



Certified Sustainable Cable Maintenance

Fire protection of electrical cables on
NAVAL VESSELS



FS has protected more than 300 vessels, including naval vessels, LNG carriers, passenger ferries and cruise ships at the rate of nearly one a month for a quarter of a century.





FS1 CABLE COATING

Passive Fire Protection



Fire Security / US Navy Testing Background

In 2012 the USS Miami - a USN Los Angeles Attack Class Submarine - was in the Portsmouth Naval Shipyard for a scheduled twenty-month engine overhaul and systems upgrade

- A twelve-hour fire raged after being intentionally set by a disgruntled contractor
- Unprotected cable routings propagated the spread of the fire
- Repairs were estimated at USD 700 Million resulting in the USS Miami being decommissioned and replaced at an estimated cost of USD 1.3 Billion.

End Result - A vital national asset decommissioned at mid-life... leaving a gap in the force and a hole in a nation's warfighting capabilities.

After the USS Miami fire the Navy set out to find solutions to mitigate these problems.

Coating the electrical cables was found as one of the solutions. The civilian market was scoured and a range of candidates for trials were found. Based on extensive US Navy testing the FS1 cable coating was down-selected.

Fire Security was then requested by the Navy to support further testing to ensure the suitability of FS1 in a naval vessel environment.

FS1 is SSRAC approved for inclusion in NAVSEA Std Item 009-32.

Non-fire tests

- FS1 found to have a "PERMITTED" usage category

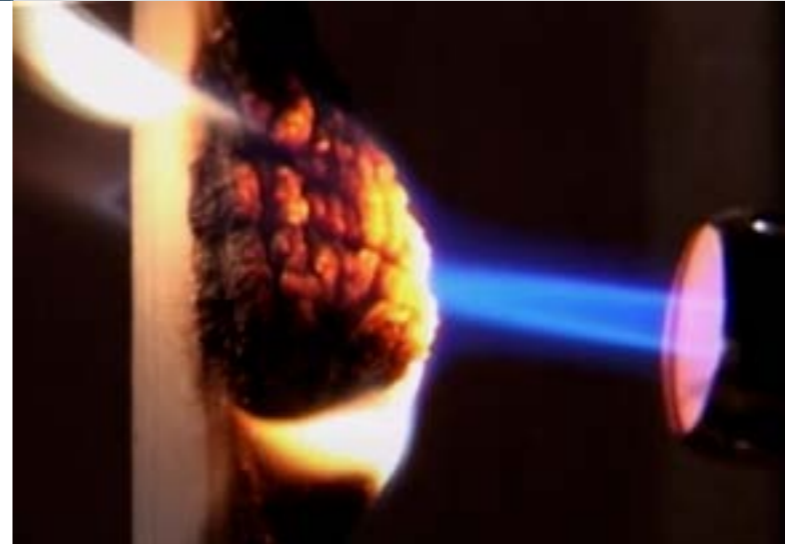
"...it is recommended that the FS1 coating be considered for transition into the fleet."

...testing conducted suggests that the installation of the coating on shipboard cableways would provide significant benefit to shipboard fire protection...

FS1 coated cables would significantly reduce the propagation and gas release potential of cables in the vicinity of the fire.

The FS1 is a persistent, passive fire risk mitigation technology designed to protect vessels and lives in the maritime environment.

- **FS1 has been in commercial use on cruise ships and oil platforms for over twenty years**
- **FS1 has been down-selected and successfully tested by the US Navy**
- **FS1 has been deemed acceptable for use in submarine reactor compartments.**



FS1 is an intumescent coating that will expand 100 times its thickness during a fire - thus protecting the cables from fire damage and making sure the cables function when needed the most.

