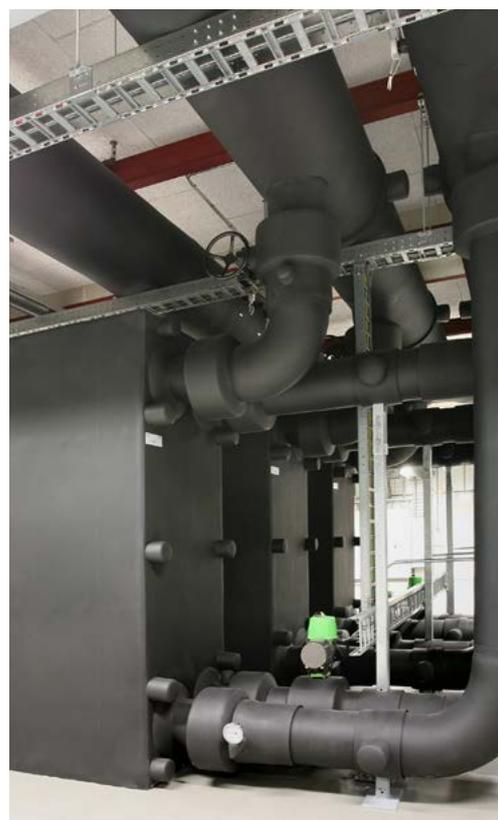


THE TRUSTED INSULATION

ArmaFlex® Class 0 Technical Guide

This guide provides an overview about the certifications of ArmaFlex Class 0. Discover today why it is the preferred insulation to deliver safety, efficiency and better indoor air quality. **The trusted insulation system for HVAC applications.**

www.armacell.com



 **armacell**[®]
ArmaFlex[®]

ArmaFlex Class 0

Discover why it is the **trusted insulation** for reliable performance in safety, efficiency and indoor air quality, according to different test standards around the world.

INTRODUCTION

ArmaFlex is an elastomeric foam material based on synthetic rubber, also known as nitrile butadiene rubber (NBR). Invented in 1954, ArmaFlex is in its seventh product generation and is the trusted flexible insulation material to reliably protect against water vapour ingress without the need for any additional water vapour barrier.

ArmaFlex Class 0 is one of Armacell's most well-known products around the world. Classified as a Class 0 product according to BS 476 Parts 6 and 7, it is infused with Microban® anti-microbial product protection to offer added resilience against mould and bacteria growth. The product's versatility and flexibility means it cuts easily and conforms to preferred shapes of pipe- and ductwork, minimising any potential for air gaps between the insulation and the equipment. This means installers can effectively deliver professionally installed insulation systems and facility owners can be assured of efficient, long-term system performance.

USING THIS DOCUMENT

Fit-for-purpose insulation correctly selected and installed is one of the simplest, fastest and most cost-effective means of improving energy efficiency. To enhance standards of living and save energy, regulatory bodies all over the world have specified standards and requirements with regards to thermal and acoustic insulation. In this document, discover more about the certifications and standards that ArmaFlex Class 0 conforms to and learn about some of the equivalent standards that apply.

Hyperlinks have been set up in the electronic version of this document to facilitate ease of reading. Selection of the blue, underlined text will display information about the standard, test method or certification. Selection of the icon within the "Certificate" column will display the test certificate or report.



TECHNICAL DATA

Brief description	ArmaFlex Class 0 is a flexible insulation material that reliably protects against water vapour ingress due to its closed-cell structure. No additional water vapour barrier is required.
Material type	Elastomeric foam based on synthetic rubber.
Colour	Black.
Special features	ArmaFlex sheets are infused with Microban anti-microbial protection to provide additional assurance against mould and bacteria growth.
Applications	Thermal insulation/protection of pipes, air ducts and vessels (incl. elbows, fittings, flanges, etc.) in hot and cold water services, chilled water lines, heating systems, air conditioning ductwork and refrigerated pipework, installed in commercial, industrial, residential and public buildings to control condensation, protect against frost and reduce energy loss.
Installation	Refer to the ArmaFlex installation manual for recommended installation method. ArmaFlex can be used together with ArmaFlex 520 adhesive and ArmaFix® pipehangers for a complete insulation system.

Property	Value/Assessment		Standard / Test method	Certificate				
Temperature range								
Service temperature	Max. service temperature	+105 °C	+85°C if sheet or tape is glued to the object with its whole surface.					
	Min. service temperature	-50 °C						
Thermal conductivity								
Declared thermal conductivity	θ_m	-20	+/-0	+20	+40	[°C]	Tested according to GB/T 10295, GB/T 10296, ASTM C518, EN ISO 8497	
	$\lambda_d \leq$	0.032	0.034	0.036	0.039	[W/(m·K)]		
Water vapour diffusion resistance								
Water vapour diffusion resistance factor	$\mu \geq$	10,000				Tested according to GB/T 17146-1997, DIN EN 13469, DIN EN 12086		
Water vapour permeability	\leq	1.96×10^{-11}	g/(m·s·Pa)					
Resistance to water								
Water absorption by vacuum	\leq	10%				Tested according to GB/T 17794		
Water absorption by volume	\leq	0.2%				Tested according to ASTM C1763		
Fire performance & approvals								
Surface spread of flame	Class	1				Tested according to BS 476 Part 7: 1997		
Fire performance according to building regulations	Class	0				Tested according to BS 476 Part 6: 1997		
Burning behaviour of building materials and products	Class	B1				Tested according to GB 8624-2012		
Flammability	V-0 rating					Tested according to UL 94		
	FM-Approved					Tested according to FM 4924		
Practical fire behaviour	Does not generate flaming droplets.							
Others	Marine application: Low flame spread material.					Classified according to 2010 FTP-Code		
	Registered by the Fire Services Department of Hong Kong for the entire range of thickness.							
	Product conforms to the requirements for building products under the Fire Safety and Shelter Department, Singapore.							
Mechanical properties								
Resilience after compression relief	\geq	70%				Tested according to GB/T 6669-2001		

4 // TECHNICAL GUIDANCE

Weather and UV resistance

UV resistance For UV protection, ArmaFinish Paint or Arma-Chek® covering system is required. For outside use, ArmaFlex should be protected within 3 days of installation.

Health and environment

Antimicrobial behaviour Built-in Microban antimicrobial product protection in sheets.

Fungal growth No fungal growth is observed.

[Tested according to ASTM G21](#)



Health aspects Free of fibre and formaldehyde. Low volatile organic compounds (VOC), and total aldehyde. GREENGUARD GOLD for even lower VOC and total chemical emissions.

[Tested according to UL2818-2013](#)



Environmental aspect Zero ODP and GWP. Complies with [Restriction of Hazardous Substances Directive](#).

[Singapore Green Building Product Certified](#): "Excellent" rating



Type III [Environmental Product Declaration](#) (EPD): Declaration number 4786944121.101.1, UL Environment.



Other technical features

Chemical resistance Excellent resistance to ozone, oil and chemicals (consult product test list).

Storage Material shall be stored in dry, clean rooms at normal relative humidity (50% to 70%) and ambient temperature (0 °C to 35 °C).

Shelf (storage) life Self-adhesive sheets, tubes and tapes: 1 year.

All data and technical information are based on results achieved under typical application conditions. Recipients of this information should, in their own interest and responsibility, clarify with Armacell's Technical department in due time whether or not the data and information apply to the intended application area. For outside use, ArmaFlex should be protected with ArmaFinish or Arma-Chek® covering within 3 days of installation.

THERMAL CONDUCTIVITY

// Test method

A heat flow meter is an instrument used to measure the steady-state heat transfer through a specimen and calculate its heat transfer properties.

// Requirement

Thermal conductivity, also known as the k-value, refers to the rate of steady-state heat flow through a unit thickness of a unit area of a homogeneous material, induced by a unit temperature increase. Using Fourier's law of heat conduction, the thermal conductivity of the test material is calculated. **The lower the value, the better the insulation property of the material.**

// ArmaFlex Class 0 performance

The thermal conductivity of ArmaFlex Class 0 is $\lambda_{0^{\circ}\text{C}} \leq 0.034 \text{ W}/(\text{m}\cdot\text{K})$. Table 1 offers a comparison of the k-values for some common materials as reference.

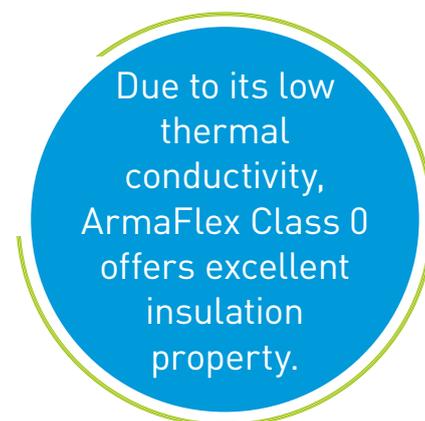


Table 1: Thermal conductivity of different materials at 0°C.

Material	Air	ArmaFlex Class 0	Water	Copper
K-value [W/m·K]	0.025	0.034	0.560	401

// Equivalent test standards

- The national standards in China, often referred to as GB standards, are developed for technical requirements. **GB/T 10295** is equivalent to the ISO 8301:1991 (E) and defines the use of the heat flow meter method to measure steady-state thermal resistance and related properties. The **GB/T 10296** is a test standard that is equivalent to the ISO 8497:1994. Both test reports are available from [page 16](#).
- **ASTM C518** defines the measurement of steady-state thermal transmission through flat slab specimens using a heat flow meter.
- **EN ISO 8497** is a test standard for measuring the steady-state of thermal transmission properties for thermal insulation of circular pipes.

WATER VAPOUR DIFFUSION RESISTANCE

// Test method

In this test, the specimen is sealed to an open side of a test dish containing a desiccant or an aqueous saturated salt solution. This assembly is then placed in a temperature- and humidity-controlled environment. Because of the difference between the partial water vapour pressures in the test assembly and in the atmosphere, water vapour flows through the test specimen.

// Requirement

The test assembly is periodically weighed so as to calculate the water vapour diffusion resistance factor and the water vapour permeability. Water vapour diffusion resistance factor is a measure of the material's reluctance to let

6 // TECHNICAL GUIDANCE

water vapour pass through. It is commonly referred to as the μ -value. **The higher the μ -value, the better the material is at limiting water vapour ingress over time.**

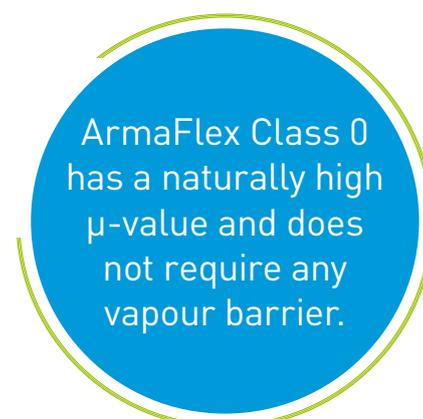
Water vapour permeability is defined as the amount of water vapour that passes through unit thickness of a material, in unit time under a given pressure. **Materials with very high resistance to water vapour transmission will have very low permeability values.**

// ArmaFlex Class 0 performance

The μ -value of ArmaFlex Class 0 is high, consistently achieving 10,000 and beyond in numerous tests over the years. According to simulated calculations by the Fraunhofer Institute, flexible elastomeric foam insulation materials like ArmaFlex Class 0 would have less than 5% moisture absorption after 10 years, as compared to almost 20% and 25% for mineral wool and polyurethane.

// Equivalent test standards

- **GB/T 17146** defines the test method for water vapour transmission properties of building materials and was updated based on the ISO 12572:2001 standard, which specifies a method for determining water vapour permeance of building products and water vapour permeability of building materials under isothermal conditions. See the report [here](#).
- **DIN EN 12086** is a European standard that specifies the equipment and procedures for determining water vapour transmission properties of thermal insulating products, in the steady state, for building applications.
- **DIN EN 13469** is a similar European standard for determining water vapour transmission properties of thermal insulating pipes for building equipment and industrial installations.



FIRE PERFORMANCE (BS 476)

// Test standard

BS 476 refers to the British standard for fire tests on building materials and structures. Part 6 specifies a method of test for providing a comparative measure of a flat material or assembly's contribution to the growth of a fire. It takes into account the combined effect of factors such as ignition characteristics, amount and rate of heat release and thermal properties of the product in relation to its ability to accelerate the rate of fire growth. Part 7 specifies the test method for measuring the lateral spread of flame along the surface of a test specimen.

// Part 6 Requirement

In this test, the set-up consists of a combustion chamber with a specimen holder fixed to one face. The combustion chamber contains a horizontal gas burner tube and two electrical heating elements that is placed below a removable steel chimney and cowl. The sheet sample is placed into the specimen holder and clamped onto the combustion chamber such that the face of the sample is in contact with the walls of the combustion chamber. The sample is subjected to flame and heat from the heating element. Temperature measurements are taken frequently throughout the 20 minutes test and used to calculate the fire propagation index, I and sub-indices i_1 , i_2 and i_3 . **The higher the fire propagation index, the greater is the influence of the product on accelerating the growth of a fire.**

A material is classified as Class 0 according to the UK Building regulations for fire safety if it is:

- composed throughout of materials of limited combustibility, or
- a Class 1 material (classified if the material passes the Part 7 test) which has a fire propagation index (I) of not more than 12 and sub-index (i_1) of not more than 6.

// Part 7 Requirement

In this test, a specimen is placed in a vertical test position adjacent to the radiation panel, within 5 seconds of igniting a pilot flame. A minute after this, the pilot flame is extinguished. The material might start to burn and the test is terminated when the flame front reaches the 825mm reference line, or after 10 minutes has lapsed, whichever is earlier. The following measurements are recorded:

- Time at which the flame front crosses each vertical reference line
- Maximum extent of flame spread during the first 1.5 minutes from the start of the test
- Maximum extent of flame spread during the whole test (i.e. 10 minutes or less, where applicable)
- Time (and distance) at which the maximum flame spread reached.



Figure 1: Test chamber for BS476 Part 7 fire test.

The flame spread at 1.5 minutes and the final flame spread results are then compared with the standard class limits as shown in Figure 2 and a classification is assigned (table 2).

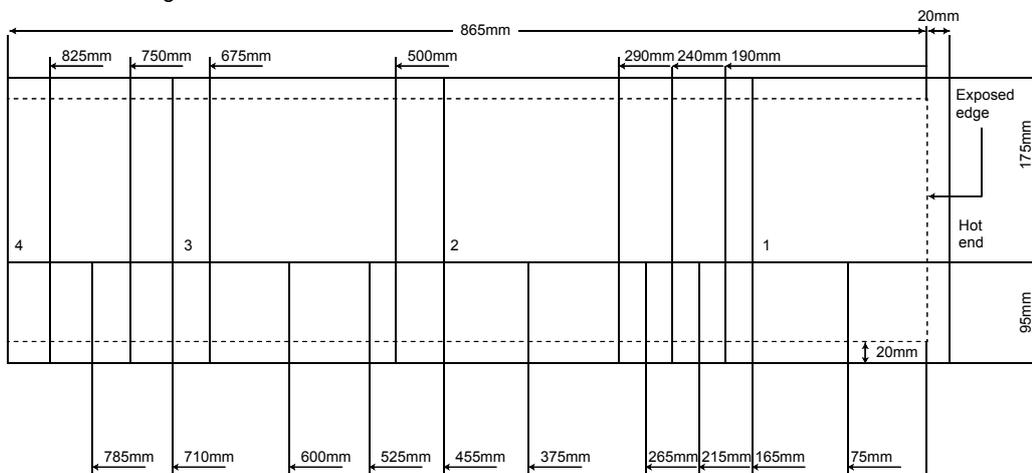


Figure 2: Reference lines to assist surface spread of flame classification.

Table 2: Standard class limits and classification of BS476 Part 7.

Classification	Spread of flame at 1.5 min		Final spread of flame	
	Limited [mm]	Limit for one specimen in sample [mm]	Limit [mm]	Limit for one specimen in sample [mm]
1	165	25	165	25
2	215	25	455	25
3	265	25	710	25
4	Exceeding the limits for class 3			

8 // TECHNICAL GUIDANCE

// ArmaFlex Class 0 performance

ArmaFlex Class 0 is a Class 1 material with $I < 12$ and $i_1 < 6$. Review the test report for part 6 from [page 27](#) and part 7 from [page 33](#).

FIRE PERFORMANCE (GB 8624)

// Test standard

GB 8624 refers to a mandatory national standard in China, that classifies the burning behaviour of building materials and products. It references the EN 13501-1 “Fire classification of construction products and building elements” and establishes specifications to relate the grading classes of both standards. According to GB 8624, the burning behaviour of building materials and products are classified into four grades as shown in Table 3.

Table 3: Grades of burning behaviour of building materials and products.

Grade	A	B ₁	B ₂	B ₃
Description	Incombustible materials (products)	Flame retardant materials (products)	Combustible materials (products)	Inflammable materials (products)

There are seven product sub-categories in GB 8624, with each sub-category to be tested and classified with methods and requirements identified in different Chinese test standards as briefly shown in Table 4. Insulation is categorised under two of these product sub-categories, namely flat building materials and cylindrical / tube shaped insulation materials.

