GEOQUEST

FREYSSINET
SUSTAINABLE TECHNOLOGY

Wynalazca i prekursor technologii gruntu zbrojonego na świecie i w Polsce (zdj. Freyssisol®)

Łukowe prefabrykowane obiekty inżynierskie TechSpan®

ArmaLynk® – geosiatki o ultrawysokiej wytrzymałości do wzmacniania i stabilizacji podłoża przy budowie dróg, linii kolejowych, mostów, wiaduktów, platform roboczych

ArmaGrid® – jedno- lub dwukierunkowe siatki PP do wzmacniania podłoża to wytrzymałość na rozciąganie do 300 KN/m, odporność na starzenie, agresję chemiczną i biologiczną

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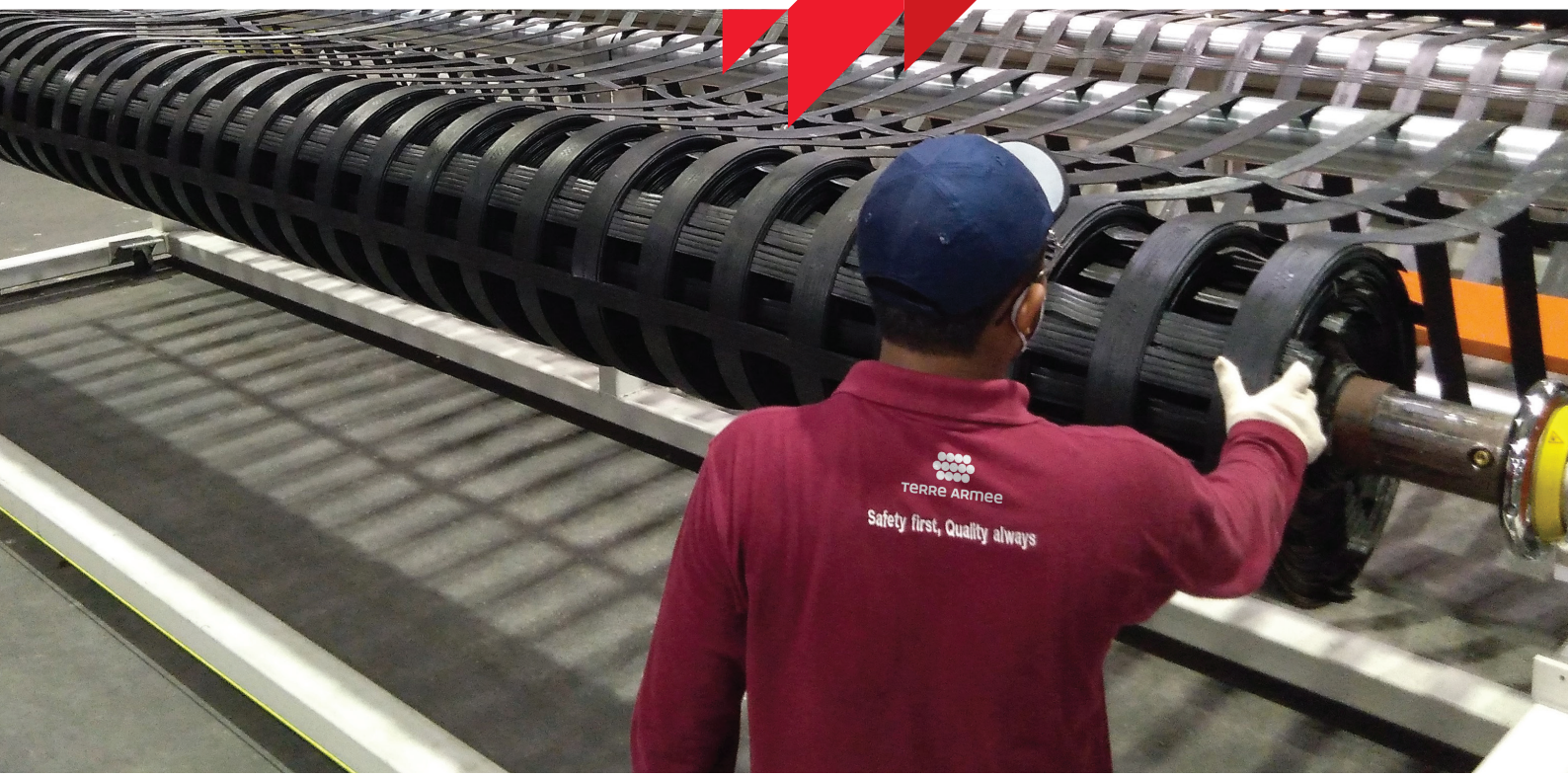
TERRE ARMEE



ArmaLynk – PET$_{HS}$

HIGH STRENGTH
SOIL REINFORCEMENT GEOSYNTHETICS

Basal Reinforcement

ArmaLynk – PET_{HS}

ArmaLynk–PET_{HS} is a soil reinforcement geosynthetic, manufactured from high tenacity polyester yarns, extruded and coated to form polymeric strips encased in Polyethylene sheath, and welded together to cross strips to generate a stable and strong geogrid structure.

