AFSS

AUTOMATIC FIRE & EXPLOSION SUPPRESSION SYSTEM

MARTEC
MARINE & TECHNOLOGIES

12 ms   24 ms   60 ms   96 ms   120 ms   156 ms   200 ms

AFSS SYSTEM

As a result of their mission, military vehicles are exposed to hydrocarbon destructive fires or explosions through their life.

In combat situations an explosion may occur in the crew compartment when an enemy round pierces the vehicle armour cutting fuel or hydraulic lines inside the vehicle: the combustible heated by the high energy round is instantaneously turned into vapour and easily ignited by high temperature fragments: the result is an explosive fire that will certainly kill the crew members. In peace keeping operations a Molotov cocktail thrown by insurgents into an open hatch of the vehicle may result in destructive fire onto the crew members. High pressure diesel injection systems and turbochargers may become a source of fast growing fires in engine compartments in case of fuel line ruptures even in peace exercise operations. In all these cases the time to react to this extremely fast phenomena cannot be left to human beings: an Automatic Fire Sensing and Suppression (AFSS) system will save the lives of your crew and protect your high value equipment. Martec's multiple spectrum infrared sensors will immediately detect the fire, a control electronics will filter the fire signals and activate high speed solenoid valves in less that 15 milliseconds.

The extinguishing agent is dispersed into the compartment by one or more suppressors in less than 100 ms. The explosion will be suppressed in less than 250 milliseconds, the duration of a blink of your eye. Early suppression will avoid pressure and temperature buildup in the compartment while reducing the combustion and acid gases generation to a minimum tolerable by personnel. Martec AFSS system components have been qualified through extensive live fire tests carried out by the Department of the Navy of the Italian Ministry of Defence: during this campaign response and suppression times have been recorded and validated using non-Halon, zero ODP (ozone depletion potential), one GWP (global warming potential) extinguishing agent, fully compliant with Montreal Protocol and F-Gas European regulation.

An artist's impression typical sequence of a vehicle without the AFSS system experiencing a destructive rapid growth fire is shown on the upper storyboard.

The lower storyboard represents a typical sequence of a suppressed fire or explosion in the same vehicle: the time stamp reported below each frame is taken by a real successful suppression test conducted during the validation campaign.

ACTIVE

12 ms   24 ms   60 ms   96 ms   120 ms   156 ms   200 ms
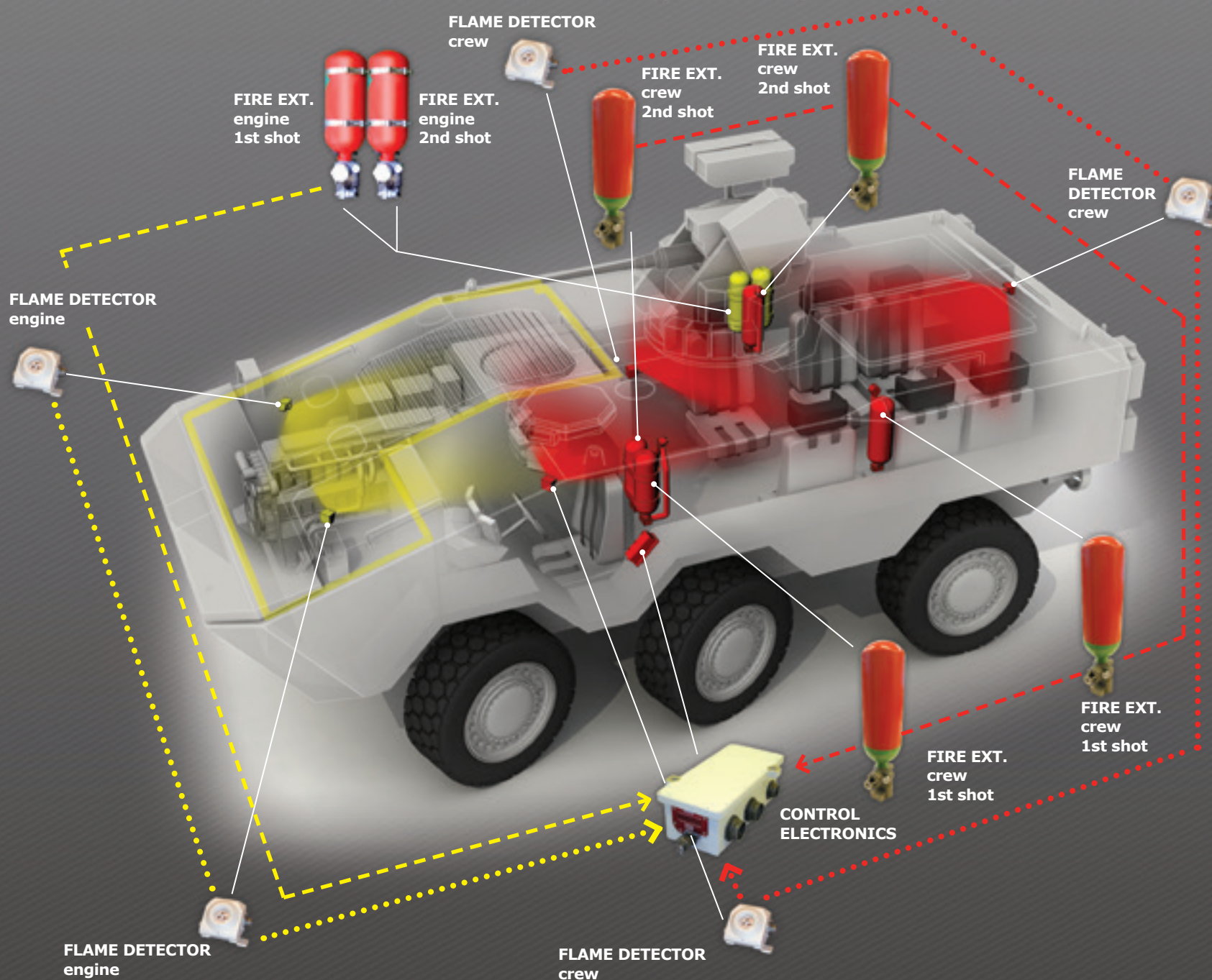
FLAME DETECTOR
crew

