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industry, buildings, occupants and property

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Watermist Protection on Railway Vehicles: The Italian Approach



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Main points of this presentation:

- ULTRA FOG First contact to train protection.
- Law requirements in Italy for train protection.
- Technical background for development of UNI11565 standard.
- UNI 11565 Standard
- Experience in the laboratory
- Final application



ULTRA FOG First contact to train protection.

Ultra Fog: A World Leader in the Development and Application of custom Quality fire protection solutions.



Marine Applications

Cruise ships, Ro-Ro, Ro-Pax, tankers, naval vessels, historic ships, special purpose vessels, luxury yachts.



Land Applications

Hotels, commercial offices, shopping malls, schools, historic buildings, museums, archives, restaurants, construction, care homes, hospitals, power plants.



Offshore Applications

Machinery space, engine rooms, thruster rooms, control rooms, accommodation, spaces, turbine enclosures, galleys, deep fat fryers and ducts, paint lockers.



ULTRA FOG First contact to train protection.

- In 2016 Ultra Fog starts partnership with PSC group in marine and land application
- PSC group propose to Ultra Fog a new challenge: train protection
- PSC participate in the bid for protection of 650 wagons offering Ultrafog watermist technology.
- PSC group get the contract from Italian train company Trenitalia.

This is how we started!



Law requirements for train protection in Italy

- In comparison with many European Union states, Italian railways have an extensive network of tunnels through which their rolling stock must travel. This exposes both trains and passengers to increased safety risks, and particular to increase fire risk.
- This consideration was the starting point for a discussion:
Protect tunnels or protect the trains?
- This conclusion was the starting point for an extensive upgrade of safety measures by both the Italian government and safety, consumer organizations over recent years which has culminated in a legislative document entitled “DM 28-10-2005 Safety in railway tunnel”



Law requirements for train protection in Italy

- “DM 28-10-2005 Safety in railway tunnel” extract of paragraph 1.5.7:

1.5.7 Impianti fissi di estinzione

Devono essere installati su tutti i mezzi di trazione, sulle carrozze notte, ristorante e passeggeri di nuova costruzione, idonei impianti fissi automatici, di estinzione incendi, con possibilità di interruzione manuale in caso di falso allarme, con le modalità dell'art. 4, comma 10.

Relativamente ai mezzi di trazione, alle carrozze notte, ristorante e passeggeri esistenti questi impianti devono proteggere i componenti elettrici di potenza e ausiliari. A protezione degli altri ambienti delle suddette carrozze dovranno essere installati impianti in grado di contrastare l'insorgere dell'incendio fatti salvi i tempi occorrenti per la disponibilità delle relative specifiche tecniche, con le modalità dell'art. 4, comma 10.

- For first time in Italy all wagons shall be equipped with Automatic Fire Suppression system.
- A working group is created to develop a guideline that defines acceptance criteria for fire fighting appliances on board of trains. This group will write the UNI11565 standard.



Technical background for development of UNI standard.

- The background of the standard is coming from ARGE Guidelines
- ARGE is a consortium of various companies operating in Rail Safety that created several “guidelines” related to safety including ARGE Guideline – Part 2 “Fire Fighting in Rolling Stock”



ARGE guideline authors

UNI-11565 Standard

- Starting from ARGE guidelines a new standard is developed: UNI-11565:2014
- Two years later, the standard is updated to a new revision UNI-11565:2016 that is the current version, applied today for all watermist system to be used on trains.

NORMA ITALIANA	Veicoli ferroviari - Progettazione, installazione, validazione e manutenzione di sistemi di rilevazione ed estinzioni incendi destinati ai veicoli ferroviari - Principi generali	UNI 11565
		GIUGNO 2016
	Railway vehicles - Design, installation, validation and maintenance of fire detection and extinguishing systems to be utilized in rail vehicles - General principles	
	Scopo della presente norma è quello di definire i criteri per la progettazione, installazione, validazione e manutenzione dei sistemi fissi di rilevazione ed estinzione incendi destinati ad essere installati a bordo dei veicoli ferroviari, nonché i relativi requisiti tecnici e prestazionali applicabili.	