Table 4: Product categories of GB 8624.

Product category	Product sub-category	Relevant test method
Building materials	Flat building materials	GB/T 5464, GB/T 14402, GB/T 20284, GB/T 8626
	Flooring materials	GB/T 5464, GB/T 14402, GB/T 11785, GB/T 8626
	Cylindrical / tube shaped insulation materials	GB/T 5464, GB/T 14402, GB/T 20284, GB/T 8626
Building products	Curtains and decorating fabrics	GB/T 5454, GB/T 5455
	Wire and cable casing, electrical equipment, enclosure and accessories	GB/T 2406, GB/T 2408, GB/T 5169
	Electrical and furniture made of plastic	GB/T 16172, GB/T 8333
	Furniture	GB/T 27904, GB/T 17927

For flat building materials, it is classified into grades as detailed in Table 5.

Table 5: Flat building materials test method and criteria.

Grade	Test method	Criteria	
A	A1	GB/T 5464 and	Temperature rise $\Delta T \leq 30^\circ$ Material loss $\Delta m \leq 50\%$ Duration of sustained flaming $t_f = 0s$
		GB/T 14402	Gross calorific potential (PCS) ≤ 2.0 MJ/kg Gross calorific potential (PCS) ≤ 1.4 MJ/m ²
	A2	GB/T 5464 or and	Temperature rise $\Delta T \leq 50^\circ$ Material loss $\Delta m \leq 50\%$ Duration of sustained flaming $t_f = 20s$
		GB/T 14402	Gross calorific potential (PCS) ≤ 3.0 MJ/kg Gross calorific potential (PCS) ≤ 4.0 MJ/m ²
	GB/T 20284	Fire growth rate $FIGRA_{0.2MJ} \leq 120W/s$ Lateral flame spread < edge of specimen Total heat release at 600s $THR_{600s} \leq 7.5$ MJ	

Grade	Test method	Criteria
B ₁	B GB/T 20284 and GB/T 8626 Time of ignition 30 seconds	Fire growth rate index FIGRA _{0.2MJ} ≤ 120W / s Lateral flame spread < edge of specimen Total heat release at 600s THR _{600s} ≤ 7.5 MJ
		Flame spread Fs ≤ 150mm within 60 seconds No flaming droplets / particles observed for 60 seconds
	C GB/T 20284 and GB/T 8626 Time of ignition 30 seconds	Fire growth rate index FIGRA _{0.4MJ} ≤ 250W / s Lateral flame spread < edge of specimen Total heat release at 600s THR _{600s} ≤ 15 MJ
		Flame spread Fs ≤ 150mm within 60 seconds No flaming droplets / particles observed for 60 seconds
B ₂	D GB/T 20284 and GB/T 8626 Time of ignition 30 seconds	Fire growth rate FIGRA _{0.4MJ} ≤ 750W / s Flame spread Fs ≤ 150mm within 60 seconds No flaming droplets / particles observed for 60 seconds
		Flame spread Fs ≤ 150mm within 20 seconds No flaming droplets / particles observed for 20 seconds
	E GB/T 8626 Time of ignition 15 seconds	Flame spread Fs ≤ 150mm within 20 seconds No flaming droplets / particles observed for 20 seconds
		No performance requirement
B ₃	F	No performance requirement

// ArmaFlex Class 0 performance

ArmaFlex Class 0 meets the performance classification of B₁ (Table 5). See the test report from [page 38](#).

FIRE PERFORMANCE (UL94)

// Test standard

UL94 is a widely quoted flammability performance standard that provides a method for rating ignition characteristics of plastic materials. It is a small-scale test that evaluates the flammability of polymeric materials, in response to a small, open flame or radiant heat source under controlled laboratory conditions.

// Requirement for vertical burning test

Test samples are placed vertically with the test flame impinging on the bottom of the sample. The flame must extinguish within specified times, without burning to the top clamp or dripping molten material which would ignite a cotton indicator (Table 6).

Table 6: Criteria for UL 94 vertical burning rating.

Rating	Criteria
V-0	Burning stops within 10 seconds. No drips allowed.
V-1	Burning stops within 30 seconds. No drips allowed.
V-2	Burning stops within 30 seconds. Drips or flaming particles allowed.

// ArmaFlex Class 0 performance

ArmaFlex Class 0 achieves V-0 rating. See the test report on [page 41](#).

// Equivalent test standard

- **ASTM D3801** is the ASTM-equivalent test method to the UL94 vertical burning test. This fire-test-response standard covers a small-scale laboratory procedure for determining comparative burning characteristics of solid-plastic material, using a 20mm (50W) premixed flame applied to the base of specimens held in a vertical position.



10 // TECHNICAL GUIDANCE

FIRE PERFORMANCE (FM APPROVED)

// Test standard

FM 4924 standard specifies the approval requirement for insulation material used on the exterior of non-combustible pipes or ducts. A pipe chase test apparatus is a three-sided 'L-shaped' channel that consists of a horizontal segment attached to a vertical segment. A test array comprised of three insulated pipes are laterally spaced inside the channel. A propane burner is placed at the end of vertical pipes and the sample is subjected to an exposed fire for 10 minutes (Figure 3).

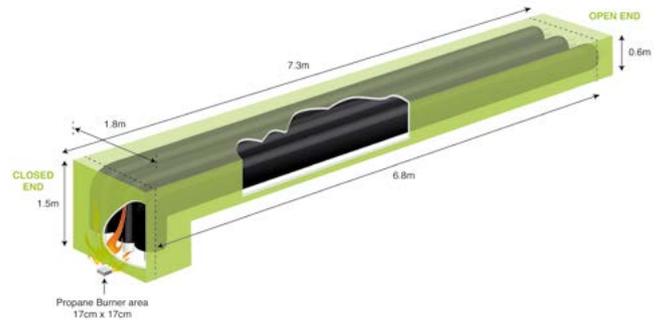


Figure 3: Pipe chase test apparatus set up.

Duct insulation (sheets) under this standard is specified according to the UBC Standard No. 26-3 or ISO 9705, where 8ft by 8ft test samples are mounted on the back wall and adjacent left wall of a room. A fire pan, starter material and wood crib are placed in the corner between these two walls. The room test runs for 15 minutes from the time the starter material is ignited (Figure 4).

// Requirement

For the pipe chase test, the fire shall not propagate to the end of the horizontal segment, the temperature must not exceed 300°C and the insulation fallen off the horizontal segment must extinguish within 10 seconds of hitting the base of the channel.



Figure 4: FM 4924 room test.

For the room test, the sheet insulation shall not burn on the floor for more than 10 seconds. Charring of the foam plastic panel cores do not extend to the outer extremities of the test area for 15 minutes, until flashover occurs as indicated by flaming out the doorway or a temperature in excess of 540°C.

// ArmaFlex Class 0 performance

ArmaFlex Class 0 is FM-Approved, and the certificate is available from [page 44](#).

FIRE PERFORMANCE (MARINE)

// Background of Marine Equipment Directive (MED)

The European Union (EU) directive (2014/90/EU) requires all marine equipment installed onboard ships flying the flag of an EU country, Norway, Iceland and other flag states to be marked with the MED mark of conformity, also known as the "wheelmark". The MED sets out performance and testing standards that these equipment must meet.

There are two conformity assessment modules for thermal insulation that covers both the design and production phases. The EC Type Examination Module B examines the technical design of a product and verifies that the product meets the

respective legislative requirements. The EC Type Examination Module D assesses the equipment manufacturer's production process quality system.

// Requirement

The thermal insulation product is tested for low flame spread characteristics according to IMO 2010 FTP Code part 5 – test for surface flammability.

// ArmaFlex Class 0 performance

The EC-Type examination certificate issued by DNV-GL for conformity in accordance with the Marine Equipment Directive 2014/90/EU is available from [page 45](#).

RESILIENCE AFTER COMPRESSION RELIEF

// Test standard

GB/T 6669 is a test standard identical to ISO 1856 and is used to determine the compression set of flexible cellular materials. The test sample is subjected to compression by either 50% or 75% of its thickness and maintained under this condition for a specific duration.

// Requirement

The sample subjected to 50% compression over 72 hours should recover more than 70%.

// ArmaFlex Class 0 performance

The compression recovery of ArmaFlex Class 0 after 72 hours is more than 70%, as shown in the results from [page 53](#).

WATER ABSORPTION BY VACUUM

// Test standard

GB/T 17794 standard specifies the test method for flexible elastomeric cellular thermal insulation to evaluate its performance in an accelerated water absorption test. In this test, the sample is submerged in water in a vacuum for 3 minutes.

// Requirement

Water absorption of the material in a vacuum should be less than 10%.

// ArmaFlex Class 0 performance

As reported from [page 56](#), ArmaFlex Class 0 passed the test with less than 10% water absorption performance in a vacuum.

WATER ABSORPTION BY VOLUME

// Test standard

ASTM C1763 standard specifies the test method for thermal insulation materials to evaluate its water absorption performance in liquid water. In this test, the sample is fully submerged in water for 2 hours under isothermal conditions.

12 // TECHNICAL GUIDANCE

// Requirement

Water absorption of the material by volume should be less than 0.2%

// ArmaFlex Class 0 performance

As reported from [page 77](#), ArmaFlex Class 0 passed the test with less than 0.2% water absorption volume.

FUNGAL GROWTH

ASTM G21 standard specifies a fungus resistance test that uses a high concentration of spores from five different fungal species, to determine the resistance of synthetic polymeric materials to fungal growth. The test samples are incubated at 28°C at 90% relative humidity for 28 days and examined every 7 days.

// Requirement

The samples are examined under a microscope at 40x magnification and rated on a score of 0 to 4 based on the amount of growth that exists as described in table 7.

Table 7: Rating system based on observed growth on specimens after 28 days

Grade	Description
0	Specimen remained free of fungal growth.
1	Traces of growth on specimen (less than 10%).
2	Light fungal growth on specimen (10 to 30%).
3	Medium fungal growth on specimen (30 to 60%)
4	Heavy fungal growth on specimen (60% to complete coverage)



// ArmaFlex Class 0 performance

No fungal growth is observed on ArmaFlex Class 0. The report is available from [page 59](#).

GREENGUARD CERTIFICATION PROGRAMME

// Test standard

UL 2818 is a test standard in the GREENGUARD Certification Programme for chemical emissions from building materials, finishes and finishing. This standard specifies that products are tested and evaluated according to the dynamic environmental chamber processes and criteria defined in UL 2821. The test lasts for 168 hours where air flow is modelled to simulate actual product use conditions. Chamber air samples are collected and analysed for volatile organic compounds (individual and total) and aldehydes (individual and total) at specified time intervals.

// Requirements

Based on exposure modelling, the measurements are then calculated and converted into air concentrations values to represent what a person will actually breathe. These concentrations are determined based on expected use of the product, amount of product, its application process and the indoor building conditions, including building volume and fresh air exchange rate. The quantity of VOCs in the environmental chamber air is determined by gas chromatography/mass spectrometry and emissions of selected aldehydes are measured using reverse-phase high-performance liquid chromatography (HPLC) with UV detection.

The allowable levels for total volatile organic compounds (TVOC), individual VOCs, formaldehyde and other aldehyde emission levels are defined in Table 8.

Table 8: Allowable limits for UL GREENGUARD Certification

Individual VOCs	≤ 0.1 TLV
Formaldehyde	≤ 0.05 ppm
4-Phenylcyclohexene	≤ 0.0065 mg/m ³
Total VOCs	≤ 0.5 mg/m ³
Total aldehydes	≤ 0.1 ppm
Particle matter ≤ 10µm (PM10)	≤ 0.05 mg/m ³

GREENGUARD GOLD Certification offers **stricter** certification criteria, considering safety factors to account for sensitive individuals (such as children and the elderly), and ensures that a product is acceptable for use in environments, such as schools and healthcare facilities. It is also referenced by both The Collaborative for High Performance Schools (CHPS) and LEED® green building programme.

Table 9: Allowable limits for GREENGUARD Gold

Individual VOCs	≤ 1/2 CA chronic REL or 0.01 TLV	Required for GREENGUARD Gold and "CDPH/EHLB/ Standard Method V1.1 "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers Version 1.1"
Formaldehyde	≤ 0.0073 ppm / 7.3 ppb	
Total VOCs	≤ 0.22 mg/m ³	
Total aldehydes	≤ 0.043 ppm / 43 ppb	
Particle matter ≤ 10µm (PM10)	≤ 0.02 mg/m ³	
1-Methyl-2-pyrrolidinone	≤ 0.16 mg/m ³	

// ArmaFlex Class 0 performance

Test results show that the chemical emissions of ArmaFlex Class 0 is within the allowable limits of GREENGUARD Gold Certification. More detailed information is available from [page 63](#).

RESTRICTION OF HAZARDOUS SUBSTANCES

// Background

The Restriction of Hazardous Substances (RoHS) Directive restricts the use of ten hazardous materials in the manufacture of various types of electronic and electrical equipment. All applicable products in the European Union must pass RoHS compliance.

// Requirement

The RoHS specifies maximum levels for ten restricted substances as shown in Table 10.

Table 10: Allowable limits for ten restricted substances according to RoHS.

Substance	Maximum allowable limit	Substance	Maximum allowable limit
Cadmium (Cd)	< 100 ppm	Polybrominated Diphenyl Ethers (PBDE)	< 1000 ppm
Lead (Pb)	< 1000 ppm	BIS (2-Ethylhexyl) phthalate (DEHP)	< 1000 ppm
Mercury (Hg)	< 1000 ppm	Benzyl butyl phthalate (BBP)	< 1000 ppm
Hexavalent Chromium (Cr VI)	< 1000 ppm	Dibutyl phthalate (DBP)	< 1000 ppm
Polybrominated Bipheyls (PBB)	< 1000 ppm	Diisobutyl phthalate (DIBP)	< 1000 ppm

// ArmaFlex Class 0 performance

The test results for ArmaFlex Class 0 on [page 65](#) shows that it complies with the RoHS directive.

14 // TECHNICAL GUIDANCE

SINGAPORE GREEN BUILDING PRODUCT CERTIFICATION

// Background

The only industry-centric certification scheme for green building products and materials, the Singapore Green Building Product (SGBP) certification scheme is used to objectively evaluate building products and benchmark against similar products in its category. Building products are assessed on their environmental properties and performance through a comprehensive list of assessment criteria covering the five key areas of Energy Efficiency, Water Efficiency, Resource Efficiency, Health & Environmental Protection and Other Green Features.

Products are rated and scored accordingly to the stipulated criteria. Depending on the assessed environmental qualities of the product, it is awarded a rating ranging from 1-tick to 4-ticks (Good to Leader).



// Use of the SGBP rating

The SGBP certification scheme is recognised under Singapore's Green Mark Scheme, the national green building rating tool. In the criteria for the Green Mark Scheme for New Buildings, SGBP certified products specified and used can score up to a maximum of 8 points¹. In addition, usage of SGBP products rated 2-ticks and above can accrue a maximum of 2 additional points. These products can form part of functional systems or singular sustainable products².

Table 11: Additional points certified products can accrue based on its SGBP rating

SGBP rating		Additional points per product
✓✓	Very good	0.25
✓✓✓	Excellent	0.5
✓✓✓✓	Leader	1

// ArmaFlex Class 0 performance

ArmaFlex Class 0 is rated Excellent and the certificate is available on [page 71](#).

ENVIRONMENTAL PRODUCT DECLARATION

// Background

An Environment Product Declaration (EPD) is a neutral, independently verified document that provides information about the impact a product has, especially on the environment, throughout its life cycle. Developed based on data compliant with ISO and Life Cycle Assessment (LCA) methodology, an EPD can be compared with other EPDs. This facilitates product evaluation, especially when designing green buildings in accordance with certification schemes such as LEED.

An LCA quantifies the direct and indirect environmental impact associated with the life cycle of a product, ranging from raw material extraction, materials processing and manufacturing to distribution, use and disposal. As an LCA provides specific information about an individual manufacturer's products, these results cannot be directly transferred or compared with similar products of another manufacturer.

¹ In the Green Mark Scheme for New Buildings (Non-Residential) 2015, under Section 3.02c Sustainable Products, SGBP certified products specified and used can score up to a maximum of 8 points under the Functional Systems Criteria and/or Singular Sustainable Products outside of Functional Systems Criteria.

² These products can form part of functional systems or singular sustainable products², scored under Section 3.02c.



In 2009, Armacell became the world's first manufacturer of flexible technical insulation materials to carry out LCA and publish EPDs.

// Use of these documents

EPDs and LCAs provide objective and transparent information about a product's environmental impact and facilitate understanding about a building's environmental footprint. EPDs also allow for a like-for-like comparison of similar products for specification and procurement purposes.

Architects,
specifiers and
those inviting
tenders

EPDs are used as the basis for calculating eco-balance, a prerequisite for green building certification. Some of the key criteria considered when selecting construction products include technical performance, costs, environmental aspects and aesthetics.

Real-estate
companies and
building owners

When EPDs and green building certifications are presented, the value of the building increases and it is easier to market properties that are certified as sustainable. Long-term cost savings can also be enjoyed as the building is designed to make efficient use of its resources.

