Certificate no.:
TAK00002ER

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Insulation Materials for Gas Carriers

with type designation(s)
Spefoam® DH-PUF 44

issued to
Dehe Technology Group Co., Ltd.
Jiaxing City, Zhejiang Province, **China**

is found to comply with

DNV rules for classification – Ships Pt.5 Ch.7 Liquefied gas tankers

Application:

Rigid cellular polyurethane foam for insulation

Issued at **Hamburg** on **2024-12-16**
This Certificate is valid until **2029-12-15**.
DNV local unit: **Shanghai**

Approval Engineer: **Joachim Rehbein**

for **DNV**

.....

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 USD 300 000.

Product description

Spefoam® DH-PUF 44: Two-component rigid polyurethane foam for production of insulating panels

Component A: Premixed polyol (PLO)

Component B: Methylene diphenyl diisocyanate (MDI/ISO)

Material Properties

Raw materials:

Properties	Standard	PLO	MDI	Unit
Viscosity at 20°C[1]	ASTM D445	400 - 800	150 - 250	mPa·s
Density	ASTM D4669	1.20 ± 0.1	1.220 – 1.250	g/cm³

Notes:
1: MDI at 25°C

Foam properties:

Density, nominal: 44 ± 4 kg/m³ according to ASTM D1622

Thermal conductivity at 20°C: ≤ 0.024 W/mK according to ASTM C518 (non-aged)

Flame retardance: B2 according to DIN 4102-1

Application/Limitation

Insulation material for conventional tanks designed to store LNG, LEG and LPG.

Compatibility testing has been carried out only for LNG. Compatibility testing with the actual kind of cargoes or fuels must be carried out prior to installation on DNV classed ships.

Storage, handling and installation of the insulation material shall be in in accordance with manufacturer's recommendations.

Area of application will be evaluated during approval of classified objects.
For each installation on DNV classed vessel the complete insulation scheme shall be reviewed and approved by DNV prior to installation.

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:

No.	Test item	Test method
1	Density	ASTM D1622 (at 23°C)
2	Thermal conductivity	ISO 8302
3	No asbestos detected	ISO 22262-1 & NIOSH 9000
4	Flammability characteristics	DIN412 Part1
5	Closed cell content	ASTM D6226
6	Cohesion	ASTM D1623
7	Ageing	ASTM D2126 (at 70°C / -30°C)
8	Shrinkage	ASTM D2126 (at -168°C)
9	Thermal conductivity	ISO 8302 (-40°C / -80°C / -120°C / -168°C)
10	Coefficient of linear thermal expansion	ASTM E228 (-170°C to 23°C)
11	Tensile strength	ISO 1926-2009
12	Compressive strength	ASTM D1621
13	Dimensional stability	ISO 175-2010
14	Resistance to vibrations	ISO 10055:1996

Compatibility to cargo evaluated for tension, compression, dimension and mass after aging test by immersion in liquid methane for 15 days.

Marking of product

Product/package shall be marked at least with *manufacturer's name* and *type designation:* ***Spefoam® DH-PUF 44***.

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.

Assessed production site

Dehe Technology Group Co., Ltd.
998, Rui Bo Wangdian Town,
Xiuzhou District, Jiaxing,
Zhejiang Province,
China

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.

A production site with a valid Approval of Manufacturer (AoM) certificate for material in question is exempted from the obligation concerning periodical and renewal assessments.

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