dehoflex®

Flexible Cryogenic Supports

A new Generation of Flexible Cryogenic Supports

Dehoflex

Development of a new Generation of Tank Support Blocks

dehonit® is the world's largest maker of Cryogenic Tank Supports offering a complete package of design assistance, support manufacture and mastic supply. We also have a fully experienced engineering and service team to provide routine inspection, on-site instruction, assistance and supervision of block and mastic installation and tank lowering.

The Deho Group has a wealth of experience in this field dating back to the mid 1950's when the world's first cryogenic supports were manufactured and supplied by Permali for the Methane Princess and Methane Pioneer.

Tank supports for IMO type A, B or C tanks are made from **dehonit®** B 740-1, a high density, compressed laminated wood, fully approved and in use as supports from the very first demand in this market.

The design of the tank supports depends on the type of tank specified and decisions made in the design process. Supports vary in size and can have differing fibre directions depending on loading and other forces acting on them during their service life.

dehonit® engineer and supervisor team

Fig. 1) Crack at the Mastic line

Thermal Stress

During routine inspections carried out by **dehonit®** engineers in recent years, it has been noted **that the traditional supporting system will develop cracks under high thermal stress** if blocks with a **vertical fibre** direction have been used. These cracks occur mainly in the mastic lines and create cold spots (Fig. 1,2 & 3). This effect is more apparent on LNG cargo/fuel systems due to the colder conditions in the tank (circa – 163°C).

Fig. 2) Cold spots in supporting system

Several disadvantages
with traditional supporting system

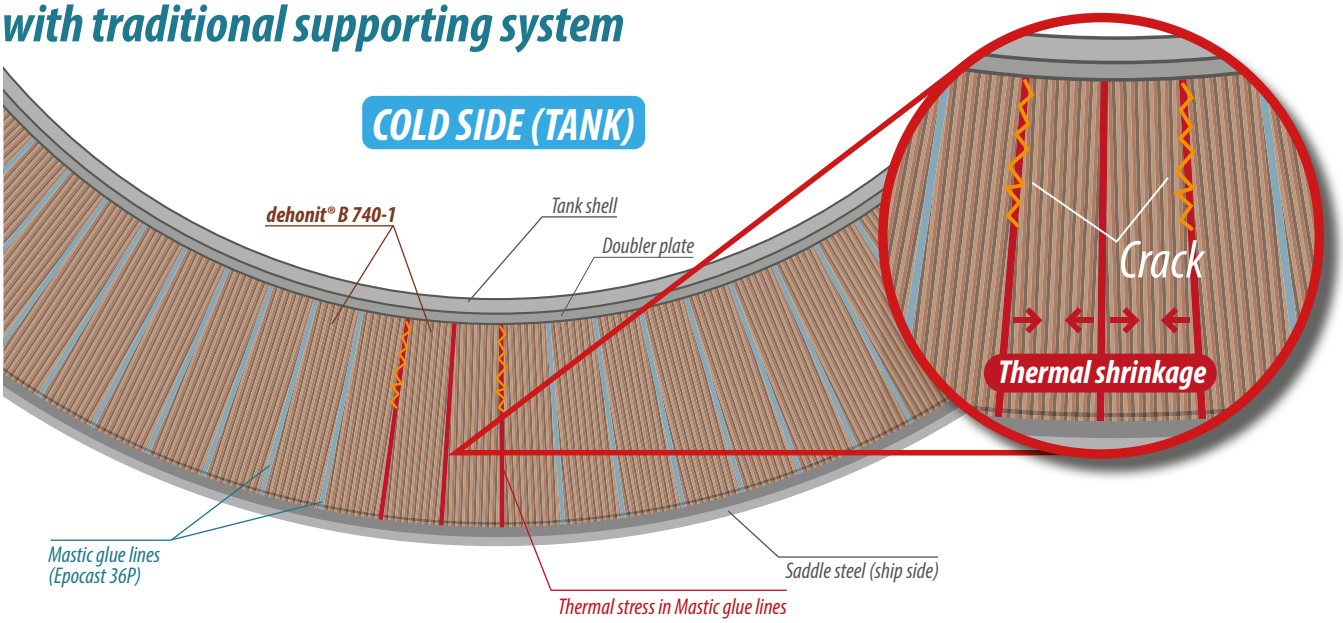


Fig. 3) Thermal shrinkage in supporting system

WARM SIDE (SHIP)

