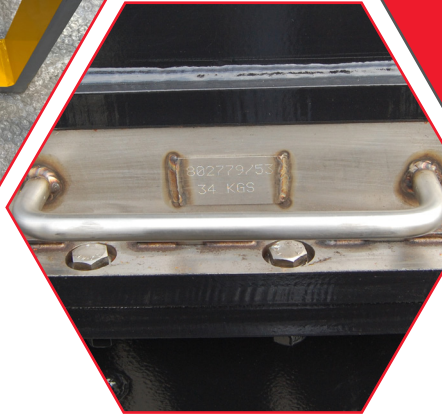
CLEANING, LIFTING AND DUMMIES

There are three main drawbacks with “plate type” exhaust flame arrestors

1. The exhaust gas has to flow through the restrictive narrow gaps in the flame arrestor, so it clogs up with soot very quickly. This means they must be removed every 8-12 hours of operation to be cleaned. This causes downtime affecting the efficiency of the operation offshore.
2. “Dummy” flame arrestors are usually shipped with an explosion proof engine which are an empty casing. These are only supposed to be for testing purposes and for when the engines are used in safe areas. Wrongly using a “dummy” in a Zone 2 hazardous area exposes the operation to sources of ignition and invalidates the whole Pyroban Zone 2 system certification.



Example of a “dummy” flame arrestor



Example of a 34kg exhaust flame arrestor

3. Exhaust flame arrestors look small, but they are extremely heavy. They typically weigh over 25kg and are usually located above waist height making them hard to handle safely. This leads to manual handling compliance issues every day that they are changed.

The working temperature is 200degC and so manual handling is a challenge. To compound this the chemicals that are needed to clean the flame arrestor must be disposed of correctly.

Example of a “plate type” exhaust flame arrestor ready for cleaning



HOW TO REMOVE EXHAUST FLAME ARRESTORS FROM YOUR OPERATION

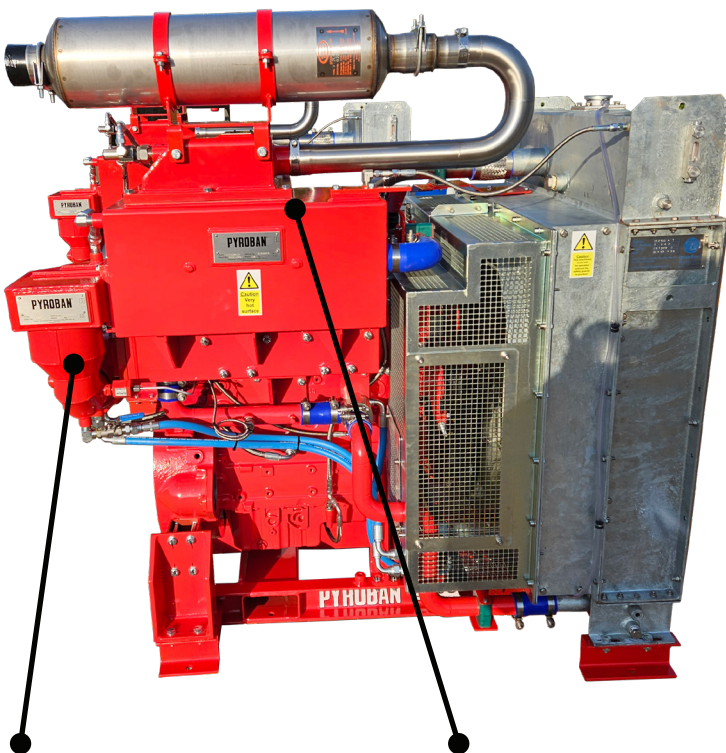
There are now two different ways to eliminate the “plate type” exhaust flame arrester from the explosion proof diesel engine design.