Applications

- **Basal Reinforcement:**

  1. Embankments Over Soft and Very Soft Soils: The stability of an embankment on soft soil is governed mostly by the shearing resistance of the foundation. Essentially, the construction of an embankment on soft soil is a problem of bearing capacity. Embankment on soft soil reinforced with ArmaLynk provides additional stability to the embankment i.e. to prevent possible slips from occurring. ArmaLynk design utilizes standard geotechnical practices to integrate strong unidirectional geosynthetic grids engineered to bear loads with minimum deformation. ArmaLynk helps in reducing the construction time and increases the global performance of the project when compared with conventional methods like excavation and replacement, displacement, desiccation, progressive displacement, chemical stabilization etc.

  2. Reinforced Embankments Over Areas Prone to Subsidence: Subsidence typically results from the sudden collapse of a subterranean cavity, typically formed as a result of natural processes such as erosion in karst areas or human intervention such as mining shafts or groundwater exploitation. Reinforced embankments with ArmaLynk over areas prone to subsidence are the subset of basal reinforcement that aims to reduce the impact of a collapse providing support to the embankment, while minimizing the effects of the failure in the surface deformation. The inclusion of ArmaLynk reinforcement ensures the possibility of first detecting a failure, second, a quick reaction allowing the repairs and filling the void underneath the embankment structure without a complete collapse.

  3. Piled Embankment with Basal Reinforcement: Structures founded over soft soils such as bridges, piers, and tanks commonly utilize piles to reduce settlements. The interaction between the piles, ArmaLynk and the granular fill provides an engineered system leading to more resilient infrastructure. The benefits of ArmaLynk are the decrease in the number of inclusions needed, faster construction, and better control of differential settlements associated with soft soils.

- **Piggyback Landfill Expansions:** High strength ArmaLynk geosynthetics can be efficiently used in combination with other Terre Armée products for landfill piggybacking to solve the ever-growing problem of waste materials disposal, especially for raising of the dykes over existing landfills and increasing the capacity of abandoned landfills.
- **Lagoon Closures:** ArmaLynk in combination with other Terre Armée products facilitates sludge lagoons remediation on soft to very soft ground condition together with special geotechnical stabilisation techniques and helps in land reclamation and redevelopment for various purposes like waste lagoon and sludge pond closures.
- **Access Roads and Load Bearing Platforms:** ArmaLynk when used in the ground improvement process of access road for heavy load movements and for load bearing platforms, induces stiffness to the soil underneath, improves lateral restraint, reduces the applied load on the soft soil and controls the differential settlement. It is used in the transition layer for distribution and transfer of load to rigid inclusions like stone columns or piles in soft foundation and optimises the requirement of such rigid inclusions.

Technical Properties

Grade	Units	AL_{PET} 200	AL_{PET} 300	AL_{PET} 400	AL_{PET} 500	AL_{PET} 600	AL_{PET} 700	AL_{PET} 800	AL_{PET} 900	AL_{PET} 1000	AL_{PET} 1100	AL_{PET} 1200	AL_{PET} 1300	AL_{PET} 1400	AL_{PET} 1500	AL_{PET} 1600
Nominal Tensile Strength	kN/m	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
Elongation at Nominal Strength	%	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Width of the single strip	mm	50	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Characteristic strength of each strip	kN	50	75	75	120	120	120	120	120	120	120	120	135	135	135	135
Polymer on the tensile element (MD)	-	High Tensile Polyester (HT-PET)														
Polymer Sheathing	-	Linear Low-Density Polyethylene (LLDPE)														
Thickness of the reinforcement strip	mm	2.60	2.50	2.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.80	4.80	4.80	4.80
Pitch (weft x wrap)	cm	100x24	100x25	100x19	100x24	100x20	100x17	100x15	100x13	100x12	100x11	100x10	100x13	100x13	100x14	100x14
Nominal Roll Length	m	200	175	150	125	100	100	90	75	60	60	60	60	50	40	40
Nominal Roll Width	m	5.70														
Nominal Roll Weight	kg	565	700	780	760	700	825	850	780	700	730	775	830	745	650	690

i. Length, width and weight are estimated values. Customized lengths and width are available upon request.
ii. Roll weight includes the core weight.
iii. Tolerance (a) Warp=10mm (b) Weft= 15mm

NOTES

A. Properties are subject to change without notification. Please contact us for the latest update on the specifications.

B. The property values listed above are effective: November 2022.

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Local Contact: .....

