



TYPE APPROVAL CERTIFICATE

Certificate No:
TAK000001N
Revision No:
2

This is to certify:

That the Sandwich Core Materials

with type designation(s)
ArmaPET™ Struct GR

Issued to

Armacell Benelux S.C.S.
Thimister - Clermont, Belgium

is found to comply with

DNV class programme DNV-CP-0084 – Type approval – Sandwich core materials
DNV rules for classification – High speed and light craft
DNV GL standard DNVGL-ST-0342 – Craft

Application :

Polyethylene Terephthalate core material for use in sandwich constructions.

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

Issued at **Høvik** on **2021-11-25**

This Certificate is valid until **2024-11-28**.

DNV local station: **Belgium FIS**

Approval Engineer: **Gisle Hersvik**

for **DNV**

.....
Gustav Heiberg
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.

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 300,000 USD.



Product description

ArmaPET™ Struct GR (GR70 to GR150)

Thermoplastic core material extruded closed cell structure foam made of recycled Polyethylene Terephthalate (PET).
 GR = Grade.

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

Properties	Test Method	ArmaPET™ Struct GR					
		GR70	GR80	GR100	GR115		
Density	ISO 845	65	75	95	110	kg/m ³	m _{smv}
Density, nominal	ISO 845	70	80	100	115	kg/m ³	m _{sv}
Tensile strength, 20°C	ASTM C297	1,4	1,6	2,0	2,2	MPa	m _{smv}
Tensile strength, 20°C	ASTM C297	1,8	2,0	2,5	2,9	MPa	m _{sv}
Tensile modulus, 20°C	ASTM C297	50	50	80	105	MPa	m _{smv}
Tensile modulus, 20°C	ASTM C297	66	80	120	140	MPa	m _{sv}
Compressive strength, 20°C	ISO 844	0,5	0,8	1,25	1,6	MPa	m _{smv}
Compressive strength, 20°C	ISO 844	0,75	1,0	1,5	1,8	MPa	m _{sv}
Compressive modulus, 20°C	ISO 844	28	40	55	65	MPa	m _{smv}
Compressive modulus, 20°C	ISO 844	40	57	77	90	MPa	m _{sv}
Shear strength, 20°C	ISO 1922	0,45	0,53	0,7	0,8	MPa	m _{smv}
Shear strength, 20°C	ISO 1922	0,5	0,6	0,75	0,95	MPa	m _{sv}
Shear modulus, 20°C	ISO 1922	11	12	18	22	MPa	m _{smv}
Shear modulus, 20°C	ISO 1922	13	16	21	26	MPa	m _{sv}
Shear elongation, 20°C	ISO 1922	6	6	5	5	%	m _{smv}
Shear elongation, 20°C	ISO 1922	15	13	10	10	%	m _{sv}
Heat resistance temperature, 80% retention of shear strength	ASTM C393	60	60	60	60	°C	
Water resistance, % retention of shear strength, 20°C	ASTM C393	>80	>80	>80	>80	%	

Remarks:

The materials comply with the DNV requirement to maximum water absorption.

Legends:

m_{smv} = Manufacturer's Specified Minimum Value

m_{sv} = Manufacturer's Specified Value (m_{sv} is mainly taken as the mean = Mean of Type Test results)

The table continues on the next page.

ArmaPET™ Struct GR

Properties	Test Method	ArmaPET™ Struct GR			
		GR135	GR150		
Density	ISO 845	130	142	kg/m ³	msmv
Density, nominal	ISO 845	135	150	kg/m ³	msv
Tensile strength, 20°C	ASTM C297	2,5	2,6	MPa	msmv
Tensile strength, 20°C	ASTM C297	3,0	3,3	MPa	msv
Tensile modulus, 20°C	ASTM C297	110	140	MPa	msmv
Tensile modulus, 20°C	ASTM C297	140	185	MPa	msv
Compressive strength, 20°C	ISO 844	2,2	2,4	MPa	msmv
Compressive strength, 20°C	ISO 844	2,3	2,6	MPa	msv
Compressive modulus, 20°C	ISO 844	85	95	MPa	msmv
Compressive modulus, 20°C	ISO 844	105	120	MPa	msv
Shear strength, 20°C	ISO 1922	1,0	1,2	MPa	msmv
Shear strength, 20°C	ISO 1922	1,2	1,35	MPa	msv
Shear modulus, 20°C	ISO 1922	28	32	MPa	msmv
Shear modulus, 20°C	ISO 1922	35	37	MPa	msv
Shear elongation, 20°C	ISO 1922	5	5	%	msmv
Shear elongation, 20°C	ISO 1922	7	7	%	msv
Heat resistance temperature, 80% retention of shear strength	ASTM C393	60	60	°C	
Water resistance, % retention of shear strength, 20°C	ASTM C393	>80	>80	%	

Remarks:

The materials comply with the DNV requirement to maximum water absorption.

Legends:

msmv = Manufacturer's Specified Minimum Value

msv = Manufacturer's Specified Value (msv is mainly taken as the mean = Mean of Type Test results)

Manufactured by

Armcell Benelux S.C.S., Thimister - Clermont, Belgium

DNV local station: Antwerp

Armcell Canada Inc., 153 Van Kirk Dr, Brampton, ON L7A 1A4, Canada

DNV local station: Montreal

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 uses of core materials for hull applications are to be approved in each individual case.

Documentation of additional material properties may be required.

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**.

Fatigue testing has been carried out for ArmaPET™ Struct GR115 to establish S/N-curves. For further details, please contact the manufacturer.

Marking of product

Product shall be marked with:

- *manufacturer's name and/or trademark; Armacell*
- *place of production,*
- *type designation/product name (ArmaPET™ Struct GR),*
- *density variant (70 / 80 / 100 / 115 / 135 / 150) and*
- *dimensions.*

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.

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 and Certificate Renewal) shall be performed according to DNV-CP-0338.

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