1. REPLACEMENT PART

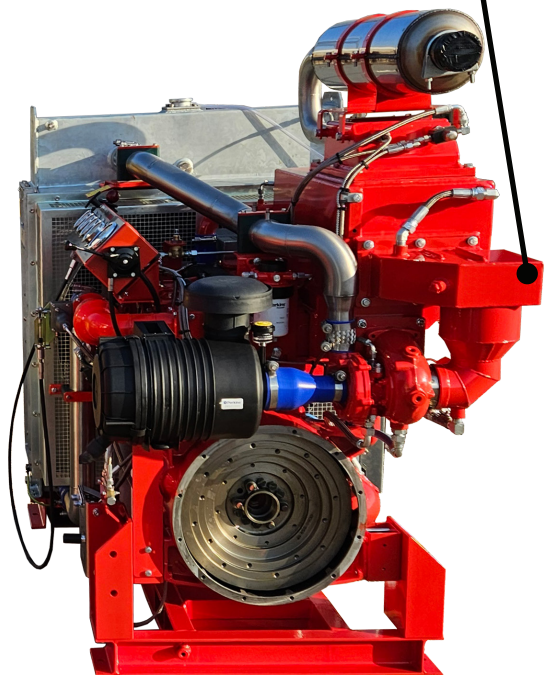
A replacement part can be bolted into the exhaust system between the turbo and gas cooler, on the hot side of the exhaust flow.

The technology was launched in 2020 as a direct replacement for the “plate type” flame arrestors.

They are low in cost and can easily be fitted in the field to existing equipment. This means that the maintenance requirements every 8-12 hours are removed as soon as it is fitted.



Backwards compatibility to existing ATEX certified Pyroban equipment



“Plate type” exhaust flame arrester would normally go here

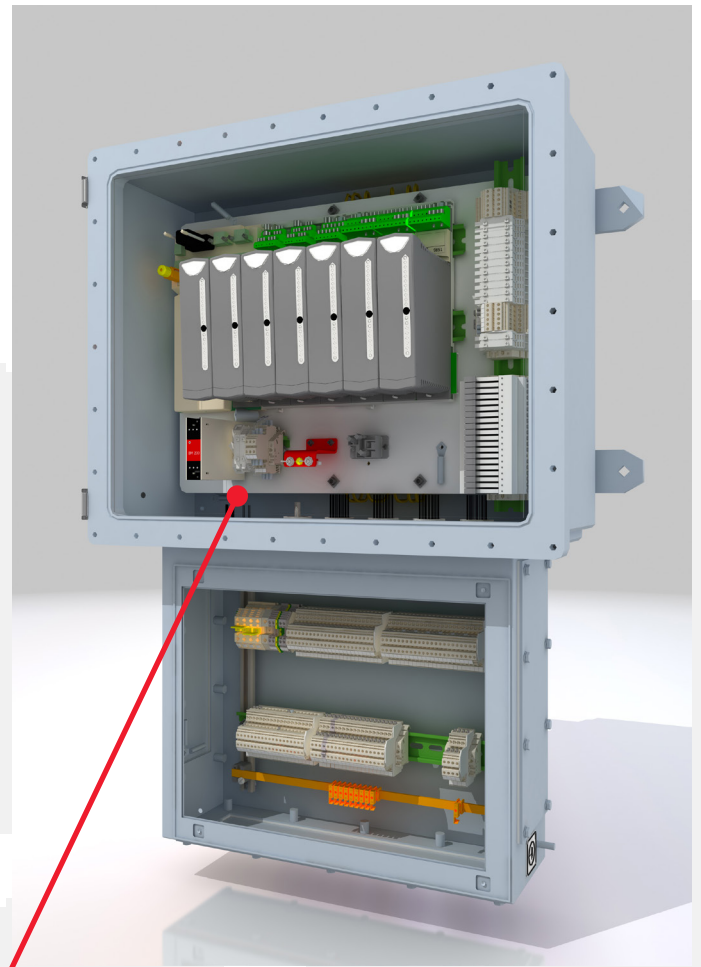
2. ACTIVE CONTROL SYSTEMS

As a more advanced alternative, it is possible to take an active approach to the overall safety system and combine safety shutdown with diesel engine control and monitoring.