SAVING COST, SAVING ASSETS, SAVING LIVES

In a fire situation our systems will prevent:

- Ignition of the cable insulation
- Release of toxic fumes from the cable insulation
- Release of poisonous gas (HCL) from the cable insulation
- The cable tray from melting and collapsing

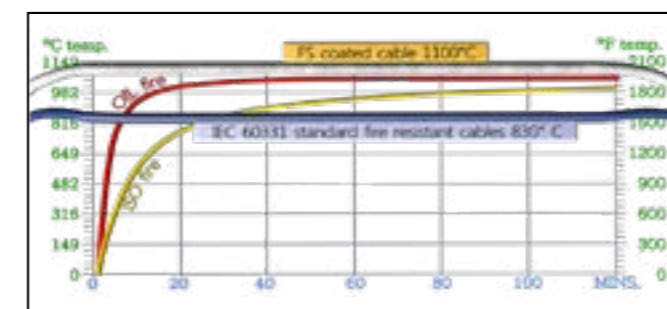


Fire Security is a Norwegian company specializing in class-approved repair and fire protection of electrical cables. We are the only producer offering a turn-key operation with specially trained personnel for application worldwide. We have more than 30 years of experience in cable fire protection worldwide.

FS coated cables will function during a fire, and if the fire is extinguished within a reasonable time, there is no need for cable replacement.

Fire Security Technical Director
Leif Harald Tveitnes

Will your cables survive a hydrocarbon fire?



The yellow curve shows the temperature of an ISO fire - 830° Celsius, which is a normal cellulose fire. The red curve represents the temperature of an oil fire - up to 1100° Celsius - the temperature to which Fire Security has tested their coatings. This is the temperature you would be facing if you had such a fire.

How the protection works

During a fire, the coating will expand up to 100 times its thickness, thus protecting the cable from fire damage. Coated cables will function during a fire and be usable afterwards. If the fire is extinguished within a reasonable time, there is no need for cable replacement.

A PROVEN SOLUTION TO CABLE FIRE PROTECTION

Problem

- MIL- DTL-24643 and MIL-DTL-24640 compliant cables are excellent cables comparable to the best in the commercial market. Nevertheless, these cables have over a long time been known to contribute to fuel fires and propagate fires.
- Cable outer sheath and ships paint and general protective coatings burn off in the first minutes of a high temp space fire.
- Shipboard cables provide a significant fuel source for fires.
- Fires propagate in minutes on uncoated cables.
- Electrical cables and cableways provide conduit for fire-spread.
- Legacy Polyvinyl Chloride (PVC) cabling is still present on older ships and releases hydrogen chloride acid gas when exposed to fire presenting threat to life and critical electrical systems.



Solution

- Among others, the Cruise industry uses the commercial marketplace's most sophisticated and safest cables. Nevertheless, the Cruise industry has experienced on numerous occasions that these cables fail prematurely and contribute fuel to the fire. Subsequently, the Cruise industry has implemented FS1 as a voluntary standard.
- FS1 is a Mature/High TRL passive fire protection - Ready TODAY.
- More than twenty years' experience in Offshore, Cruise ships, and Commercial shipping - Proven high ROI
- FS1 is an intumescent coating system available to mitigate fire risks used on cruise ships and oil platforms for more than 20 years.
- Significantly reduces the fire-spread and the release of toxic gasses from PVC cabling.
- Improves fire survivability and inhibits fire spread involving MIL- DTL-24643 compliant cables and cableways.



FIRE PROTECTION AND EXTENDED OPERATIONAL LIFE

Fire Security's coating systems have the ability to upgrade the cables fire technically and at the same time extend the lifetime of the cables without any shutdown. This gives you a huge flexibility when maintaining or upgrading an existing ship.

US NAVY TESTING COMPLETED 2015-2017

- NSWCCD: Fire Performance Evaluation Of Coated and PVC Electric Cable
- NMCPHC: Submarine Materials Review for the use of FS1 onboard LOS ANGELES, OHIO, and SEAWOLF class submarines.
- BUMED: Health Hazard Assessment (HHA) surface ships.
- MIL-DTL-24643 Large-scale fire testing on coated and uncoated cables.
- UL 910 and UL 1666 Worst-case fire threats in both the horizontal and vertical orientations.
- NSWCCD down selected FS1 coating during testing and provided recommendation for Fleet use in 2017
- New test in 2021
- Navsea standard Item 009-32 Approved
- Test job USS Bulkeley 2020

Flame spread

"Uncoated cables spread flame more than 2.4 m (8 ft) further than the coated cable array. This additional flame spread produced significantly more heat, and the fire growth associated with the uncoated cable was so untenable that the test was terminated early due to flames breaching the test enclosure. ...the benefit of FS1 becomes more apparent as the severity of the exposure fire increases."