November, 2022 (TAF)

TERRE ARMEE

Sub-grade Stabilisation

ArmaGrid – BX_{pp}

INTEGRAL POLYPROPYLENE
BIAXIAL GEOGRIDS

Track Bed Stabilisation

ArmaGrid – BX_{PP}

ArmaGrid – BX_{PP} is a biaxial geogrid made from polypropylene by accurate punching, and then stretching in two directions under strictly controlled conditions with a continuous orientation through the nodes. ArmaGrid – BX_{PP} is inert to chemicals, including acids, alkalis and salts, normally found in soils. ArmaGrid – BX_{PP} does not suffer any attack by microorganisms in soil.

Applications

- **Railways**: Enhancing the ballast performance in railways and stabilisation of track foundation layers with reduced ballast degradation and settlement.
- **Roadways**: Subbase and sub-grade improvement by reinforcement and stabilisation; and increase in durability of flexible pavement and unpaved roads.
- **Airport Runways and Taxiways**: Subbase and sub-grade improvement for the runway and taxiway pavements of airfield.
- **Ports**: Sub-grade reinforcement and load distribution for container yards, under warehouse or similar load carrying platforms.

Technical Parameters

Properties		Test Method	Unit	AG-BX_{PP} 1616	AG-BX_{PP} 2020	AG-BX_{PP} 3030	AG-BX_{PP} 4040	AG-BX_{PP} 2020L	AG-BX_{PP} 3030L	AG-BX_{PP} 4040L
Physical Properties[i]										
Material				Polypropylene						
Pitch Size	Pmd[vi]		mm	40	40	40	38	66	66	61
Pitch Size	Ptd[vi]		mm	40	40	40	38	66	66	61
Rib Width	Wmd[vi]		mm	2.3	2.3	2.4	2.6	4.4	4.4	4.7
Rib Width	Wtd[vi]		mm	3.1	3.1	3.7	4.5	5.5	5.6	6.1
Rib Depth	Tmd[vi]		mm	1.2	1.3	2.4	2.8	1.4	2	2.8
Rib Depth	Ttd[vi]		mm	0.6	0.7	1	1	0.7	0.9	1.1
Tj[vi]		-	mm	1.7	2.1	2.5	3.5	3	3.6	4.5
Mechanical Properties										
				Minimum Average Roll Value (MARV)[ii]						
Ultimate Tensile Strength	MD[v]	ASTM D6637 B	kN/m	16	20	30	40	20	30	40
	CD[v]	ASTM D6637 B	kN/m	16	20	30	40	20	30	40
Maximum Elongation (±6)	MD[v]	ASTM D6637 B	%	15	15	15	15	15	15	15
Maximum Elongation (±3)	CD[v]	ASTM D6637 B	%	10	10	10	10	10	10	10
Tensile Strength @ 2% Strain	MD[v]	ASTM D6637 B	kN/m	5.6	7	11	14	7	11	14
	CD[v]	ASTM D6637 B	kN/m	5.6	7.4	11	14	7.4	11	14
Tensile Strength @ 5% Strain	MD[v]	ASTM D6637 B	kN/m	11.2	14	21	28	14	21	28
	CD[v]	ASTM D6637 B	kN/m	11.2	14.6	21	28	14.6	21	28
Junction Efficiency		ASTM D7737/D6637	%	95%	95%	95%	95%	95%	95%	95%
Radial Stiffness[iv]		ASTM D6637	kN/m	280	350	550	700	350	550	700
Standard Packaging										
Roll Width[vii]			m	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Roll Length[vii]			m	100	51.3	51.3	30.8	51.3	51.3	30.8
Standard Roll Area[iii]			m^2	390	200	200	120	200	200	120