Cover page of UNI-11565 Standard

UNI-11565 Standard

- Suppression part consists of 3 configurations to be tested:
 - Single Deck
 - Double Deck
 - Small compartment



UNI-11565 Standard

- Single Deck

- Single Deck arrangement simulates a single big seating area of a wagon. Mock up is set to accommodate seats with (IMO foam) cushions, an overhead luggage rack, and fire source represented as a baggage with paper, textile and plastic material.
- Single deck configuration is to be repeated 3 times with different set-up:
 1. Thermal test: to check system efficiency and correct functioning with a reduced fuel load.
 2. Under one nozzle: full scale test with nozzle centered over fuel source
 3. Between two nozzle: full scale test with fire source centered between two nozzles to determine maximum spacing.

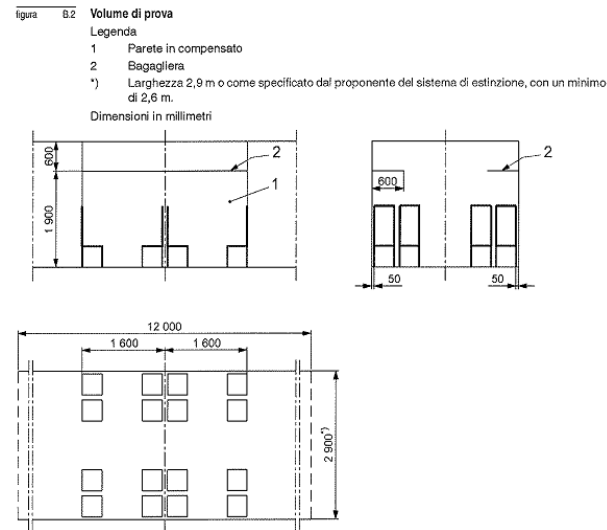


Foto 1: prima della prova
Picture 1: before the test

UNI-11565 Standard

- Double Deck

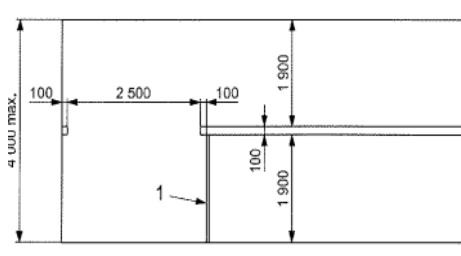
- Double Deck arrangement simulates a wagon having 2 levels and creating a single big volume. Ceiling is lower compared to single deck configuration. Mock up is set to accommodate seats with (IMO foam) cushions, an overhead luggage rack, and fire source represented as a baggage with paper, textile and plastic material.
- Double deck configuration is to be repeated 3 times with different set-up:
 1. Thermal test: to check system efficiency and correct functioning with a reduced fuel load.
 2. Under one nozzle: full scale test with nozzle centered over fuel source
 3. Between two nozzle: full scale test with fire source centered between two nozzles to determine maximum spacing.

Vano a 2 piani

Legenda

1 Pannello di chiusura

Dimensioni in millimetri



Arredo base

Legenda

1 Parete di compensato di 3 mm di spessore

2 Cappelliera

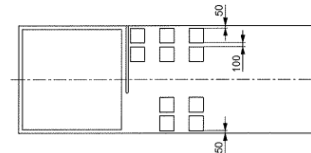
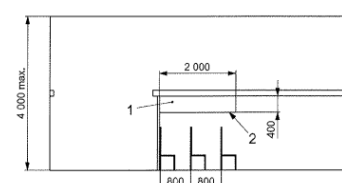


Foto 1: prima della prova
Picture 1: before the test

UNI-11565 Standard

- Small Compartment

- Small compartment arrangement simulates the space between seating areas (e.g. entrance area). Mock up is set to accommodate seats with (IMO foam) cushions, an overhead luggage rack, and fire source represented as a baggage with paper, textile and plastic material.
- Small compartment configuration is to be repeated 2 times with different set-up:
 1. Thermal test: to check system efficiency and correct functioning with a reduced fuel load.
 2. Under one nozzle: full scale test with nozzle positioned over fuel source

Ambiente tipo scompartimento

Dimensioni

L'ambiente tipo scompartimento sarà rappresentato da un volume avente le seguenti dimensioni:

- a) lunghezza 2,5 m;
- b) larghezza 2,5 m;
- c) altezza 2,5 m.

Aperture di ventilazione naturale

L'ambiente tipo scompartimento ha solo una porta di accesso da 2 m x 0,8 m da mantenere aperta durante le prove.