There are several disadvantages with traditional supporting systems using vertical fibre direction:

- Loss of thermal insulation
- Saddle cooling below the minimum permissible temperature of -30°C.
- High boil off rate
- Loss of mechanical properties

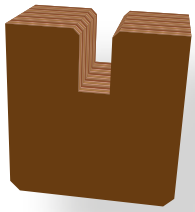
One important question raised by ship designers – Why is it not possible to always use horizontal fibre direction?

As shown in the Fig. 4, three varying fibre directions are available. However, mechanical properties are directional dependent, and every configuration has advantages and disadvantages. Fibre direction should assessed and specified as needed for each specific design case.

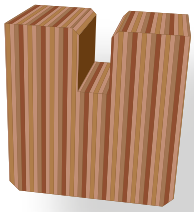
For example, if blocks with horizontal fibre direction are used, high thermal stress issues are eliminated, but lower shear strength is a disadvantage. In this case, larger blocks are required to withstand the same shear forces as vertical fibre direction blocks. This, in turn, creates a higher material cost and the larger surface area of each block gives rise to a higher boil off rate. Larger blocks also require the area of reinforcing on both tank and ship to be increased, consume more mastic and take longer to assemble due to the increased weight of the blocks.

The choice of fibre direction has evolved over time with vertical fibre direction blocks being common for tanks subjected to higher shear forces, (Fuel tanks, Type C tanks, and horizontal fibre direction blocks being common for bigger tanks where lower shear forces occur (Type B tanks).

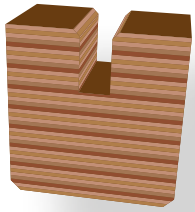
Vertical Lamination



Vertical Lamination 90°

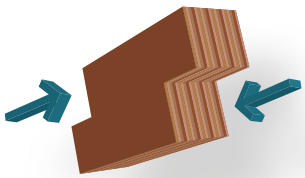


Horizontal Lamination



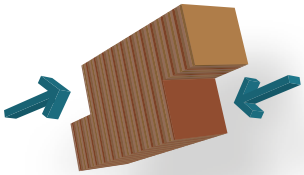
Shear strength: dehonit® B740-1 - tested acc. DIN 7707, at RT

Flatwise (Perpendicular)



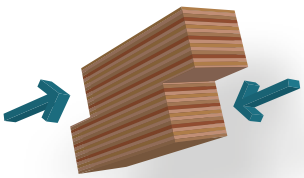
≥ 76,0 N/mm²

Edgewise



≥ 73,0 N/mm²

Interlaminar



≥ 25,0 N/mm²

Fig. 4) Different fibre directions, vertical, vertical at 90° and horizontal

At the start of 2019, in partnership with Technical University of Dresden, we commenced work on a project to develop a new block system to eliminate thermal stress cracks where vertical fibre direction blocks are used. We have a good cooperation and working relationship with TUD having worked with them for many years on various successful projects in the past.

What is dehoflex®

dehoflex® is a combination of various materials, our well-known **dehonit®** B740-1 compressed laminated wood and a flexible layer.

By accurately inserting the flexible layer at various points within the block during manufacture, we can eliminate the thermal stress cracks when the blocks are assembled into the supporting structure. The system was developed and refined using many small-scale simulation tests and confirmed by carrying out a test on full size blocks in our own cooling chamber, see Fig. 5, 6 & 9.

Following comprehensive testing (Fig. 8) we can show this system as a viable long-term working solution to eliminate thermal stress cracking on blocks with vertical fibre direction and guarantee safety under all conditions.