FIRE EXT.
crew
2nd shot

FIRE EXT.
crew
2nd shot

FIRE EXT.
engine
1st shot

FIRE EXT.
engine
2nd shot

FLAME
DETECTOR
crew

FLAME DETECTOR
engine

FIRE EXT.
crew
1st shot

FIRE EXT.
crew
1st shot

CONTROL
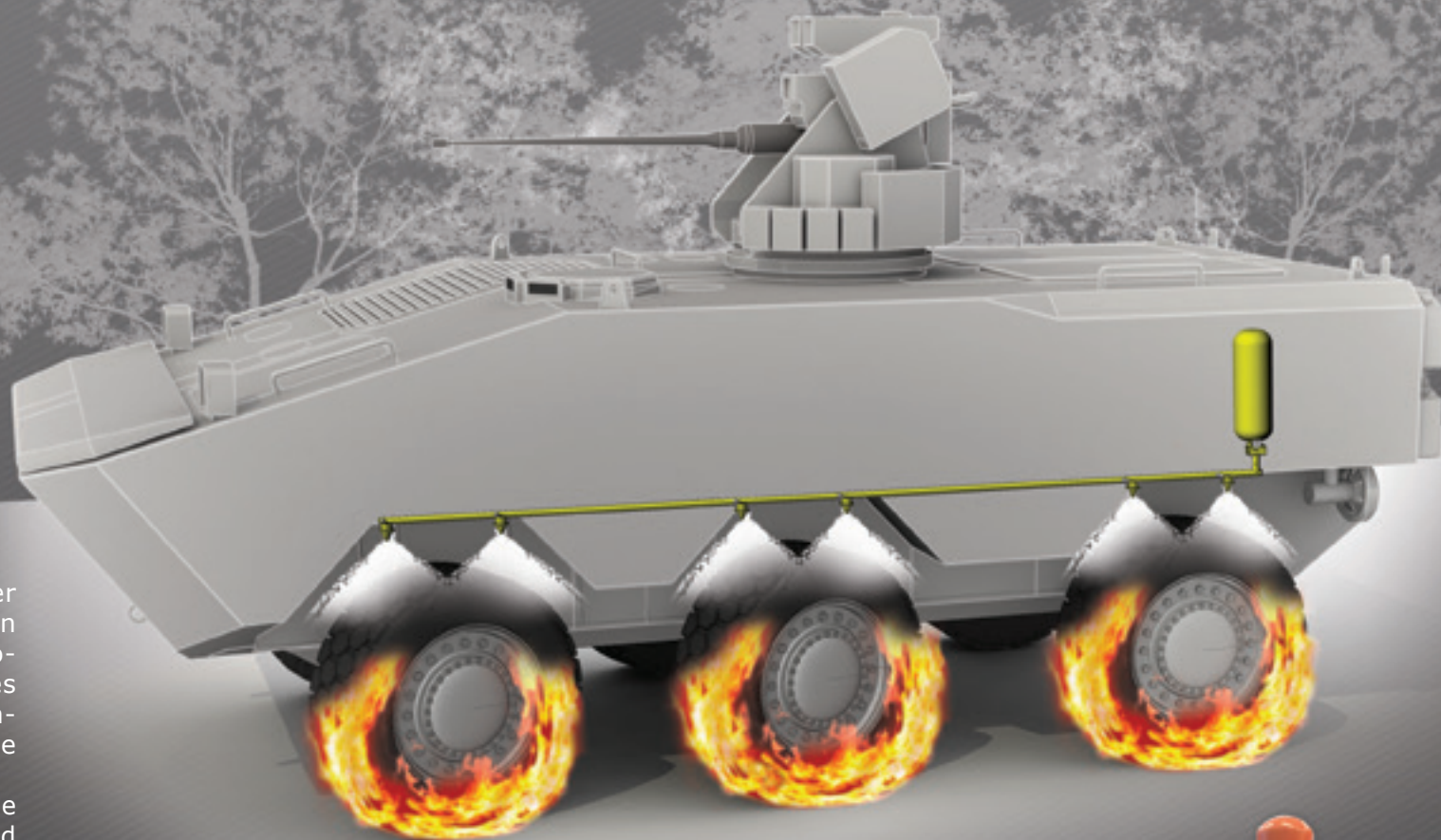ELECTRONICS

FLAME DETECTOR
engine

FLAME DETECTOR
crew

A medium or heavy military vehicle may have two to four compartments to be protected.

Crew, Engine, APU, Payload or ammo locker can be protected by the same control electronics plus optical sensors and explosion suppressors. The vehicle driver can monitor the status of the AFSS system through a control panel with leds and switches. In the example shown the vehicle engine is equipped with a dual shot extinguisher system and two sensors: in case a fire is detected by any of the two sensors, one extinguisher will be automatically released while the second extinguisher will be ready as a backup that the driver can manually activate from the control panel in case of re-ignition. The crew AFSS is configured with 3 optical sensors and a dual shot system with two extinguishers per shot: in case a fire is detected by any of the 3 sensors, two extinguishers located in different points of the vehicle will be discharged at the same time. After the first discharge, the vehicle is still protected against a second fire or explosion: if this occurs, the control electronics, based on a fire alarm coming form any of the sensor, will trigger the second batch of two extinguishers. The number of extinguishers depends on the volume of the compartment and its clutter: to achieve a good suppression quick distribution from different points of the compartment is essential to rapidly attack the fireball and saturate the volume.