End-users and
governments

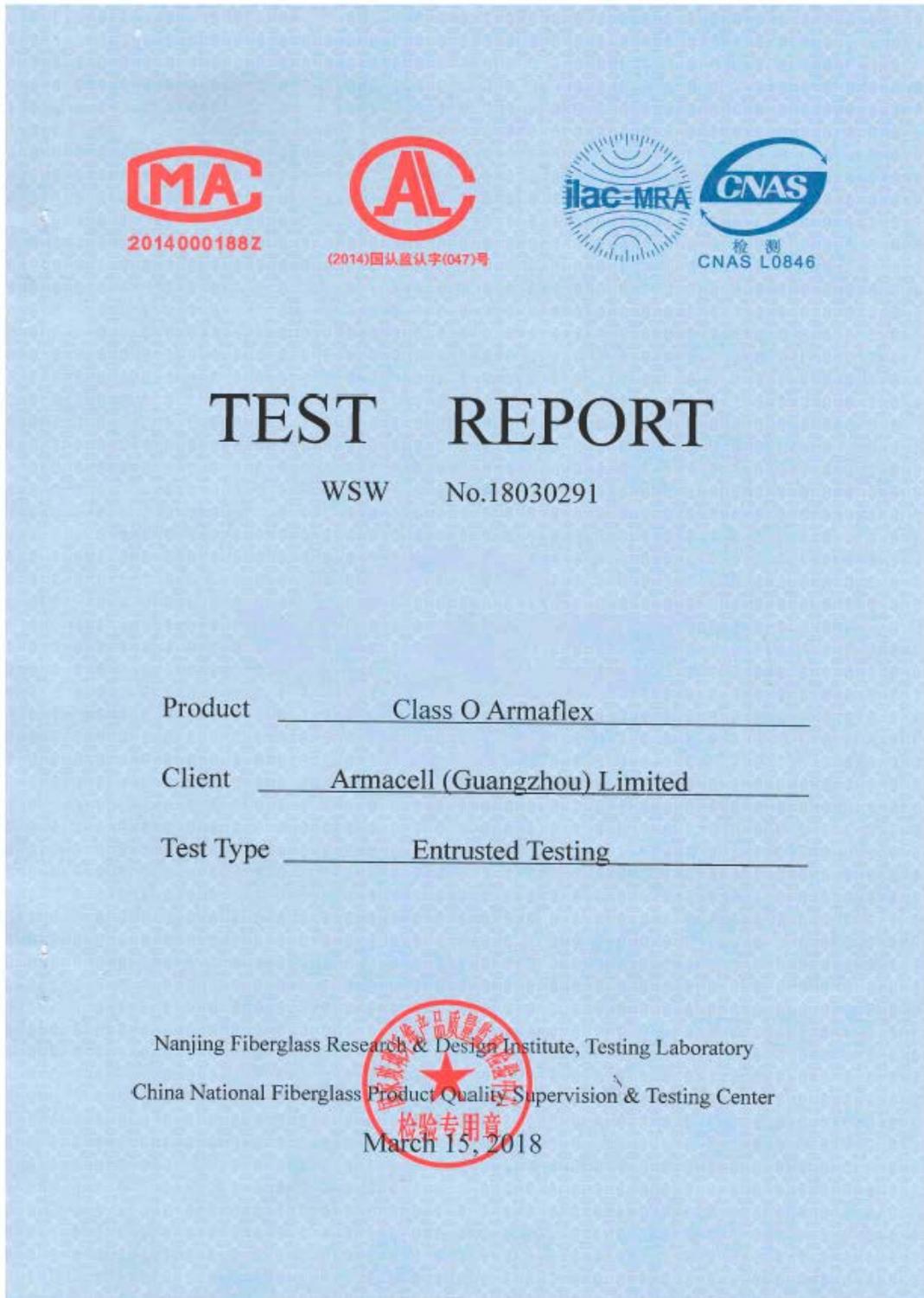
As awareness of sustainability and healthy working environments for increased productivity increases, governments are keen to develop green building initiatives. Individuals are also driven to engage in energy consumption behavioural change and place higher emphasis on occupant well-being. **EPDs can provide assurance that the manufacturers' claims are substantiated.**

// ArmaFlex Class 0 performance

Certified by UL Environment, the EPD for ArmaFlex Class 0 is available from [page 73](#).

Test reports and certificates

GB/T 10295



The image shows a test report form on a light blue background. At the top, there are four logos: MA (2014000188Z), AL ((2014)国认监认字(047)号), ilac-MRA, and CNAS (检测 CNAS L0846). The main title is 'TEST REPORT' in large black letters, with 'WSW No.18030291' below it. The form contains three lines of text: 'Product Class O Armaflex', 'Client Armacell (Guangzhou) Limited', and 'Test Type Entrusted Testing'. At the bottom, it lists 'Nanjing Fiberglass Research & Design Institute, Testing Laboratory' and 'China National Fiberglass Product Quality Supervision & Testing Center'. A red circular stamp with a star and the text '检验专用章' is overlaid on the bottom center, with the date 'March 15, 2018' printed below it.

MA 2014000188Z

AL (2014)国认监认字(047)号

ilac-MRA

CNAS 检测 CNAS L0846

TEST REPORT

WSW No.18030291

Product Class O Armaflex

Client Armacell (Guangzhou) Limited

Test Type Entrusted Testing

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
China National Fiberglass Product Quality Supervision & Testing Center

检验专用章
March 15, 2018

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
 China National Fiberglass Product Quality Supervision & Testing Center

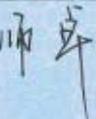
Test Report

WSW No.18030291

Page 1 of 2

Client	Armacell (Guangzhou) Limited	Address of client	Guanqiao, Shilou Town, Panyu District, Guangzhou City, Guangdong Province
Product	Class O Armaflex	Specification	25mm board
Trade mark	Armaflex	Sample sender	Huang Guangfeng
Producer	Armacell (Guangzhou) Limited	Date of production	PCY-030-2018
Inspections required	Thermal conductivity(-20°C, 0°C, 24°C, 40°C) of the sample.		
Additional information	None.		
The above information is provided by the client, the Center is not responsible for its truthfulness.			
Test type	Entrusted Testing	Date of sample received	March 9, 2018
Sample state	Black foam board		
Sample quantity	(600×600)mm, 4 pieces	Testing period	2018.3.9~2018.3.14
Test standard	GB/T 17794-2008 Preformed flexible elastomeric cellular thermal insulation		
Testing result	<p>The sample has been tested. The test results of thermal conductivity conform to the stipulation of GB/T 17794-2008 <i>Preformed flexible elastomeric cellular thermal insulation</i>. Test results are detailed in the annex (page2).</p> <p>The test results only represent the technical properties of the samples received.</p>		
Remark			



Approved by:  /Technical Chief Checked by:  Compiled by: 

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
 China National Fiberglass Product Quality Supervision And Testing Center

Annex to Test Report

WSW No.18030291

Page 2 of 2

Test items		Standard requirements	Test results	Judgment
Thermal conductivity W/(m·K)	Average temperature -20°C	≤0.034	0.028	Pass
	Average temperature 0°C	≤0.036	0.032	Pass
	Average temperature 24°C	—	0.034	—
	Average temperature 40°C	≤0.041	0.036	Pass

Attached product information (provided by client):

Armcell no.	Dimension	Product-name	Producer	Material-description
PCY-030-2018	25-099	Class O Armaflex	Arma-cell (Guangzhou) Ltd	FEF - Flexible Elastomeric Foam Pipe or duct insulation product called "Class O Armaflex" consisting of elastomeric foam made of synthetic rubber. The colour of the product is black.

(Blank below)

GB/T 10296



TEST REPORT

WSW No17050628

Product Class 0 Armaflex

Client Armacell (Guangzhou) Limited

Test Type Entrusted Testing

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
China National Fiberglass Product Quality Supervision & Testing Center



June 21, 2017

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
China National Fiberglass Product Quality Supervision & Testing Center

Test Report

WSW No.17050628

Page 1 of 2

Client	Armacell (Guangzhou) Limited	Address of client	Guanqiao, Shilou Town, Panyu District, Guangzhou City, Guangdong Province
Product	Class 0 Armaflex	Specification	25×038mm tube
Trade mark	Armaflex	Sample sender	Huang Guangfeng
Producer	Armacell (Guangzhou) Limited	Date of production	PCY-068-2017
Inspections required	Resilience after compression relief, dimension stability, water absorption by vacuum, thermal conductivity, density of the sample.		
Additional information	None.		
The above information is provided by the client, the Center is not responsible for its truthfulness.			
Test type	Entrusted Testing	Date of sample received	May 24, 2017
Sample state	Black cellular tube		
Sample quantity	1 meter-long, 6 pieces	Testing period	2017.05.24~2017.06.20
Test standard	GB/T 17794-2008 Preformed flexible elastomeric cellular thermal insulation		
Testing result	<p>The sample has been tested. The items tested conform to the stipulation of <i>GB/T 17794-2008 Preformed flexible elastomeric cellular thermal insulation</i>. The test results are detailed in the annex (page 2).</p> <p style="text-align: right;">Seal for test report June 21, 2017</p> <p>The test results only represent the technical properties of the samples received.</p>		
Remark			

Approved by:  Technical Chief Checked by:  Compiled by: 

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
 China National Fiberglass Product Quality Supervision And Testing Center

Annex to Test Report

WSW No.17050628

Page 2 of 2

Test item		Standard requirement	Test result	Judgement
Thermal conductivity W/(m • K)	Average temperature -20℃	≤0.034	0.032	Pass
	Average temperature 0℃	≤0.036	0.034	Pass
	Average temperature 24℃	----	0.036	----
	Average temperature 40℃	≤0.041	0.038	Pass
Density	kg/m ³	≤95	51	Pass
Water absorption by vacuum	%	≤10	4	Pass
Dimension stability (105℃, 7d)	%	≤10.0	-5.0 “-“ contract	Pass
Resilience after compression relief (50% compression, 72h)	%	≥70	79	Pass

Attached product information (provided by client):

Amacell no.	Dimension	Product-name	Producer	Material-description
PCY-068-2017	25x038	Class O Armaflex	Amacell (Guangzhou) Ltd	FEF - Flexible Elastomeric Foam Pipe or duct insulation product called "Class O Armaflex" consisting of elastomeric foam made of synthetic rubber. The colour of the product is black.

GB/T 17146



中国认可
国际互认
检测
TESTING
CNAS L0846

TEST REPORT

WSW No.18010135

Product Class 0

Client Armacell (Guangzhou) Limited

Test Type Entrusted Testing

Research & Design Institute, Testing Laboratory
China National Fiberglass Product Quality Supervision & Testing Center

April 10, 2018



Nanjing Fiberglass Research & Design Institute, Testing Laboratory
 China National Fiberglass Product Quality Supervision & Testing Center

Test Report

WSW No.18010135

Page 1 of 4

Client	Armacell (Guangzhou) Limited	Address of client	Guangqiao, Shilou Town, Panyu District, Guangzhou City, Guangdong Province
Product	Class 0 Armaflex	Specification	25 mm sheet
Trade mark	Armaflex	Sample sender	Huang Guangfeng
Producer	Armacell (Guangzhou) Limited	Date of production	PCY-007-2018
Inspections required	Moisture permeability, moisture resistance factor, moisture flow rate density of the sample.		
Additional information	None.		
The above information is provided by the client, the Center is not responsible for its truthfulness.			
Test type	Entrusted Testing	Date of sample received	January 22, 2018
Sample state	Black cellular board		
Sample quantity	(300×300) mm, 4 pieces	Testing period	2018.01.22~2018.04.04
Test standard	GB/T 17794-2008 Preformed flexible elastomeric cellular thermal insulation		
Testing result	<p>The sample has been tested. The items tested conform to the stipulation of <i>GB/T 17794-2008 Preformed flexible elastomeric cellular thermal insulation</i>. The test results are detailed in the annex (page 2-4).</p> <p style="text-align: right;">Seal for test report April 10, 2018</p> <p>The test results only represent the technical properties of the samples received.</p>		
Remark			

Approved by:  /Technical Chief Checked by:  Compiled by: 

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
 China National Fiberglass Product Quality Supervision And Testing Center

Annex to Test Report

WSW No.18010135

Page 2 of 4

Test item	Standard requirement	Test result	Judgment
Moisture permeability g/(m·s·Pa)	$\leq 1.3 \times 10^{-10}$	1.8×10^{-11}	Pass
Moisture resistance factor	$\geq 1.5 \times 10^3$	1.1×10^4	Pass
Moisture flow rate density g/(m ² ·s)	----	1.8×10^{-6}	----
Detailed in the page 3-4.			

(Blank below this page)

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
 China National Fiberglass Product Quality Supervision And Testing Center

Annex to Test Report

WSW No.18010135

Page 3 of 4

Moisture permeability test details of Class 0 Armaflex

1. Test item

Moisture permeability, moisture resistance factor and Moisture flow rate density.

2. Test method

GB/T 17146-1997 *Test methods for water vapor transmission of building materials*, desiccant method.

3. Sample description

Black foamed board products with nominal thickness 25mm.

The sample's information provided by the client is detailed in the table1.

Table1 Sample's information provided by the client

Armacell no.	Dimension	Product-name	Producer	Material-description
PCY-007-2018	25-099	Class O Armaflex	Armacell (Guangzhou) Ltd	FEF - Flexible Elastomeric Foam Pipe or duct insulation product called "Class O Armaflex " consisting of elastomeric foam made of synthetic rubber. The colour of the product is black.

4. Specimen information

4.1 Dimension and number

Dimension : board, normal thickness 26mm (Initial sample thickness).

Number: 2 testing specimens.

4.2 Conditioning

The specimens are conditioned at the temperature 23°C, and relative humidity 50% for 96 hours.

4.3 Testing process

4.3.1 After the specimens are conditioned, put the desiccant into the specimen, then attach the sample to the dish to form the sample dish assembly. One sample dish assembly without desiccant is also prepared

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
 China National Fiberglass Product Quality Supervision And Testing Center

Annex to Test Report

WSW No.18010135

Page 4 of 4

for improving the test accuracy.

4.3.2 There are two testing specimen dishes and a dummy specimen dish for the test.

4.3.3 Put all of the dish assemblies into the environment of temperature $25^{\circ}\text{C}\pm 1^{\circ}\text{C}$, and relative humidity $75\%\pm 2\%$, weigh regularly until the test end.

5. Test result

5.1 Sample weight gain curve

During the test, the weight increment curve of the sample with time is shown in Figure 1 (2 specimens in total).

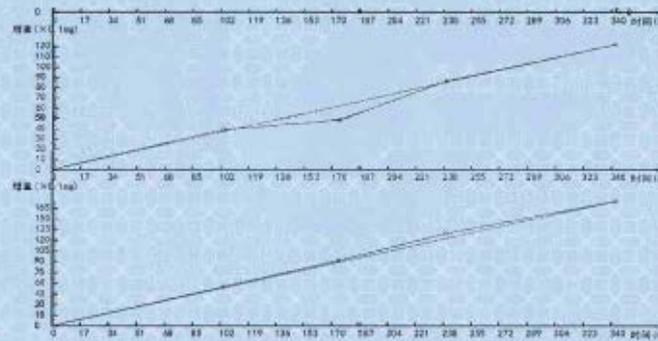


Figure1 the weight increment curve of the sample with time

5.2 Test data and calculation

By calculation, the moisture permeability of the sample is shown in Table 2.

Table 2 Test data

Test item	No.1	No.2	Mean value
Moisture permeability $\text{g}/(\text{m}\cdot\text{s}\cdot\text{Pa})$	1.512×10^{-11}	2.171×10^{-11}	1.8×10^{-11}
Moisture resistance factor	1.296×10^4	9.028×10^3	1.1×10^4
Moisture flow rate density $\text{g}/(\text{m}^2\cdot\text{s})$	1.455×10^{-6}	2.081×10^{-6}	1.8×10^{-6}

BS 476 PART 6

Test Report No. 7191146701-MEC16/B-YWA/PIC
dated 27 Sep 2016

Note: This report is issued subject to the Testing and Certification Regulations of the TÜV SÜD Group and the General Terms and Conditions of Business of TÜV SÜD PSB Pte Ltd. In addition, this report is governed by the terms set out within this report.



PSB Singapore

Choose certainty.
Add value.

SUBJECT:

Fire propagation test on Armacell no.: "PCY-135-2016", Dimension: "06-099", Product name: "Armaflex Class 0" Thermal Insulation material bonded on one face of an approximately 1mm thick steel plate submitted by Armacell Asia Pte Ltd on 13 Sep 2016.

