DELTA INSULATION SYSTEMS

TECHNICAL DATA

Thermosetting Phenolic Composite

(TPC)

ISO 45001 CERTIFIED SCI QUAL INTERNATIONAL

ISO 9001 CERTIFIED SCI QUAL INTERNATIONAL

ISO 14001 CERTIFIED SCI QUAL INTERNATIONAL

Delta Insulation Systems
P: +61 07 3271 2170 E: info@deltainsulationsystems.com W: www.deltainsulationsystems.com.au
A: 49 Bernoulli Street, Darra Qld. 4076 ABN: 12 122 760 552

Version Date: 2023-10-16

What is Thermosetting Phenolic Composite (TPC)

The TPC product is produced by coating Expanded Polystyrene (EPS), a closed cell lightweight cellular plastics material with a phenolic composite coating to produce a core material with superior fire ratings. The EPS material has been modified by the addition of flame-retardant additives.

The finished product produces a core material with all the known physical attributes of EPS with a vastly superior fire performance.

The Manufacturing Process

Pre-Expansion of the EPS
The small expandable beads are subjected to steam, which causes the thermoplastic polystyrene to soften. Increasing vapour pressure caused by the blowing agent causes the beads to expand to up to 40 times their original volume. It is this prefoam stage which determines the final density of the expanded polystyrene block.

Aging of the EPS bead
After pre-expansion the pre-foam is transferred via to fluidized drying bed to large silos for aging. This process is designed to allow for the replacement of expanding agent by air in the cells of the bead. Aging also allows for stabilization and cooling of the pre-foam.

Blending the Pre-Mix
The resin along with the addition of additional additives are thoroughly mixed under temperature control conditions as per strict SOP requirements

Coating the EPS bead
The aged EPS beads and the Pre-Mix are fed into the coating machine along with a catalyst. The flow rates are critical to ensure an even coating over the EPS beads. The coated beads travel along a fluidized bed allowing them to dry.

Aging of the Coated Beads
After clearing the coating machine, the treated beads are transferred to an aging silo. This allows for stabilization and cooling of the coated beads

Moulding of the TPC Blocks
Once conditioned by aging, the coated beads are transferred to specially designed Moulding machines to be formed through the introduction of steam into fused blocks.

Drying of the TPC Blocks
To provide dimensionally stable dry blocks it is necessary to pass them through a temperature-controlled oven. This process also ensures that any residual blowing agent has been removed.

Finished Product
For most customers the manufacturing process is not complete until the EPS blocks have been cut into various shapes. This process is mainly carried out using a hot wire cutting machine that gives a fine finish to the product and enables very fine cutting tolerances to be achieved.

Quality Control

To ensure compliance with customer requirements we operate a fully accredited Integrated Managed System (IMS) to ISO9001. Additionally, we a have a Safety Management System accredited to ISO 45001:2018.

Table 1
Physical Properties of TPC, according to AS 1366, Part 3 – 1992

Physical Property	Unit		Test Method
Nominal Density (kg/m^3)		40	N/a
Compressive stress at 10% deformation (min)	kPa	165	AS2498.3
Cross-breaking strength (min)	kPa	320	AS2498.4
Rate of water vapour transmission (max) measured parallel to rise at 23°C	µg/m^{2}s	400	AS2498.5
Dimensional stability of length, width, thickness (max) at 70°C, dry condition 7 days	%	1.0	AS2498.6
Thermal resistance (min) at a mean temperature of 25°C (50mm sample)	M^{2}K/W	1.70	AS2464.5 or AS2464.6

Delta Insulation Systems
P: +61 07 3271 2170 E: info@deltainsulationsystems.com W: www.deltainsulationsystems.com.au
A: 49 Bernoulli Street, Darra Qld. 4076 ABN: 12 122 760 552

Thermal Properties

As TPC consists of a coated EPS bead, it retains the Thermal properties of the EPS which is the exceptional insulating properties from the stabilised air trapped within its cellular structure. Since it contains no CFCs or any other gas that may leak out, it will not harm the ozone layer or decrease its insulation properties.

As Australian Standard 1366 Part 3 is a minimum conformance standard the thermal resistances quoted will be achieved as a minimum in 97.5% of cases in a statistical sample, when tested at a mean sample temperature of 25°C.

For design purposes the average thermal resistance is a better guide than the minimum thermal resistance.

Moisture Resistance

The EPS bead within the TPC is highly resistant resistant to the adverse effects of moisture content. At ten times its dry weight, EPS has been found to maintain 80% of its R value.

Australian Standard

Australian Standard 1366, Part 3 – 1992 Physical Properties of Rigid Cellular Polystyrene – sets out minimum properties for six classes (see table 1) and methods for determination and compliance. Flexibility in production allows EPS to be produced to this standard or to other requirements that specialized applications may demand.

