LANKHORST

STRENGTH IN DEPTH

OG OIL & GAS

SINGLE POINT MOORING.

WIRECO
A World Ahead

LANKHORST

CONTENTS

LANKHORST OFFSHORE... STRENGTH IN DEPTH

Lankhorst Offshore is a world leader in the development, engineering and manufacture of synthetic fibre ropes for single point mooring offloading systems, 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 departments, located in Portugal and at our sister company Lankhorst Euronete Brasil Indústria e Comércio Ltds (LEB), with capabilities to produce 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).

Certificate of Approval

Lankhorst-Euronete Portugal S.A.

LANKHORST EURONETE BRASIL INDÚSTRIA E COMÉRCIO LTDA.

Rua Minas Gerais, 1920, Distrito Industrial, 26373-280 - **Queimado/RJ**

Brazil

Bureau Veritas Certification Holding SAS – UK Branch certifies that the Management System of the above organization has been audited and found to be in accordance with the requirements of the Management System standards detailed below.

Standards

ISO 9001:2015

Scope of Certification

DESIGN, DEVELOPMENT, MANUFACTURE AND COMMERCIALIZATION OF SYNTHETIC FIBER ROPES, SUCH AS: TWISTED ROPES, BRAIDED ROPES, MOORING ROPES AND ROPES FOR ANCHORING SYSTEMS.

Original cycle start date: **08 February 2012**

Expiry date of previous cycle: **06 February 2018**

Certification / Recertification Audit date: **14 December 2017**

Certification / Recertification cycle start date: **06 February 2018**

Subject to the continued satisfactory operation of the organization's Management System, this certificate expires on: **05 February 2021**

Certificate N°: **BR027701** Version: **1** Revision date: **08 January 2018**

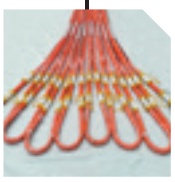
LANKHORST

OIL & GAS

CR Cranes & OEM | MI Mining | EP Engineered products | WI Wire | MA Maritime | YA Yarns | FI Fishing

DEEPWATER MOORING

SINGLE POINT MOORING



SYNTHETIC TETHERS

DEEPWATER DEPLOYMENT

RENEWABLES

LOCATIONS
The most modern factories in the world dedicated to production 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. 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 capacity to handle single piece weights of up to 250 tonnes gross (rope and reel).

Lankhorst Euronete Portugal in Viana do Castelo

Lankhorst Euronete Brasil in Rio de Janeiro

THE MOST MODERN FACTORIES IN THE WORLD DEDICATED TO PRODUCTION OF ROPES FOR THE OFFSHORE INDUSTRY

Brazil
The production facility of Lankhorst Euronete Brasil covers around 10,000m^2 in an 17,000m^2 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. 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.

OFFSPRING INTERNATIONAL LTD (OIL)
Offspring International is the worldwide agent for Lankhorst Offshore single point mooring systems. Formed in 1991, OIL consists of a dedicated team of mooring professionals, who together have over 150 years’ experience in the design, supply and deployment of single point mooring systems. It offers complete project management; this ensures correct and total integration of each system, helping to eliminate operating risks and ensuring targets are met.

LANKHORST OFFSHORE IN SINGLE POINT MOORING

Lankhorst Offshore is a leading supplier of Single Point Mooring (SPM) systems, setting the standard for quality, reliability and performance for offtake systems. Designed to withstand a wide range of offloading environments typical of both oil terminals and Floating Production Storage and Offloading (FPSO) vessels, Lankhorst SPM systems are used worldwide.

All SPM systems are bespoke packages incorporating mooring hawsers, pick-up and messenger ropes, and chafe chains. Together with support buoys, shackles and associated fittings and ancillary equipment. Lankhorst Offshore SPM hawsers and ancillary equipment meet or exceed the latest OCIMF Guidelines for such systems, namely the OCIMF 2000 “Guidelines for the Purchasing & Testing of SPM Hawsers” and OCIMF 2018 “Guidelines for Offshore Tanker Operations”.

Lankhorst Offshore mooring hawser constructions are optimised for not only strength but also energy absorption and fatigue performance. We can assist operators to maximise hawser service life and reduce cost-of-ownership by conducting residual strength testing of used / retired mooring hawsers to better understand hawser behaviour and performance in specific field operations. In this way, terminal operators are better equipped to determine the appropriate hawser for the mooring system and hawser retirement criteria.

LANKHORST EFFECTIVE SINGLE POINT MOORING SYSTEMS ARE USED WORLDWIDE

Total System Management
We offer a comprehensive designed package, tailored to suit individual location requirements and water temperatures. We concentrate on operational performance, reliability, safety and ontime delivery.

Our bespoke packages can incorporate:
- Mooring hawsers
- Pick-up and messenger ropes
- Chafe chains
- Support buoys
- Shackles
- Associated fittings
- Ancillary equipment.

Load monitoring equipment and marine hoses can be supplied via Offspring International Ltd.

Materials
In the manufacture of our mooring system hawsers, we carefully select premium quality yarns of multifilament nylon, HT polyester and blended fibres. For submerged turret loading and recovery systems, we also use Dyneema® fibres. Hawsers can be supplied with an integral flotation system and/or PU encapsulation for increased durability and operational cost savings.

Rope construction
We manufacture in double braid (DOUBLE BRAID 32/64), circular braided (GAMA 98®) and conventional eight strand DOUBLE BRAID constructions.

DOUBLE BRAID conventional 32/64 strand construction with a separate outer braided (64 strands) sheath and an inner braided core (32 strands). The balanced flexible construction distributes the weight and strength equally between the sheath and braided core.

GAMA 98® is constructed from high efficiency sub-rope cores laid parallel within an outer braided jacket. Each sub-rope is computer monitored during production to ensure all sub-ropes have equal tension and length. The outer jacket is essentially non load bearing.

ASTRALINE® based on conventional 8 strand construction manufactured from polyester in combination with polyolefin fibres.

Quality and design
Continuous research and practical field experience, combined with the latest CAD technology, have kept us at the forefront of the technological advancement in the design and manufacture of cost effective, safe offshore mooring systems.

All single point and tandem mooring systems are project designed and custom built under rigorous quality assurance conditions which conform to appropriate classification requirements and / or OCIMF 2000/2018 Guidelines.

