

# TenCoat™ Marine 5-Layer Syntactic Polypropylene (5LPP Syntactic)

TenCoat™ Marine 5-Layer Polypropylene is a high performance external coating developed to provide thermal insulation to tubular systems in deep water 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 Polypropylene is used are temperatures ranging up to 140°C

and water depths up to 3000 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 Syntactic	W/(m.K)	0.20 – 0.22 0.150 – 0.165
Specific Heat Capacity	ISO 11357 - 4	Solid PP PP Syntactic	J/(g.K)	1.8 – 2.4 (20°C – 80°C) 1.6 – 2.0 (20°C – 80°C)

## Mechanical properties

PROPERTY	STANDARD	LAYER	UNIT	VALUE
Peel Strength	ISO 21809 - 1	3LPP	N/mm	≥ 25 at 23°C ≥ 10 at 90°C
Compression Strength @ 10% strain	ISO 844	Solid PP PP Syntactic	MPa	≥ 25 ≥ 14
Compression Module	ISO 844	Solid PP PP Syntactic	MPa	≥ 900 ≥ 750
Tensile Strength at Break	ISO 527	Solid PP PP Syntactic	MPa	≥ 18 ≥ 6
Elongation at Break	ISO 527	Solid PP PP Syntactic	%	≥ 400 ≥ 100
Young Module	ISO 527	Solid PP PP Syntactic	MPa	≥ 900 ≥ 850
Adhesion Between Layers	Internal Procedure	Solid PP – PP Syntactic PP Syntactic – PP Syntactic	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 Syntactic	Shore D	≥ 65 ≥ 55
Fatigue 0.2% Strain	ISO 12736 – Annex C	5LPP Syntactic	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 Syntactic	–	No defects
Impact Resistance	ISO 12736 – Annex E	5LPP Syntactic	kJ	≥ 12
Interlayer Ring Shear Test	ISO 12736 – Annex I	5LPP Syntactic	MPa	≥ 5
UV Resistance 5 GJ/m <sup>2</sup>	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

### Notes

- \* Any additional property not listed, can be provided upon request.
- \* The nominal values informed herein should not to be considered as specification limits

## Physical properties

PROPERTY	STANDARD	LAYER	UNIT	VALUE
Density	ISO 1183	PP Adhesive Solid PP PP Syntactic	g/cm <sup>3</sup>	0.89 – 0.91 0.89 – 0.91 0.65 – 0.69
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 (250 bar, 120°C, 125 days)	ASTM D 570	Solid PP PP Syntactic	%	≤ 0.5 ≤ 3.0
Tri-axial Creep (250 bar, 120°C, 125 days)	ISO 12736 – Annex A	Solid PP PP Syntactic	%	≤ 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 <sup>2</sup> K]
2012	Guara Lula	Subsea 7	Petrobras	239.8	14.6	11,500	41	80	Reel Lay	5.90
				199.6	14.6	70,000	76	3.70		
2013	Egina	Saipem	Total	355.6	27.0	33,000	110	74	J Lay	2.70
				457.2	31.8	6,000	115	4.40		
	Kizomba Satellite II	Saipem	ExxonMobil	219.1	20.6	800	84	85	J Lay	4.00
				273.1	22.2	900	77	4.00		
323.9	23.8	1050	69	4.00						
2014	Akpo Ext.	Saipem	Total	308.0	27.0	2500	107	74	J Lay	2.85
				168.3	15.9	5,950	135	120		2.90
	Gunflint	EMAS	Noble Energy	219.1	34.1	6350	56	94	Reel Lay	5.68
				244.5	20.6	26,360	105	95		2.67
274.5	19.0	15,860	92	80	2.96					
2015	Block 15 EH	Saipem	ENI	273.1	25.3	10,000	76	80	J Lay	3.65
				314.9	27.3	1950	185	120		1.86
	253.5	22.0	900	200	120	1.86				
2016	Kodiak	Technip	DGE	193.7	30.2	12,000	83	130	Reel Lay	4.30



For additional information, please visit  
[www.tenaris.com](http://www.tenaris.com)



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