[i] All the values are Nominal values
[ii] Values shown are minimum average roll values determinate in accordance with ASTMD4759.
[iii] Other weight option available
[iv] At 2% strain under 360° radial loading. Determined from tests in accordance with ISO10319.
[v] MD= Machine Direction, CD= Cross Machine Direction
[vi] Refer to figure 1
[vii] These values are subject to ±1% variation

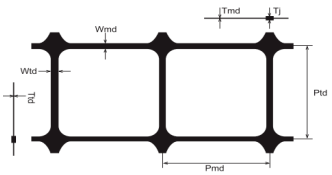

Figure 1

NOTES
A. These properties may change at the time of handling, storage and shipping.
B. The values can be customized.
C. The above values are subject to change as per discretion of the company
D. All mechanical properties are based on the manufacturer's laboratory test results at 21±1°C.
E. Carbon black content ≥ 2%
F. ASTM D7737 performed at 10% per minute strain rate.
G. Expressed as a comparison of ASTM D7737 strength to ASTM D6637 strength of the same sample.
H. Using specimens 2 ribs wide with ribs transverse to the specimen cut flush with the exterior edges of the ribs in the direction of the specimen.

Local Contact: .....

March, 2021

TERRE ARMEE

Embankment on Soft Soil

Temporary Reinforced Slope

ArmaGrid – UX_{PP}

INTEGRAL POLYPROPYLENE
UNIAXIAL GEOGRIDS

ArmaGrid – UX_{PP}

Uniaxial PP ArmaGrid is made of polypropylene, by the process of stretching of high quality punched sheet in one direction under strictly controlled conditions. ArmaGrid – UX_{PP} has consistent high performance properties including high tensile strength up to 300KN/m and high modulus, ageing resistance, chemical and biological durability. These products are used where high strength is required for a relatively short period, for example during the consolidation of embankment foundations.

Applications

- **Foundation Treatment:** ArmaGrid – UX_{PP} with their high tensile strength and optimum interlock characteristics, combined with compacted granular fill, with its high compressive strength, provide an integrated load-bearing platform on soft ground.
- **Embankment on Soft Soil:** Often considerable consolidation takes place in the soft soil before it develops adequate bearing capacity during the construction of high embankments. The conventional process is to build the embankment in stages so that the embankment height is only increased as the ground develops sufficient strength to support the embankment, without risk of global stability failures. Under these conditions, construction time can be significantly shortened by using High Strength Uniaxial PP TA Grids to reinforce the base of the embankment. ArmaGrid – UX_{PP} are useful for strengthening of soft soil for dam construction, land reclamation project and alike.
- **Temporary Reinforced Slope**: ArmaGrid – UX_{PP} can be used to build reinforced steep slopes required for relatively short service life periods (typically, less than 5 years), in which the long term design strength of soil reinforcement is ignored in design. Such applications are necessary for construction of temporary elevated diversions, protective bunds, steep slopes and overpass embankments and for short term construction needs like for flyovers, interchanges, bridging and underpass solutions where space constraints and site encumbrances prevent permanent works at early construction stages.

Technical Parameters

Properties	Test Method	Unit	AG-UX_{PP} 120B	AG-UX_{PP} 160B	AG-UX_{PP} 200B	AG-UX_{PP} 260B	AG-UX_{PP} 300B
Physical Properties							
Material			Polypropylene				
Atd[i]		mm	19	19	19	19	19
Bw[i]		mm	19	19	19	19	19
Sw[i]		mm	5.5	5.5	5.5	5.5	5.5
Tb[i]		mm	4	5	6.2	6.8	6.9
Tr[i]		mm	1.4	1.7	2.1	2.6	2.8
Pnom[i]		mm	450	450	450	450	450
Mechanical Properties							
			Minimum Average Roll Value (MARV)[ii]				
Ultimate Tensile Strength	ASTM D6637 B	kN/m	120	160	200	260	300
Tensile Strength 2% Strain[iv]	ASTM D6637 B	kN/m	45	60	80	100	110
Tensile Strength 5% Strain	ASTM D6637 B	kN/m	90	120	150	200	220
Typical Stain at Peak Load		%	8	8	8	8	8
Standard Packaging							
Roll Width[v]		m	3	3	3	3	3
Roll Length[v]		m	50	50	50	50	50
Standard Roll Area[iii]		m^2	150	150	150	150	150

[i] Refer to figure 1
[ii] Values shown are minimum average roll values
[iii] Other roll option available
[iv] At 2% strain under 3600 radial loading. Determined from tests in accordance with ISO 10319.
[v] These values are subject to ±1% variation

