

TenCoat™ Marine 5-Layer Foam Polypropylene (5LPP Foam)

TenCoat™ Marine 5-Layer Polypropylene is a high performance external coating developed to provide thermal insulation to tubular systems in shallow and deep waters maritime environments.

The product can be supplied with the desired thickness and coating configura-

tion in order to fulfill the requested thermal performance (during steady and transient states) and installation requirements of each project.

Typical field conditions where TenCoat™ Marine 5-Layer Foam Polypropylene is used are temperatures ranging up to

140°C and water depths up to 600 meters. Besides thermal properties, TenCoat™ Marine 5-Layer Polypropylene is able to supply excellent anticorrosive properties and mechanical resistance.

Insulation properties

PROPERTY	STANDARD	LAYER	UNIT	VALUE
Thermal Conductivity	ISO 8301	Solid PP PP Foam	W/(m.K)	0.20 – 0.22 0.165 – 0.175
Specific Heat Capacity	ISO 11357 - 4	Solid PP PP Foam	J/(g.K)	1.8 – 2.4 (20°C – 80°C) 1.8 – 2.1 (20°C – 80°C)

Mechanical properties

PROPERTY	STANDARD	LAYER	UNIT	VALUE
Adhesion Resistance	ISO 21809 - 1	3LPP	N/mm	≥ 25 at 23°C ≥ 10 at 90°C
Compression Strength	ISO 844	Solid PP PP Foam	MPa	≥ 25 ≥ 10
Tensile Strength at Break	ISO 527	Solid PP PP Foam	MPa	≥ 18 ≥ 6
Elongation at Break	ISO 527	Solid PP PP Foam	%	≥ 400 ≥ 80
Adhesion Between Layers	Internal Procedure	Solid PP – PP Foam PP Foam – PP Foam	MPa	≥ 5 ≥ 5
Abrasion (CS 17 Wheel / 1000 Cycles / 1 Kg)	ASTM D 4060	Solid PP	mg	≥ 30
Indentation	ISO 21809 -1	Solid PP	mm	≤ 0.1 at 23°C ≤ 0.4 at 110°C
Hardness at 1 second	ISO 868	Solid PP PP Foam	Shore D	≥ 65 ≥ 45
Fatigue 0.2% Strain	ISO 12736 – Annex C	5LPP Foam	Cycles (No failures)	>1,000,000
Reeling Test (Simulated Bend Test) Bend radius 7.0 m, Straightening radius: 31.1 m	ISO 12736 – Annex B	5LPP Foam	–	No defects
Impact Resistance	ISO 12736 – Annex E	5LPP Foam	kJ	≥ 12
Shear Test	ISO 12736 – Annex I	5LPP Foam	MPa	≥ 0.5
UV Resistance 5 GJ/m²	ISO 21809 -1 Annex G	Solid PP (Top coat)	% MFI	≤ 35 from original value
Heat Ageing	ISO 21809 -1 Annex G	Solid PP (Top coat)	% MFI	≤ 35 from original value

Physical properties

PROPERTY	STANDARD	LAYER	UNIT	VALUE
Density	ISO 1183	PP Adhesive Solid PP PP Syntactic	g/cm ³	0.89 – 0.91 0.89 – 0.91 0.72 – 0.76
Melting Point	ISO 11357 - 3	PP Adhesive Solid PP PP Syntactic	°C	≥ 140 ≥ 160 ≥ 160
Cathodic Disbondment @ 48 hs / 90 ± 3°C / -1.5V / NaCl (3%)	ISO 21809 - 1	3LPP	mm	≤ 3
Cathodic Disbondment @ 28 days / 20 ± 3°C / -1.5V / NaCl (3%)	ISO 21809 - 1	3LPP	mm	≤ 5
Water Absorption (1 bar, 65°C, 7 days)	ASTM D 570	Solid PP PP Foam	%	≤ 0.5 ≤ 3.0
Tri-axial Creep (60 bar, 90°C, 28 days)	ISO 12736 – Annex A	Solid PP PP Foam	%	≤ 0.5 ≤ 3.0

Track record

Year	Project	Contractor	End Customer	STEEL PIPE CHARACTERISTICS			COATING CHARACTERISTICS			
				OD [mm]	WT [mm]	Length [m]	Thickness [mm]	Max. Temp. [°C]	Installation method	U-value [W/m ² K]
2016	Peregrino (Qualification)	Subsea 7	Petrobras	273.1	20.6	500	48	80	Reel Lay	5.25
				323.9	17.5	500	45			5.20



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