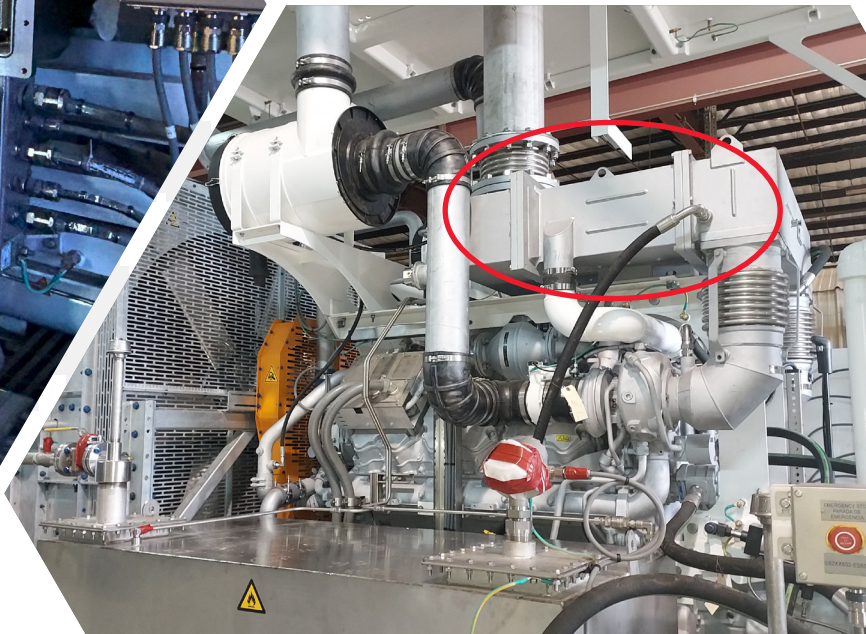
Gas detection is introduced into the engine inlet tract at a certified position and also within the equipment DNV 2.7-1 enclosure.

A safety shutdown is then triggered on detection of a flammable gas in the engine air inlet or in the atmosphere, diesel engine over speed, high exhaust gas and coolant temperatures, low oil pressure or if there is a manual emergency stop activation for example.

This active approach makes it easy to incorporate additional driven equipment controls such as pumps, generators, transmissions, or the well head platform's DCS (distributed control system).



There is no need for any type of exhaust flame arrestor, as seen here



At the end of 2023, Pyroban® shipped a new batch of diesel engines for ATEX Zone 2 areas offshore. Featuring Ever Clear™, each HazPak™ unit has the benefit of low maintenance requirements when in operation.



The Zone 2 diesel engines are built for safe and reliable operation in harsh offshore environments in accordance with ATEX 2014/34/EU and all necessary standards including EN1834-1:2000. This means they cannot be the source of an ignition in the event of a hydrocarbon release.

Ever Clear is seen on the left of this C4.4TA diesel engine between the turbo and gas cooler, on the hot side of the exhaust flow. The engine provides 91kW of reliable power and will be operating in the Gulf of Mexico.

Pyroban HazPaks feature an air inlet shut-off valve, air inlet flame arrestor, water-cooled turbocharger and exhaust manifold, exhaust gas heat exchanger, thermal control and treatment, ATEX certified spark arrestor and much more.



Pyroban's Ever Clear™ drives down maintenance costs on Malaysian rental firm's ATEX generators



Pyroban's Ever Clear™ long-life flame arrestor has been successfully deployed with long standing Pyroban customer Rotorniaga in Malaysia. Rotorniaga serve both peninsular and east Malaysian operations with their Zone 2 rental generator sets equipped with Pyroban Zone 2 engines and alternators.

Based in KSB, Mr Mohd. Imriqis Suhaimie, MD of Rotorniaga commented: ***"We've been using Pyroban since 2009 and have had a long-standing relationship. The original Pyroban coolers were upgraded in 2021 with the Ever Clear™ solution."***

"I've had the Ever Clear™ system on trial for the last year and have been so pleased with the 1000 hours plus (on local fuel) and we've achieved a 50% reduction in carbon deposits in the gas cooler," he says.

"I'm going to switch all my Pyroban equipped generators to use Ever Clear™ in 2022 during a deep equipment refurbishment programme I'm running. Pyroban is driving down cost from my maintenance activities, whilst increasing safety and up-time. This is exactly what I need and value as a responsible business owner," he confirms.

Having a non-electrical passive solution to eliminate the intensive cleaning intervals on exhaust flame arrestors is a real benefit in Asia where clients prefer mechanical engines and have existing fleets of equipment.

Pyroban® completed the production, certification, and testing of two Cat® C18 diesel powerpacks for Zone 2 hazardous area operation at a North African refinery. Featuring the Ex-SCS™ control system, the ATEX powerpacks do not need exhaust flame arrestors.



Destined for a production and pumping application in North Africa, the two HazPak™ units are built in accordance with ATEX and all necessary standards including EN1834-1:2000. With a 50 degree C ambient the radiators and surface temperature thermal signature have been under particular design scrutiny, with the thermal signature reduced with the application of Pyroban's patented SCTB (Soft Compound Thermal Barrier) to the turbo compressor scrolls.