Fig. 6) Test specimen

Fig. 8) Compression test at Otto-Mohr-Laboratory, TUD

Fig. 5) dehonit® cooling chamber

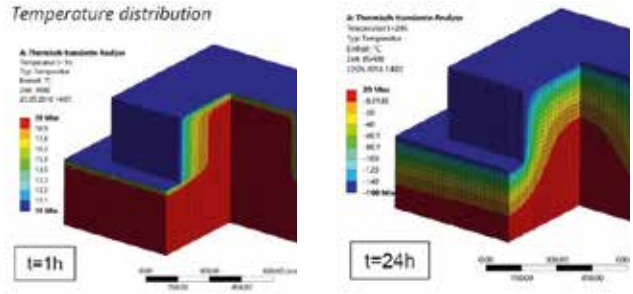


Fig. 7) FEM Analysis

dehonit® engineers worked continuously with TUD scientists to simulate different test configurations for FEM analysis see Fig. 7. Throughout the process inspection services from DNV GL were involved as part of the process for approval of the new system.

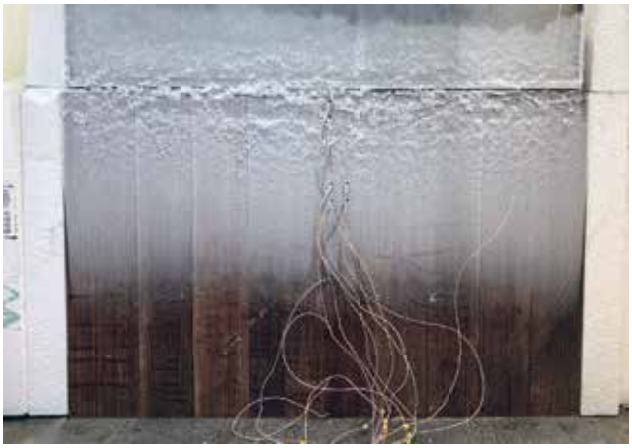


Fig. 9) Specimen on test at operational temperature after cool down

dehoflex® Cryogenic Tank Supports - new generation

The mechanical properties of the new **dehoflex®** are comparable to the standard **dehonit®** B740-1:

- High compressive strength
- Low thermal conductivity
- Low specific weight
- Low coefficient of linear expansion
- Low coefficient of friction
- Water resistant
- Temperature stability

The **dehoflex®** support system can be offered, and is suitable, for all tank types.

Our in-house machining centre can produce finished parts of all sizes, to high accuracy, as may be required. We have modern 3 & 5 axis CNC machines and work with all the latest software and tool technology to produce parts in accordance with the design and drawings.

Our engineering team would be pleased to advise on grades and materials most suited to your application and we can offer advice to help resolve any design issues that may be encountered. The option to carry out a full-size cool down test at our in-house facility is available to prove any new design.

Please do not hesitate to contact our Technical Sales personnel at any of our worldwide offices, at a time to suit you, should you require any assistance.

Contact & Distribution

Deutsche Holzveredelung Schmeing GmbH & Co. KG

Würdinghauser Straße 53
D- 57399 Kirchhundem

TEL +49 27 23 / 77 2-120
FAX +49 27 23 / 77 2-233

MAIL info@deho.de

Czech Republic
Dehonit-Falke s.r.o.

Chebska 2116
CZ 356 01 Sokolov

TEL +420 352 / 46 7132
FAX +420 352 / 46 7131

MAIL dehonit@volny.cz

United Kingdom
Permali Deho Ltd.

Unit 4, Permali Park
Bristol Road,
Gloucester GL1 5 SR

TEL +44 14 52 / 41 16 07
FAX +44 14 52 / 41 16 17

MAIL sales@permalideho.co.uk

P.R. China
Deutsche Holzveredelung Schmeing GmbH & Co. KG Dalian Representative Office

Rm. 2206B, Gold Name Tower, No. 68,
Renmin Rd., Dalian, Liaoning Province,
P. C.: 116001, P. R. China

TEL +86 411 / 82 75 92 96
+86 411 / 82 75 92 97
FAX +86 411 / 82 75 92 98

MAIL kerry.wu@deho.de

dehonit® leading in compressed laminated wood

Permali Compressed Wood

WWW.DEHO.DE **WWW.PERMALIDEHO.CO.UK**