TESTED FOR:

Armacell Asia Pte Ltd
1 Kim Seng Promenade
#12-01
Great World City East Tower
Singapore 237994

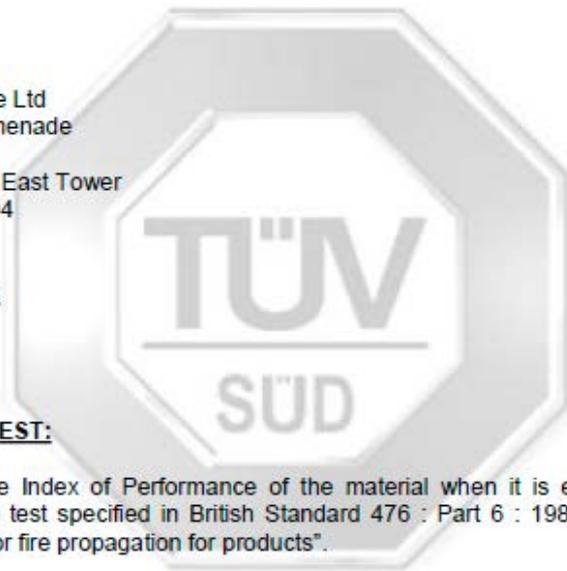
DATE OF TEST:

25 Sep 2016

PURPOSE OF TEST:

To determine the Index of Performance of the material when it is exposed to the conditions of the test specified in British Standard 476 : Part 6 : 1989 + A1 : 2009 "Method of test for fire propagation for products".

The test was conducted at TÜV SÜD PSB's fire test laboratory located at No. 10 Tuas Avenue 10, Singapore 639134.



Ying Ho



LA-2007-0385-A
LA-2007-0381-F
LA-2007-0382-B
LA-2007-0383-G

LA-2007-0384-G
LA-2007-0385-E
LA-2007-0386-C
LA-2010-04654-D

The results reported herein have been performed in accordance with the laboratory's terms of accreditation under the Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme. Tests/Calibrations marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our laboratory.

Laboratory:
TÜV SÜD PSB Pte. Ltd.
No.1 Science Park Drive
Singapore 118221

Phone : +65-6886 1333
Fax : +65-6776 8670
E-mail: enquires@tuv-sud-psb.sg
www.tuv-sud-psb.sg
Co. Reg : 199002667R

Regional Head Office:
TÜV SÜD Asia Pacific Pte. Ltd.
1 Science Park Drive, #02-01
Singapore 118221
TÜV®

Test Report No. 7191146701-MEC16/B-YWA/PIC
dated 27 Sep 2016



DESCRIPTION OF SPECIMENS:

Six pieces of specimen, said to be Armacell no.: "PCY-135-2016", Dimension: "06-099", comprised of a FEF – Flexible Elastomeric Foam Pipe or duct insulation product called "Armaflex Class 0" consisting of elastomeric foam made of synthetic rubber (6mm thick) bonded with "Armaflex 520" adhesive on one face of an approximately 1mm thick steel plate, each of nominal test size of 225mm x 225mm were submitted. The colour of the product is black. As declared by test sponsor, the bulk density of the Elastomeric Foam was said to be 40kg/m³ - 60kg/m³. The overall bulk density of the specimen was found to be approximately 1154kg/m³. As declared by test sponsor, the manufacturer was said to be Armacell (Guangzhou) Ltd.

TEST PROCEDURE:

Prior to test, the specimens were prepared and conditioned in accordance with paragraph 4.4 of the standard.

Three specimens, backed with calcium silicate board, were tested with the foam face exposed to the specified heating conditions, in an apparatus conforming to paragraph 5 and illustrated in Figures 1 to 3 of the Standard.

The calibration and test procedures were as defined in paragraphs 8 and 9, respectively, of the specification. The apparatus was calibrated prior to test and the actual calibration curve obtained is shown in Figure 1 of this report.

The mean temperature rise above ambient obtained from three specimens is also shown in Figure 1 (i.e. with the actual calibration curve). The mean temperature readings for the material and the calibration curve were obtained at the following intervals from the start of the test: at 1/2 minute intervals up to 3 minutes, at 1 minute intervals from 4 to 10 minutes, and at 2 minutes intervals from 12 to 20 minutes.



Test Report No. 7191146701-MEC16/B-YWA/PIC
dated 27 Sep 2016



From these readings, the index of performance for the material was determined as follows:

$$s_1 = \sum_{t=0.5}^{t=3} \frac{\Theta_s - \Theta_c}{10t}; \quad s_2 = \sum_{t=4}^{t=10} \frac{\Theta_s - \Theta_c}{10t}$$

and $s_3 = \sum_{t=12}^{t=20} \frac{\Theta_s - \Theta_c}{10t};$

$$S = s_1 + s_2 + s_3$$

where S = Index of performance for each of the specimens tested and s_1 , s_2 and s_3 are sub-indices

t = Time in minutes from the origin at which readings are taken.

Θ_s = Temperature rise in deg. C for the specimen at time, t

Θ_c = Temperature rise in deg. C for the calibration sheet at time, t

In computations only the positive value of $\frac{\Theta_s - \Theta_c}{10t}$ was used.

Test Report No. 7191146701-MEC16/B-YWA/PIC
dated 27 Sep 2016



RESULTS OF TEST:

The following test results were obtained for each specimen tested:

Specimen	Sub-Indices			Index of Performance
	S ₁	S ₂	S ₃	S
A	4.4	2.7	0.6	7.7
B	3.5	2.2	0.4	6.1
C	3.5	2.2	0.5	6.2

CONCLUSION:

The test results obtained, as an average of the 3 samples tested are as follows:

Index of overall performance, I = 6.7
(Fire propagation index)

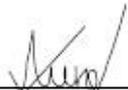
Sub-index, i₁ = 3.8

Sub-index, i₂ = 2.4

Sub-index, i₃ = 0.5

REMARKS:

The test results relate only to the behaviour of the test specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.


Ye Wint Aung
Associate Engineer


Ong Kian Huat
Senior Associate Engineer
Fire Property
Mechanical

Test Report No. 7191146701-MEC16/B-YWA/PIC
dated 27 Sep 2016

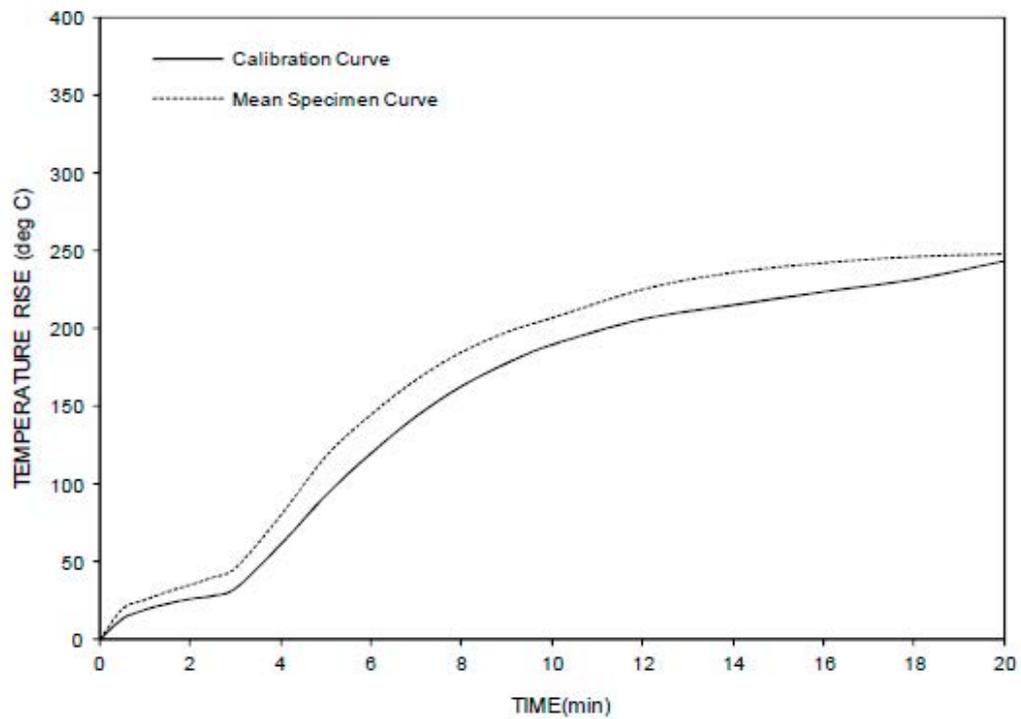


FIGURE 1 : COMPARISON OF MEAN SPECIMEN AND CALIBRATION CURVES

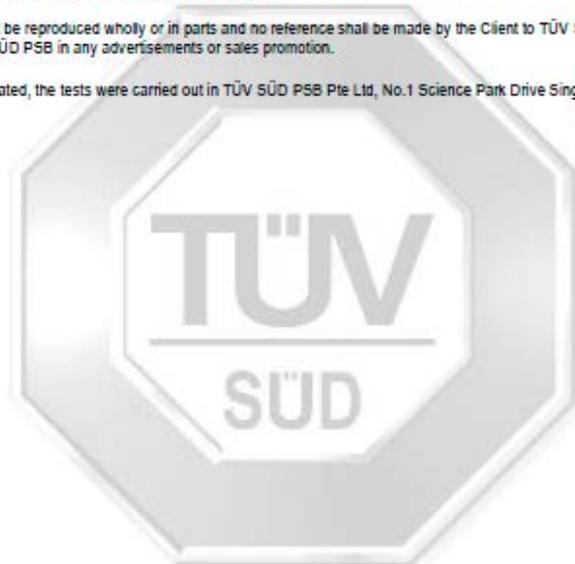
Test Report No. 7191146701-MEC16/B-YWA/PIC
dated 27 Sep 2016



Please note that this Report is issued under the following terms :

1. This report applies to the sample of the specific product/equipment given at the time of its testing/calibration. The results are not used to indicate or imply that they are applicable to other similar items. In addition, such results must not be used to indicate or imply that TÜV SÜD PSB approves, recommends or endorses the manufacturer, supplier or user of such product/equipment, or that TÜV SÜD PSB in any way "guarantees" the later performance of the product/equipment. Unless otherwise stated in this report, no tests were conducted to determine long term effects of using the specific product/equipment.
2. The sample/s mentioned in this report is/are submitted/supplied/manufactured by the Client. TÜV SÜD PSB therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.
3. Nothing in this report shall be interpreted to mean that TÜV SÜD PSB has verified or ascertained any endorsement or marks from any other testing authority or bodies that may be found on that sample.
4. This report shall not be reproduced wholly or in parts and no reference shall be made by the Client to TÜV SÜD PSB or to the report or results furnished by TÜV SÜD PSB in any advertisements or sales promotion.
5. Unless otherwise stated, the tests were carried out in TÜV SÜD PSB Pte Ltd, No.1 Science Park Drive Singapore 118221.

July 2011



BS 476 PART 7

Test Report No. 7191142282-MEC16/B-YWA/PIC
dated 25 Jul 2016

Note: This report is issued subject to the Testing and Certification Regulations of the TÜV SÜD Group and the General Terms and Conditions of Business of TÜV SÜD PSB Pte Ltd. In addition, this report is governed by the terms set out within this report.



PSB Singapore

Choose certainty.
Add value.

SUBJECT:

Large scale surface spread of flame test on Armacell no.: "PCY-108-2016", Dimension: "06-099", Product name: "Armaflex Class 0" Thermal Insulation material bonded on one face of an approximately 1mm thick steel plate submitted by Armacell Asia Pte Ltd on 08 Jul 2016.

TESTED FOR:

Armacell Asia Pte Ltd
1 Kim Seng Promenade
#12-01
Great World City East Tower
Singapore 237994

DATE OF TEST:

13 Jul 2016

PURPOSE OF TEST:

To determine the tendency of the surface of a material or a combination of materials to support the spread of flame across its surface and to classify the surface according to the test given in British Standard 476 : Part 7 : 1997.

The test was conducted at TÜV SÜD PSB's fire test laboratory located at No. 10 Tuas Avenue 10, Singapore 639134.



LA-2007-0385-A
LA-2007-0385-F
LA-2007-0385-B
LA-2007-0385-G

LA-2007-0384-Q
LA-2007-0385-E
LA-2007-0385-C
LA-2010-0464-D

The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council. Inspection/Calibration Tests marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our inspection body/laboratory.

Laboratory:
TÜV SÜD PSB Pte. Ltd.
No.1 Science Park Drive
Singapore 118221

Phone : +65-6885 1333
Fax : +65-6776 8670
E-mail: enquiries@tuv-sud-psb.sg
www.tuv-sud-psb.sg
Co. Reg : 199002657R

Regional Head Office:
TÜV SÜD Asia Pacific Pte. Ltd.
1 Science Park Drive, #02-01
Singapore 118221
TÜV®

Test Report No. 7191142282-MEC16/B-YWA/PIC
dated 25 Jul 2016



DESCRIPTION OF SPECIMENS:

Nine pieces of specimen, said to be Armacell no.: "PCY-108-2016", Dimension: "06-099", Product name: "Armaflex Class 0" Thermal Insulation material bonded on one face of an approximately 1mm thick steel plate comprising of FEF – Flexible Elastomeric Foam Pipe or duct insulation product called "Armaflex Class 0" consisting of elastomeric foam (6mm thick) made of synthetic rubber, each of nominal test size of 885mm x 270mm were submitted. As declared by test sponsor, the bulk density of the Elastomeric Foam was said to be 45kg/m³. The overall thickness of the specimen was found to be approximately 7mm. As declared by test sponsor, the manufacturer was said to be Armacell (Guangzhou) Ltd.

TEST PROCEDURE:

Prior to test, the specimens were prepared and conditioned in accordance with paragraphs 5.3 to 5.6 of the standard and secured to a specimen holder as described in paragraph 6.3.

Six specimens, backed with calcium silicate board, were tested with the elastomeric foam face exposed to the specified thermal radiation from the apparatus described in paragraph 6.1 of the standard. The intensity of the radiated heat incident on the specimen varies with distance from the hotter end, so that when the specified calibration panel is mounted in the place to be occupied by the specimen, the irradiance of the radiometer is as given in Table 1. The test was terminated when the flame front reached the 825mm reference line, or after 10 minutes has elapsed, whichever is the shorter.

Table 1 : Irradiance Along Horizontal Reference Line on the Calibration Board

Distance along reference line from inside edge of specimen holder mm	Irradiance kW/m ²		
	specified	min.	max.
75	32.5	32.0	33.0
225	21.0	20.5	21.5
375	14.5	14.0	15.0
525	10.0	9.5	10.5
675	7.0	6.5	7.5
825	5.0	4.5	5.5

Test Report No. 7191142282-MEC16/B-YWA/PIC
dated 25 Jul 2016



RESULTS OF TEST:

Specimen No.	1	2	3	4	5	6
Spread of flame at first 1½ minutes (mm)	0	0	0	0	0	0
Distance (mm)	Time of spread of flame to indicated distance (minutes • seconds)					
Start of flaming	nil	nil	nil	nil	nil	nil
75	-	-	-	-	-	-
165	-	-	-	-	-	-
190						
215						
240						
265						
290						
375						
455						
500						
525						
600						
675						
710						
750						
785						
825						
865						
Time of maximum spread of flame (minutes • seconds)	-	-	-	-	-	-
Distance of maximum spread of flame (mm)	0	0	0	0	0	0
Comments	None					

Yuy H

Test Report No. 7191142282-MEC16/B-YWA/PIC
dated 25 Jul 2016



Classification of Surface Spread of Flame

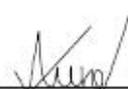
Classification	Spread of flame at 1.5 min.		Final spread of flame	
	Limit (mm)	Limit for one specimen in sample (mm)	Limit (mm)	Limit for one specimen in sample (mm)
Class 1	165	165 + 25	165	165 + 25
Class 2	215	215 + 25	455	455 + 45
Class 3	265	265 + 25	710	710 + 75
Class 4	Exceeding the limits for class 3			

CONCLUSION:

In accordance with the class definitions specified in the Standard, the test results show that the sample tested has a Class One Surface Spread of Flame.

REMARKS:

1. The test results relate only to the behaviour of the test specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.
2. The testing of Specimen 1 was witnessed by Mr. Peter Cheng from Armacell Asia Pte Ltd.


Ye Wint Aung
Associate Engineer


Ong Kian Huat
Senior Associate Engineer
Fire Property
Mechanical

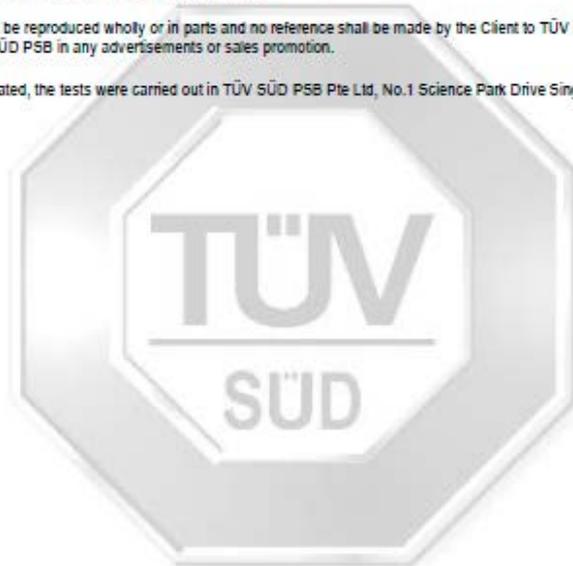
Test Report No. 7191142282-MEC16/B-YWA/PIC
dated 25 Jul 2016



Please note that this Report is issued under the following terms :

1. This report applies to the sample of the specific product/equipment given at the time of its testing/calibration. The results are not used to indicate or imply that they are applicable to other similar items. In addition, such results must not be used to indicate or imply that TÜV SÜD PSB approves, recommends or endorses the manufacturer, supplier or user of such product/equipment, or that TÜV SÜD PSB in any way "guarantees" the later performance of the product/equipment. Unless otherwise stated in this report, no tests were conducted to determine long term effects of using the specific product/equipment.
2. The samples mentioned in this report is/are submitted/supplied/manufactured by the Client. TÜV SÜD PSB therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.
3. Nothing in this report shall be interpreted to mean that TÜV SÜD PSB has verified or ascertained any endorsement or marks from any other testing authority or bodies that may be found on that sample.
4. This report shall not be reproduced wholly or in parts and no reference shall be made by the Client to TÜV SÜD PSB or to the report or results furnished by TÜV SÜD PSB in any advertisements or sales promotion.
5. Unless otherwise stated, the tests were carried out in TÜV SÜD PSB Pte Ltd, No.1 Science Park Drive Singapore 118221.