UNI-11565 Standard

- Target

- Every test can be considered passed if all of listed parameters are achieved and maintained during the all test duration (20 minutes):
- $T_{max} \leq 65^{\circ}$ @ Thermocouple (located 1,5 mtrs away from fire source at 1,6 mtrs height)
- CO,CO₂,HCN below prescribed limits.
- O₂ min >15%

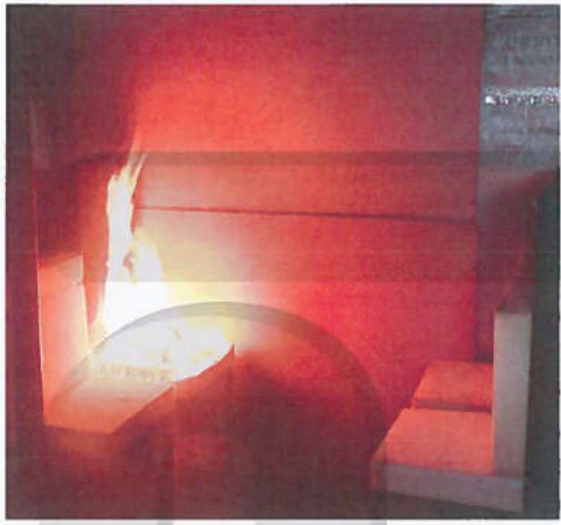
Risultati della prova

Parametro	Prova "termica"	Prova "bagaglio"
T max	65 °C	65 °C
CO max	N/A ¹⁾	1400 ppm
CO ₂ max	N/A	6 % Vol
HCN max	N/A	55 mg/m ³
O ₂ min	15 % Vol.	15 % Vol



Experience in the laboratory

Some action!



1. Single Deck test



2. Nozzle during test



3. Double deck test



Offshore



Land



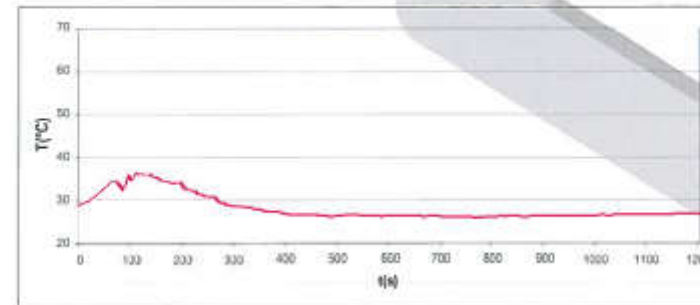
Marine

Experience in the laboratory

- Thermal test

- First test for all compartment is so called “thermal test”. It consist of a small quantity of paper ignited over seat cushion. Fire spreads over the cushion and ignite also adjacent seats.
- Fire is exposed directly to nozzle spray pattern making it quite easy to pass.
- Purpose of test is to check correct installation of the system and lab instrumentation as well.
- As you can see in the graph , temperatures are always very low , going up in the pre-burn period of 60 and decreasing when the system is activated.

Grafico dell'andamento delle temperature massime in funzione del tempo (prova termica sotto ugello)
Plot of trend of max. temperatures as a function of time (thermal test under the nozzle)



Offshore



Land



Marine

Experience in the laboratory

- Bag test

- A simulated bag filled up with paper, textile, plastic is placed under the seat and ignited using alcohol.
- During pre-burn period, flames will propagate to adjacent seat.
- Fire coming from the seat will be directly exposed to nozzle spray pattern. Fire coming from the bag will be underneath the seat and the nozzle spray will be stopped , making almost impossible to extinguish.
- The correct approach is to contain the fire as much as possible.



1. Simulated Baggage



2. Simulated Baggage on fire under seat.

Experience in the laboratory

- Key points

- Most difficult part of the test is to keep temperatures below prescribed limits for the duration of the test
- The water quantity is really small due to restrictions of available space in the wagon .
- Extinguishing the fire is almost impossible due to hidden fire source.
- The correct approach is to contain the fire for the longest possible time.
- Small compartment test is –beside expectation- very tough to pass, as small volume is heating up quicker compared to other two scenarios.



1. Simulated Baggage



2. Simulated Baggage on fire under seat.



Offshore



Land



Marine

Final application

- Wagon retrofit case

- A further step in development was necessary due to the application of watermist system on existing wagons.
- Wagons were not designed to accommodate fire fighting components so the second challenge after passing the test was to find suitable components for the small space left on board.
- Wagons are 20 years old and already passed several refit activities (e.g HVAC) with inhomogeneous solutions. Space available on one wagon may be not available on another one, so the challenge was to reduce needed space as much as possible.



1. Searching for space...



2. Wagon in workshop.



Thank you for your attention.

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