WHEEL PROTECTION

Tactical vehicles and heavier armoured vehicles are often used in peace keeping and police operations. In both cases cocktail Molotovs thrown by insurgents can easily attack the vehicle tyres.
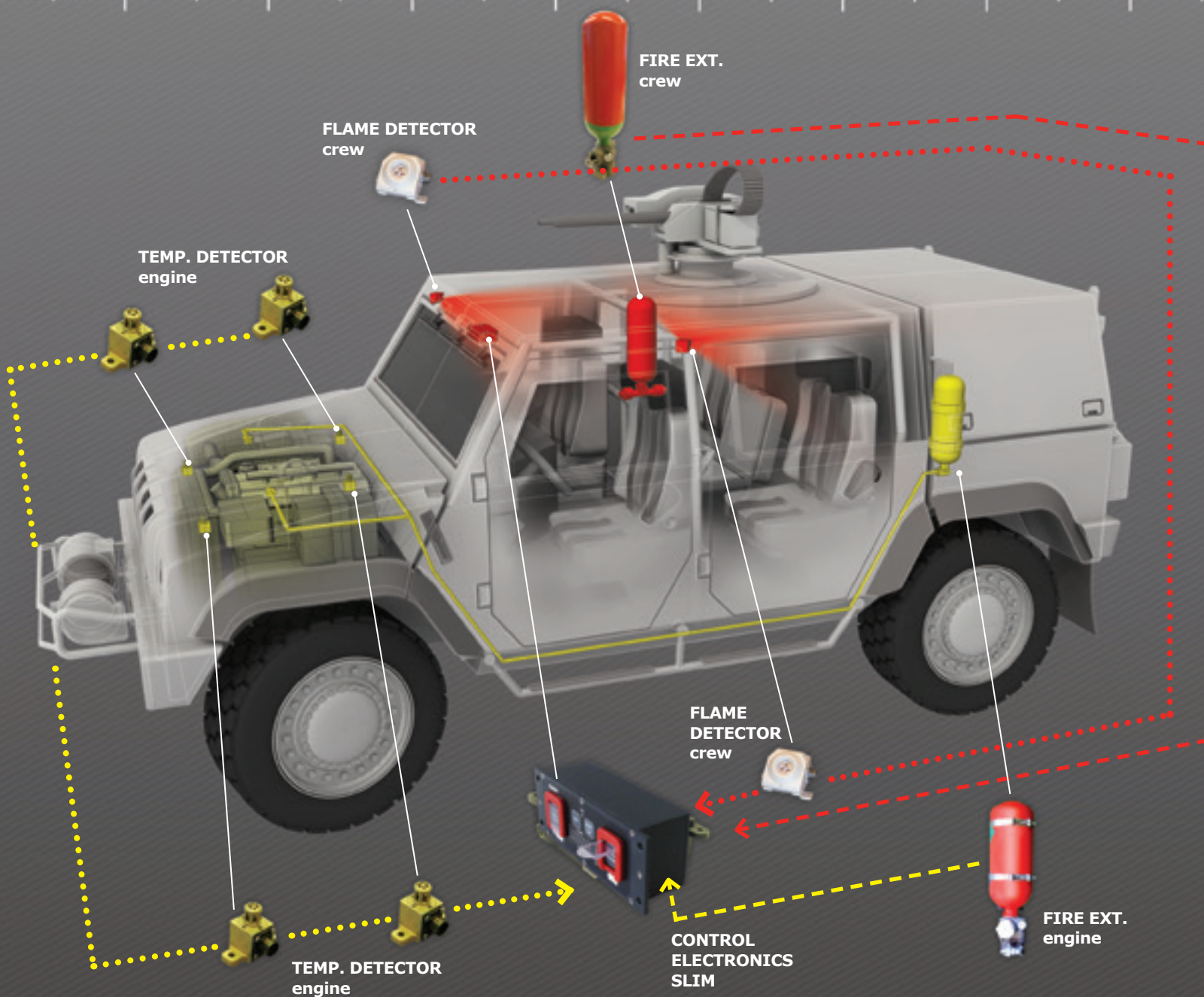
Once on the rubber tyre, the smouldering fire could extend from the wheels to the whole vehicle, pressing the crew to evacuate the vehicle and exposing them to sniper or enemy fire. A manual foam extinguishing system can be installed to suppress the fire and generate a barrier between the tyre and the fire threat.

CONTROL ELECTRONICS

FIRE EXT.
wheels

FIRE EXT.
crew

FLAME DETECTOR
crew

TEMP. DETECTOR
engine

FLAME
DETECTOR
crew

FIRE EXT.
engine

CONTROL
ELECTRONICS
SLIM

TEMP. DETECTOR
engine

Tactical vehicles both up-armoured or not, can also take advantage of the installation of an AFSS system. A smaller control electronics (named CE slim) has been specifically designed for retrofit and small vehicles installation: it incorporates both the logical electronics and the control panel. A "night mode" is available to switch off all the leds in case of night watch operations. In the example shown