Certificate No:
TAK000025R

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Insulation Materials for Gas Carriers

with type designation(s)
VESCOAT

Issued to
Woojo Hightech Co., Ltd.
Chungju-si,, Chungcheongbuk-do, **Republic of Korea**

is found to comply with
DNV rules for classification – Ships

Application :

Polyurea spray coating for protection of PUF insulation spray foam for LNG/LGP/LEG independent cargo and fuel tanks.

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV.

Issued at **Høvik** on **2022-10-14**
This Certificate is valid until **2027-10-13**.
DNV local station: **Gimhae Station**

Approval Engineer: **Gisle Hersvik**

for **DNV**

Gustav Heiberg
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 AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") 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

VESCOAT: Polyurea spray coating for protection of PUF insulation spray foam for LNG/LGP/LEG independent cargo and tanks.

- Mixing ratio (Isocyanate:Polyol) is 1:1 (by volume)

General properties of VESCOAT spray coating:

Properties	Test Method	Test Result	Manufacturer's Specification
Density	ISO 2781:2018	1,030 kg/m^3	1000-1200 kg/m^3
Tensile strength	ASTM D412-16	5.4 mPa	min. 4.0 mPa
Elongation	ASTM D412-16	148 %	min. 100 %
Tear strength	ASTM D624-00	32.5 kN/m	min. 12 kN/m
Hardness (Shore A)	ASTM D2240-15	81	90±10
Hardness (Shore D)	ASTM D2240-15	46	min. 30
Water vapor transmission	ISO 20344:2011	0.07 mg/(cm^2.h)	max. 0.4 mg/(cm^2.h)
Water absorption	ASTM D471-16	0.7 %	Max. 2.0 %
Flammability	DIN 4102-1:1998	Class B2	Class B2

Application/Limitation

For protection of PUF insulation spray foam for LNG/LGP/LEG independent cargo and fuel tanks.

For each installation on DNV classed vessel the complete thermal insulation scheme, including the spray coating system, shall be reviewed and approved by DNV prior to installation.

The spray coating applicators must have adequate training and relevant experiences in accordance with manufacturer's recommendations.

Storage, handling and installation of the coating system components shall be in in accordance with manufacturer's recommendations.

When installed, the complete insulation system, spray foam plus spray coating, shall protect or be adequately protected against penetration of water vapor and mechanical damage.

Where the thermal insulation is located on or above the exposed deck, and in way of tank cover penetrations, it shall have suitable fire resistance properties in accordance with recognized standards or be covered with a material having low flame-spread characteristics and forming an efficient approved vapor seal.

Any significant changes in design and / or quality of the material will render the approval invalid.

Type Approval documentation

Tests carried out

Type Testing carried out in accordance with **Type Approval documentation**, including:

ISO 2781	Density
ASTM D412	Tensile strength
ASTM D412	Elongation
ASTM D624	Tear strength
ASTM D2240	Hardness (Shore A)
ASTM D2240	Hardness (Shore D)
ISO 20344	Water vapor transmission
ASTM D471	Water absorption (168 hrs)
DIN 4102-1	Flammability (B2)

Marking of product

Product/package shall be marked with *manufacturer's name* and *type designation;* ***VESCOAT***.

The marking is to be carried out in such a way that it is visible, legible and indelible. The marking of product is to enable traceability to the DNV Type Approval Certificate.

Periodical assessment

The scope of the Periodical Assessment is to verify that the conditions stipulated for the Type Approval is complied with and that no alterations are made to the product design or choice of materials.

Periodical assessments (for Certificate Retention / Certificate Renewal) shall be performed according to DNV-CP-0338.

This certificate is only valid if required Periodical assessments are carried out with satisfactory results. To check the validity of this certificate, please look it up in https://approvalfinder.dnv.com

END OF CERTIFICATE