

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Sandwich Core Materials**

with type designation(s)

Divinycell® HP; HP60, HP80, HP100, HP130, HP160, HP200, HP250

Issued to

**DIAB International AB
Laholm, Sweden**

is found to comply with

Det Norske Veritas' Rules for Classification of High Speed, Light Craft and Naval Surface Craft**Det Norske Veritas' Type Approval Programme 1-501.10, 2009, Sandwich Core Materials****Det Norske Veritas Standards' for Certification No. 2.21, Craft, 2010****Det Norske Veritas' Standards for Certification No. 2.20, Lifeboats and Rescue Boats, 2007****Application :****Core material for sandwich construction. The core material (HP100 to HP250) is approved for use in areas exposed to slamming and slamming fatigue.****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.**This Certificate is valid until **2019-08-30**.Issued at **Høvik** on **2015-08-31**DNV GL local station: **Gothenburg**Approval Engineer: **Gisle Hersvik**for **DNV GL**

Martin Strande
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.



Job Id: **262.1-020221-1**
Certificate No: **TAK000002C**

The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

Product description

Divinycell® HP; HP60, HP80, HP100, HP130, HP160, HP200 and HP250.

Core material for sandwich construction. A resilient, closed cell, foam sheet consisting of a polymeric alloy of a cross-linked aromatic polyurea and a linear vinyl polymer with dimensional stability at temperatures up to 130°C.

The following manufacturer's specified values are confirmed by type testing:

Properties	Test Method	HP60	HP80	HP100	HP130		
Tensile Strength ¹⁾	ASTM D1623	1,8	2,8	3,5	4,8	MPa	msv
Tensile Strength ¹⁾	ASTM D1623	1,5	2,2	2,5	3,5	MPa	msmv
Tensile Modulus ¹⁾	ASTM D1623	75	100	130	175	MPa	msv
Tensile Modulus ¹⁾	ASTM D1623	57	80	105	135	MPa	msmv
Compressive Strength ¹⁾	ASTM D1621	0,95	1,5	2,0	3,0	MPa	msv
Compressive Strength ¹⁾	ASTM D1621	0,85	1,2	1,65	2,4	MPa	msmv
Compressive Modulus ¹⁾	ASTM D1621-B-73	80	105	135	170	MPa	msv
Compressive Modulus ¹⁾	ASTM D1621-B-73	58	90	115	145	MPa	msmv
Shear Strength	ASTM C273	0,85	1,25	1,6	2,2	MPa	msv
Shear Strength	ASTM C273	0,75	1,0	1,4	1,9	MPa	msmv
Shear Modulus	ASTM C273	20	28	35	50	MPa	msv
Shear Modulus	ASTM C273	18	22	28	40	MPa	msmv
Shear Strain	ASTM C273	23	40	40	40	%	msv
Density	ASTM D1622	65	80	100	130	kg/m ³	msv
Density	ASTM D1622	62	72	90	117	kg/m ³	msmv
Slamming Grade Testing, Shear Strength	ASTM C393	²⁾	²⁾	²⁾	>1,4 (msmv) >1,6 (msv)	MPa	

Properties	Test Method	HP160	HP200	HP250		
Tensile Strength ¹⁾	ASTM D1623	5,4	7,1	9,2	MPa	msv
Tensile Strength ¹⁾	ASTM D1623	4,0	6,3	8,0	MPa	msmv
Tensile Modulus ¹⁾	ASTM D1623	205	250	320	MPa	msv
Tensile Modulus ¹⁾	ASTM D1623	160	210	260	MPa	msmv
Compressive Strength ¹⁾	ASTM D1621	3,4	5,4	7,2	MPa	msv
Compressive Strength ¹⁾	ASTM D1621	2,8	4,5	6,1	MPa	msmv
Compressive Modulus ¹⁾	ASTM D1621-B-73	200	310	400	MPa	msv
Compressive Modulus ¹⁾	ASTM D1621-B-73	175	265	350	MPa	msmv
Shear Strength	ASTM C273	2,6	3,5	4,5	MPa	msv
Shear Strength	ASTM C273	2,2	3,2	3,9	MPa	msmv
Shear Modulus	ASTM C273	60	73	97	MPa	msv
Shear Modulus	ASTM C273	50	65	81	MPa	msmv
Shear Strain	ASTM C273	40	45	45	%	msv
Density	ASTM D1622	160	200	250	kg/m ³	msv
Density	ASTM D1622	145	180	230	kg/m ³	msmv
Slamming Grade Testing, Shear Strength	ASTM C393	³⁾	³⁾	6,0	MPa	

¹⁾ Perpendicular to the plane. All values measured at 23°C.

²⁾ Not approved for use in areas exposed to slamming and slamming fatigue.

³⁾ Not tested to slamming and slamming fatigue requirements, however, please refer to DNV's Rules for Classification of High Speed, Light Craft and Naval Surface Craft (2013), Pt.3 Ch.4, Sec.5, A105.

Remarks:

Standards used for Type Testing are others than required in the Rules/Standards.

Legends:

msmv = Manufacturer's Specified Minimum Value

msv = Manufacturer's Specified Value (average values)

Slamming Grade Testing - test panel lay-up for HP250:

- skins comprising 1 layer 200 g/m² and 5 layers 800/100 g/m², with total thickness of approx. 6 mm
- resin used for both lay-up and joints: Reichhold's PolyLite 505
- core material used was HP250 with thickness 45 mm

Slamming Grade Testing - test panel lay-up for HP100:

The adhesive system used in the slamming tests is POLYLITE® 506-647 (a polyester resin)

Manufactured by

DIAB AB, Norra Sofieroleden 8, 312 32 Laholm, Sweden

DNV GL local station: Gothenburg

DIAB S.p.A., Via Alemagna, 29, 32013 Faè di Longarone BL, Italy

DNV GL local station: Venice

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

The core material (HP100 to HP250) is approved for use in areas exposed to slamming and slamming fatigue.

DIAB AB, Laholm, Sweden – Manufacturer of **Divinycell® HP60, HP80, HP100, HP130, HP160, HP200, HP250**

DIAB S.p.A., Longarone, Italy – Manufacturer of **Divinycell® HP60, HP80, HP100, HP130**

Type Approval documentation

Tests carried out

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

- DNV GL's Standard for Certification No. 2.9, Type Approval Programme no. 1-501.10, including the tests in accordance with DNV GL's Slamming and Slamming Fatigue Grade Requirements.

Marking of product

Product shall be marked with *manufacturer's name, place of production and type designation*.

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.



Job Id: **262.1-020221-1**
Certificate No: **TAK000002C**

Periodical Assessment to be performed after two (2) years (Certificate Retention) and at renewal after four (4) 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