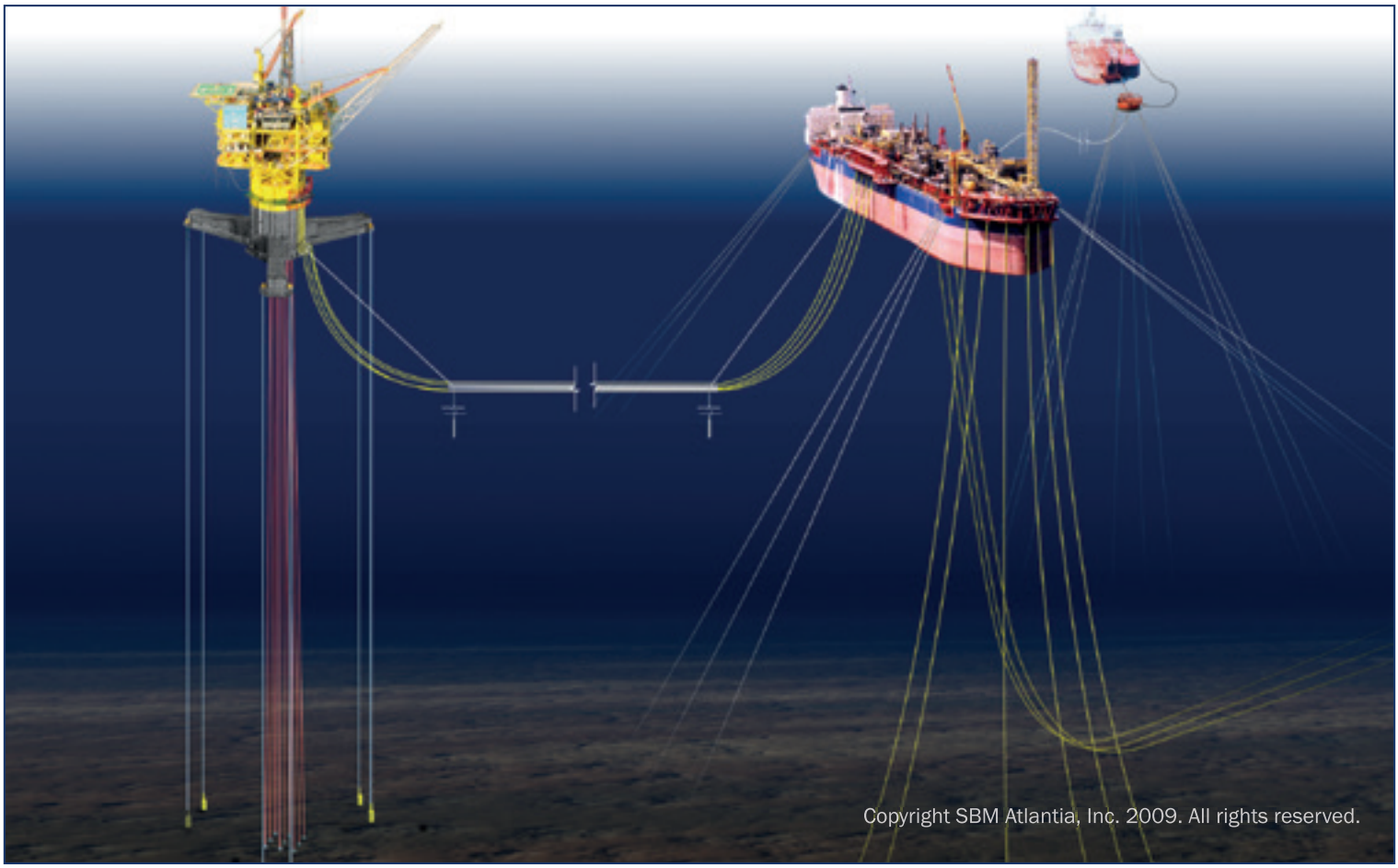
Technical support services
As part of our total commitment and reputation for quality and service, our sales engineering support team is charged with providing invaluable technical support to all our customers. A far reaching service, this can extend from advice given over the telephone regarding the most suitable system for your individual requirements, to visiting operational terminals around the world, with recommendations given at first hand to ensure the most cost effective solutions to in-service problems.

The latest Computer Aided Design and DeskTop Publishing technology allow us to produce “As Built” drawings, and fully documented manuals, for any mooring system to accompany the QA and/or independent inspection authority certification.

Our technical department, responsible for research, design and development, product engineering and quality data management, is manned by highly qualified engineers and inspectors. In addition to a fully equipped chemical laboratory for forensic analyses, we have direct access to in-house computer controlled testing equipment to evaluate, reverse bend, elongation, abrasion, tensile loading of yarn and fibre ropes with a load capacity up to 1,200 tonnes.

OCIMF
We can supply a full range of products manufactured and supplied in strict accordance with the OCIMF 2000 “Guidelines for the Purchasing and Testing of SPM Hawsers” and OCIMF 2018 “Guidelines for Offshore Tanker Operations”. Our technical department is committed to ongoing testing, development and optimisation of rope designs.

EQUIPMENT SELECTION



Mooring hawsers
When selecting hawsers, terminal operators should take into account not only strength but also energy absorption and fatigue performance. Detailed information can be found in the OCIMF 2000 'Guidelines for the Purchasing and Testing of SPM Hawsers'.

The NWBS (New Wet Break Strength), energy absorption and fatigue performance of hawsers will deteriorate during service under the influence of factors such as service life, cyclic load history, hawser type, construction, environmental conditions, damage and stowage arrangements between use. Terminal operators should take these factors into account when determining the appropriate hawser for the mooring system and hawser retirement criteria.

Chafe chains
Each mooring hawser should terminate at its shipboard end with a chafe chain. The standard recommend size of the chafe chain has been established at 76mm based on the diameter of the material forming the common stud links. Terminal operators should select the appropriate chain by taking into account the designed SPM mooring arrangement, SWL required and the properties of the chain grade selected. Typically chafe chains form a single chain of approximately 8 metres or more in length, composed of 76mm stud link chain. If through-type chain support buoys are utilised the length of the chain may have to be increased. Each chain should terminate, at the shipboard end with an oblong plate for connecting the chain to the pick up rope bow shackle.

Weak links
Weak links, if fitted, should be selected such that the recommended bow chain stopper, chafe chain, hawser or connection to the SPM do not constitute the weakest yield strength of MBL component of the entire system. Weak links, if fitted, should be designed, manufactured and tested under a certification scheme.

Support buoys
When the berth is unoccupied, each chafe chain may be supported by flotation devices. One method is to use a swivel ended type support buoy that is connected by a short length of chain to the end link of the chafe chain, adjacent to the hawser. Another method is to use a through type chain support buoy. Support buoys should have reserve buoyancy equivalent to at least 20% of the weight in air of the material to be supported.