In addition to the "explosion proof" Pyroban kit the packages have been fitted with Pyroban's Ex-SCS engine control system which not only protects the engines but also features additional analogue and digital inputs for monitoring pump oil temperature, bearing temperature and gearbox vibration, all items commonly encountered on API pumps.

Pyroban has supplied the radiator to gearbox coupling and integrated the Ex-SCS system into the ATEX powerpack package known as a HazPak™. The pump packager then integrated the complete HazPak and control system with their sub-base, speed increasing gearbox and centrifugal pump.

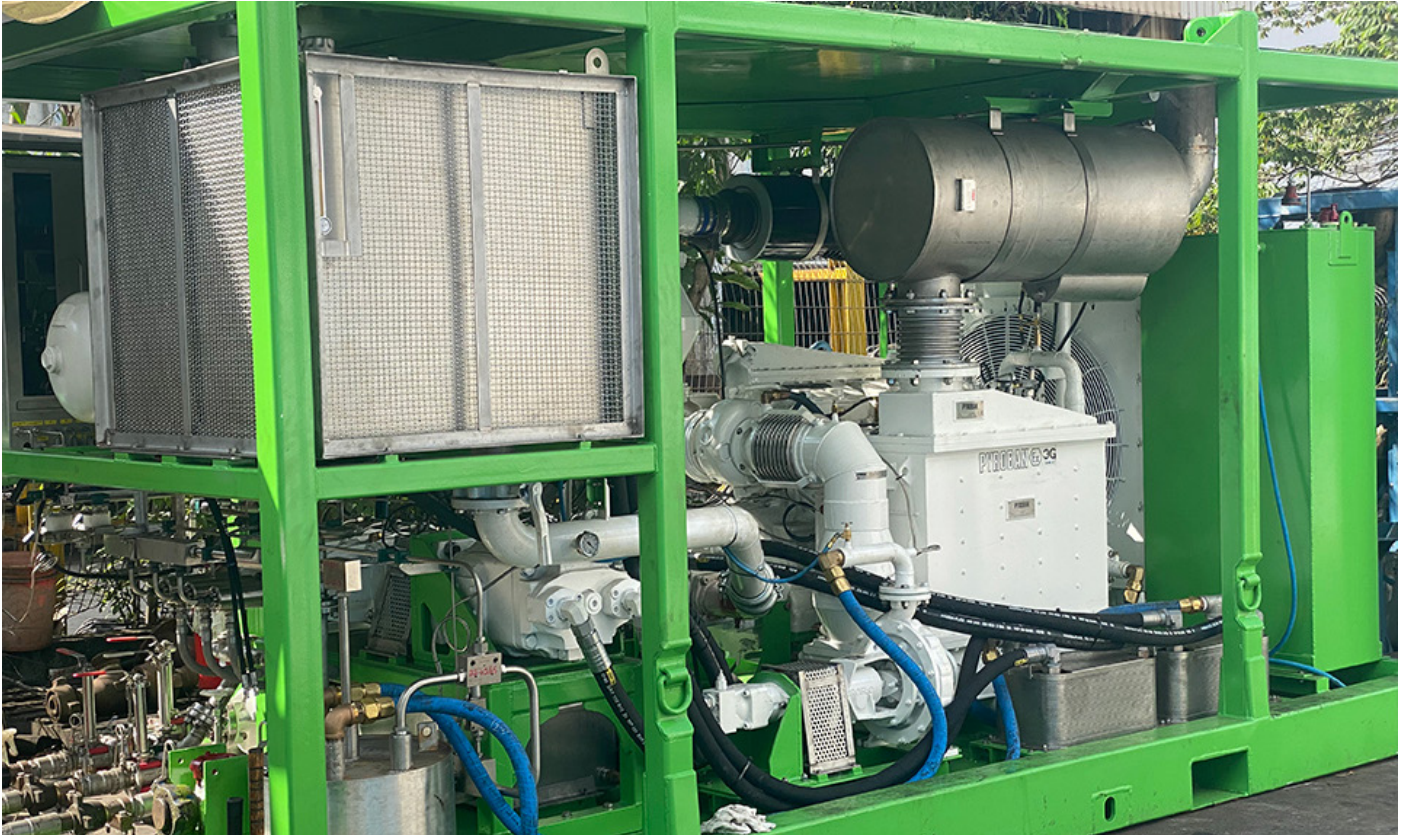
Pyroban collaborated with the NOC client and EPC to ensure that the specification and documentation requirements have been adhered to.

