

STRENGTH IN DEPTH

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OIL & GAS



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LANKHORST OFFSHORE... STRENGTH IN DEPTH

Lankhorst Offshore is a world leader in the development, engineering and manufacture of synthetic fibre ropes for deepwater mooring, fibre rope deployment systems, riser and mid-water arch tether systems, single point mooring offloading systems and floating offshore wind turbines.

Innovation is at the heart of our business. We are committed to setting the standard for performance and reliability in the most demanding offshore environments. Our strengths in engineering and technical know-how are matched by an in-depth knowledge of offshore applications stretching back over more than 200 years.

Lankhorst Offshore continuously strives for improved product performance, customer satisfaction and product innovation. As part of WireCo® WorldGroup, the world's leader in manufacturing, engineering, and distributing wire rope, synthetic rope, specialized assemblies, wire products and electromechanical cable, we draw on extensive research and testing facilities at WireCo® WorldGroup's Global Synthetics R&D facility in Portugal. Here we have an on-going research program into mooring and deployment rope materials and constructions, designed to support offshore energy companies in meeting ever more demanding project and environmental challenges.

We have fully equipped production sites and R&D facilities located in Portugal, and at our sister company Lankhorst Euronete Brasil Industria e Comercio Ltds (LEB), with capabilities to develop and manufacture a wide range of offshore ropes.

Lankhorst Euronete Portugal has been certified by Lloyd's Register Quality Assurance and Lankhorst Euronete Brasil by Bureau Veritas Certification according to ISO 9001:2015.

Lankhorst Offshore trades under the names of Lankhorst Euronete Portugal S.A. (LEP) and Lankhorst Euronete Brasil (LEB).

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OMMERCIALIZATION OF OPES, BRAIDED ROPES, ORING SYSTEMS.
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LOCATIONS The most modern factories in the world dedicated to production Viana do Castelo (Portugal) of ropes for the offshore industry: Portugal The Lankhorst Offshore site of 6,000 m² is located in Viana do Castelo, Portugal and became operational in September 2012. It is the most modern factory worldwide dedicated to the production of ropes for the offshore industry. Rio de Janeiro Positioned near the port of Viana do Castelo, the facility is well suited to produce heavy deepwater mooring ropes. Next to this facility we have factories in Maia and Paredes. The company entered the deepwater tether market in 1998. The recent commissioning of a new reel take-up stand brings our factory / sales office capacity to handle single piece weights of up to 250 tonnes gross (rope and reel).

Lankhorst Euronete Portugal in Viana do Castelo 🛛 🗧

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Brazil

The production facility of Lankhorst Euronete Brasil covers around 10,000m² in an 17,000m² property in the industrial site of Queimados in Rio de Janeiro with easy access to the ports of Rio de Janeiro and Sepetiba. The company started production of deepwater mooring ropes in 2012. Production capacity was doubled in 2015 with the addition of a complete new production line using state-of-the-art machinery.

FACILITIES

The factories are dedicated to the design, production and testing of offshore mooring ropes and specialty products such as deepwater installation ropes and synthetic tethers. Modern production and testing equipment permits all the following activities to be undertaken in-house:

- Stranding of base yarn into strands
- Braiding or twisting of strands into sub-ropes
- Application of soil ingress filters
- Production of braided jacket material (twisted yarn / cut resistant tape)
- Closing (over braiding) of sub-ropes into mooring ropes
- Length Measurement System (LMS) under tension up to 30 tonnes
- Length marking under tension in 75 m increments
- Axial (anti-twist) line marking
- Full scale proto-type testing
 - Break strength testing up to 1,200 tonnes
 - Tension-tension fatigue testing
 - Stiffness and elongation testing
 - Simulation of installation and "What If" scenarios
 - Cut resistant jacket testing
 - Linear density testing.



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SECURE TETHERING ...

With growing consolidation of offshore oil and gas fields, through longer tie backs, the integrity and reliability of synthetic fibre tethers are crucial in ensuring the smooth flow of oil to surface processing facilities. Lankhorst Offshore's high performance tethers provide an effective method of securing risers, umbilicals and mooring mid-water arches connected to subsea production systems such as well manifolds, wellheads, Christmas trees and well jumpers.

Lankhorst deepwater tethers are project specific and engineered to withstand the prevailing subsea conditions. Rope construction and performance that has set the standard for deepwater moorings provides the strength and mechanical performance expected of these long-term tethers.

The synthetic tethers are available as either a LANKO®FORCE or GAMA 98® rope construction in Dyneema®. The high modulus polyethylene core provides the strength and mechanical performance expected of these subsea tethers. The entire rope core is protected by a braided jacket and polyurethane coating and includes ROV handling points for ease of installation and maximum service life.

All riser, umbilical and mid-water arch tethers are manufactured at the Lankhorst Offshore deepwater rope production facility in Portugal. In addition to industry leading, rope manufacture and test facilities, the company's rope engineering team is able to provide comprehensive technical support at every stage of tether production. During tether installation, Lankhorst is able to ensure that experienced service engineers are on hand to monitor on-site handling and installation, as required.