Pick-up / Messenger rope
The pick-up rope is connected to the ship end of the chafe chain and typically consists of 150 metres of floating rope (generally polypropylene based) complete with an eye at each end. The rope can vary in length from 120 – 180 metres, and in diameter from 64 – 80 mm. At some terminals where the pick-up rope is not kept connected to the chafe chain when the berth is unoccupied, differing arrangements may be employed to facilitate connection / disconnection of the pick-up rope.

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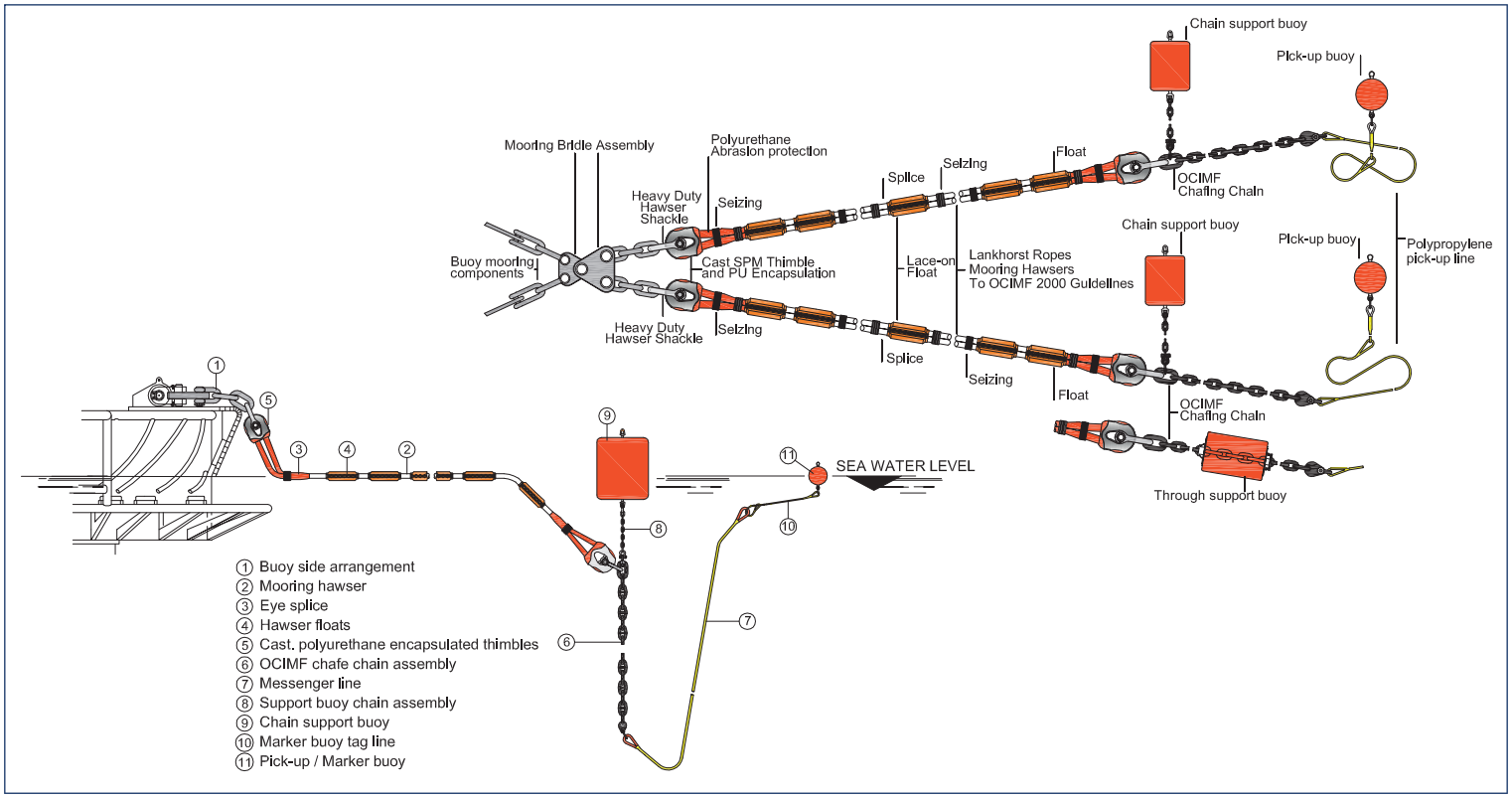
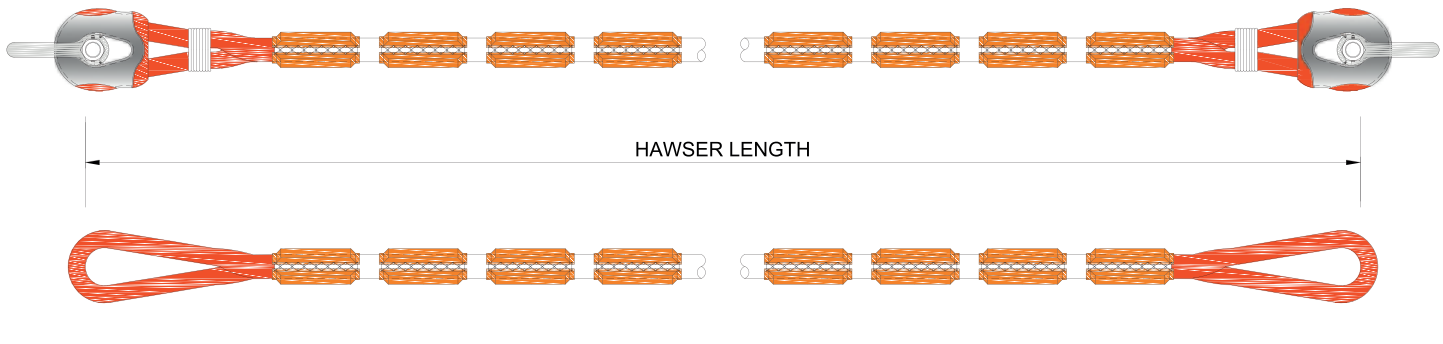
TYPICAL OFFTAKE SYSTEM