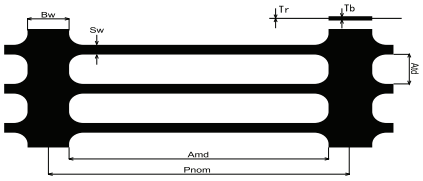

Figure 1

NOTES
A. These properties may change at the time of handling, storage and shipping.
B. Other grades and polyester material also available as per requirement
C. The values can be customized.
D. The above values are subject to change as per discretion of the company
E. All Strength and Load figures are based on test results from the manufacturer's laboratory in accordance with ISO 10319 at the temperature of 21±1°C and calculated as a lower 95% Confidence limit in accordance with ISO 2602.
F. Carbon Black content ≥ 0.5%.
G. Measured by comparing the results of tests in accordance with test methods GRI/GG2 and GRI/GG1.

Local Contact: .....

March, 2021

TERRE ARMEE

Soil Reinforcement

ArmaGrid – UX PET

COATED POLYESTER UNIAXIAL GEOGRIDS

Foundation Improvement

ArmaGrid – UX_{PET}

ArmaGrid – UX_{PET} is a knitted polyester Geogrid providing tensile reinforcement capacity in one direction. ArmaGrid – UX_{PET} is best suited for demanding soil reinforcement applications.

Applications

- **Steep Slopes**: Used as soil reinforcement for reinforced soil steep slopes and embankments.
- **Basal Reinforcement**: ArmaGrid – UX_{PET} improves the stability of soft sub-soils by interacting with engineered fill and providing a strong mattress foundation for embankments and platforms.
- **Foundation Improvement**: ArmaGrid – UX_{PET} is used to support shallow structural foundations, by improving stability, enhancing load distribution and reducing differential settlement.

Technical Parameters

Properties	Test Method	Units	AG-UX_{PET} 40	AG-UX_{PET} 60	AG-UX_{PET} 80	AG-UX_{PET} 100	AG-UX_{PET} 120	AG-UX_{PET} 150	AG-UX_{PET} 180	AG-UX_{PET} 200	AG-UX_{PET} 250	AG-UX_{PET} 300
			Minimum Average Roll Value (MARV)[i]									
Physical Properties												
Material			Polyester									
Mechanical Properties												
Ultimate Tensile Strength in Machine Direction	ASTM D 6637B	kN/m	40	60	80	100	120	150	180	200	250	300
UltimateTensile Strength in Cross Machine Direction		kN/m	20	20	30	30	30	30	30	30	30	30
Elongation at Designated Strength (±2%)		%	10	10	10	10	10	10	10	11	11	11
Tensile Strength at 5% Strain (±5%)			20	30	40	50	60	75	81	90	100	120
Creep Reduction Factor (114 Years Design Life)	ASTM D 6637A	at 20°C	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39
		at 30°C	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Partial Factor - Installation Damage	ASTM D 5818	Particle size < 5mm (Silty Sand)	1.10	1.10	1.02	1.02	1.02	1.02	1.02	1.06	1.06	1.06
		Particle size < 35mm (Gravely Sand)	1.12	1.12	1.06	1.06	1.04	1.04	1.04	1.10	1.10	1.10
		Particle size < 125mm (Sandy Gravel)	1.19	1.19	1.16	1.16	1.11	1.11	1.11	1.10	1.10	1.10
Partial Factor - Environmental Effects	GRI-GG7, GRI-GG8 Environment	4 < pH < 8	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Molecular Properties												
Molecular Weight (GRI GG8)		g/mol	minimum 25,000									
Carboxyl End Group (CEG) (GRI GG7)		mmol/kg	maximun 30									
Standard Packaging												
Roll Width[ii]		m	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Roll Length[ii]		m	100	100	100	100	100	100	100	100	100	100
Roll Area[ii]		m^2	380	380	380	380	380	380	380	380	380	380
Weight Per Roll[iii]		kg	90.5	112.9	138.4	157.8	182.1	199.2	232.6	246.7	287	315

[i] All the values mentioned are of minimum average roll values (MARV).
[ii] These values are subject to ±1% variation
[iii] Other roll sizes available

NOTES
A. All prescribed values are minimum unless otherwise mentioned and tested in GAI-LAP accredited laboratories.
B. These properties may change at the time of handling, storage and shipping.
C. Roll weights are average values including shipping cores. Actual roll weight may vary.
D. Customized rolls with varying lengths or master rolls can be manufactured.
E. The above values are subject to change as per discretion of the company.

Local Contact: .....

March, 2021