Lankhorst synthetic tethers are highly technical products that provide the highest levels of mechanical and fatigue performance for production critical risers, umbilicals and mid-water arches over many years.





LANKHORST SUBSEA TETHERS ARE ENGINEERED TO WITHSTAND THE PREVAILING SUBSEA CONDITIONS

INDUSTRY LEADING ROPE TEST FACILITY

Lankhorst Offshore has a dedicated rope test machine for loads up to 1,200 tonnes. It can also conduct tension-tension fatigue testing of ropes to any fatigue regime specified by clients and certified verification authorities. The test facility can be used for proof loading and length verification of tethers up to 25m in accordance with various industry standards such as ABS, BV and DNV GL rules.



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TETHER SELECTION

SYNTHETIC FIBRE TETHERS

Lankhorst Offshore synthetic fibre tethers have a proven track in demanding offshore applications such as riser and umbilical tethers and mooring mid-water arches.

The use of synthetic fibre tethers such as the LANKO®FORCE and GAMA98® with Dyneema® has significant performance advantages over chain and steel wire tethers. In addition to being lighter and with almost neutral buoyancy, synthetic fibre tethers offer:

- Reduced cost of buoyancy elements
- No corrosion
- No fatigue issues
- Easy system installation.





RISERS, UMBILICALS AND MWA TETHERS



Strength, weight and stiffness

LANKO[®]FORCE and GAMA98[®] Dyneema[®] ropes has the same (or lower) diameter as a conventional steel wire rope yet the corresponding weight is 7 times lower. In water, it has negligible weight. The stiffness is similar to steel wire.

Filter

Filter elements are included between jacket and sub-rope cores. They are effective in filtering out particles greater than 5 microns whilst allowing free flooding of the rope.

Creep

Under constant loading, LANKO[®]FORCE and GAMA98[®] Dyneema[®] rope can show an irreversible deformation that will depend on the time, load and temperature. For 25 years and for normal water temperatures, the irreversible elongation (creep) is null.

Fatigue

The fatigue life of synthetic ropes is typically quoted as being at least 80 decades superior to steel wire rope.









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A 12 strand braided rope made of Dyneema® DM20, protected with a braided jacket made of polyester, Tipto® or Dyneema®.

ELONGATION:





SPECIFIC GRAVITY **UV-RESISTANCE** ABRASION RESISTANCE very good

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0,97 excellent

- ٦ 8
- MELTING POINT CORE approx. 147 °C

CONSTRUCTION

- WATER ABSORPTION 0%
- 12 strand with jacket

CHEMICAL RESISTANCE good

LANKO[®]FORCE WITH POLYESTER JACKET R30 <

LANKO[®]FORCE WITH TIPTO® JACKET R31 🖤



MELTING POINT JACKET Jt COLOUR

approx. 265 °C

white

MARKER	YARN	

blue and orange

ø	weight in air	weight in water	minimum bro	eaking force
mm	kg/100m	kg/100m	kN	ton
$\begin{array}{c} 30\\ 34\\ 36\\ 38\\ 40\\ 44\\ 46\\ 48\\ 50\\ 52\\ 60\\ 62\\ 64\\ 68\\ 74\\ 82\\ 84\\ 92\\ 102\\ 108\\ 118\\ 126\\ 134\\ 146\\ 160 \end{array}$	$\begin{array}{r} 49.3\\ 65\\ 80.7\\ 85.1\\ 94.2\\ 105\\ 123\\ 130\\ 144\\ 159\\ 193\\ 215\\ 219\\ 255\\ 310\\ 354\\ 411\\ 454\\ 528\\ 618\\ 725\\ 855\\ 957\\ 1,133\\ 1,339\end{array}$	3.0 5.1 7.1 6.9 6.7 6.8 8.8 9.4 8.9 10.9 13.7 13.7 13.7 13.1 12.1 12.8 14.3 19.3 17.4 15.8 13.4 15.0 20.2 15.7 27.7 34.4	387 464 547 569 670 783 888 930 1,060 1,140 1,310 1,570 1,650 1,990 2,410 2,800 3,090 3,550 3,900 4,790 5,530 5,920 6,730 7,800 9,020	$\begin{array}{c} 39.5\\ 47.3\\ 55.8\\ 58.0\\ 68.3\\ 79.8\\ 90.5\\ 94.8\\ 105\\ 116\\ 134\\ 160\\ 168\\ 203\\ 245\\ 285\\ 315\\ 362\\ 398\\ 488\\ 564\\ 603\\ 686\\ 795\\ 920\\ \end{array}$



Ĵ,	MELTING POINT JACKET	approx. 140 °C
٢	COLOUR	yellow
ত্	MARKER YARN	blue and orange