Floatation Properties

The density of TPC is low compared to water, with a normal density range of 38 to 42 kg/m^3 compared to water at 100 kg/m^3. The water buoyancy per cubic metre of TPC is determined by subtracting its kg/m^3 density from 1000. The result is the weight in kilograms that a cubic metre of TPC can support when fully submerged in water.

Temperature Cycling

TPC is able to withstand the effects of temperature cycling thereby providing long term performance in low temperature applications.

Core specimens of EPS removed from freezer walls in place for twenty years have demonstrated no deterioration in the structural integrity or physical properties.

The K Value of EPS decreases at lower average mean temperatures, hence its popularity and success in subzero applications.

Toxicity

Extensive research programs have been conducted overseas [(i)] to determine if thermal decomposition products of EPS present a toxicity hazard. The test results have revealed that these decomposition products are less harmful than those of burning wood.

Gases released during combustion are predominantly carbon monoxide and, to a lesser extent, carbon dioxide. A CSIRO report [(ii)]comments that the toxicity of the gases associated with the burning of EPS is no greater than that associated with timber.

Combustibility

As with all other organic material the EPS component of TPC insulation products must be considered combustible and to constitute a fire hazard if improperly used or installed.

The material contains a flame retardant additive to inhibit accidental ignition from small fire sources. Table 2 shows test results for EPS and other common building materials to provide a good guide as to how these products compare.

(i) H.Hoffmann & H Oettel "Comparative Toxicity of Thermal Decomposition Products

(ii) P.R.Nicholl & K.G. Martin "Toxicity Considerations of Combustion Products from Cellular Plastics."

Table 2

Comparative testing of some materials to AS 1530, Part 3 – Early Fire Hazard Test

Material	Ignitability Index (0-20)	Spread of Flame Index (0-10)	Heat Evolved Index (0-10)	Smoke developed index (0-10)
EPS	12	0	3	5
Australian Softboard	16	9	7	3
Oregon	13	6	5	3
Bluegum	11	0	3	2

Source: EBS Notes on the Science of Building NSB66

Delta Insulation Systems
P: +61 07 3271 2170 E: info@deltainsulationsystems.com W: www.deltainsulationsystems.com.au
A: 49 Bernoulli Street, Darra Qld. 4076 ABN: 12 122 760 552

Core Material Comparisons

CORE MATERIAL	Expanded Polystyrene with Fire Retardant		Thermosetting Phenolic Composite		Mineral Wool	
	EPS-FR		TPC		MW	
ACOUSTIC CHARACTERISTICS						
Frequency: 50mm Panel -STC	24		24		25	
Frequency: 125mm Panel -STC	23		25		26	
CORE CHARACTERISTICS						
Core Density	13.5kg/m^3		36kg/m^3		100kg/m^3	
THERMAL CONDUCTIVITY						
W/mK @ 22.5C/23.0C	0.0442		0.0394		0.0365	
ENERGY PERFORMANCE						
	Winter (15°C)	Summer (23 °C)	Winter (15°C)	Summer (23 °C)	Winter (15°C)	Summer (23 °C)
R Value: 50mm Panel	1.36	1.33	1.25	1.20	1.90	1.85
R Value: 75mm Panel	1.94	1.89	1.90	1.80	2.65	2.45
R Value: 100mm Panel	2.51	2.44	2.55	2.40	3.85	3.75
R Value: 150mm Panel	3.60	3.51	3.85	4.00	N/A	N/A
FIRE PERFORMANCE INFORMATION						
C1.1 Non Combustible C1.9e	Combustible		Combustible		Non-Combustible	
Early fire hazard properties (A.S. 1530.3 1999)	Ignitability - 0		Ignitability - 0		Ignitability - 0	
	Spread of Flame - 0		Spread of Flame - 0		Spread of Flame - 0	
	Heat Evolved - 0		Heat Evolved - 0		Heat Evolved - 0	
	Smoke Developed - 2		Smoke Developed - 1		Smoke Developed - 2	
AS/ISO 9705 classification	Group 1		Group 1		Group 1	
Factory Mutual (FM Approved)	-		-		-	
SMORGA (m2/S2 x 1000)	3.8		2.2		N/A	
Non Load Bearing Wall (AS 1530.4:2014)	N/A		N/A		-/60/120	
PHYSICAL INFORMATION						
Panel Weights: 0.6mm skins at 100mm core	11.6kgs/m^2		14.2kgs/m^2		20.25kgs/m^2	
Recyclability	Yes		Yes		Limited	
Safety handling requirements	Safety Data Sheet		Safety Data Sheet		Safety Data Sheet	

Delta Insulation Systems
P: +61 07 3271 2170 E: info@deltainsulationsystems.com W: www.deltainsulationsystems.com.au
A: 49 Bernoulli Street, Darra Qld. 4076 ABN: 12 122 760 552