Gas detection is introduced into the engine inlet tract at a certified position and also within the equipment DNV 2.7-1 enclosure. A safety shutdown is then triggered on detection of a flammable gas in the engine air inlet or in the atmosphere, diesel engine over speed, high exhaust gas and coolant temperatures, low oil pressure or if there is a manual emergency stop activation for example.

This API centrifugal pump application features the 15" screen which gives an enhanced viewing and control experience for operators working offshore in often difficult environments. Viewable under direct sunlight the resistive touch screen is operable with a gloved hand.



In early 2023, Pyroban® supplied two Cat® 3406 “Pyroban kits” featuring Ever Clear™ to a customer in Singapore. The engines power two 180k nitrogen pumps in ATEX Zone 2 areas offshore and do not need operators to clean the exhaust flame arrestors on a daily basis.



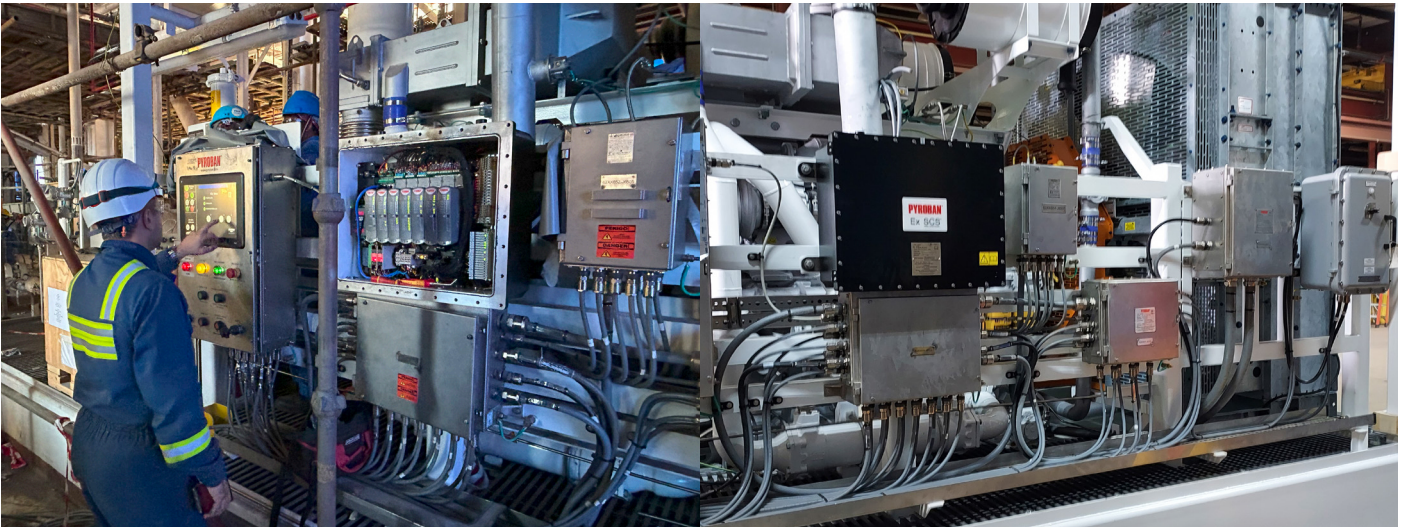
The customer, a major service company, values all the benefits that the 1000 hour flame arrestor maintenance intervals bring while the units will be in operation offshore. The aim is to reduce operational downtime and increase safety even further for personnel offshore.

Ever Clear exhaust flame arrestors enable the exhaust gases to pass without clogging and are positioned in the exhaust system between the turbo and gas cooler, on the “hot side” of the exhaust flow, as seen below right.

Photo Credits: Tang Seng – <https://www.tangsengservices.com>



In early 2024, three Pyroban protected Cat® C32 engines featuring Ex SCS™ control systems were commissioned by Pyroban onboard an FPSO (Floating production storage and offloading) destined for Brazil.



These dual certified ATEX / IECEx prime movers are rated for continuous duty in Zone 2 hazardous area operations. The engines have been converted using “explosion proof” Pyroban kits in combination with Pyroban’s Ex SCS engine control system as part of a total Ex solution powering the pumps.

