

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Inside Air Foam Fire Extinguishing System**with type designation(s)
NK SUPER HI-EX (1%) FOAM SYSTEM

Issued to

NK Co., Ltd.
Busan, Republic of Korea

is found to comply with

DNV GL rules for classification – Ships**DNV GL offshore standards****DNV GL statutory interpretations DNVGL-SI-0364 – SOLAS interpretations****Application :****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.**Issued at **Hamburg** on **2020-10-06**This Certificate is valid until **2025-10-05**.DNV GL local station: **Gimhae Station**for **DNV GL**Approval Engineer: **Andrii Pishchanskyi**

Olaf Drews
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV GL AS, its parent companies and subsidiaries as well as their officers, directors and employees ("DNV GL") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.



Product description

"NK SUPER HI-EX (1%) FOAM SYSTEM",

consists of foam generators, foam concentrate as specified below and other system components like water and foam pumps, foam proportioner, steel distribution piping, strainer, valves, test and blow through lines, power and control system.

The system is suitable for use in machinery spaces, cargo spaces, cargo pump rooms, vehicle, special category and ro-ro spaces as per FSS Code Ch.6.1. The system is to be designed according to FSS Code Ch.6 as amended by IMO Res. MSC.327(90) for fixed high-expansion inside air foam fire-fighting systems.

Only the foam generators are type approved by this certificate. All other systems components are subject to case-by-case approval.

The foam generators are manufactured by NK Co., Ltd., Busan, Republic of Korea.

Application/Limitation

The system shall be installed according to the below specifications:

Volume of protected space [m ³]	Minimum required filling rate [m/min]
≤500	2.31
>500 and ≤3081	$1.49 + 0.00031 \times (3100 - V)$
>3081	1.49

NK SUPER HI-EX (1%) FOAM SYSTEM is approved for use with the below specifications for the foam generators:

Nozzle Type		NWK-HF350		NWK-HF450		NWK-HF550		NWK-HF650	
Nozzles material		SUS304	Nickel coated brass	SUS304	Nickel coated brass	SUS304	Nickel coated brass	SUS304	Nickel coated brass
Foam production ¹⁾ [m ³ /min]	2 bar	9	1.4	24	16	39	24	46	29
	4 bar	16	15	40	42	63	56	77	70
	6 bar	17	12	46	49	66	67	80	91
k-factor ($Q = k \times p^{1/2}$) ^{1),3)} [lpm/bar ^{1/2}]		12.6	11.0	30.3	30.5	47.4	46.5	57.6	58.0
Premix consumption ²⁾ [lpm]	2 bar	17	17	44	43	68	67	80	86
	4 bar	25	22	61	61	95	93	115	116
	6 bar	31	26	76	70	119	112	139	142
Expansion ratio ¹⁾		1:670		1:670		1:670		1:670	
Drawing No.		274-152-002, Rev. 1	274-152-002, Rev. 2	274-152-003, Rev. 1	274-152-003, Rev. 2	274-152-004, Rev. 1	274-152-004, Rev. 2	274-152-005, Rev. 1	274-152-005, Rev. 2

Footnote

- 1) cold condition, fresh water
- 2) solution of foam concentrate and water
- 3) at 4 bar

The following additional applications / limitations apply:

- A. Nominal pressure is 4.0 bar. Approved pressure range is 2-6 bar. Application of generators at a pressure above or below the approved pressure range is subject to case by case approval.
- B. A DNVGL approved foam proportioner shall be used. Only DNVGL approved foam concentrate "NK.D-101M" (1 %) manufactured by NK Co., Ltd. shall be used.

