DET NORSKE VERITAS

EC TYPE-EXAMINATION CERTIFICATE

Application of: Council Directive 96/98/EC of 20 December 1996 on Marine Equipment as amended by directive 2008/67/EC, issued as "Forskrift om Skipsutstyr" by the Norwegian Maritime Directorate. This certificate is issued by Det Norske Veritas under the authority of the Government of the Kingdom of Norway.

CERTIFICATE NO. **MED-B-5573**

This is to certify that the
Equivalent fixed gas fire extinguishing systems components for machinery spaces and cargo pump rooms

with type designation(s)
NAF S 227 Fire Extinguishing System

Manufacturer
SAFETY HI-TECH SRL
AVEZZANO - AQ, Italy

is found to comply with the requirements in the following Regulations/Standards:
Annex A.1, item No. A.1/3.45 and Annex B, Module B in the Directive. SOLAS 74 as amended Regulation II-2/10 & X/3, IMO MSC/Circ. 848, FSS Code 5 and 2000 HSC Code 7

Further details of the equipment and conditions for certification are given overleaf.

Høvik, 2009-11-24
for **Det Norske Veritas AS**

Eivind Mykland
Head of Department

Notified Body No.: **0575**

DNV local office:
DNV Naples

This certificate is valid until
2012-06-30

Øyvind Hoff
Surveyor

Notice: The certificate is subject to terms and conditions overleaf. Any significant changes in design or construction of the product, or amendments to the Directive or Standards referenced above may render this certificate invalid. The product liability rests with the manufacturer or his representative in accordance with Council Directive 96/98/EC, as amended.
The Mark of Conformity may only be affixed to the product and a Declaration of Conformity may only be issued when the production/product assessment module referred to in the council directive, is fully complied with.

Product description

"NAF S 227 Fire Extinguishing System",
Is a fixed gas fire extinguishing system using fire extinguishing agent NAF-S-227 stored in cylinders with Nitrogen as propellant for distribution through pipes and nozzles.

The extinguishing concentration and nozzles are covered by this type examination certificate. Documentation for the other system components shall be submitted and approved for each project.

The system is to be designed in accordance with IMO MSC/Circ. 848 as amended by IMO MSC.1/Circ. 1267.
The gas and nozzles are to be produced by Safety Hi-Tech SRL.

NAF-S-227 Physical properties

Commercial name	NAF S 227®
Chemical formula	C_3HF_7
Composition	99.8 wt-% HFC-227 (Heptafluoropropane - CF_3CHFCF_3) 0.1-0.2 wt-% D-limone ($C_{10}H_{16}$)
Vapour density @ 20 °C and 1 atm. [1)]	7.30 kg/m^3
Design concentration, specific mass [1)]	0.696 kg/m^3
Design concentration	8.7 %
NOAEL (No Observed Adverse Effect Level)	9 %
LOAEL (Lowest Observed Adverse Effects Level)	10.5 %
GWP (Global Warming Potential) 100-year time horizon, CO_2 warming equivalent	3300

1) To be applied in conjunction with IMO MSC/Circ. 848, 3.4.2.3.1. Properties, see NFPA 2001 (2008 Edition). Calculated at 20 °C. Ambient temperature to be determined case by case for each project.

Application/Limitation

The design concentration (based on diesel fuel) shall be minimum 8.7 % applied on the net volume of the protected space. Maximum agent discharge time is 10 seconds. The system shall be designed and installed according to SOLAS Ch. II-2, IMO MSC/Circ.848 as amended by IMO MSC.1/Circ. 1267 and the technical information from Safety Hi-Tech (see Type Examination documentation on page 3).

The following additional limitations will apply:

A. NAF S 227 is approved for use in engine rooms, cargo pump rooms (hydrocarbon only) and similar spaces. This certificate does not address use of the system for protection of cargo holds and cargo handling spaces for other cargoes than oil (alcohol, LPG, LNG). This will have to be considered by the applicable Administration on a case by case basis.

B. Evacuation time and warning procedures as per IMO MSC.1/Circ. 1267, 6.1 should be considered for each project. In no case should the design concentration exceed LOAEL (calculated at net volume and minimum expected ambient temperature).

C. Steel storage cylinders are of sizes 5 - 240 litre. Cylinders being 81 litre or larger is only accepted when arrangements are provided on board to ensure that cylinders can be easily moved (even to shore) for service and recharging.

D. Cylinders are topped up with Nitrogen to 42 bar at 21 °C. The fill density shall be maximum 1.15 kg/l. Cylinders shall be delivered with DNV product certificate, or equivalent certificate acceptable to the flag administration and class in question.

E. Cylinders are to be located in a separate room in accordance with SOLAS Ch. II-2 Reg.10.4.3, or distributed throughout the protected space in accordance with the requirements in IMO MSC/Circ.848 as amended by IMO MSC.1/Circ. 1267 item 11 and the technical information from Safety Hi-Tech (see Type Examination documentation on page 3). When distributed within the protected space, the minimum extinguishing concentration (after any single failure) shall be taken as 6.7%.

F. Components in the system shall be of pressure class I with a maximum design pressure of 52 bar (at 55 °C). Consideration will though be made for piping and couplings inside the protected space.