July 2011



GB 8624

报告编号：2019100719



中国认可
国际互认
检测
TESTING
CNAS L0698

检 验 报 告

送检单位名称：阿莱斯绝热材料（广州）有限公司

产品名称型号：柔性泡沫橡塑绝热制品
零级福乐斯管材 32×022m 厚度32mm

检 验 类 别：型式检验（安全性能）

NFTC

国家防火建筑材料质量监督检验中心

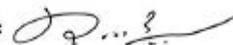


国家防火建筑材料质量监督检验中心 检 验 报 告

报告编号: 2019100719

共 4 页 第 1 页

产品名称	柔性泡沫橡塑绝热制品	型号规格	零级福乐斯管材 32×022m 厚度 32mm
委托单位	阿莱斯绝热材料(广州)有限公司	商 标	福乐斯
生产单位	阿莱斯绝热材料(广州)有限公司	检验类别	型式检验(安全性能)
送检单位	阿莱斯绝热材料(广州)有限公司	抽样基数	1000根
抽样单位	广州质量监督检测研究院	抽样日期	2019.04.19
抽样地点	企业成品仓库	到样日期	2019.04.29
检验地点	本中心	检验日期	2019.05.22~2019.05.29
样品数量	2m×72根	样品编号	2019100719
检验依据	GB 8624-2012 《建筑材料及制品燃烧性能分级》		
检验项目	燃烧性能B ₁ 级(管状绝热材料)通用项目		
检 验 结 论	<p>经检验,该制品所检项目符合燃烧性能B-s3, d0, t1级的规定要求。 按GB 8624-2012判定,该制品燃烧性能达到难燃B₁(B-s3, d0, t1)级。 (以下空白)</p> <p style="text-align: right;">(检验专用章) 签发日期: 2019年06月03日</p>		
备注	<p>本报告仅对所承检项目负责。本报告仅对所承检项目负责。</p> <p style="text-align: right;">检验专用章</p>		

批准: 

审核:



编制:



国家防火建筑材料质量监督检验中心
检验结果汇总表

报告编号: 2019100719

共 4 页 第 2 页

序号	检验项目	检验方法	标准要求	检验结果	结论	
1	可燃性	GB/T 8626 -2007	≤150	90	合格	
	60s内焰尖高度, mm		过滤纸 未被引燃	过滤纸 未被引燃		
2	燃烧增长速率指数, W/s	GB/T 20284 -2006	B级	≤270	126	合格
	600s总热释放量, MJ		≤7.5	5.6		
	火焰横向蔓延		未达到试样 长翼边缘	未达到试样 长翼边缘		
	烟气生成速率指数, m ² /s ²	s2级	≤580	648	s3级	
	600s总烟气生成量, m ²		≤1600	378		
	燃烧滴落物/微粒	d0级	600s内无燃烧 滴落物/微粒	600s内无燃烧 滴落物/微粒	符合	
3	烟气毒性等级	GB/T 20285 -2006	t1级	达到ZA ₃ 级	ZA ₃ 级	符合
	以	下	空	白		
备注						

UL94



中国认可
国际互认
检测
TESTING
CNAS L7877

Test Report

No. SDFS2102000819FF

Date: Mar.01, 2021

Page 1 of 3

ARMACELL (GUANGZHOU) LIMITED
GUANQIAO , SHILOU TOWN , PANYU DISTRICT , GUANGZHOU CITY , GUANGDONG PROVINCE CHINA
511447

Sample Description : ARMAFLEX CLASS 0 JP
 Armacell test number : QPY-036-2021
 Item No. : THICKNESS 25MM
 Manufacturer : ARMACELL (GUANGZHOU) LIMITED

The above data and information was / were submitted and identified on behalf of the client. SGS is not responsible for the authenticity, integrity and results of the data and information and / or the validity of the conclusion.

SGS Ref No. : GZHL2102004511OT
 Sample Receiving Date : Feb.19, 2021
 Test Performing Date : Feb.19, 2021 to Mar.01, 2021

Test Result Summary

Test(s) Requested	Result(s)
UL 94-2020 Clause 8	Classification: V-0
Summary:	
1. For further details, please refer to the following page(s).	

Signed for and on behalf of
Shunde Branch
SGS-CSTC Co., Ltd.

Ada



Ada Liu
Approved signatory



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-a-Document.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.
Attention: To check the authenticity of testing/inspection report & certificate, please contact us at telephone: (86-755)83071443, or email: CN_Doccheck@sgs.com
 1F/Building Europe Industra Park No.1 Shunde South Road, Huanu Sector, Daliang Town, Shunde, Foshan, Guangdong, China 528330 | (86-757)22605888 | (86-757)22605869 | www.sgs.com.cn
 中国·广东·佛山市顺德区大良街道办办事处五沙朗和南路1号欧洲工业园一号楼四楼 邮编: 528330 | (86-757)22605888 | (86-757)22605869 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



Test Report

No. SDFS2102000819FF

Date: Mar.01, 2021

Page 2 of 3

TESTS AND RESULTS

Test Conducted:

UL 94-2020 Clause 8. 50W (20 mm) Vertical Burning Test; V-0, V-1, or V-2

Conditioning:

Set 1(Initial): Temperature: (23±2)°C; Relative Humidity:(50±10)%; Duration:168h;

Set 2(Oven Aging): Temperature: (70±2)°C; Duration:168h, Duration of room temperature cooling time: 4h

Acceptance Criteria:

	V-0	V-1	V-2
Afterflame time for each individual specimen t_1 or t_2	≤10s	≤30s	≤30s
Total afterflame time for any condition set (t_1 plus t_2 for the 5 specimens)	≤50s	≤250s	≤250s
Afterflame plus afterglow time for each individual specimen after the second flame application ($t_2 + t_3$)	≤30s	≤60s	≤60s
Afterflame or afterglow of any specimen up to the holding clamp	No	No	No
Cotton indicator ignited by flaming particles or drops	No	No	Yes

Retest Provision:
If only one specimen from a set of five specimens does not comply with the requirements, another set of five specimens is to be tested. In the case of the total number of seconds of flaming, an additional set of five specimens is to be tested if the totals are in the range of 51– 55 seconds for V-0 and 251 – 255 seconds for V-1 and V-2. All specimens from this second set shall comply with the appropriate requirements in order for the material in that thickness to be classified V-0, V-1, or V-2.

Test Results:

No.	t_1 (sec.)	t_2 (sec.)	t_3 (sec.)	SUM ($t_2 + t_3$)	Whether the afterflame or afterglow of any specimen up to the holding clamp	Whether the cotton indicator ignited by flaming particles or drops
Set1	1	0	0	0	NO	NO
	2	0	1	0	1	NO
	3	0	1	0	1	NO
	4	0	0	0	0	NO
	5	0	0	0	0	NO
	SUM	0	2	$\sum t_1 = \sum t_2: 2$		---
Set2	1	0	1	0	1	NO
	2	0	1	0	1	NO
	3	0	1	0	1	NO
	4	0	0	0	0	NO
	5	0	1	0	1	NO
	SUM	0	4	$\sum t_1 = \sum t_2: 4$		---

Conclusion:

The specimen complies with the requirement of the V-0.



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Documents.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Insofar as otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only. Attention: To check the authenticity of testing (inspection report & certificate), please contact us at telephone: (86-755)83011443, or email: CN.Doccheck@sgs.com

IFP Building, European Industrial Park (L) / Shunde South Road / Waixi Sector / Daliang Town / Shunde / Foshan / Guangdong / China 528333 | (86-757)22805888 | (86-757)22805889 | www.sgs.com.cn
 中国·广东·佛山顺德龙江大良街道办事处五沙路顺和南1号欧洲工业园一号楼南楼 邮编: 528333 | (86-757)22805888 | (86-757)22805889 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



Test Report

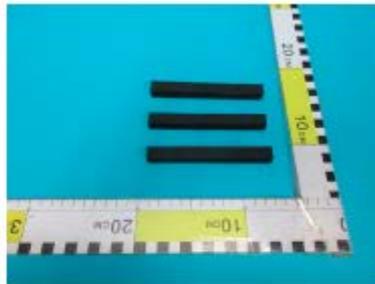
No. SDFS2102000819FF

Date: Mar.01, 2021

Page 3 of 3

SAMPLE INFORMATION AND PICTURES

Specified size of sample: 125 ±5mm×13.0 ±0.5mm, thickness≤13mm
 Actual size of sample: 122mm×13.0mm×13mm



Test sample

End of Report



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Documents.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted in the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

Attention: To check the authenticity of testing inspection report & certificate, please contact us at telephone: (86-755)8397 1443, or email: CN_Doccheck@sgs.com

15/F Building, Guangzhou Hezuo Park (No.1 Shunde East Road, Huihuo Sector, Daliang Town, Shunde, Foshan, Guangdong, China) 528333 | (86-757)22805888 | (86-757)22805869 | www.sgs.com.cn
 中国·广东·佛山市顺德区大良街道办东涌五沙村和合园15号欧洲工业园一号楼15楼 邮编: 528333 | (86-757)22805888 | (86-757)22805869 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)

FACTORY MUTUAL (FM) APPROVAL



Certificate of Compliance

This certificate is issued for the following:

NH/Armaflex, Armaflex Class 0 and Armaflex Class 1

Prepared for:

Armacell (Guangzhou) Ltd
Guanqiao, Shilou Town, Panyu District
Guangzhou City, Guangdong 511447
China

FM Approvals Class: 4924

Approval Identification: 3062016 Approval Granted: 12/20/2017

To verify the availability of the Approved product, please refer to www.approvalguide.com or www.roofnav.com

Said Approval is subject to satisfactory field performance, continuing Surveillance Audits, and strict conformity to the constructions as shown in the Approval Guide, an online resource of FM Approvals.

A handwritten signature in dark ink that reads 'Cynthia Frank'.

Cynthia Frank
VP - Manager of Materials
FM Approvals
1151 Boston-Providence Turnpike
Norwood, MA 02062



FIRE PERFORMANCE (MARINE)



Certificate No:
MEDB00004AV

EC-TYPE EXAMINATION CERTIFICATE (MODULE B)

Application of: Directive 2014/90/EU of 23 July 2014 on marine equipment (MED), issued as "Forskrift om Skipsutstyr" by the Norwegian Maritime Authority. This Certificate is issued by DNV GL AS under the authority of the Government of Norway.

This is to certify:

That the Surface materials and floor coverings with low flame-spread characteristics: pipe insulation covers

with type designation(s)
Class 0 Armaflex

Issued to
Armacell (Guangzhou) Ltd.
GUANGZHOU, GUANGDONG, China

is found to comply with the requirements in the following Regulations/Standards:
Regulation (EU) 2018/773,
item No. MED/3.18d. SOLAS 74, Reg. II-2/3, II-2/5 & X/3, IMO MSC/Circ. 1120, 2000 HSC Code 7 and IMO 2010 FTP Code

Further details of the equipment and conditions for certification are given overleaf.

This Certificate is valid until **2023-10-21**.
Issued at **Høvik** on **2018-10-22**

DNV GL local station:
China South NB

Approval Engineer:
Karolina Kusmider



Notified Body
No.: **0575**

for **DNV GL AS**

Digitally Signed By: Hoff, Øyvind
Location: DNV GL Høvik, Norway
on behalf of

Roald Vårheim
Head of Notified Body



The mark of conformity may only be affixed to the above type approved equipment and a Manufacturer's Declaration of Conformity issued when the production-surveillance module (D, E or F) of Annex B of the MED is fully complied with and controlled by a written inspection agreement with a Notified Body. The product liability rests with the manufacturer or his representative in accordance with Directive 2014/90/EU.

This certificate is valid for equipment, which is conform to the approved type. The manufacturer shall inform DNV GL AS of any changes to the approved equipment. This certificate remains valid unless suspended, withdrawn, recalled or cancelled.

Should the specified regulations or standards be amended during the validity of this certificate, the product is to be re-approved before being placed on board a vessel to which the amended regulations or standards apply.

Form code: MED 201.NOR

Revision: 2017-07

www.dnvgl.com

Page 1 of 2

© DNV GL 2014. DNV GL and the Horizon Graphic are trademarks of DNV GL AS.

Job Id: **344.1-004019-4**
Certificate No: **MEDB00004AV**

Product description

"Class 0 Armaflex"

An elastomeric insulation foam for pipe insulation.

Nominal thickness: 9 – 32 mm.

Density: 41 kg/m³

Colour: black

Application/Limitation

Approved for use as low flame spread surface material, not generating excessive quantities of smoke nor toxic products in fire.

The product may be used on cold service pipework / fittings for refrigeration system everywhere onboard, and for pipework, fittings, air ducts and tanks insulation in cargo areas, mail rooms, baggage rooms and refrigerated compartments of service spaces, and exterior locations (SOLAS II-2/5.3.1.1)". (Piping for hot and cold sanitary water can not be considered "cold service pipe work/fittings")

Any adhesive used, other than the one used during testing, has to be tested for low flame spread characteristics according to IMO 2010 FTP Code part 5 and to be approved according to the Marine Equipment Directive and bear the Mark of Conformity and bear the Mark of Conformity.

Extent of application is to be considered and accepted for each case/project.

Each product is to be supplied with its manual for its installation, use and maintenance.

Type Examination documentation

Test reports Nos. FT13164 and FT13165 both dated 8 June 2013 from Far East Fire Testing Centre (FTFTC), Shanghai, China.

Tests carried out

Tested according to IMO 2010 FTP Code Part 5 and Annex 2 Item 2.2.

Marking of product

The product or packing is to be marked with name and address of manufacturer, type designation, MED Mark of Conformity and USCG approval number (see page 1).

DNV·GL

Certificate No:
MEDD00001KC

QS - CERTIFICATE OF ASSESSMENT - EC (MODULE D)

Application of: Directive 2014/90/EU of 23 July 2014 on marine equipment (MED), issued as "Forskrift om Skipsutstyr" by the Norwegian Maritime Authority. This Certificate is issued by DNV GL AS under the authority of the Government of Norway.

This is to certify:

That the Quality System for the products

with type designation(s) as specified in the Appendix to this Certificate

Issued to

**Armacell (Guangzhou) Limited
GUANGZHOU, GUANGDONG, China**

is found to comply with the applicable requirements.
The quality system has been assessed with respect to the procedure of conformity assessment described in Annex II, Module D in the directive 2014/90/EU and regulation (EU) 2018/773.

This Certificate is valid until **2023-10-21**.

Issued at **Høvik** on **2018-10-22**

DNV GL local station:
China South NB

Approval Engineer:
Karolina Kusmider



Notified Body
No.: **0575**



for **DNV GL AS**
Digitally Signed By: Hoff, Øyvind
Location: DNV GL Høvik, Norway
on behalf of

Roald Vårheim
Head of Notified Body



0575/yyyy

0575: Notified Body number undertaking quality surveillance
yyyy: The year in which the mark is affixed



The product liability rests with the manufacturer or his representative in accordance with Directive 2014/90/EU. This certificate authorizes the manufacturer in conjunction with the valid EC Type Examination (Module B) Certificate(s) of the equipment listed before to affix the Mark of Conformity (wheelmark) to the product described herein. This certificate loses its validity if the manufacturer makes any changes to the approved quality system which have not been notified to and agreed with the notified body named on this certificate. This certificate remains valid unless suspended, withdrawn, recalled or cancelled. The Manufacturer has to apply for periodical audits to verify the maintenance and application to the quality system every 12 months.



Form code: MED 211.NOR

Revision: 2017-07

www.dnvgl.com

Page 1 of 2

© DNV GL 2014. DNV GL and the Horizon Graphic are trademarks of DNV GL AS.