- C. The foam generators shall be equally spaced in a horizontal plane at a level above the main and auxiliary engines. The generators shall have at least 1 m free space in front of the foam outlet without obstructions.
- D. Positions exposed to overpressure in case of boiler and crankshaft explosions shall be avoided as far as practicable. Generators shall also be arranged to cover other high-risk objects at all levels in the machinery spaces. Extra foam generators may be required in locations where the normally required generators have problem to reach due to obstructions like gratings, (semi-)tight bulkhead/decks, structures, etc.
- E. At least two foam generators shall be fitted in all protected with fuel oil installations like engines, boilers or separators. Other spaces (workshops, etc.) may be designed using the lowest filling rate (regardless of volume).
- F. Enough foam is to be provided to produce a volume of foam equal to five times the largest space to be protected, applying the expansion ratio above, or 30 minutes operation, whatever value is larger. The system shall be activated with as little delay as possible and it is recommended that natural ventilation openings in upper part of the space are kept in open position.
- G. With respect to cargo pump rooms, the system is approved for pump rooms which handle oil cargos only. The system shall not be applied for pump rooms which are also intended for alcohol cargos (polar solvents).
- H. Pipes, couplings and other components are regarded as "Class III" piping.
- I. A strainer with mesh openings of maximum 1.5 mm shall be fitted on the water supply line before the foam proportioner (this to avoid clogging).
- J. Ambient room temperature for foam pump/foam container should be between 4 °C and 45 °C.
- K. The water supply pumps and foam concentrate pumps with capacity exceeding 25 m³/h (measured at 10 bar) shall be delivered with DNV GL Product Certificate. Foam concentrate pumps with lower capacity shall be delivered with certificate issued by the maker (work certificate).
- L. The system shall in addition to the above comply with relevant parts of SOLAS Ch. II-2, the FSS Code and DNV-SI-0364, Sec.3, 21.

The following items are to be submitted for approval for each project:

- a. System arrangement plans including location of generators, section valves, release stations, pumps, foam tank and foam proportioner.
- b. Documentation of power supply and control system.
- c. Specification of pipes, section valves, electrical motors, pumps, foam concentrate, foam tank, foam proportioner and associated components.
- d. Foam capacity calculations and pressure drop calculations, including actual pressure characteristic (pump curve) of water supply pump.
- e. Design, installation, operation (including emergency operation) and maintenance manual.

Installation testing:

- Pipes, valves and fittings and assembled systems shall be tested to the satisfaction of the Society.
- All distribution piping shall be blown through with air to ensure that the piping is free from obstructions.
- Function testing of the foam proportioner shall be performed as per its Type Approval Certificate. A mixing range of 1 - 1.3% will normally be accepted. The mixing ratio shall be measured.
- Function testing of the power and control systems, water pump(s), foam pumps(s), valves, remote and local releases stations and alarms shall be carried out.
- Other tests as required by Class Rules (pressure testing of piping, etc.) and according to maker's manual shall be carried out.

Periodical testing:

Periodical testing is to be performed according to flag requirements, IMO MSC.1/Circ.1432 and maker's recommendations/manual.

Test log and condition test report for foam concentrate shall be presented to the surveyor. Other tests may be required on a case by case basis.

Job Id: **262.1-034006-1**
Certificate No: **TAF00001EG**

Type Approval documentation

Certification in accordance with Class Programme DNVGL-CP-0338, September 2018.

1. TA booklet "High Expansion Foam Fire Fighting System (Model: NK Super Hi-Ex (1%) Foam System)" from NK Co., Ltd.;
2. Fire performance test reports:
 - a. Test report No. P2008001340 (500 m³) dated 2008-02-29 from KIMM, Daejeon, Korea
 - b. Test report No. P2009022526 (500 m³) dated 2009-11-05 from KIMM, Daejeon, Korea
 - c. Test report No. P2010015526 (3081 m³) dated 2010-04-02 from KIMM, Daejeon, Korea
3. Component test reports:
 - a. Test report No. P2010015526 dated 2010-04-02 from KIMM, Daejeon, Korea
 - b. Vibration test report No. 2010214524 dated 2010.07.19 from KIMM, Daejeon, Korea
 - c. Test report "NK HI - EX Expansion ratio test (2~6 bar) rev.1" from NK Co. Ltd.
 - d. Stress corrosion test report No. 2011345526 dated 2011-10-04 from KIMM, Daejeon, Korea;
 - e. Test report No. 2011416526 dated 2011-12-05 from KIMM, Daejeon, Korea;
4. Foam generator capacity test report:
 - a. Test report No. P2010015526 dated 2010-04-02 from KIMM
 - b. Test report No. KOMERI-To-12T1215 dated 2012.03.21 from KOMERI, Busan, Korea.

Tests carried out

Tested according to IMO MSC.1/Circ.1271 and IMO MSC.1/Circ.1384.

Marking of product

The foam generators, foam mixer and other main components in the system are to be marked with type designation, whereas the main pump unit is to be marked with the name of manufacturer.

Periodical assessment

DNV GL's surveyor is to be given permission to perform Periodical Assessments at any time during the validity of this certificate and at least every second year. The arrangement is to be in accordance with procedure described in Class Programme DNVGL-CP-0338, Section 4.