Ex SCS combines EN1834-1:2000 safety shutdown with diesel engine control and monitoring and means the powerpacks do not need exhaust flame arrestors, eliminating daily cleaning requirements.

In this case, the Ex SCS application also includes driven equipment parameters such as mechanical seal system operating pressures, gearbox and pump vibration, gearbox oil temperature and pressure, diesel day tank level, suction and discharge pressure. In the picture Pyroban Engineer Martyn Ballinger is onboard the FPSO completing the successful commissioning of the PLC’s.

The programming on the Ex SCS units was bespoke for these pump skids and features a unique automatic starting sequence conducting pump safety checks before allowing engine start up.

The ATEX / IECEx engine control system features infrared gas detection and is a 100% stand-alone safety control system for ATEX 2014/34/EU compliance. A safety shutdown is triggered on detection of a flammable gas in the engine air inlet or in the atmosphere, diesel engine over speed, high exhaust gas and coolant temperatures, low oil pressure or if there is a manual emergency stop activation for example.

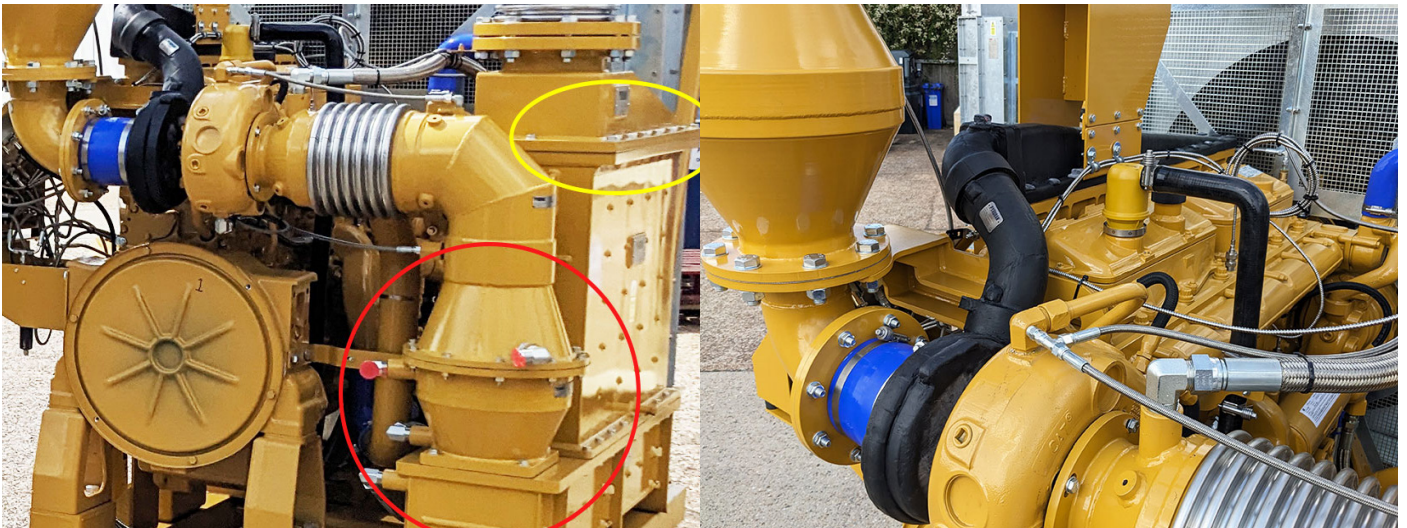
The EX SCS system was favoured over others due to its 3rd party IECEx certification which allows simple approval to INMETRO codes (for Brazil).



In the photo above, the operator can be seen operating the HMI screen of the EX SCS system. The colour 15” touchscreen HMI displays the current safety status and the diesel engine control and monitoring screens can also be integrated. For example, engine and driven equipment controls and sensor parameters can all be fed into Ex SCS. Viewable under direct sunlight the resistive touch screen is operable with a gloved hand. Easy to use password protected inspection and test menu pages allow the end user to verify the machine will shutdown during annual audit cycles without removing field devices.

Pyroban engineers have all necessary offshore safety certificates and are ready to support customers in any of the global oil and gas fields offshore as needed.