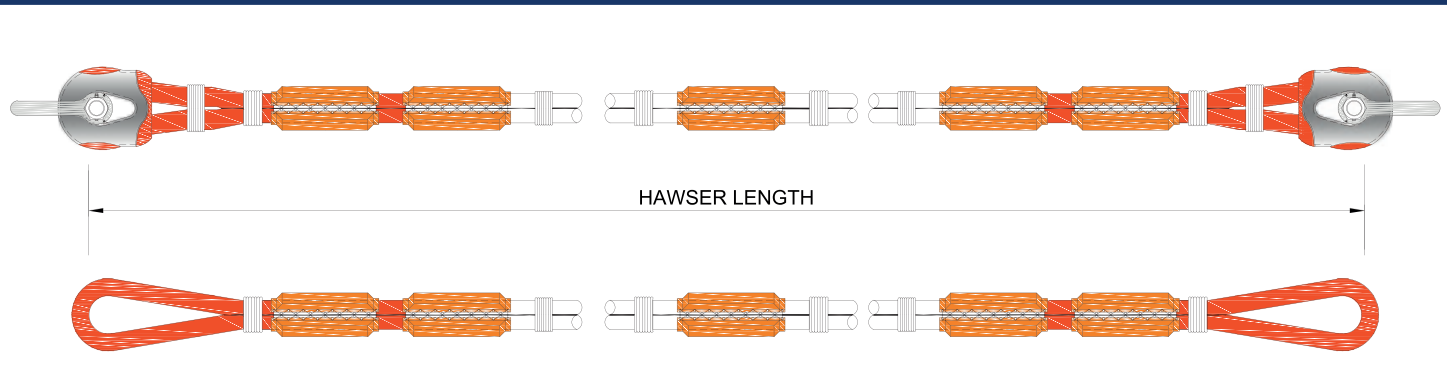


HAWSER CONFIGURATIONS

Single leg type mooring hawser



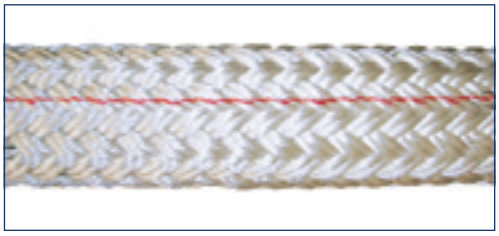
Grommet type mooring hawser

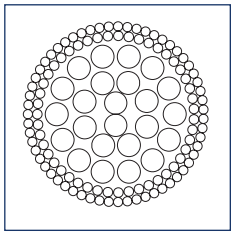


MOORING HAWSER SELECTION

DOUBLE BRAID 32/64

Rope with an inner braid of hollow structure manufactured in a separate operation serves as the core, while a cover (outer braid) is braided over it in a second operation. The conventional construction has 32 strands on the inner core and 64 strands on the cover. It is also called 2 in 1 and Braidline.





Material: nylon

Construction: DOUBLE BRAIDED ropes are constructed by braiding a sheath over a braided hollow core. They have 32 core strands and 64 sheath strands with an equal number of left and right hand providing a perfectly torque free rope.

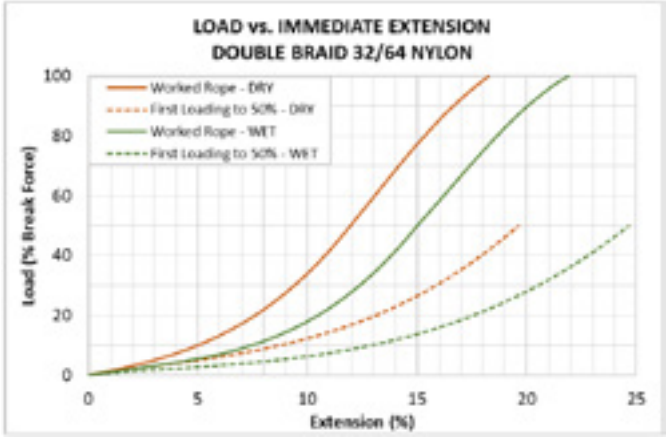
DOUBLE BRAID is acknowledged as the best rope construction to absorb the enormous dynamic forces generated at SPM's. The weight of either the inner braid or the outer braid shall not exceed 55 % of the total weight of the rope as per ISO 10554.

Lankhorst DOUBLE BRAID hawser ropes have been fully prototype tested and are manufactured, inspected and supplied in accordance with the OCIMF 2000 "Guidelines for the Purchasing & Testing of SPM Hawsers".

diameter mm	size in	weight kg/100m	NDBS kN	NDBS tonne	NWBS kN	NWBS tonne
80	10	388	1,724	176	1,498	153
88	11	482	2,117	216	1,840	188
96	12	562	2,450	250	2,129	217
104	13	662	2,861	292	2,486	254
112	14	762	3,269	333	2,841	290
120	15	883	3,760	383	3,267	333
128	16	1,024	4,326	441	3,759	383
136	17	1,144	4,804	490	4,174	426
144	18	1,285	5,362	547	4,660	475
152	19	1,426	5,918	603	5,143	524
160	20	1,606	6,625	676	5,758	587
168	21	1,747	7,175	732	6,235	636

other sizes are available on request
New Dry Break Strength (NDBS) and New Wet Break Strength (NWBS) data are for guidance purpose only and are subject to change without prior notice.

ELONGATION:



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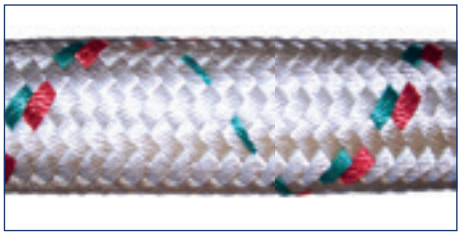
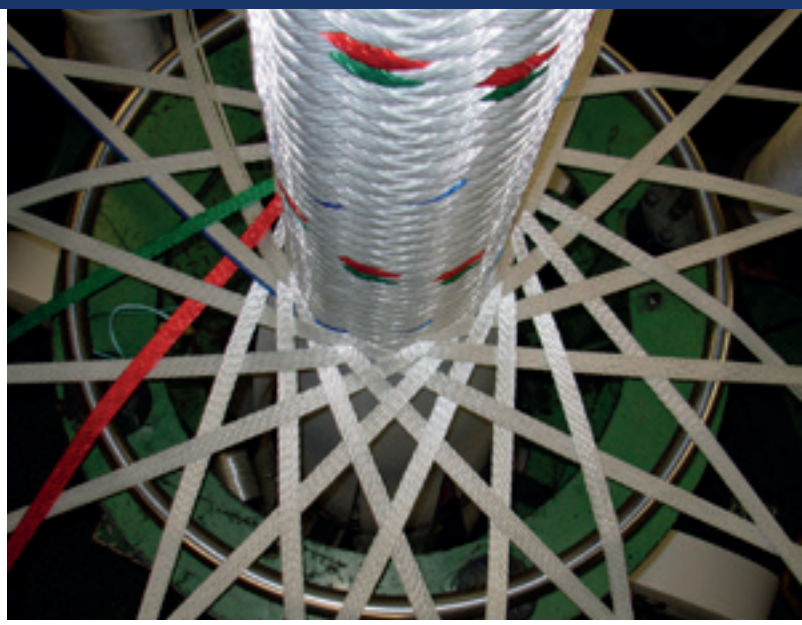
GAMA98®