Job Id: **344.1-004029-4**
Certificate No: **MEDD00001KC**

APPENDIX

Item no. **MED/3.18d Surface materials and floor coverings with low flame-spread characteristics: pipe insulation covers**

Type designation	EC Type-Examination Certificate No.	Expiry date	Notified Body No.	USCG approval number
Class 0 Armaflex ¹	MEDB00004AV	2023-09-19	0575	N/A

Places of production

1. Armacell (Guangzhou) Limited, Guanqiao, Shilou Town, Panyu, GUANGZHOU, China

APPROVAL FROM HONG KONG FIRE SERVICE DEPARTMENT

消防處
牌照及審批總區
通風系統課
香港九龍尖沙咀東康莊道1號5樓
消防總部大廈



FIRE SERVICES DEPARTMENT
LICENSING & CERTIFICATION COMMAND
Ventilation Division
5/F, FIRE SERVICES HEADQUARTERS BUILDING
No. 1 Hong Chong Road,
Tsim Sha Tsui East, Kowloon,
Hong Kong

本處權號 Our Ref.: FP(LC) 316/14
來函權號 Your Ref.: AAL/17/966
圖文傳真 Fax: 2367 3206
電話 Tel. No.: 2733 1557

21 July 2017

Armacell Asia Ltd.
Room 1501-08, Millennium City 5
418 Kwun Tong Road
Kwun Tong, Kowloon
Hong Kong
(Attn.: Mr. Sam YEUNG)

Dear Sir,

**Class 0 “Armaflex” Closed Cell Nitrile-based
Elastomeric Insulation Materials**

I refer to your above referenced letter of 27.3.2017 enclosing a set of catalogue and test reports; and the subsequent letter ref. no. AAL/17/988 of 19.7.2017 enclosing the laboratory’s clarification letter with respect to the captioned materials.

We have no objection in principle to the use of Class 0 “Armaflex” closed cell nitrile-based flexible elastomeric insulation material for ventilating system in Hong Kong subject to compliance with the requirements stipulated in Part XI of FSD Circular Letter No. 4/96 and according to the following details:

Manufacturer	: Armacell (Guangzhou) Limited, PRC
Brand Name	: Armacell Armaflex
Material	: Closed cell nitrile based flexible elastomeric insulation
Thickness/ Density	: 6 mm, 9 mm, 13 mm, 19 mm, 25 mm, 30 mm, 32 mm, 40 mm and 50 mm having density of 65 kg/m ³ Approx.
Test Reports	: By SGS-CSTC Standard Technical Services Co. Ltd.
	a) No. GZHL 1702006191OT of 10.3.2017
	b) No. GZHL 1611050525OT of 2.12.2016
	c) No. GZHL 1611050528OT of 2.12.2016
	d) No. GZHL 1611050530OT of 2.12.2016
	e) No. GZHL 1702006200OT of 13.3.2017

/2...

REF NUMBER AND DATE SHOULD BE QUOTED IN REFERENCE TO THIS LETTER
凡提及本信件時請引據編號及日期

-2-

- Test Reports (cont.) : f) No. GZHL 1701000932OT of 22.1.2017
g) No. GZHL 1611050532OT of 2.12.2016
h) No. GZHL 1701000934OT of 22.1.2017
i) No. GZHL 1702003857OT of 20.2.2017
- Test Standards : a) BS 476: Part 6: 1989 + A1: 2009
b) BS 476: Part 7: 1997
- Test Results : a) Fire Propagation Index
For the specimens : $I \leq 12$, $i_1 \leq 6$
b) Surface Spread of Flame
For other specimens: Class 1
- Application : For internal or external insulation of ductwork and pipework in ventilating system.
- Remarks : a) No assessment was made on the density and toxicity of smoke generated by the product under fire conditions as that are not our requirements.
b) This assessment letter supersedes our previous one of the same series dated 11.12.2013.
c) This assessment is subject to review by June 2022.

Yours faithfully,



(LAM Sui-hang)
for Director of Fire Services

SHL/MM

FileCode: armacell armaflex class 0 20170721.doc

CERTIFICATE OF CONFORMITY (COC) SINGAPORE

ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT



PSB Singapore

CERTIFICATE OF CONFORMITY

No. CLS2 18 03 80741 005

Certificate Holder: **Armacell Asia Limited**
Suite No 60 of Jumpstart Business Centre
Flat/RM 01-08 15/F Millennium City 5
418 Kwun Tong Road
Kwun Tong
HONG KONG

Product: Thermal Insulation Materials

Brand Name: Armaflex

Model(s): Armaflex Class 0

Product Details: Elastomeric foam bonded on a steel plate
Foam Density: 40kg/m³ – 60kg/m³
Foam Thickness: 6mm – 50mm
Bulk Density: 221kg/m³ – 1166kg/m³
Tested on the foam face
(Rating: Class 0)

Standard(s): BS 476-6:1989/A1:2009
BS 476-7:1997

Country of Origin: People's Republic of China

Test Report(s): See COC Appendix (1 pg)

Issued on: 2018-03-27

Vice-President (Certification Department)
TÜV SÜD PSB

Valid until: 2023-03-26

Page 1 of 2

This Certificate is part of a full report and should be read in conjunction with it. This Certificate remains the property of TÜV SÜD PSB Pte Ltd and shall be returned upon request. The use of this Certificate is subjected to TÜV SÜD Group Testing and Certification Regulations; TÜV SÜD PSB Pte Ltd (PSB) General Terms and Conditions of Business; and PSB Product Listing Scheme (PLS) Application Fact Sheet. The manufacturer is solely responsible for compliance of any product that has the same designation as the product type tested. Persons relying on this Certificate should verify its validity by checking TÜV SÜD PSB's website at www.tuv-sud-psb.sg



PSB 130321

TÜV SÜD PSB Pte Ltd • 1 Science Park Drive • Singapore 118221

TÜV®



PRODUCT LISTING SCHEME APPENDIX

TO CERTIFICATE OF CONFORMITY NUMBER: CLS2 18 03 80741 005

Date of Issue : 2018-03-27

Issued To : **Armacell Asia Limited**
Suite No 60 Jumpstart Business Centre
Flat/RM 01-08 15/F Millennium City 5
418 Kwun tong Road
Kwun Tong
HONG KONG

Test Report (s) : 7191028108-MEC12/2-YWA
7191142282-MEC16/B-YWA/PIC
7191146701-MEC16/A-YWA/PIC
7191146701-MEC16/B-YWA/PIC

A handwritten signature in blue ink, appearing to read 'Chay Z', positioned above a horizontal line.

Vice President (Certification Department)
TÜV SÜD PSB

Page 2 of 2

Amendments or additions to this appendix other than those authorised by TÜV SÜD PSB Pte Ltd render the appendix invalid.

GB/T 6669-2001

 **2014000188Z**

 (2014)国认监认字(047)号

  检测
CNAS L0846

TEST REPORT

WSW No.18040439

Product Class 0 Armaflex

Client Armacell (Guangzhou) Limited

Test Type Entrusted Testing

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
China National Fiberglass Product Quality Supervision & Testing Center

 April 13, 2018

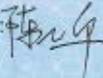
Nanjing Fiberglass Research & Design Institute, Testing Laboratory
China National Fiberglass Product Quality Supervision & Testing Center

Test Report

WSW No.18040439

Page 1 of 2

Client	Armacell (Guangzhou) Limited	Address of client	Guanqiao, Shilou Town, Panyu District, Guangzhou City, Guangdong Province
Product	Class 0 Armaflex	Specification	25mm sheet
Trade mark	Armaflex	Sample sender	Huang Guangfeng
Producer	Armacell (Guangzhou) Limited	Date of production	PCY-030-2018
Inspections required	Resilience after compression relief of the sample.		
Additional information	None.		
The above information is provided by the client, the Center is not responsible for its truthfulness.			
Test type	Entrusted Testing	Date of sample received	April 4, 2018
Sample state	Black cellular board		
Sample quantity	(300×300) mm, 2 pieces	Testing period	2018.04.04~2018.04.12
Test standard	GB/T 17794-2008 Preformed flexible elastomeric cellular thermal insulation		
Testing result	<p>The sample has been tested. The test result of resilience after compression relief conforms to the stipulation of <i>GB/T 17794-2008 Preformed flexible elastomeric cellular thermal insulation</i>. The test result is detailed in the annex (page 2).</p> <p style="text-align: right;">Seal for test report April 13, 2018</p> <p>The test results only represent the technical properties of the samples received.</p>		
Remark			

Approved by:  /Technical Chief Checked by:  Compiled by: 

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
 China National Fiberglass Product Quality Supervision And Testing Center

Annex to Test Report

WSW No.18040439

Page 2 of 2

Test item	Standard requirement	Test result	Judgment
Resilience after compression relief % (50% compression, 72h)	≥ 70	85	Pass

Attached product information (provided by client):

Armacell no.	Dimension	Product-name	Producer	Material-description
PCY-030-2018	25-099	Class O Armaflex	Armacell (Guangzhou) Ltd	FEF - Flexible Elastomeric Foam Pipe or duct insulation product called "Class O Armaflex" consisting of elastomeric foam made of synthetic rubber. The colour of the product is black.

(Blank below)

GB/T 17794

2014000188Z (2014)国认监认字(047)号 检测 CNAS L0846

TEST REPORT

WSW No.18030292

Product Class 0 Armaflex

Client Armacell (Guangzhou) Limited

Test Type Entrusted Testing

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
China National Fiberglass Product Quality Supervision & Testing Center


March 21, 2018

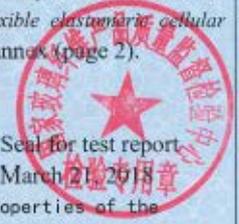
Nanjing Fiberglass Research & Design Institute, Testing Laboratory
 China National Fiberglass Product Quality Supervision & Testing Center

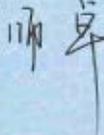
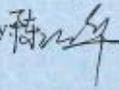
Test Report

WSW No.18030292

Page 1 of 2

Client	Armacell (Guangzhou) Limited	Address of client	Guanqiao, Shilou Town, Panyu District, Guangzhou City, Guangdong Province
Product	Class 0 Armaflex	Specification	25mm sheet
Trade mark	Armaflex	Sample sender	Huang Guangfeng
Producer	Armacell (Guangzhou) Limited	Date of production	PCY-030-2018
Inspections required	Water absorption by vacuum of the sample.		
Additional information	None.		
The above information is provided by the client, the Center is not responsible for its truthfulness.			
Test type	Entrusted Testing	Date of sample received	March 9, 2018
Sample state	Blue cellular board		
Sample quantity	(600×600) mm, 4 pieces	Testing period	2018.03.09~2018.03.19
Test standard	GB/T 17794-2008 Preformed flexible elastomeric cellular thermal insulation		
Testing result	<p>The sample has been tested. The water absorption by vacuum conforms to the stipulation of <i>GB/T 17794-2008 Preformed flexible elastomeric cellular thermal insulation</i>. The test results are detailed in the annex (page 2).</p> <p style="text-align: right;">Seal for test report March 20 2018</p> <p>The test results only represent the technical properties of the samples received.</p>		
Remark			



Approved by:  /Technical Chief Checked by:  Compiled by: 

Nanjing Fiberglass Research & Design Institute, Testing Laboratory
China National Fiberglass Product Quality Supervision And Testing Center

Annex to Test Report

WSW No.18030292

Page 2 of 2

Test item	Standard requirement	Test result	Judgement
Water absorption by vacuum %	≤ 10	8	Pass

Attached product information (provided by client):

Armocell no.	Dimension	Product-name	Producer	Material description
PCY-030-2018	25-099	Class O Armaflex	Armocell (Guangzhou) Ltd	FEF - Flexible Elastomeric Foam Pipe or duct insulation product called "Class O Armaflex" consisting of elastomeric foam made of synthetic rubber. The colour of the product is black.

(Blank below)

ASTM G21-15



Test Report

No.: GZHL1705017570OT-01

Date: Jul 12, 2017

Page 1 of 4

ARMACELL (GUANGZHOU) LIMITED
 GUANQIAO, SHILOU TOWN, PANYU DISTRICT, GUANGZHOU CITY GUANGDONG PROVINCE CHINA
 511447

The following sample(s) was/were submitted and identified on behalf of the client as:

Sample Description : CLASS O ARMAFLEX
 SGS Ref No. : GZAFN1705006130P001
 Style / Item No. : 25 MM SHEET
 Manufacturer : ARMACELL (GUANGZHOU) LIMITED
 Other Info : SEE ATTACHMENT
 Sample Receiving Date : May 04, 2017
 Test Performing Date : May 04, 2017 to Jun 19, 2017

TEST(S) REQUESTED:
 Selected test(s) as requested by the applicant

TEST METHOD(S):
 Please refer to next page(s)

TEST RESULT(S):
 Please refer to next page(s)

Signed for and on behalf of
 Guangzhou Branch,
 SGS-CSTC Ltd.

Johnny Lee
 Approved Signatory

This test report refers only to the sample(s) tested. This document cannot be used for improper publicity, without prior written approval of the SGS.



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-Conditions-Document.aspx>. Attention is drawn to the limitations of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.
 Attention: To check the authenticity of testing / inspection report & certificate, please contact us at telephone: (86-755) 8387 1443, or email: CN.Doccheck@sgs.com
 18 Kache Road, Saitad Park, Guangzhou, China & Technology Development District, Guangzhou, China 510663 | (86-20) 82155555 | (86-20) 82075191 | www.sgs.com | www.sgs.china
 中国·广州·经济技术开发区科学城科珠路180号 邮编: 510663 | (86-20) 82155555 | (86-20) 82075191 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



Test Report

No.: GZHL1705017570OT-01

Date: Jul 12, 2017

Page 2 of 4

ATTACHMENT:

Armaceil no.	Dimension	Product-name	Producer	Material-description
PCY-067-2017	25-099	Class O Armaflex	Armaceil (Guangzhou) Ltd	FEF - Flexible Elastomeric Foam Pipe or duct insulation product called "Class O Armaflex " consisting of elastomeric foam made of synthetic rubber. The colour of the product is black.



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.cn/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com.cn/Terms-and-Conditions/Terms-e-Documents.aspx>. Attention is drawn to the limitations of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information comprising hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from ascertaining all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and each sample(s) are retained for 30 days only.

Attention: To check the authenticity of testing / inspection report & certificate, please contact us at telephone: (86-755) 8387 1443, or email: CN_OnlineCheck@sgs.com
 198 Kache Road, Science Park, Guangzhou Economic & Technology Development District, Guangzhou, China 510663 | (86-20) 82155555 | (86-20) 82875181 | www.sgs.com.cn
 中国·广州·经济技术开发区科学城科珠路198号 邮编: 510663 | (86-20) 82155555 | (86-20) 82875181 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



Test Report

No.: GZHL1705017570OT-01

Date: Jul 12, 2017

Page 3 of 4

TEST RESULT(S):

Antimicrobial activity test

Test method: With reference to ASTM G 21-15

Test organisms: *Aspergillus brasiliensis*^A ATCC 9642, *Penicillium funiculosum*^B ATCC 11797, *Aureobasidium pullulans* ATCC 15233, *Chaetomium globosum* ATCC 6205, *Trichoderma virens*^C ATCC 9645

Test Fungi	Concentration of spores (spores /mL)	Rating observed growth on specimens (after 28 days)
<i>Aspergillus brasiliensis</i> ^A ATCC 9642	1.1x10 ⁶	0 Grade*
<i>Penicillium funiculosum</i> ^B ATCC 11797		
<i>Aureobasidium pullulans</i> ATCC 15233		
<i>Chaetomium globosum</i> ATCC 6205		
<i>Trichoderma virens</i> ^C ATCC 9645		

Notes:

1. According to ASTM G 21-15 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi, observed fungi growth rating on the specimens include:

- 0 – None
- 1 – Traces of growth (less than 10%)
- 2 – Light growth (10 to 30%)
- 3 – Medium growth (30 to 60%)
- 4 – Heavy growth (60% to complete coverage)

2. History name of test organism

^AHistorically known as *A. niger*.

^BHistorically known as *P. pinophilum*.

^CHistorically known as *Glodadium virens*.

3.* The microscope(50 X) was used to confirm the observation.

Remark: This test report is to supersede No. GZHL1705017570OT test report which was issued on Jun 20, 2017. And the original test reports (paper and electronic) are invalid.



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Electronic-Document.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information compiled herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and each sample(s) are retained for 30 days only.

Attention: To check the authenticity of testing / inspection report & certificate, please contact us at telephone: (+86-755) 8387 1443, or email: CN.Doccheck@sgs.com

116 Kefu Road, Saitan Park, Guangzhou, Economic & Technology Development District, Guangzhou, China 510663 | (86-20) 82155555 | (86-20) 82975191 | www.sgs.com.cn
 中国·广州·经济技术开发区科学城科珠路116号 邮编: 510663 | (86-20) 82155555 | (86-20) 82975191 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



Test Report

No.: GZHL1705017570OT-01

Date: Jul 12, 2017

Page 4 of 4

SAMPLE DESCRIPTION: Block sample

Photo Appendix



Test side

End of Report



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Documents.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from upholding all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

Attention: To check the authenticity of testing / inspection report & certificate, please contact us at telephone: (86-755) 8307 1443, or email: GM.Backcheck@sgs.com.
118 Xuehu Road, Saitan Park, Guangzhou, Economic & Technology Development District, Guangzhou, PRC 510663 | (86-20) 82155555 | (86-20) 82075181 | www.sgs.com.cn
中国·广州·经济技术开发区科学城科珠路118号 邮编: 510663 | (86-20) 82155555 | (86-20) 82075181 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)

UL 2818

CERTIFICATE OF COMPLIANCE



Armacell Asia Ltd

ArmaFlex® Class o

13157-470

Certificate Number

10/28/2015 - 10/28/2022

Certificate Period

Certified

Status

UL 2818 - 2013 Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings

Building products and interior finishes are determined compliant in accordance with California Department of Public Health (CDPH) Standard Method V1.2-2017 using an Office and Classroom Environment.
Product tested in accordance with UL 2821 test method to show compliance to emission limits on UL 2818. Section 7.1 and 7.2.