ø	weight in air	weight in water	minimum bre	eaking force
mm	kg/100m	kg/100m	kN	ton
$\begin{array}{c} 30\\ 34\\ 36\\ 38\\ 40\\ 44\\ 46\\ 48\\ 50\\ 52\\ 60\\ 62\\ 64\\ 68\\ 74\\ 82\\ 84\\ 92\\ 102\\ 108\\ 118\\ 126\\ 134\\ 146\\ 160\\ \end{array}$	$\begin{array}{c} 44.3\\ 57.4\\ 73.8\\ 78.1\\ 87.2\\ 97.7\\ 106\\ 114\\ 125\\ 142\\ 164\\ 185\\ 196\\ 234\\ 285\\ 315\\ 370\\ 412\\ 485\\ 574\\ 661\\ 786\\ 888\\ 1,033\\ 1,224\\ \end{array}$	$\begin{array}{c} -3.3\\ -4.6\\ -6.2\\ -6.4\\ -6.9\\ -7.5\\ -7.9\\ -8.6\\ -9.0\\ -10.7\\ -11.9\\ -13.1\\ -14.7\\ -15.6\\ -19.1\\ -20.2\\ -24.8\\ -26.7\\ -30.4\\ -34.6\\ -38.7\\ -47.2\\ -51.8\\ -51.8\\ -51.8\\ -51.5\\ -73.6\end{array}$	387 464 547 569 670 783 888 930 1,060 1,140 1,310 1,650 1,990 2,410 2,800 3,090 3,550 3,900 4,790 5,530 5,920 6,730 7,800 9,020	39.5 47.3 55.8 68.3 79.8 90.5 94.8 105 116 133.6 160 168 203 245 285 315 362 398 488 564 603 686 795 920

LANKO[®]FORCE WITH DYNEEMA[®] JACKET R32 🖤



Image: Second system
Image: Second system

Image: Second

approx. 147 °C white blue and orange

ø	weight in air	weight in water	minimum br	eaking force
mm	kg/100m	kg/100m	kN	ton
$\begin{array}{c} 30\\ 34\\ 36\\ 38\\ 40\\ 44\\ 46\\ 48\\ 50\\ 52\\ 60\\ 62\\ 64\\ 82\\ 84\\ 92\\ 102\\ 108\\ 118\\ 126\\ 134\\ 146\\ 160\\ \end{array}$	$\begin{array}{r} 44.9\\ 58.3\\ 75.2\\ 79.6\\ 88.6\\ 99.2\\ 108\\ 115\\ 127\\ 144\\ 166\\ 188\\ 196\\ 237\\ 288\\ 318\\ 374\\ 416\\ 489\\ 578\\ 666\\ 792\\ 894\\ 1,041\\ 1,234\\ \end{array}$	-2.3 -2.9 -3.7 -3.9 -4.4 -4.9 -5.2 -5.6 -6.1 -7.0 -9.0 -9.8 -11.2 -13.6 -14.9 -17.6 -19.5 -22.8 -26.8 -30.7 -36.6 -41.1 -47.9 -56.7	387 464 547 569 670 783 888 930 1,060 1,140 1,310 1,570 1,650 1,990 2,410 2,800 3,090 3,550 3,900 4,790 5,530 5,920 6,730 7,800 9,020	$\begin{array}{c} 39.5\\ 47.3\\ 55.8\\ 58\\ 68.3\\ 79.8\\ 90.5\\ 94.8\\ 105\\ 116\\ 134\\ 160\\ 168\\ 203\\ 245\\ 285\\ 315\\ 362\\ 398\\ 488\\ 564\\ 603\\ 686\\ 795\\ 920\\ \end{array}$

GAMA98[®] WITH DYNEEMA[®]



GAMA98[®] made with Dyneema[®] is manufactured from high efficiency sub-ropes cores (strength member) laid parallel within an outer braided jacket (non-strength member). The sub-cores are high efficiency braided Dyneema[®] ropes. The external jacket is a 32-carrier twill polyester braid. This construction is torque balanced and is one of the strongest rope constructions currently available. The breaking load is the same whether the rope is wet or dry and considerably higher than nylon or polyester size for size. The characteristics of high strength, low weight, make this rope easy to handle with consequent reduction in operational costs. The polyester jacket confers to the rope an excellent resistance to abrasion.



ø	weight in air	weight in water	minimum breaking force
mm	kg/m	kg/m	ton
108	5.77	0.115	600
116	6.59	0.132	700
125	7.47	0.113	800
132	8.19	0.096	900
140	9.70	0.255	1,000
156	12.0	0.299	1,250
172	14.4	0.334	1,500
198	19.0	0.386	2,000

ELONGATION:



{	SPECIFIC GRAVITY	variab
*	ABRASION RESISTANCE	excelle
	CHEMICAL RESISTANCE (JA	ACKET)
	acids	good
	alkalis	moder
	oil/gas	very g

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UV-RESISTANCE
MELTING POINT

CONSTRUCTION

COLOUR MARKER YARN

WATER ABSORPTION

excellent approx. 140°C/260°C

white

parallel

red and green

TION 0%

SUBSEA SYNTHETIC TETHERS



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