

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Wood Products**

with type designation(s)
Yongwooden 2005S, Laminated Compressed Wood

Issued to

YONGWOO INC.
Yongsan-si, Gyeongsangnam-do, Republic of Korea

is found to comply with
DNV GL class programme DNVGL-CP-0099 – Type approval – Hardwood for tank supports

Application :

For use as supporting material between cargo tanks for liquified gas and support in hull structure, for minimum temperature of cargo -196°C.

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

Issued at **Høvik** on **2019-06-27**

This Certificate is valid until **2024-06-26**.

DNV GL local station: **Gimhae Station**

for **DNV GL**

Approval Engineer: **Gisle Hersvik**

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Rikard Törnqvist
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.



Product description

Yongwooden 2005S Laminated Compressed Wood for Tank Support of LNG and LPG vessels.
- Crosswise arrangement of beech veneers, impregnated with a phenolic resin.

Manufactured by

Yong Woo Incorporated, 30, Green gongdan 3-gil, Yangsan-si, Gyung-sangnam-do, Korea

DNV GL local station: Gimhae

Responsibility

The Company (stated on the front page of this Certificate) takes the responsibility that both design and production are in compliance with Rules, Standards and/or Regulations listed on page 1 of this certificate.

Application/Limitation

For use as supporting material between cargo tanks for liquified gas and support in hull structure, for minimum temperature of cargo -196°C.

For regular, not submerged material, the Manufacturer has specified:

- | | | |
|--|---------|---------------|
| - Compressive strength perpendicular ($\perp$) to veneers: | 240 MPa | [ISO 604] |
| - Compressive strength parallel ($\parallel$) to veneers: | 160 MPa | [ISO 604] |
| - Shear strength perpendicular ($\perp$) to veneers: | 70MPa | [IEC 61061-2] |
| - Shear strength parallel ($\parallel$) to veneers: | 30MPa | [IEC 61061-2] |

Recommended safety factor = 4 for long-term loading.

Water resistance when compared with tested compressive strength is:

- | | | |
|--|-----|-----------|
| - Compressive strength perpendicular ($\perp$) to veneers: | 74% | [ISO 604] |
| - Compressive strength parallel ($\parallel$) to veneers: | 84% | [ISO 604] |

Water resistance when compared with Manufacturer's specified compressive strength is:

- | | | |
|--|-----|-----------|
| - Compressive strength perpendicular ($\perp$) to veneers: | 80% | [ISO 604] |
| - Compressive strength parallel ($\parallel$) to veneers: | 94% | [ISO 604] |

In accordance with the Manufacturer's instructions, the maximum service temperature is +100°C.

Further information regarding properties, applications and limitations: As per Manufacturer's data sheets and instructions.

Drawings showing arrangement of the laminated compressed wood together with calculation of the compressive stresses shall be submitted for approval for each ship application.

The laminated compressed wood shall be delivered with a works certificate in accordance with EN 10204/3.1 B, or equivalent.

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**.

Job Id: **262.1-019048-2**
Certificate No: **TAK00001NW**

Marking of product

Product package shall be marked with *manufacturer's name*; **Yong Woo Inc., Korea** or *manufacturer's symbol*, and *type designation*; **Yongwooden 2005S** Laminated Compressed Wood.

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 GL 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 Assessment to be performed after 2 and 3.5 years (Certificate Retention) and at renewal after 5 years (Certificate Renewal).

The main elements of the Periodical Assessment are to:

- Ensure that **Type Approval documentation** is available.
- Review design, materials, production process, and performance with respect to possible changes, in order to ensure compliance with **Type Approval documentation** and/or referenced material specifications.
- Ensure traceability between manufacturer's product marking and the DNV GL Type Approval Certificate.

END OF CERTIFICATE