UL investigated representative samples of the identified Product(s) to the identified Standard(s) or other requirements in accordance with the agreements and any applicable program service terms in place between UL and the Certificate Holder (collectively "Agreement"). The Certificate Holder is authorized to use the UL Mark for the identified Product(s) manufactured at the production site(s) covered by the UL Test Report, in accordance with the terms of the Agreement. This Certificate is valid for the identified dates unless there is non-compliance with the Agreement.

*Certificate is renewed annually. Contact the Technical Services department for the latest certificate.

GREENGUARD Gold Certification Criteria for Building Products and Interior Finishes

Criteria	CAS Number	Maximum Allowable Predicted Concentration	Units
TVOC (A)	-	0.22	mg/m ³
Formaldehyde	50-00-0	9 (7.3 ppb)	µg/m ³
Total Aldehydes (B)	-	0.043	ppm
4-Phenylcyclohexene	4994-16-5	6.5	µg/m ³
Particle Matter less than 10 µm (C)	-	20	µg/m ³
1 Methyl 2 pyrrolidinone (D)	872 50 4	160	µg/m ³
Individual VOCs (E)	-	1/2 CREL or 1/100th TLV	-

- (A) Defined to be the total response of measured VOCs falling within the C6 – C14 range, with responses calibrated to a toluene surrogate. Maximum allowable predicted TVOC concentrations for GREENGUARD Gold (0.22 mg/m³) fall in the range of 0.5 mg/m³ or less, as specified in CDPH Standard Method v1.2.
- (B) The sum of all measured normal aldehydes from formaldehyde through nonanal, plus benzaldehyde, individually calibrated to a compound specific standard. Heptenal through nonanal are measured via TD/GC/MS analysis and the remaining aldehydes are measured using HPLC/UV analysis.
- (C) Particle emission requirement only applicable to HVAC Duct Products with exposed surface area in air streams (a forced air test with specific test method) and for wood finishing (sanding) systems.
- (D) Based on the CA Prop 65 Maximum Allowable Dose Level for inhalation of 3,200 µg/day and an inhalation rate of 20 m³/day.
- (E) Allowable levels for chemicals not listed are derived from the lower of 1/2 the California Office of Environmental Health Hazard Assessment (OEHHA) Chronic Reference Exposure Level (CREL) as required per the CDPH/EI/ILD/Standard Method v1.2 and DIFMA level credit 7.G.2 and 1/100th of the Threshold Limit Value (TLV) industrial work place standard (Reference: American Conference of Government Industrial Hygienists, 6500 Glenway, Building D-7, and Cincinnati, OH 45211-4438).



UL investigated representative samples of the identified Product(s) to the identified Standard(s) or other requirements in accordance with the agreements and any applicable program service terms in place between UL and the Certificate Holder (collectively "Agreement"). The Certificate Holder is authorized to use the UL Mark for the identified Product(s) manufactured at the production site(s) covered by the UL Test Report, in accordance with the terms of the Agreement. This Certificate is valid for the identified dates unless there is non-compliance with the Agreement.

ROHS



中国认可
国际互认
检测
TESTING
CNAS L0167

Test Report

No. CANEC1826492901

Date: 26 Dec 2018

Page 1 of 6

ARMACELL (SUZHOU) LIMITED

ZHENXING ROAD, ZHANGJIAGANG ECONOMIC DEVELOPMENT ZONE, ZHANGJIAGANG, JIANGSU PROVINCE, CHINA

The following sample(s) was/were submitted and identified on behalf of the clients as : ArmaFlex Class 0

SGS Job No. : CP18-068328 - GZ
 Date of Sample Received : 20 Dec 2018
 Testing Period : 20 Dec 2018 - 26 Dec 2018
 Test Requested : Selected test(s) as requested by client.
 Test Method : Please refer to next page(s).
 Test Results : Please refer to next page(s).
 Conclusion : Based on the performed tests on submitted sample(s), the results of Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBBs), Polybrominated diphenyl ethers (PBDEs) and Phthalates such as Bis(2-ethylhexyl) phthalate (DEHP) , Butyl benzyl phthalate (BBP), Dibutyl phthalate (DBP) , and Diisobutyl phthalate (DIBP) comply with the limits as set by RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU.

Signed for and on behalf of
 SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch

Dirk Yang

Dirk Yang
 Approved Signatory



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed hereof, available on request or accessible at <http://www.sgs.com/sgs/termsandconditions.aspx> and for electronic-based documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/sgs/termsandconditions/Terms-e-Documents.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
 Attention: To check the authenticity of testing/inspection report & certificate, please contact us at telephone: (86-755)83071443, or email: CS.DocsCheck@sgs.com
 198 Kechu Road, Sanchi Park, Guangzhou Economic Technology Development Zone, Guangzhou, China 510663 | (86-20) 82155555 | (86-20) 82075113 | www.sgs.com
 中国·广州·经济技术开发区科学城科珠路198号 邮编: 510663 | (86-20) 82155555 | (86-20) 82075113 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



中国认可
国际互认
检测
TESTING
CNAS L0167

Test Report

No. CANEC1826492901

Date: 26 Dec 2018

Page 2 of 6

Test Results :

Test Part Description :

Specimen No.	SGS Sample ID	Description
SN1	CAN18-264929.001	Black foam w/ white printing

Remarks :

- (1) 1 mg/kg = 0.0001%
- (2) MDL = Method Detection Limit
- (3) ND = Not Detected (< MDL)
- (4) "-" = Not Regulated

RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU

Test Method : With reference to IEC 62321-4:2013+A1:2017, IEC 62321-5:2013, IEC 62321-7-2:2017, IEC 62321-6:2015 and IEC 62321-8:2017, analyzed by ICP-OES, UV-Vis and GC-MS.

Test Item(s)	Limit	Unit	MDL	001
Cadmium (Cd)	100	mg/kg	2	ND
Lead (Pb)	1,000	mg/kg	2	8
Mercury (Hg)	1,000	mg/kg	2	ND
Hexavalent Chromium (CrVI)	1,000	mg/kg	8	ND
Sum of PBBs	1,000	mg/kg	-	ND
Monobromobiphenyl	-	mg/kg	5	ND
Dibromobiphenyl	-	mg/kg	5	ND
Tribromobiphenyl	-	mg/kg	5	ND
Tetrabromobiphenyl	-	mg/kg	5	ND
Pentabromobiphenyl	-	mg/kg	5	ND
Hexabromobiphenyl	-	mg/kg	5	ND
Heptabromobiphenyl	-	mg/kg	5	ND
Octabromobiphenyl	-	mg/kg	5	ND
Nonabromobiphenyl	-	mg/kg	5	ND
Decabromobiphenyl	-	mg/kg	5	ND
Sum of PBDEs	1,000	mg/kg	-	ND
Monobromodiphenyl ether	-	mg/kg	5	ND
Dibromodiphenyl ether	-	mg/kg	5	ND
Tribromodiphenyl ether	-	mg/kg	5	ND
Tetrabromodiphenyl ether	-	mg/kg	5	ND
Pentabromodiphenyl ether	-	mg/kg	5	ND



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/terms-and-conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/terms-and-conditions/terms-e-document.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

Attention: To check the authenticity of testing/inspection report & certificate, please contact us at telephone: (86-755) 8387 1443, or email: CN_Qcchcck@sgs.com

SGS CSTC (China) Inspection & Testing Services Co., Ltd. 198 Kechu Road (Scientific Park) Guangzhou Economic & Technology Development District, Guangzhou, China 510663 | (86-20) 82155555 | (86-20) 82075113 | www.sgs.com or www.sgschina.com
中国 - 广州 - 经济技术开发区科学城科珠路198号 邮编: 510663 | (86-20) 82155555 | (86-20) 82075113 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



中国认可
国际互认
检测
TESTING
CNAS L0167

Test Report

No. CANEC1826492901

Date: 26 Dec 2018

Page 3 of 6

Test Item(s)	Limit	Unit	MDL	QOT
Hexabromodiphenyl ether	-	mg/kg	5	ND
Heptabromodiphenyl ether	-	mg/kg	5	ND
Octabromodiphenyl ether	-	mg/kg	5	ND
Nonabromodiphenyl ether	-	mg/kg	5	ND
Decabromodiphenyl ether	-	mg/kg	5	ND
Dibutyl phthalate (DBP)	1000	mg/kg	50	ND
Butyl benzyl phthalate (BBP)	1000	mg/kg	50	ND
Bis (2-ethylhexyl) phthalate (DEHP)	1000	mg/kg	50	ND
Diisobutyl Phthalates (DIBP)	1000	mg/kg	50	ND

Notes :

(1) The maximum permissible limit is quoted from RoHS Directive (EU) 2015/863.IEC 62321 series is equivalent to EN 62321 series

http://www.cenelec.eu/dyn/www/f?p=104:30:1742232870351101:::FSP_ORG_ID,FSP_LANG_ID:1258637,25



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed hereon, available on request or accessible at <http://www.sgs.com/zh/terms-and-conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/zh/terms-and-conditions/Terms-e-Documents.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings of the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

Attention: To check the authenticity of testing/inspection report & certificate, please contact us at telephone: (86-755)83671443, or email: CN.Scs@sgs.com

SGS-CSTC Guangzhou Economic & Technology Development Zone Laboratory Co., Ltd. 198 Xuehu Road, Science Park, Guangzhou Economic & Technology Development Zone, Guangzhou, China 510663 | (86-20) 82155555 | (86-20) 82075113 | www.sgs.com
中国·广州·经济技术开发区科学城科裕路198号 邮编: 510663 | (86-20) 82155555 | (86-20) 82075113 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



中国认可
国际互认
检测
TESTING
CNAS L0167

Test Report

No. CANEC1826492901

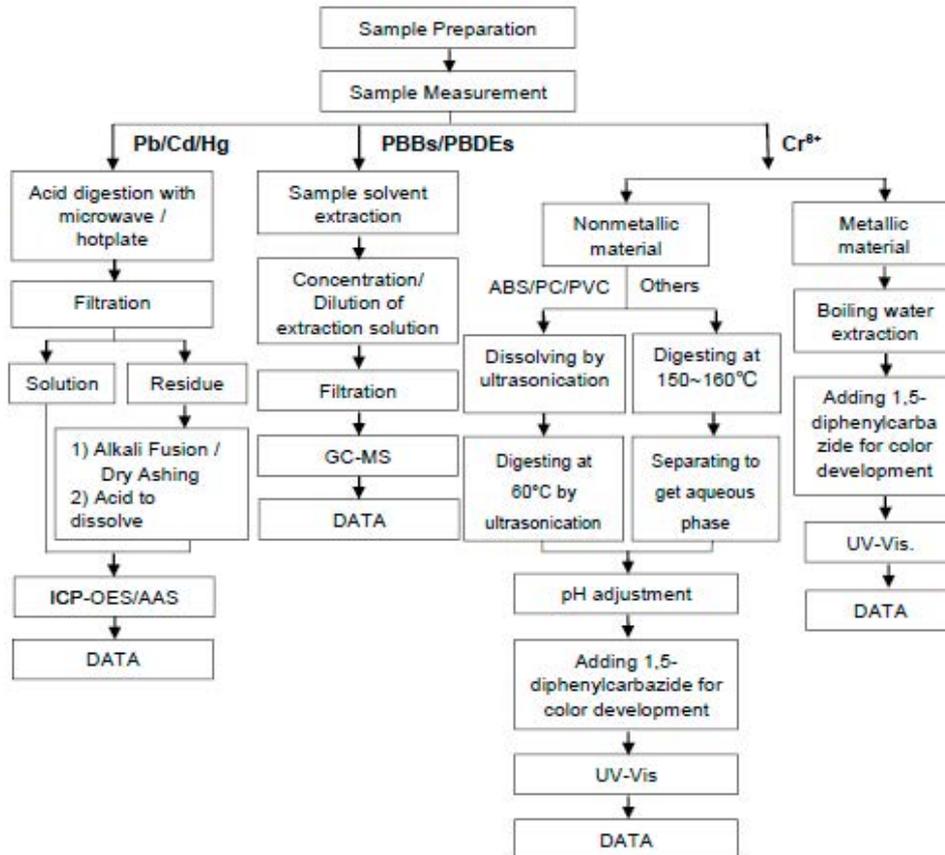
Date: 26 Dec 2018

Page 4 of 6

ATTACHMENTS

Pb/Cd/Hg/Cr⁶⁺/PBBs/PBDEs Testing Flow Chart

1) These samples were dissolved totally by pre-conditioning method according to below flow chart. (Cr⁶⁺ and PBBs/PBDEs test method excluded).



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.cn/terms-and-conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/terms-and-conditions/terms-and-conditions.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

Attention: To check the authenticity of testing/inspection report & certificate, please contact us at telephones: (86-755) 8307 1443, or email: CN.Doccheck@sgs.com
 191 Kechu Road, Science Park, Guangzhou Economic Technology Development District, Guangzhou, China 510663 | (86-20) 82155555 | (86-20) 82075113 | www.sgs.com.cn
 中国·广州·经济技术开发区科学城科珠路190号 邮编: 510663 | (86-20) 82155555 | (86-20) 82075113 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



中国认可
国际互认
检测
TESTING
CNAS L0167

Test Report

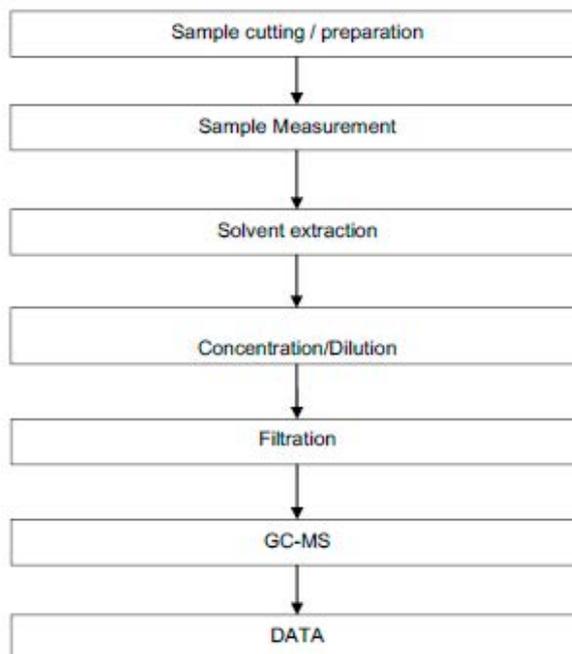
No. CANEC1826492901

Date: 26 Dec 2018

Page 5 of 6

ATTACHMENTS

Phthalates Testing Flow Chart



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.cn/terms-and-conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com.cn/terms-and-conditions/terms-e-document.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

Attention: To check the authenticity of testing/inspection report & certificate, please contact us at telephone: (86-755)83071443, or email: CN.SCS@sgs.com

SGS-CTC (China) Testing Services Co., Ltd. 198 Foshan Road, Science Park, Guangzhou Economic Technology Development Zone, Guangzhou, China 510663 | (86-20) 82155555 | (86-20) 82075113 | www.sgs.com.cn
 中国·广州·经济技术开发区科学城科裕路198号 邮编: 510663 | (86-20) 82155555 | (86-20) 82075113 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



中国认可
国际互认
检测
TESTING
CNAS L0167

Test Report

No. CANEC1826492901

Date: 26 Dec 2018

Page 6 of 6

Sample photo:



SGS authenticate the photo on original report only

*** End of Report ***



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/terms-and-conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/terms-and-conditions/terms-e-document.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings of the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

Attention: To check the authenticity of testing/inspection report & certificate, please contact us at telephone: (+86-755) 8397 1443, or email: CN.Doccheck@sgs.com
198 Kechu Road, Science Park, Guangzhou Economic & Technology Development District, Guangzhou, China 510663 | (86-20) 82155555 | (86-20) 82075113 | www.sgs.com.cn
中国·广州·经济技术开发区科学城科珠路198号 邮编: 510663 | (86-20) 82155555 | (86-20) 82075113 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)

SINGAPORE GREEN BUILDING PRODUCT



SINGAPORE GREEN BUILDING PRODUCT CERTIFICATE

AWARDED TO

Armacell Asia Ltd

Suite No. 60 Of Jumpstart Business Centre,
Flat/Rm 01-08 15/F Millennium City 5
418 Kwun Tong Road, Kwun Tong, Kowloon, Hong Kong
Singapore Hong Kong

FOR THE PRODUCT

Thermal Insulation

PRODUCT BRAND

ArmaFlex

PRODUCT MODEL

ArmaFlex Class 0, Tube insulation: 6mm, 9mm, 13mm, 19mm, 25mm, 32mm, 40mm, 50mm, Sheet insulation: 6mm, 9mm, 13mm, 16mm, 19mm, 25mm, 30mm, 32mm, 35mm, 40mm, 50mm

THE PRODUCT HAS BEEN ASSESSED ACCORDING TO THE ASSESSMENT CRITERIA OF SINGAPORE GREEN BUILDING PRODUCT CERTIFICATION SCHEME. IT HAS BEEN AWARDED THE RATING:

Director
SGBC Pte Ltd



Certificate Number	Original Issue Date	Revised Date	Valid Till
SGBP 3835	07 December 2020	-	06 December 2022

✓ Good ✓✓ Very Good ✓✓✓ Excellent ✓✓✓✓ Leader

The use and reliance on this certificate is subject to the terms and conditions of the Singapore Green Building Product Certification Scheme. Revised certificates may also be issued at the discretion of the Council. The certification status may be



verified at the Singapore Green Building Council website (www.sgbc.sg).

