DNV·GL

Certificate No:
TAS000021Z

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Helideck Planking

with type designation(s)
E0110-049

Issued to
Bayards Aluminium Constructies B.V.
Nieuw-Lekkerland, Zuid-Holland, Netherlands

is found to comply with
DNV GL rules for classification – Ships
DNVGL-OS-E401 – Helicopter decks
CAP 437 Standards for offshore helicopter landing areas

Application :

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

Issued at **Høvik** on **2019-08-22**

This Certificate is valid until **2024-08-21**.

for **DNV GL**

DNV GL local station: **Oslo Floating Offshore Structures**

Approval Engineer: **Svein Leite**

Arild Rogne
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

These helicopter deck planks are extruded aluminium profile of Bayards' type E0110-049 being made of aluminium alloy 6005A T6.

Application/Limitation

Rules/Standards:
Compliance with strength requirements for helicopter deck according to DNVGL-OS-E401 "Helicopter Deck" July 2019, DNVGL-RU-SHIPS Pt.6 Ch.5 "HELICOPTER INSTALLATIONS-HELDK" Edition July 2019 and CAP437 "Standard for offshore helicopter landing areas" Edition 8.1 September 2018.

The deck planks shall comply with:

- dimensions and tolerances according to drawing no. E0110-049, Rev. R1, "E0110-049"
- material specification for aluminium alloy 6005A T6 with a $f_{0.2}$ of at least 215MPa and f_u of at least 255MPa.

Maximum span of aluminium plank:

- Simply supported plank span: 5.1m
- Continuous[1)] plank span: 5.1m

1) Minimum 2 span continuous deck planking.

Welding shall not be used for structural connections or to attach any equipment to the helideck plank as the material strength will be reduced in the heat affected zone.

Limit curves for combination of MTOW [t] and span [m] for compliance with DNVGL and CAP437 are given in the following figures 1, 2, 3 and 4.

Any arrangements deviating from this type approval documentation or applications according to other codes or standards shall be specially considered and approved on a case by case basis.

DNV GL compliance (MTOW-Span) capacity curves

- The DNVGL MTOW limitation are based on 40% of MTOW being distributed to a single landing gear with single or double wheels.
- The capacity curves for continuous plank span represents planks being arranged as continuous planks for a minimum of 2 span lengths. I.e. arranged with a continuous plank at minimum one side of the span.
- The capacity curves for simply supported plank span represent planks being arranged with a single span. I.e. planks are only supported at the plank ends.
- Landing gear – Wheel prints:
  The applied wheel prints used in the load test are covering the most commonly used type of helicopter undercarriages/landing-gear with single or double wheels:
  - Single wheel print: [180x360] mm2
  - Double wheel print: 2x[180x360] mm2 (wheel prints are arranged with 300mm space)

Figure 1 is showing the DNVGL limits for combination of helicopter Max Take Off Weight (MTOW) in [t] and plank span in [m] for continuous plank span:

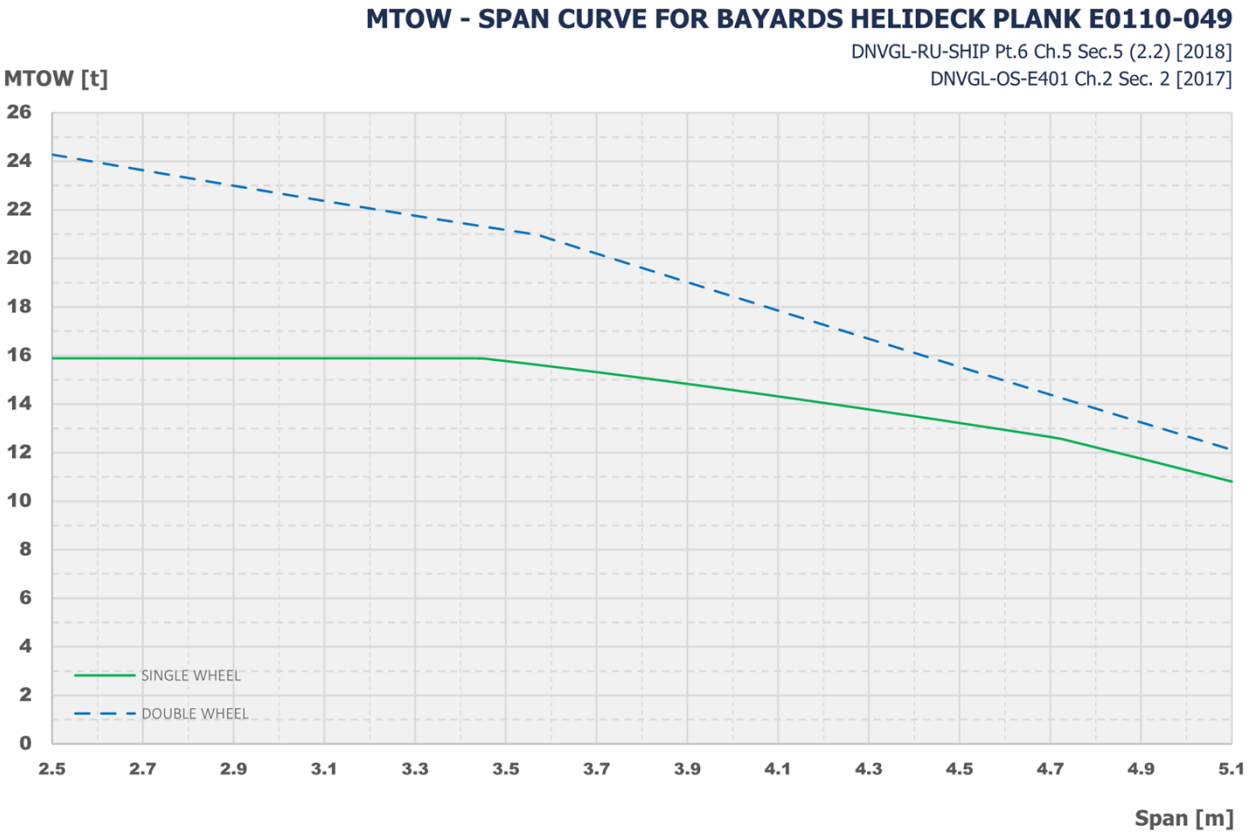

Figure 1 – DNVGL MTOW limits for double and single wheel – Continuous plank span

Figure 2 is showing the DNVGL limits for combination of helicopter Max Take Off Weight (MTOW) in [t] and plank span in [m] for simply supported plank span, e.g. hatches etc.:

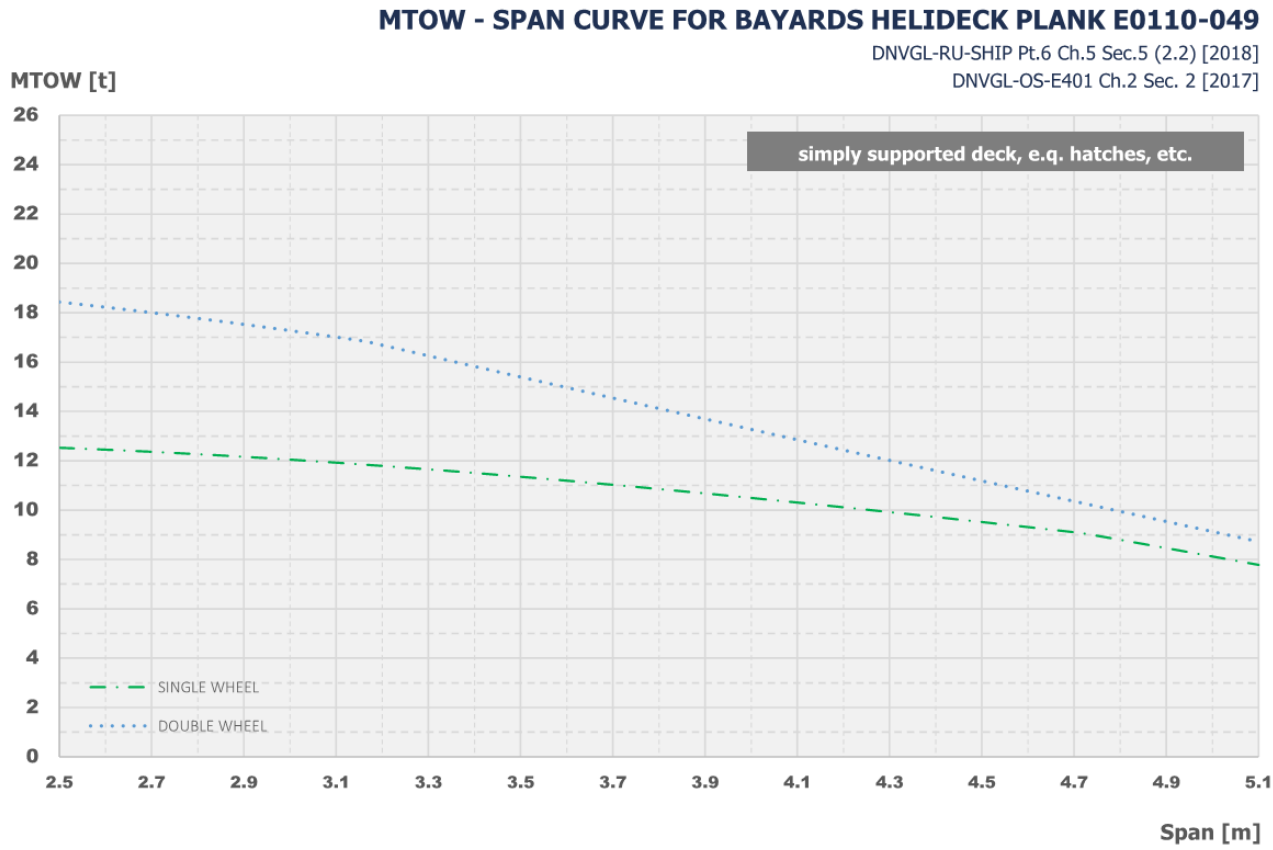

Figure 2 – DNVGL MTOW limits for double and single wheel for simply supported plank span

CAP437 compliance (MTOW-Span) capacity curves

- The CAP437 MTOW limitation are based on 50% of MTOW being distributed to a single landing gear with single or double wheels.
- The capacity curves for continuous plank span represents planks being arranged as continuous planks for a minimum of 2 span lengths. I.e. arranged with a continuous plank at minimum one side of the span.
- The capacity curves for simply supported plank span represent planks being arranged with a single span. I.e. planks are only supported at the plank ends.
- Landing gear – Wheel prints:
  The applied wheel prints used in the load test are covering the most commonly used type of helicopter undercarriages/landing-gear with single or double wheels:
  - Single wheel print: [180x360] mm2
  - Double wheel print: 2x[180x360] mm2 (wheel prints are arranged with 300mm space)

Figure 3 is showing the CAP437 limits for combination of helicopter Max Take Off Weight (MTOW) in [t] and plank span in [m] for continuous plank span:

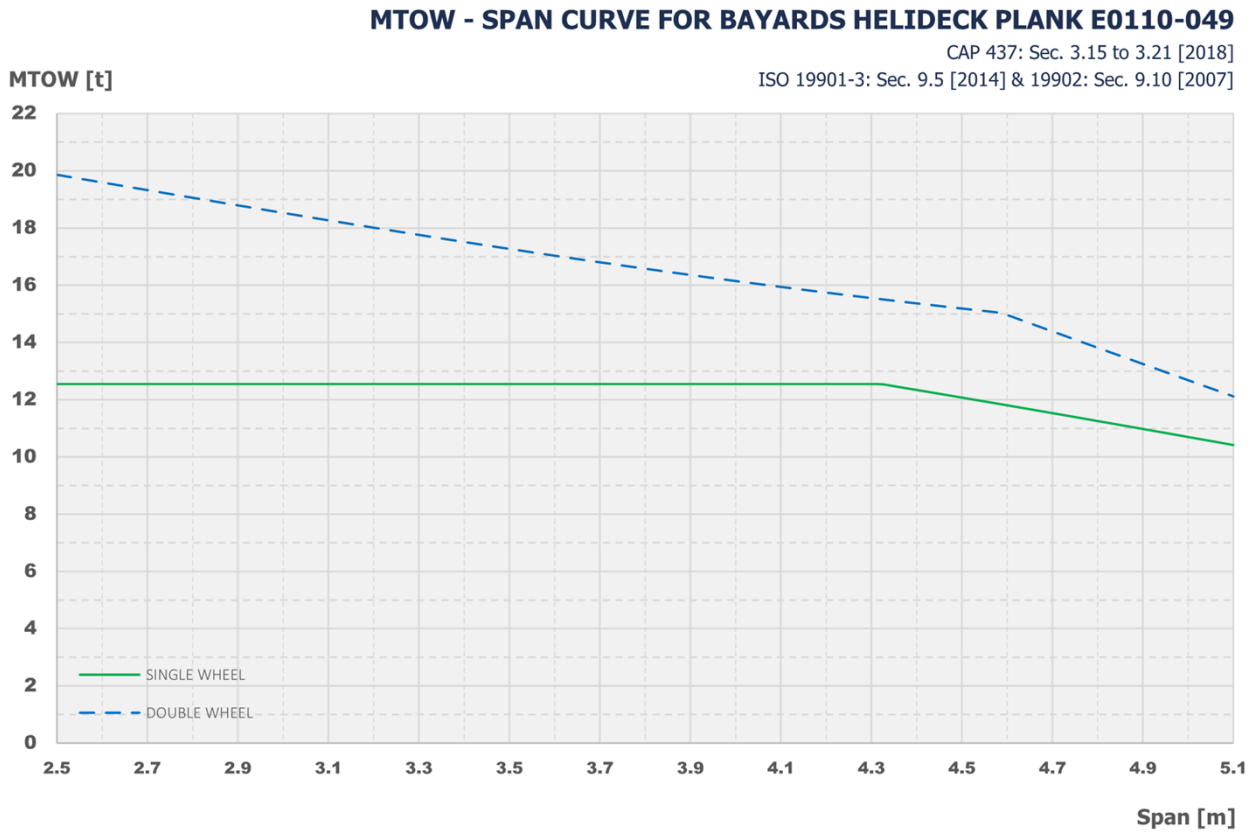

Figure 3 – CAP437 MTOW limits for double and single wheel - Continuous plank span

Figure 4 is showing the CAP437 limits for combination of helicopter Max Take Off Weight (MTOW) in [t] and plank span in [m] for simply supported plank span, e.g hatches etc.:

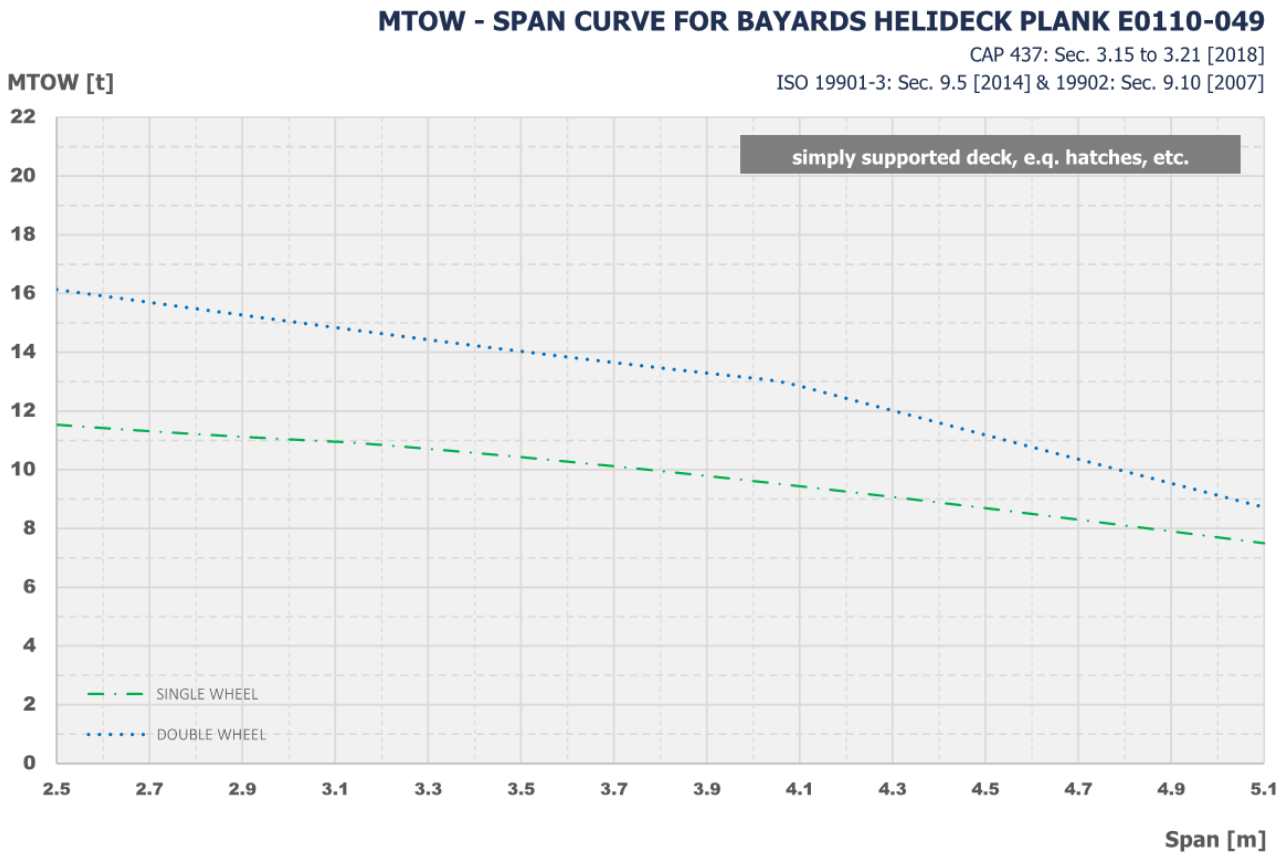

Figure 4 – CAP437 MTOW limits for double and single wheel for simply supported plank span

Type Approval documentation

1. Drawing No. E0110-049, Rev. R1, "E0110-049"
2. Doc. No. 0901-01-CLA-002-R0, "FEM ANALYSIS HELIDECK PLANKING SYSTEM"
3. Doc. No. 118027[01]-TR-0001-R1 dated 14-3-2019, "New generation helideck – New design 450mm planking, Test report"
4. Doc. No. 118027[01]-CURVE-DNVGL-001, "Capacity curve calculation according to DNVGL-RU-SHIPS Pt.6 Ch.5 Sec.5 2.2 [2018] and DNVGL-OS-E401 Ch.2 Sec.2 [2017], Continuous plank span"
5. Doc. No. 118027[01]-CURVE-DNVGL-002, "Capacity curve calculation according to DNVGL-RU-SHIPS Pt.6 Ch.5 Sec.5 2.2 [2018] and DNVGL-OS-E401 Ch.2 Sec.2 [2017], Simply supported plank span"
6. Doc. No. 118027[01]-CURVE-CAP437-001, "Capacity curve calculation according to CAP 437 Section 3.15 to 3.21 [2018], Continuous plank span"
7. Doc. No. 118027[01]-CURVE-CAP437-002, "Capacity curve calculation according to CAP 437 Section 3.15 to 3.21 [2018], Simply supported plank span"
8. Doc. No. 118027[01]-CURVE-FEA-001, "Capacity curve calculation for max load on helideck deck plank E0110-049, Continuous plank span"
9. Doc. No. 118027[01]-CURVE-FEA-002, "Capacity curve calculation for max load on helideck deck plank E0110-049, Simply supported plank span"

Tests carried out

Prototype test for strength of the helideck plank was carried out on the 11th January 2019 at Bayards' production facility "Dintelmond" in Heijningen, the Netherlands and witnessed by DNV GL Rotterdam surveyor.

For test results, ref. approval documentation [3].

Marking of product

- Type designation: E0110-049
- DNV GL Type Approval Certificate No. TAS000021Z

Periodical assessment

DNV GL's surveyor has the permission to perform Certification Retention Survey at any time during the validity period of this certificate.

Periodic assessment will be required after two years (+/- 90 days) and after 3.5 years (+/- 90 days) to verify that the conditions for the approval are complied with. Reference is made to DNVGL-CP-0338.

END OF CERTIFICATE