a tactical vehicle is equipped with one CE slim system configured with four rugged temperature point detectors in the engine compartment and one extinguisher. In the crew two optical flame detectors and one explosion suppression are used to protect the personnel. Various configurations can be set via software in order to change the number of detectors and extinguishers to protect each compartment.

Temperature sensors may have a different temperature environment depending on how close to hot spots they are: to prevent overheat false alarms, the CE slim in the development or maintenance phase of the vehicle can be connected to a laptop computer to download temperature recording at the sensor location during each mission profile of the vehicles. With this database pre-warning and alarm thresholds can be set on the field for each location with the same safety margin.

Two pre-warning thresholds are available to warn the pilot of an overheat condition and one alarm threshold is also available; these three values can be set as increased temperature with respect to average mission temperature.
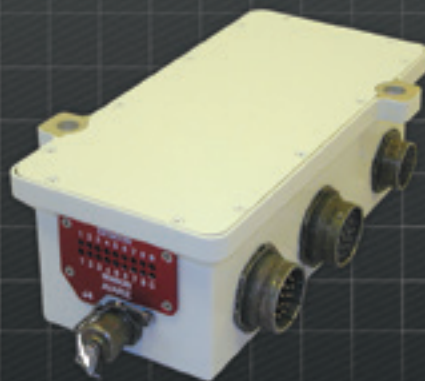
TECHNICAL DATA