PARALLEL STRAND

Rope in which components are laid parallel to each other within an outer braided jacket (also called circular braided). The jacket is non-load bearing. Lankhorst GAMA98® hawsers have become the industry standard for FPSO/FSO tandem offtake mooring arrangements. Lankhorst GAMA98® hawser ropes have been fully prototype tested and are manufactured, inspected and supplied in accordance with the OCIMF 2000 “Guidelines for the Purchasing & Testing of SPM Hawsers”.





diameter mm	size in	weight kg/100m	NDBS kN	NDBS tonne	NWBS kN	NWBS tonne
80	10	398	1,798	183	1,705	174
88	11	497	2,239	228	2,124	217
96	12	590	2,680	273	2,542	259
104	13	696	3,119	318	2,958	302
112	14	782	3,557	363	3,374	344
120	15	926	4,103	418	3,892	397
128	16	1,029	4,649	474	4,409	450
136	17	1,163	5,138	524	4,874	497
144	18	1,286	5,790	590	5,492	560
152	19	1,437	6,441	657	6,109	623
160	20	1,602	7,091	723	6,725	686
168	21	1,756	7,902	806	7,495	764

other sizes are available on request
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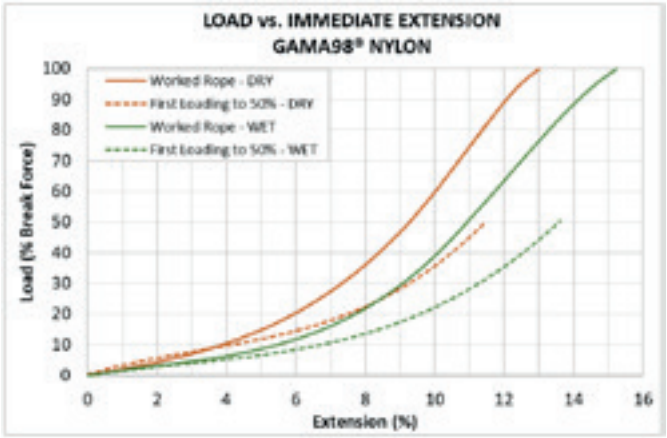

ASTRALINE®

8 STRAND MULTIPLAIT

Rope construction of two pairs of stands with right hand twist and two pairs of left hand twist, braided together in such a way that pairs of strands of opposite twist overlay one another.

Material: Composite yarns (polyester high tenacity / polyolefin)

Construction: ASTRALINE® is an 8 strand multiplait constructed rope, comprising Lankhorst special polyolefin blend inner yarns and high grade polyester yarns. This composite yarn has been proven to have excellent abrasion resistance performance.

Lankhorst ASTRALINE® hawser ropes have been fully prototype tested and are manufactured, inspected and supplied in accordance with the OCIMF 2000 “Guidelines for the Purchasing & Testing of SPM Hawsers”.

diameter mm	size in	weight kg/100m	NDBS kN	NDBS tonne	NWBS kN	NWBS tonne
80	10	397	1,373	139	1,373	139
88	11	480	1,657	168	1,657	168
96	12	571	1,943	198	1,943	198
104	13	671	2,294	233	2,294	233
112	14	778	2,652	270	2,652	270
120	15	893	3,024	308	3,024	308
128	16	1,016	3,373	343	3,373	343
136	17	1,147	3,830	390	3,830	390
144	18	1,286	4,284	436	4,284	436
152	19	1,433	4,788	488	4,788	488
160	20	1,587	5,292	539	5,292	539

other sizes are available on request
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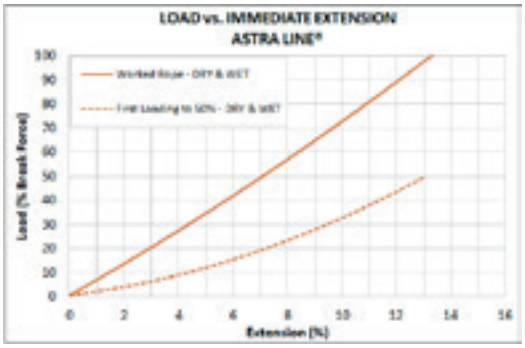
ELONGATION:



HAWSER FLOTATION

Single point mooring hawsers typically manufactured from nylon (SG 1.14) will not float naturally in seawater. A hawser which sinks will foul the catenary moorings of a CALM buoy or other subsea equipment. Lankhorst Offshore has a range of flotation methods.

- Lace-on hawser float
- Integral hawser flotation
- Tubular float

Please ask us for detailed data sheets on the below flotation types.

LACE-ON HAWSER FLOAT

The integrity of the mooring hawser depends on the floats sustaining hawser buoyancy. All our floats feature a double outer layer manufactured from high abrasion resistant ballistic nylon cloth. All seams are double stitched from heavy denier yarn using a locking stitch, so yarn breakages cannot lead to an unzipping effect. The floats utilize high quality 48 kg/m^3 100% closed cell polyethylene foam, and high quality eyelets exceeding Shell pull test standards. Additionally these floats can be polyurethane elastomer coated on the outside.

LACE-ON HAWSER FLOAT

number of pockets	single hawser mm	grommet hawser mm	nett buoyancy kg	approx. dry wt kg	width dimension mm
3	80 - 96		6.0	0.8	385
4	104 - 128		8.0	1.0	480
5	136 - 152	80 - 96	10.0	1.3	575
6	160 - 184	104 - 112	12.0	1.4	670
7	192	120 - 128	14.0	1.7	765
8		136 -144	16.0	1.9	860
9		152 - 168	18.0	2.1	955
10		176 - 184	20.0	2.3	1,050
11		192	22.0	2.5	1,145

NOTE: Width dimension is taken when the float is laid out flat and foams are installed. Measured under a pre-load of 2.5kg. All floats are approximately 1,100mm in length.

INTEGRAL FLOTATION

It has been reported by operators using mooring hawsers with conventional lace-on floats, that during the lifetime of the hawser the floats tend to suffer damage and can be ripped away from the rope. This can be costly to the operator having to secure replacement floats and organise maintenance crews to replaced damaged / missing floats. Our integral flotation system overcomes these issues, and in addition offers many other operational benefits.