In September 2023, two new Pyroban® 3406 HazPaks were shipped featuring Pyroban's unique Soft Compound Thermal Barrier (SCTB) and Ever Clear™. The ATEX powerpacks are used by a large service provider in the USA in support of offshore well service operations



Pyroban supplied an explosion proof Caterpillar 3406 Pyroban Kit for local installation at PETROGEAR in the United Arab Emirates. The explosion proof engine kit has been used as part of a Zone 2 diesel hydraulic power unit (HPU) for a hydraulic workover rig.



The hot climate in the middle east is always extra challenging for ATEX Zone 2 powerpack packages, and on this occasion the engine had to stay within T3 limits in an ambient specified to 50 Deg C. To achieve these temperature targets, Pyroban applied its extensive knowledge of the Caterpillar 3406 engine and strategically applied SCTB (Soft compound thermal barrier) to target the hot charge air system which will start to exceed T3 (200 Deg C) temperature class in ambient temperatures as low as 30 Deg C.

Dubai based Pyroban partner Auto Craft Trading was on hand for commissioning and completion of the final SCTB on the charge air system joints and bolts, to ensure that the final thermal test by a third party notified body was a success. Ever Clear provides maximum uptime and can be seen in the image below on left of the cooler.



Pyroban® supplied two Cat® C18 diesel powerpacks rated for continuous duty in Zone 2 hazardous area operations in Egypt. The engines feature Pyroban's Ex-SCS™ control system which means the ATEX powerpacks do not need exhaust flame arrestors, eliminating daily cleaning requirements.



Installed at a crude oil pumping facility in Egypt, the two HazPak™ units are built in accordance with ATEX and all necessary standards including EN1834-1:2000. Pyroban's Service Technician Mr Martyn Ballinger visited the site location in November 2022 to complete the successful commissioning of the PLC's.

In addition to the "explosion proof" Pyroban kit the two packages are fitted with Pyroban's Ex-SCS engine control system which helps operators take an active approach to the overall safety system and combines ATEX safety shutdown with diesel engine control and monitoring.

This Ex-SCS application also includes driven equipment parameters such as seal pressure, gearbox and pump vibration, gearbox oil temperature and pressure, diesel day tank level, suction and discharge pressure.

The ATEX engine control system features infrared gas detection and is a 100% stand-alone safety control system for ATEX 2014/34/EU compliance.

A safety shutdown is triggered on detection of a flammable gas in the engine air inlet or in the atmosphere, diesel engine over speed, high exhaust gas and coolant temperatures, low oil pressure or if there is a manual emergency stop activation for example.



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By eliminating the need for plate type exhaust flame arrestors, operators simply reduce downtime and improve productivity straight away.

Manual handling and environmental compliance issues also disappear because you have removed the need to regularly change the heavy flame arrestors and clean with solvents, offshore. The dangers of “Dummy” arrestors are also avoided.

Lewis Cleary, Ex Power Systems, Pyroban Ltd

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Explosion proof kits being fitted at the UK Pyroban factory for operations in the Middle East

EVER CLEAR™

Ever Clear™ Exhaust (ECE) Flame Arrestors developed by Pyroban are a direct replacement for the plate type flame arrestors found in Pyroban explosion protected diesel engines.

Costing as little as half the annual cleaning costs of a plate type exhaust flame arrestor, they are suitable for new, or existing, Pyroban protected turbo diesel engines above 100bhp. Tested in accordance with EN1834-1:2000 and suitable for T3, IIA & IIB gas groups.

Ex SCS™

Pyroban's Ex SCS™ is an active approach combining flame arrestor elimination, safety shutdown and diesel engine control and monitoring into one flexible package. It features infrared gas detection and is a 100% stand-alone safety control system for ATEX 2014/34/EU compliance.

A colour touchscreen HMI (Human Machine Interface) displays the current safety status and the diesel engine control and monitoring screens can also be integrated. For example equipment controls, pump sensors, as well as fire and smoke detectors can all be fed into Ex SCS.



QUALITY

Additional to the ISO9001:2015 quality standard certification, each Pyroban Group company attains the required level of 3rd party certification for the business markets it serves including ATEX, IECEx and GB.

ABOUT PYROBAN

Pyroban provide explosion protection solutions for materials handling equipment and diesel engines.

For over 50 years Pyroban has been at the forefront of the industry developing products to protect your people, your site and equipment when operating in hazardous areas.

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