INFRARED FLAME DETECTOR

- Infrared tri-band flame detector for hydrocarbon flames
- Explosion response time < 2 milliseconds (Navy certified)
- Available as combined flame & temperature
- Built-in-self test
- Connection cable continous monitoring
- 90° cone field of view
- Designed with 45° oriented optics for easy installation
- IP67 degree of protection
- MIL- Standard qualified to shock, vibration, EMI
- Operating temperature range from -40°C to + 120 °C
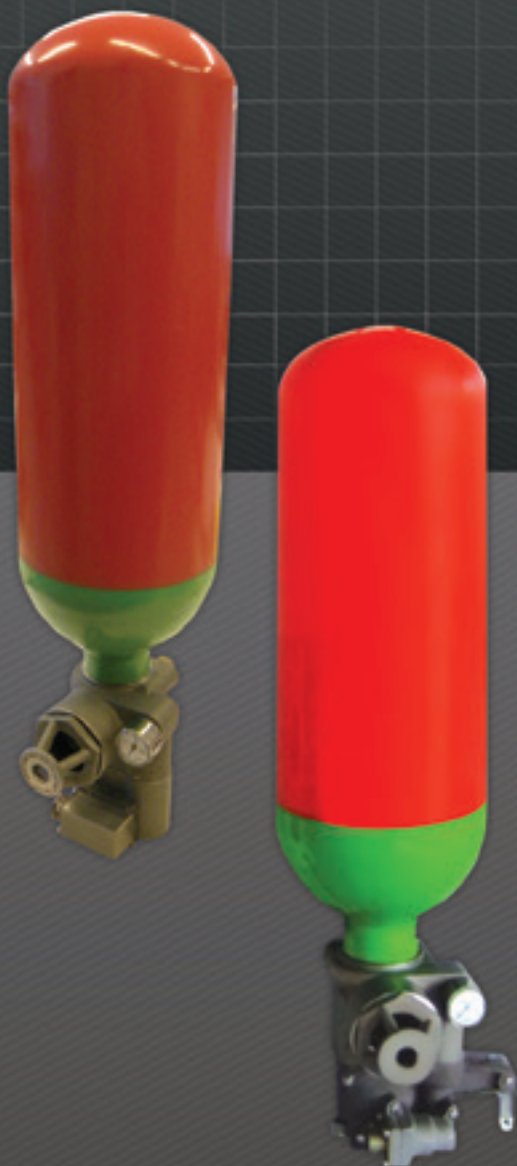- Full metal housing, weight 0,33 Kg

CONTROL ELECTRONICS (CE) MK2

- Microprocessor based digital electronics
- Can manage up to 4 independent protection zones
- Can manage up to 8 flame detectors
- Can manage up to 8 extinguishers
- Advanced diagnostic with lateral led display
- Compact size
- Field and/factory configurable with RS485 connector
- RS485, CANBUS digital interface with vehicle
- Digital interface for external I/O
- Internal memory log file
- IP67 degree of protection
- MIL - Standard qualified to shock, vibration, EMI
- Operating temperature range from
- 40°C to + 70 °C
- Full metal housing: weight 2 Kg

SMALLER CONTROL ELECTRONICS (CE slim MK3)

- Specifically designed for tactical vehicles: small dimensions control electronics with same performance of bigger "CE"
- Integrated control panel with leds , backlighted pushbuttons and toggle switch
- up to 4 explosion or combined flame detectors for crew/engine and 8 temperature detectors for engine
- Up to 3 extinguishers
- Full Built In Test Equipment
- Software configurable on the field
- Up to 2 pre-warning and one alarm threshold for each temperature detector
- Continuous temperature monitoring download for threshold identification during system design
- Night mode feature available
- RS485 & CANBUS digital interface with vehicle

HIGH RATE EXTINGUISHER DISCHARGE VALVE

- SOLENOID-non pyrotechnic VALVE
- Service pressure max 106 bars at 70°C.
- DN 32 mm
- Opening time < 7 milliseconds (Navy certified)
- Discharge time in less than 100 milliseconds (with standard bottle)
- External gauge, overpressure relief valve
- Internal pressure-switch for pressure / leakage monitoring
- Both coil and pressure continuous monitoring
- IP67 degree of protection
- Temperature range from -40°C to + 70 °C
- ASTM AISI 316 main body, weight 2 Kg
- Approved according with ISO 17871:2015, ISO 10297:2014 and Transportable Pressure Equipment Directive 2010/35/EU
- Available with and without mechanical override
- Low life-cycle cost due to easy RESET after activation: no replacement parts needed

ENVIRONMENTAL QUALIFICATIONS

All components are qualified to MIL-Standards and Specification by Italian MoD or third party test laboratory.

EXPORT CONTROL

All Martec AFSS components are NON-ITAR, NON DUAL USE (EU Regulation No. 1232/11) controlled items, according to official Italian Chief of Staff ITAR Agency determination on December 2010. **Therefore they can be exported worldwide without limitations.**

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