Mooring hawsers incorporating our integral flotation system are wrapped in closed cell buoyancy foam, ensuring sufficient reserve buoyancy is calculated into the construction to support the hawser in seawater. This is covered with an over braided jacket. Additionally this can be polyurethane elastomer coated to enhance the abrasion characteristics of the assembly.

Benefits of integral flotation:

- Integral flotation system does not need to be replaced / maintained during the hawser lifetime, eliminating the need for spare floats and expensive maintenance crews.
- The construction of the integral flotation system enhances the abrasion resistance of the hawser to external mechanical damage, ie. floating hose flanges.
- At CALM buoys where the hawsers may be left floating in the water between offtakes, the integral flotation system reduces the amount the rope will flex with the wave action. This reduces internal yarn-on-yarn abrasion damage and can help to increase hawser service life.
- Ropes left floating in the water between offtakes are subject to ‘water wash’ through the rope, which over time will remove the unique marine finishes applied to modern day synthetic fibres to reduce abrasion / fatigue damage internally. The integral flotation system with polyurethane elastomer coating reduces the effects of water wash.

TUBULAR FLOAT

In cases where long service life with minimal maintenance is required, we recommend the use of our tubular floats. These are available in varying lengths and diameter to suit. Tubular floats are stiffer than the fibre rope, so flexing may occur at the exit points from the floats. The longer the float length, the greater the flexural concentration. Therefore we do recommend a larger quantity of short length floats, as opposed to a smaller quantity of longer length floats.

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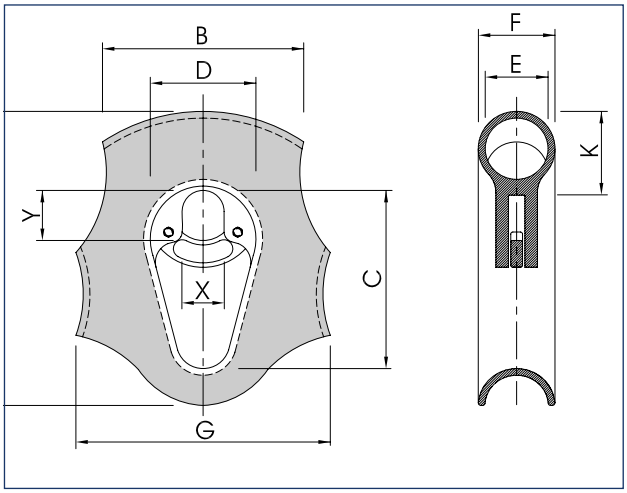
HAWSER THIMBLES AND SHACKLES

CAST SPM HAWSER THIMBLE



Material:
Cast steel
Stainless steel

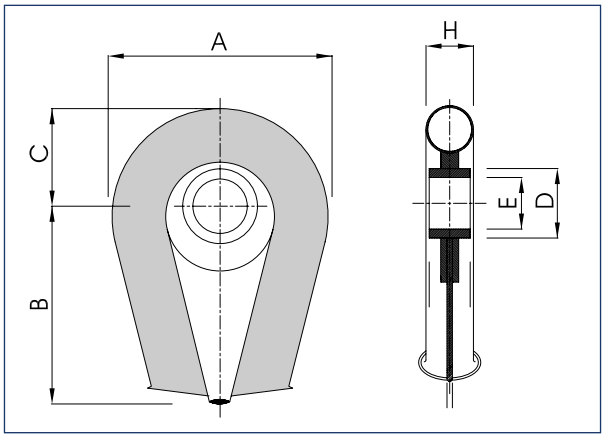
Finish:
Galvanised (mild steel)
Self coloured (stainless steel)

rope size inch	A mm	B mm	C mm	D mm	E mm	F mm	G mm	K mm	X mm	Y mm	weight kg
11”-13”	530	320	270	175	132	157	477	170	105	105	52
14”-15”	655	476	357	258	154	183	598	200	116	124	83
16”-18”	795	542	380	283	184	212	721	252	136	140	118
19”-21”	940	657	457	348	209	261	880	309	158	177	315
22”-24”	1,043	814	575	410	244	298	867	360	180	200	406

TUBULAR HAWSER THIMBLE

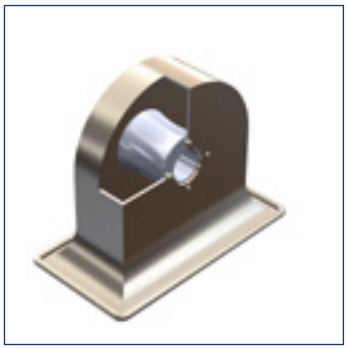
Material:
Mild steel

Finish:
Galvanised / Plastic coating
on request



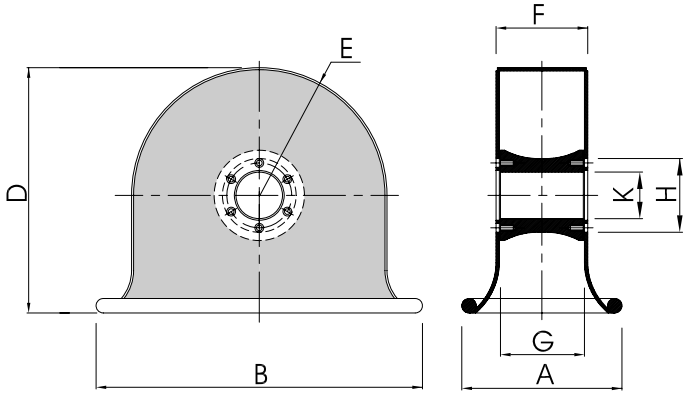
rope size inch	A mm	B mm	C mm	D mm	E mm	H mm	weight kg
12”	521	416	250	194	144	140	46
15”	625	539	282	194	144	168	74
18”	734	640	336	219	169	194	126
21”	829	780	374	219	169	219	176
24”	924	915	421	273	201	245	272

BELLMOUTH HAWSER THIMBLE



Material:
Mild steel
Stainless steel

Finish:
Galvanised (mild steel)
Self coloured (stainless steel)



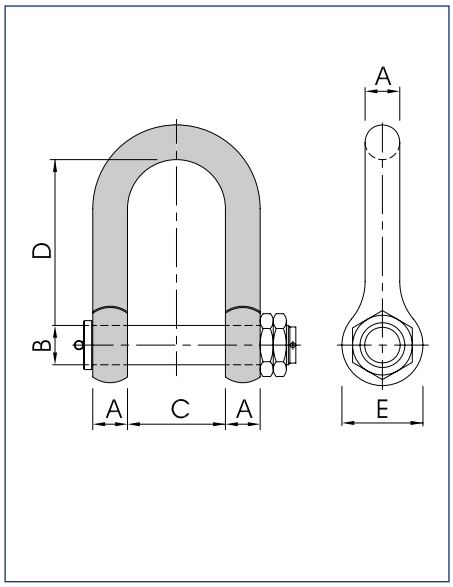
rope size inch	A mm	B mm	D mm	E mm	F mm	G mm	H mm	K mm	weight kg
10”-12”	400	640	480	195	166	147	175	86	75
15”-16”	440	746	608	248	193	172	196	105	110
18”-21”	454	844	660	300	228	205	204	118	135
22”-24”	450	1,000	758	400	266	245	290	148	236