G. The steel nozzles, type SHT30400006, are to be located in accordance with the reqirements in IMO MSC/Circ.848 as amended by IMO MSC.1/Circ. 1267 item 9 and Safety Hi-Tech Technical Information (see Type Examination documentation on page 3). NAF S 227 Hydraulic Flow Calculation Software

version SHT 3.03 CD and later versions shall be used. A basic rule is that the nozzle spacing is not to exceed 5 metres for a 360 degree nozzle (coverage area 10x5=50 m^2). The maximum nozzle vertical spacing is not to be greater than 5 metres. The average minimum pressure at each nozzle shall not be less than 7.5 bar.

H. Bilges (except open bilges in small volume engine rooms) are to be protected with a dedicated nozzle network.

The following documentation is to be submitted to the flag administration in each case:

1. Plans showing location of cylinders, piping, nozzles and release stations as well as the assembled system.
2. NAF S 227 capacity calculations, including hydraulic flow calculations.
3. Plans defining release lines and alarm system.
4. Specification for piping, valves and other components in the system.
5. Ship specific release procedures and post discharge ventilation procedures.
6. The manual containing design, inspection, operation and maintenance procedures.
7. Control arrangements for closure of openings and stop of fans and any pressure relief devices as per IMO MSC/Circ. 848 as amended by IMO MSC.1/Circ. 1267 item13. These plans can also be supplied by yard.

Testing at installations and periodical surveys

The system shall be tested as per maker's manual both at installations and at periodical surveys, except that DNV do not require monthly content check of cylinders. The test pressure is minimum 63 bar for any closed sections, whereas open section shall be tightness tested at minimum 7 bar.

The system is subject to biannual (every 2nd year) inspections by a DNV approved service supplier. The attending surveyor will also apply the DNV Instructions to Surveyors on newbuilding and ship in operation surveys.

Type Examination documentation

Test report No. VTT-S-1550-09 dated 05 March 2009 from VTT Technical Research Centre of Finland.

Technical Information from Safety Hi-Tech:

- Installation, Maintenance and User Manual for NAF S 227® Fire Extinguishing Systems, doc. SHIMS227EN, Rev. 0, July 2007.
- NAF S 227® Engineered Systems Design Manual for Marine Uses, doc. DMS227MR, Rev. 0, April 2009.

Tested according to IMO MSC/Circ. 848 as amended by IMO MSC.1/Circ. 1267.

Marking of product

The nozzles and other main components in the system are to be marked with name of manufacturer, type designation and MED Mark of Conformity (see below).

Mark of Conformity

The manufacturer is allowed to affix the Mark of Conformity according to Article 11 in the Council Directive 96/98/EC on Marine Equipment and shall issue a Declaration of Conformity, only when the module D or E or F of Annex B in the same directive is fully complied with.

Module D: The quality system for production and testing shall be approved by the Notified Body.

Module E: The quality system for inspection and testing shall be approved by the Notified Body.

Module F: Compliance of the products to type as described in this EC Type-Examination Certificate must be verified by the Notified Body who also shall issue a of Certificate Conformity.

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QS - CERTIFICATE OF ASSESSMENT - EC

Application of: Council Directive 96/98/EC of 20 December 1996 on Marine Equipment as amended by directive 2008/67/EC, issued as "Forskrift om Skipsutstyr" by the Norwegian Maritime Directorate. This certificate is issued by Det Norske Veritas under the authority of the Government of the Kingdom of Norway.

CERTIFICATE NO. **MED-D-1258**

This is to certify that the Quality System for the
Equivalent fixed gas fire extinguishing systems components for machinery spaces and cargo pump rooms

with type designation(s) as specified in the Appendix to this certificate

Manufacturer
SAFETY HI-TECH SRL
AVEZZANO - AQ, Italy

is found to comply with the requirements applicable to it.
The quality system for the product, defined in Annex A.1, Item No. **A.1/3.45**, has been assessed with respect to the procedure of conformity assessment described in Annex B, Module D in the directive.

Limitations:
Modifications made to the Quality System shall immediately be reported to Det Norske Veritas AS in order to examine whether this certificate remains valid. Annual periodical audits will be held to verify the validity of the certificate.

Høvik, 2009-11-24
for **Det Norske Veritas AS**

for **Eivind Mykland**
Head of Department

Notified Body No.: **0575**

DNV local office:
DNV Naples

This certificate is valid until
2014-11-24

Øyvind Hoff
Surveyor

Notice: The certificate is subject to terms and conditions overleaf. Any significant changes in design or construction of the product, or amendments to the Directive or Standards referenced above may render this certificate invalid. The product liability rests with the manufacturer or his representative in accordance with Council Directive 96/98/EC, as amended.

Certificate No.: MED-D-1258
Item No.: A.1/3.45
Job Id.: 344.1-002148-2

APPENDIX, REV. NO. 0

QS - Certificate of Assessment – EC, Certificate no. MED-D-1258

Type designation	EC Type-Examination Certificate No.	Expiry date	DNV QS Assess. Report dated
NAF S 227 Fire Extinguishing System	MED-B-5573	2012-06-30	2009-11-06

The manufacturer complies with the Council Directive 96/98/EC on Marine Equipment and is allowed to affix the Mark of Conformity followed by the DNV identification number 0575 and the two last digits of the number of the year in which the product is produced.

Example: ⊙ 0575/09

The manufacturer shall issue a Declaration of Conformity for each product with reference to the EC Type–Examination Certificate and this QS – Certificate of Assessment – EC.

Place and date: **Høvik, 2009-11-24**

for **DET NORSKE VERITAS AS**

Øyvind Hoff

Surveyor

Name in block letters:
Øyvind Hoff