Extract: NAVSEA Test Report 2017

Enhanced Circuit Integrity in a fire situation

- More time to stay on mission
- More systems online to support the mission
- More time to fight the fire.
- More systems online to fight the fire
- The larger the scale of the test or severity of the exposure, the greater the benefit that is provided by the FS1 coating."

Extract: NAVSEA Test Report 2017

Smoke and toxicity

The FS1 cable coating material met and exceeded test criteria for US Navy tests conducted in both small- and full-scale scenarios.

"All cases had reductions in gas release concentrations, and in some cases the complete prevention of a certain species of gas from being released was observed."

KEY FEATURES OF FS1 INTUMESCENT COATING

Our products have been approved by the world's leading classification societies and authorities. In a fire situation our FS1 coating will prevent:

- Ignition of the cable insulation.
- Release of toxic fumes from the cable insulation
- Release of poisonous gas (HCL) from the cable insulation
- The cable tray from melting and collapsing

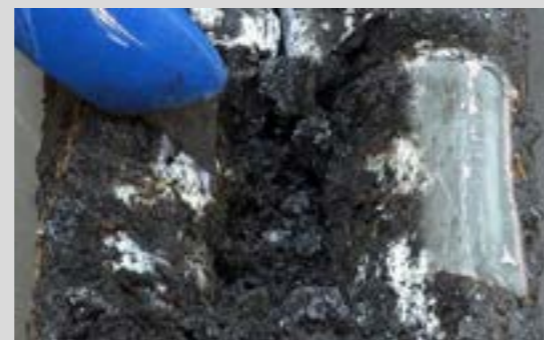


FS1 Intumescent coating product will expand up to 100-times its original thickness. As the coating expands, it becomes considerably more voluminous creating a lightweight char insulator that keeps high temperature away from cable cores and structural members, such as cable supports and cable trays.

FS1 Intumescent coating is made of a series of chemicals suspended in a binder. When the binder is exposed to heat it begins to soften, which allows the suspended chemicals to heat. The chemicals begin to react. A carbonization occurs and this solidifies into an off-black insulating material that is often referred to as char.

Protects uncoated areas up to 4cm

The picture above shows how the intumescent coating expands to provide protection from heat and flames. It is also important to note that the FS1 Product is not burning. Instead, a chemical reaction is taking place that builds up an insulating material that protects even unprotected exposed areas up to 4cm for the whole length of the cable tray vertical and horizontal from heat and direct flame contact.



AN INTERNATIONAL STANDARD FOR THE CRUISE INDUSTRY



Millions of people travel the ocean every year for business or pleasure. Fire Security is one of the most important partners in making this travel as safe as possible. It is our objective to enhance the safety of the vessel, its passengers and crew and consequently Fire Security's products have become an international standard for the cruise industry.

Fire Security - what we offer and how we work.

Fire Security is a company specializing in class-approved repair and fire protection of electrical cables. We are the only producer offering a turnkey operation with specially trained personnel for application worldwide.

Fire Security offers to conduct surveys of cables in high-risk areas of your vessels, after which a detailed report is handed over to you with suggestions to what we can do to improve the fire technical properties of your cables, what you will gain and a price quote. This is done totally free of charge with no commitment from your side.

Our **Vice President Terje Waage** is in charge of the cruise sector at Fire Security. As a co-founder of the company, he has more than 30 years of experience and has overseen more than 270 cruise ships being protected by our team of applicators at the rate of one a month for the last twenty-three years.





Certified Sustainable Cable Maintenance

FS offer certified sustainable solutions to extend cable life and avoid electrical fire, using non-toxic materials.

Save Lives / Save Costs / Save The Environment

Our products have been approved by leading classification societies and authorities including U.S. COAST GUARD, IMO MED D & IMO MED B, Lloyd's Register, Achilles, Bureau Veritas, DNV, RINA, NMA, ABS, FM and UL



Global headquarters

Skibåsen 20B, 4636 Kristiansand, NORWAY
Tel: +47 95 47 80 00 Fax: +47 38 02 15 31
Email: headquarter@fire-security.com
www.fire-security.com