HEAVY DUTY HAWSER SHACKLE

thimble size inch	A mm	B mm	C mm	D mm	E mm	weight kg	SWL tonne	proof load tonne	MBL tonne
11” - 13”	70	76	160	360	165	59	60	90	300
14” - 15”	80	90	220	390	178	85	85	127.5	425
16” - 18”	90	100	254	430	210	122	110	165	550
19” - 21”	100	114	290	480	235	170	130	195	650
19” - 21”	125	133	300	600	265	282	200	300	1,000
22” - 24”	130	146	333	720	305	349	225	337.5	1,125
15”	115	125	254	400	238	203	250	482	612
18”	105	120	285	500	228	205	200	330	498
18”	125	130	220	500	238	248	250	482	612
21”	115	125	254	520	238	244	200	330	498
21”	125	130	285	480	260	274	250	482	612

Material:
Forged high alloy steel
Quenched & tempered

Finish:
Galvanised



LANKHORST

SUPPORT BUOYS AND PICK-UP BUOYS

SWIVEL END TYPE BUOY

nett buoyancy kg	body length m	overall length m	body diameter m	nominal weight (in air) kg
900	1.5	2.1	1.1	252
1,360	1.5	2.1	1.2	272
1,815	1.5	2.1	1.4	300
2,270	2.0	2.6	1.3	342
2,500	2.0	2.6	1.4	354
2,750	2.0	2.6	1.5	367
3,630	2.0	2.6	1.7	475
4,540	2.0	2.6	1.8	516
5,450	2.0	2.6	2.0	564

Dimensions are approximated. Tolerance ±10%

CHAIN THROUGH TYPE BUOY

nett buoyancy kg	body length m	overall length m	body diameter m	nominal weight (in air) kg
1,360	2.0	2.1	1.3	440
1,815	2.0	2.5	1.3	480
2,270	2.0	2.5	1.4	520
2,500	2.0	2.5	1.5	535
2,750	2.0	2.5	1.5	545
3,630	2.0	2.5	1.7	625
4,540	2.1	2.6	1.8	658
5,450	2.1	2.6	2.0	703

Dimensions are approximated. Tolerance ±10%

The Lankhorst Offshore range of chain support buoys has a typical reserve buoyancy of 900kg up to 5,000kg – but our flexible manufacturing process allows us to produce products to suit customers exact buoyancy requirements. The buoys can be supplied with swivel eyes top and bottom, or with a chain through / locking plate arrangement. We also supply pick-up buoys with reserve buoyancy of up to 500kg.

SPHERICAL TYPE PICK-UP BUOY

nett buoyancy	overall length m	body diameter m	nominal weight (in air) kg
100 kg cw swivel	0.95	0.64	20
100 kg cw fix eyes	0.86	0.62	19

Dimensions are approximated. Tolerance ±10%

CHAFE CHAINS AND FLOATING PICK-UP / MESSENGER LINES

CHAFE CHAINS

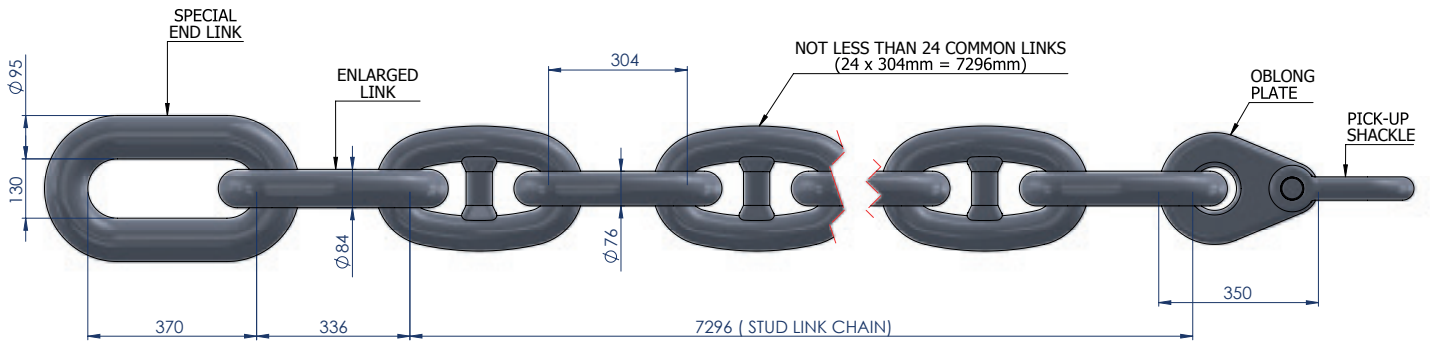
We can supply a full range of OCIMF compliant chafe chains, as well as customer bespoke assemblies configured to individual operator specifications.

- Chafe chain A & B in accordance with latest OCIMF 2018 Guidelines, 1st edition
- Chafe chain A & B in accordance with OCIMF 2007 Guidelines, 4th edition
- Chafe chain A, B & C in accordance with OCIMF 1993 Guidelines, 3rd edition
- Weak links, Kenter shackles, Joining shackles, Delta plates, etc.
- Topside SPM bridle assemblies

Typical Chain A / B configuration per OCIMF 2018. Chain manufactured, tested and inspected in accordance with IACS W22.

type	size mm	grade per IACS W22	SWL tonne	MBF tonne
A	76	R4	250	611.7
B	76	R3	200	497.8

The number and size of chains used should be determined by the terminal operator after an analysis of the maximum mooring load. If necessary, weak links or quick release devices should be incorporated into the mooring system.



FLOATING PICK-UP / MESSENGER LINES

Our range of floating pick-up / messenger lines are based on Lankhorst TIPTO® brand ropes. These ropes exhibit high strength, excellent abrasion resistance and energy absorption properties, ensuring a long service life. The low weight makes messenger line handling on board easier. Lankhorst TIPTO® brand ropes are supplied in high visibility yellow colour and have a specific gravity of 0.93 – self floating.

circ. in	diameter mm	weight kg/100m	MBF
3	24	27.3	103
3 1/2	28	37.3	137
4	32	53	177
4 1/2	36	66	222
5	40	75.6	269
6	48	109	378
7	56	149	508
8	64	194	651
9	72	246	814
10	80	305	992

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TESTING AND TECHNICAL SUPPORT INFORMATION

Residual hawser strength testing
We can assist operators to understand hawser behaviour and performance in specific field operations by residual strength testing of used / retired mooring hawsers.