ENVIRONMENTAL PRODUCT DECLARATION (EPD)



EPD Transparency Summary

COMPANY NAME Amacell Asia Pte Ltd

PRODUCT NAME ArmaFlex® Class 0

PRODUCT DESCRIPTION Flexible elastomeric foam solution for HVAC applications such as air conditioners, chilled water systems and air ducts.

PRODUCT CATEGORY RULE (PCR)+ VERSION Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Standard 10010, Version 3.2
Part B: Mechanical, Specialty, Thermal, and Acoustic Insulation Product EPD Requirements, UL 10010-03, version 1.0

CERTIFICATION PERIOD October 1, 2020-October 2025

DECLARATION NUMBER 4789125188.101.1

EPD TYPE **PRODUCT SPECIFIC** **INDUSTRY AVERAGE**

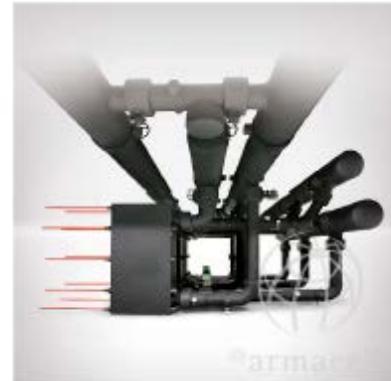
DECLARED/ FUNCTIONAL UNIT 1m² for Non-piping applications

GREEN BUILDING QUALIFICATIONS
LEED v4 Building Product Disclosure and Optimization - EPDs, Option 1
ASHRAE 189.1 Material Compliance
IgCC Material Compliance Green Globes 3.5.12.1
NAHB Material Selection

REFERENCE SERVICE LIFE (IF APPLICABLE) 75 years

LCA SOFTWARE + VERSION SimaPro 9

IMPACT ASSESSMENT METHOD + VERSION CML-IA (baseline)



LIFECYCLE IMPACT CATEGORIES

The environmental impacts listed below were assessed through the product's production phase (cradle to gate impacts).

	ATMOSPHERE			WATER		EARTH	
	Global Warming Potential refers to long-term changes in global weather patterns that are caused by increased concentrations of greenhouse gases in the atmosphere.	Ozone Depletion Potential is the destruction of the stratospheric ozone layer, which shields the earth from ultraviolet radiation that's harmful to life, caused by human-made air pollution.	Photochemical Ozone Creation Potential happens when sunlight reacts with hydrocarbons, nitrogen oxides, and volatile organic compounds, to produce air pollution known as smog.	Acidification Potential is the result of human-made emissions and refers to the decrease in pH and increase in acidity of oceans, lakes, rivers, and streams – polluting groundwater and harming aquatic life.	Eutrophication Potential occurs when excessive nutrients cause increased algae growth in lakes, blocking the underwater penetration of sunlight needed to produce oxygen and resulting in the loss of aquatic life.	Depletion of Abiotic Resources (Elements) refers to the reduction of available non-renewable resources, such as metals, that are found on the periodic table of elements, due to human activity.	Depletion of Abiotic Resources (Fossil Fuels) refers to the decreasing availability of non-renewable carbon-based compounds, such as oil and coal, due to human activity.
TRACI	kg CO ₂ -Equiv.	kg CFC 11-Equiv.	kg O ₃ -Equiv.	kg SO ₂ -Equiv.	kg N-Equiv.	kg Sb-Equiv.	MJ
CML	4.85E+00 kg CO ₂ -Equiv.	2.94E-07 kg R11-Equiv.	1.29E-03 kg Ethene-Equiv.	2.26E-02 kg SO ₂ -Equiv.	9.03E-03 kg PO ₄ -Equiv.	6.65E-06 kg Sb-Equiv.	8.53E+01 MJ



Environment
© 2018 UL Environment



EPD Transparency Summary

COMPANY NAME Amacell Asia Pte Ltd

PRODUCT NAME ArmaFlex® Class 0

PRODUCT DESCRIPTION Flexible elastomeric foam solution for HVAC applications such as air conditioners, chilled water systems and air ducts.

PRODUCT CATEGORY RULE (PCR)+ VERSION Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Standard 10010, Version 3.2
Part B: Mechanical, Specialty, Thermal, and Acoustic Insulation Product EPD Requirements, UL 10010-03, version 1.0

CERTIFICATION PERIOD October 1, 2020-October 1, 2025

DECLARATION NUMBER 4789125188.101.1

EPD TYPE **PRODUCT SPECIFIC** **INDUSTRY AVERAGE**

DECLARED/ FUNCTIONAL UNIT 1m for Piping applications

GREEN BUILDING QUALIFICATIONS
LEED v4 Building Product Disclosure and Optimization - EPDs, Option 1
ASHRAE 189.1 Material Compliance
IgCC Material Compliance
Green Globes 3.5.12.1
NAHB Material Selection

REFERENCE SERVICE LIFE (IF APPLICABLE) 75 years

LCA SOFTWARE + VERSION SimaPro 9

IMPACT ASSESSMENT METHOD + VERSION CML-IA (baseline)



LIFECYCLE IMPACT CATEGORIES

The environmental impacts listed below were assessed through the product's production phase (cradle to gate impacts).

	ATMOSPHERE			WATER		EARTH	
	Global Warming Potential refers to long-term changes in global weather patterns that are caused by increased concentrations of greenhouse gases in the atmosphere.	Ozone Depletion Potential is the destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation that's harmful to life, caused by human-made air pollution.	Photochemical Ozone Creation Potential happens when sunlight reacts with hydrocarbons, nitrogen oxides, and volatile organic compounds, to produce air pollution known as smog.	Acidification Potential is the result of human-made emissions and refers to the decrease in pH and increase in acidity of oceans, lakes, rivers, and streams – polluting groundwater and harming aquatic life.	Eutrophication Potential occurs when excessive nutrients cause increased algae growth in lakes, blocking the underwater penetration of sunlight needed to produce oxygen and resulting in the loss of aquatic life.	Depletion of Abiotic Resources (Elements) refers to the reduction of available non-renewable resources, such as metals, that are found on the periodic table of elements, due to human activity.	Depletion of Abiotic Resources (Fossil Fuels) refers to the decreasing availability of non-renewable carbon-based compounds, such as oil and coal, due to human activity.
TRACI	kg CO ₂ -Equiv.	kg CFC 11-Equiv.	kg O ₃ -Equiv.	kg SO ₂ -Equiv.	kg N-Equiv.	kg Sb-Equiv.	MJ
CML	2.92E+00 kg CO ₂ -Equiv.	1.77E-07 kg R11-Equiv.	7.79E-04 kg Ethene-Equiv.	1.36E-02 kg SO ₂ -Equiv.	5.44E-03 kg PO ₄ -Equiv.	4.01E-06 kg Sb-Equiv.	5.14E+01 MJ



Environment
© 2018 UL Environment



Environment

© 2018 UL Environment

MATERIAL CONTENT

Material content measured to 1%.

COMPONENT	MATERIAL	AVAILABILITY	MASS%	ORIGIN
	Blowing agent	Non-Renewable	13%	
	Fillers and pigments	Non-Renewable	3%	
	Flame retarder	Non-Renewable	33%	
	Rubber and polymers	Non-Renewable	24%	
	Vulcanisation system additives, plasticisers	Non-Renewable	27%	

ADDITIONAL ENVIRONMENTAL INFORMATION

PRE-CONSUMER RECYCLED CONTENT	0 %
POST-CONSUMER RECYCLED CONTENT	0 %
VOC EMISSIONS	-
WATER CONSUMPTION	5.15E-04 (m3)

ENERGY

RENEWABLE ENERGY	2.19 %	1.68E+00	MJ
NON-RENEWABLE ENERGY	97.81 %	7.52E+01	MJ

MANUFACTURER CONTACT INFO

NAME	Amacell Asia Pte Ltd
PHONE	+65 6661 0540
EMAIL	info.singapore@amacell.com
WEBSITE	www.amacell.com

RECYCLING OR REUSE

None

STANDARDS

ASTM C534
EN 14304
GB/T 17794
BS 476 Part 6&7 - Class 0
FM 4924
UL 2818

CERTIFICATIONS



© 2018 UL Environment

www.UL.com/environment | environment@ul.com

The information presented herein is a summary of content contained in the manufacturer's ISO 14025-compliant EPD certified by UL. Please visit www.ul.com/environment to download the full EPD. UL, the UL logo, and UL certification marks are trademarks of UL LLC. All other marks are the property of their respective owners.

ASTM C1763



Test Report

No.: GZHL21040153130T

Date: May 14, 2021

Page 1 of 4

ARMACELL (GUANGZHOU) LIMITED
 GUANQIAO, SHILOU TOWN, PANYU DISTRICT, GUANGZHOU CITY, GUANGDONG PROVINCE CHINA
 511447

Sample Description : ARMAFLEX CLASS 0
 Armacell Test No. : QPY-102-2021
 Item No. : 25mm THICKNESS
 Manufacturer : ARMACELL (GUANGZHOU) LIMITED

As above test item and its relevant information regarding to the submission are provided and confirmed by the applicant. SGS is not liable to either the test item or its relevant information, in terms of the accuracy, suitability, reliability or/and integrity accordingly.

SGS Ref No. : GZIN2104022483MR
 Sample Receiving Date : Apr 26, 2021
 Test Performing Date : Apr 26, 2021 to May 14, 2021
 Test Performed : Selected test(s) as requested by applicant
 Test Result(s) : For further details, please refer to the following page(s)

Signed for and on behalf of
 SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch



Arthur Mak
 Authorized Signatory



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/eng/terms-and-conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/eng/terms-and-conditions/terms-e-document.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.
 Attention: To check the authenticity of testing / inspection report & certificate, please contact us at telephone: (86-755) 8307 1843, or email: CN_Doccheck@sgs.com
 196 Kashu Road, Sienleh Park, Guangzhou Economic Technology Development Zone, Guangzhou, China 510663 | (86-20) 82155555 | (86-20) 82075191 | www.sgs.com
 中国·广州·经济技术开发区科学城科珠路196号 邮编: 510663 | (86-20) 82155555 | (86-20) 82075191 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



Test Report

No.: GZHL21040153130T

Date: May 14, 2021

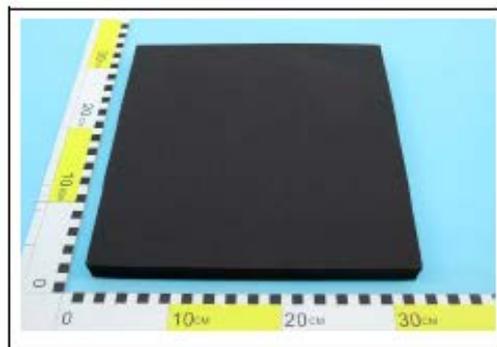
Page 2 of 4

Summary of Results:

No.	Test Item	Test Method	Result	Conclusion
1	Water Absorption by Volume	ASTM C1763-20 Procedure B	0.04%	/

Note: Pass : Meet the requirements;
 Fail : Does not meet the requirements;
 / : Not Apply to the judgment.

Original Sample Photo:



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/ww/terms-and-conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/terms-and-conditions/terms-e-document.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

Attention: To check the authenticity of testing / inspection report & certificate, please contact us at telephone: (86-731) 83871443, or email: CN_Doccheck@sgs.com
 196 Kailu Road, Science Park Guangzhou Economic & Technology Development Zone, Guangzhou, China 510663 | (86-00) 82155555 | (86-20) 82075191 | www.sgs.com.cn
 中国·广州·经济技术开发区科学城珠晖路196号 邮编: 510663 | (86-00) 82155555 | (86-20) 82075191 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



Test Report

No.: GZHL21040153130T

Date: May 14, 2021

Page 3 of 4

Test Item: Water Absorption by Volume

Sample Description: Foam

Test Method: ASTM C1763-20 Procedure B

Test Condition:

Specimen: 304mm × 304mm × 25.8mm

Immersion condition: 23 °C, 2 h

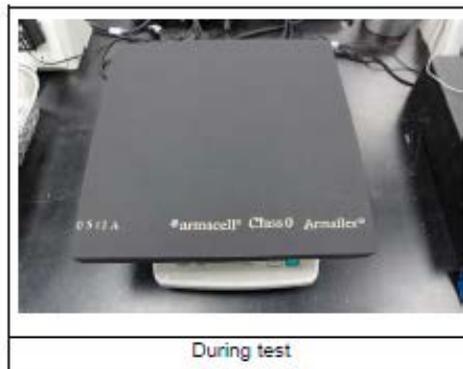
Lab Environmental Condition: 23 ± 2 °C, 50 ± 5 % RH

Test Result:

Test Item	Test Result
Water Absorption by Volume	0.04%

Note: Water Absorption by Volume, % = Percent by Weight x Material Density/ Water Density

Test Photo:



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Document.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.
 Attention: To check the authenticity of testing / inspection report & certificate, please contact us at telephone: (86-753) 6307 1442, or email: CN.Docscheck@sgs.com
 199 Kaitu Road, Shenzhen Paiti Guangzhou Economic & Technology Development Zone, Guangzhou, China. 510663 | (86-20) 82155555 | (86-20) 82075191 | www.sgs.com
 中国·广州·经济技术开发区科学城科珠路199号 邮编: 510663 | (86-20) 82155555 | (86-20) 82075191 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)



Test Report

No.: GZHL21040153130T

Date: May 14, 2021

Page 4 of 4

Equipment Information:

Equipment	Model	Equipment No.	Calibration date	Next Calibration date
Electron Balance	JJ8000A	GZMR-PL-E079	2020-08-18	2021-08-17
Straight Steel Ruler	600mm	GZMR-PL-E017-10	2021-01-13	2022-01-12

End of Report



Unless otherwise agreed in writing, this document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Documents.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction clauses defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention, only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

Attention: To check the authenticity of testing / inspection report & certificate, please contact us at telephone: (86-755) 8307 1443, or email: CN-Docheck@sgs.com

186 Xinhai Road, Science Park, Guangzhou Economic & Technology Development Zone, Guangzhou, China. 510663 | (86-20) 82155555 | (86-20) 82075191 | www.sgs.com.cn
 中国·广州·经济技术开发区科学城珠晖路186号 邮编: 510663 | (86-20) 82155555 | (86-20) 82075191 | sgs.china@sgs.com

Member of the SGS Group (SGS SA)

All data and technical information are based on results achieved under the specific conditions defined according to the testing standards referenced. Despite taking every precaution to ensure that said data and technical information are up to date, Armacell does not make any representation or warranty, express or implied, as to the accuracy, content or completeness of said data and technical information. Armacell also does not assume any liability towards any person resulting from the use of said data or technical information. Armacell reserves the right to revoke, modify or amend this document at any moment. It is the customer's responsibility to verify if the product is suitable for the intended application. The responsibility for professional and correct installation and compliance with relevant building regulations lies with the customer. This document does not constitute nor is part of a legal offer to sell or to contract.

At Armacell, your trust means everything to us, so we want to let you know your rights and make it easier for you to understand what information we collect and why we collect it. If you would like to find out about our processing of your data, please visit our Data Protection Policy.

© Armacell, 2022. All rights reserved. ArmaFlex® is a trademark of the Armacell Group.

00189 | ArmaFlex Class 0 | ArmaFlex | TechSheet | 012022 | APAC | EN MASTER

ABOUT ARMACELL

As the inventors of flexible foam for equipment insulation and a leading provider of engineered foams, Armacell develops innovative and safe thermal, acoustic and mechanical solutions that create sustainable value for its customers. Armacell's products significantly contribute to global energy efficiency making a difference around the world every day. With more than 3,000 employees and 24 production plants in 16 countries, the company operates two main businesses, Advanced Insulation and Engineered Foams, and generated net sales of EUR 591 million and adjusted EBITDA of EUR 120 million in 2020. Armacell focuses on insulation materials for technical equipment, high-performance foams for high-tech and lightweight applications and next generation aerogel blanket technology.

For more information, please visit:
www.armacell.com