Our fully equipped laboratories in Portugal have the capability to analyse mooring hawsers for signs of internal abrasion damage or ingress of foreign particles, and to perform residual break tests. This information will help operators to understand the hawsers in use at their terminal and make better informed judgements on current and future retirement programmes. Our engineers are able to offer advice and guidance on this. Customers are always welcome to witness testing of hawsers.

Lankhorst Offshore has participated in many Joint Industry Projects (JIPs) and has been instrumental in helping to shape the industry and the rules governing the deployment of fibre ropes in offshore applications. In addition to the JIPs, we also participate in privately sponsored research projects and other JIPs specifically related to fibre rope mooring applications, chain and mooring jewellery.

Technical support information
Our SPM sales and engineering team is always on hand to provide comprehensive customer care and technical support services. We are able to undertake site surveys and bespoke development work. Further technical information on our range of SPM associated products is available upon request by sending an email to spm@lankhorstoffshore.com

JIPs listed
- Double Braid Nylon – Load v Extension data
- Double Braid Nylon – Fatigue (TCLL) data
- Gama 98® - Load v Extension data
- Gama 98® - Fatigue (TCLL) data
- OCIMF 2000 Form A Compliance Certificates
- Single Leg vs Grommet Hawser Configuration
- OCIMF Chafe Chain drawings / data sheets
- Pick-up rope / Messenger Line data sheets
- SPM Hawser Reference List
- SPM Technical Manual
- Operation & Maintenance Manual
- Synthetic Fibre Material & Rope constructions

Trial fits
All assemblies and components are fully fitted prior to despatch from factory to ensure no interface issues once items arrive at site.




GLOSSARY OF TERMS

Marine terms and abbreviations are open to variation around the world, the following are used in all our literature and correspondence:

BOW CHAIN STOPPER
A mechanical device for securing chafe chains onboard a tanker.

BRAIDED ROPE
Rope constructed by braiding or interweaving strands together.

BRAIDLINE OR DOUBLE BRAID ROPE
Rope consisting of a hollow core of many braided strands enclosed in a cover of many braided strands.

BREAKING LENGTH
The length of rope, whose mass will equal that of its breaking strength.

CBS
Calculated breaking strength.

CHAFE CHAIN
A length of stud-link chain at the end of an SPM mooring hawser which passes through a ship's fairlead and is used to connect the SPM mooring hawser to the bow chain stopper of a tanker.

CIRCULAR BRAIDED ROPE
Rope consisting of multiple parallel laid load-bearing cores, enclosed in a non-load bearing braided jacket.

CONVENTIONAL TANKER
An oil tanker equipped for regular trading and not specially designed or adapted for loading at offshore terminals requiring specialised mooring or bow loading equipment.

DISPLACEMENT
The mass of water in tonnes displaced by a vessel at a given draft.

DWT
Deadweight tonnage of a vessel at the maximum summer draft, expressed in tonnes.

EIGHT STRAND ROPE
Rope construction of two pairs of strands with right hand twist and two pairs of strand with left hand twist, braided together in such a way that pairs of strands of opposite twist overlay one another.

END FOR END SPLICE
The joining of two ropes by means of a splice.

FPSO
Floating Production, Storage and Offloading unit.

FSO
Floating Storage and Offloading unit.

GROMMET ROPE OR DOUBLE LEG HAWSER
An assembly of rope spliced into an endless loop then two legs seized together to form a singl length. Ancillary equipment fitted as required.

LAID ROPE
Rope constructed by laying and twisting several strands together. The direction of the twist is opposite that of the strand twist. Common forms are three, four and six strand (with core).

LINEAR DENSITY
The weight per unit length of the rope.

MAXIMUM SUMMER DRAFT
Maximum summer draft for which the structural strength of the ship has been designed.

MBL
Minimum breaking load of a new mooring line or chain, as declared by the manufacturer. It does not include allowance for splicing (mooring line) or for wear and tear.

MINIMUM YIELD LOAD
The mooring load applied to a mooring fitting (eg. Bow fairlead, bow chain stopper) that, if exceeded, would cause permanent (plastic) deformation of the fitting, its components or foundations and, therefore, impair or otherwise compromise its continued safe use.

MOORING HAWSER
An assembly of rope and fittings, terminations, flotation aids and anti-chafe protection.

NEW DRY BREAKING STRENGTH (NDBS)
The average breaking strength of prototype ropes, which have not been exposed to water, and conditioned by 10 load cycles.

NEW WET BREAKING STRENGTH (NWBS)
The average breaking strength of prototype ropes that have been soaked in water and conditioned by 10 load cycles.

OCIMF
Oil Companies International Marine Forum, a London based organisation of marine representatives from SPM terminal operators, primarily oil companies.

PTC
Polyester tubular cloth

PU
Polyurethane elastomer

REFERENCE LOAD
A nominal pre-tension load, approximately 1% of the breaking load, which is applied to the rope to remove slack when taking certain measurements.

ROPE SIZE
Is a number approximately equivalent to the nominal diameter measured in mm.

ROPE STRENGTH FACTOR
The ratio of the strength of the finished rope to the sum of the strengths of the rope yarns used to make the rope.

SAFE WORKING LOAD (SWL)
A load less than the yield or breaking load by a safety factor defined by a code, standard or good engineering practice.

SHUTTLE TANKER
An oil tanker specially designed or adapted for loading at offshore terminals requiring specialised mooring or bow loading equipment.

SINGLE POINT MOORING (SPM)
An integrated mooring arrangement for bow mooring a conventional tanker. For example conventional tanker bow mooring arrangements to Catenary Anchor Leg Mooring (CALM) system, Single Anchor Leg Mooring (SALM) system, FPSO or FSO.

SINGLE ROPE ASSEMBLY
An assembly of a single rope with terminations at each end. Ancillary equipment fitted as requested.

SPLICED EYE
A loop formed at the end of a rope and secured by interweaving the strands or braids.

TANDEM MOORING
A hawser-mooring arrangement between two vessels, either bow-to-bow or bow-to-stern. It is normally taken to mean a mooring arrangement between the bow of a conventional tanker and the stern of bow of a FPSO or FSO.

EFFECTIVE SINGLE POINT MOORING SYSTEMS

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