Edition 2018

Composite cables and standing rigging

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Emirates Team New Zealand won the 35th America's Cup with ropes supplied by Armare Ropes

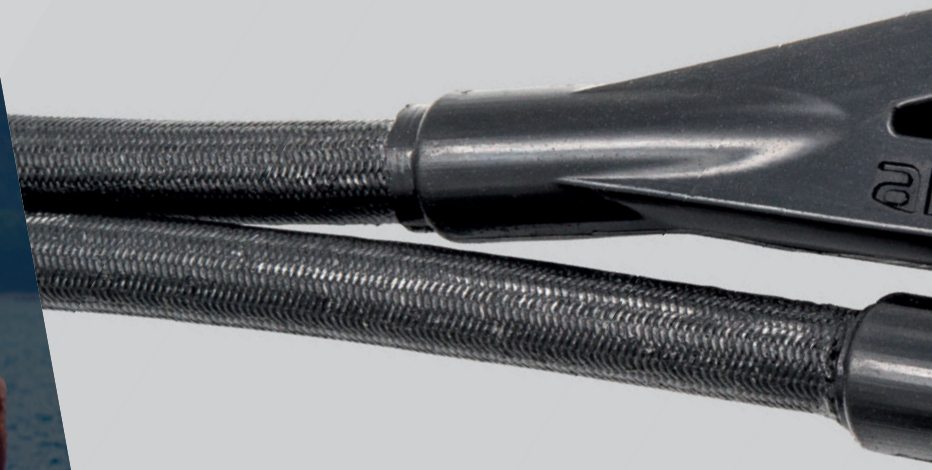
Emirates TEAM NEW ZEALAND
OFFICIAL SUPPLIER 2017

Photo: © Richard Hodder / Emirates Team New Zealand
Base: Bermuda, Emirates Team New Zealand, Great Sound

Armare composite cables and standing rigging

THE YACHT DESIGN EVOLUTION IS THE MAJOR DEMONSTRATION OF HOW RIGGING IS NOW ONE OF THE MAIN AREAS OF DEVELOPMENT IN WHICH IT IS POSSIBLE TO GAIN MOST IN TERMS OF LIGHTNESS AND PERFORMANCE, THROUGH THE USE OF INNOVATIVE HIGH MODULUS FIBERS SUCH AS PBO-ZYLON®, DYNEEMA® SK99 AND ARAMID FIBERS.

ARMARE RESPONDS TO THIS GROWING DEMAND BY DESIGNING, PRODUCING AND TESTING COMPLETE SOLUTIONS, MADE OF AROMATIC FIBRES, FOR HIGHTECH TEXTILE EQUIPMENT AND THANKS TO THE PARTNERSHIP WITH PROFESSIONALS WHO HAVE MANY YEARS OF EXPERIENCE IN THE FIELD OF RIGGING.



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Projects

THE OPPORTUNITY TO TEST ALL THE MATERIALS ON HIGH PERFORMANCE BOATS AND UNDER EXHAUSTING SAILING SESSIONS DURING OCEANIC REGATTAS LIKE VENDEE GLOBE, BARCELONA WORLD RACE OR TRANSAT JACQUES VABRES, GIVES ARMARE THE POSSIBILITY TO DEVELOP AN EXCELLENT PRODUCT MATCHED WITH HIGHEST RELIABILITY LEVELS.

ARMARE BECOMES A CONSOLIDATED COMPANY, THANKS TO A TEAM OF PROFESSIONALS ABLE TO SATISFY EACH INQUIRY AND THANKS TO A VERY SPECIAL AND UNIQUE WAY TO ASSEMBLE DIFFERENT MATERIALS THAT ELEVATES THESE COMPOSITE CABLES TO AN AVANT-GARDE PRODUCT IN THE FIELD OF FIBER RIGGING.

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Racing, cruising, luxury Maxi Yachts: each project has its own story

Armare Ropes has been cooperating for many years with a team of internationally qualified sailors aimed to develop and test its products. Pro-Rig Armare, a network of specialized technicians assist the teams during the different steps of development and testing as well as during the setting up of their boats for the most challenging races.

This is how the participation of Armare to some of the most challenging oceanic world races, such as Vendee Globe, Barcelona World Race, Route du Rhum or Transat Jacques Vabres came off.

Nowadays composite cables are used on both, high performance sailing boats of any size and oceanic racing boats e.g. VOR 70, IMOCA 60s, Class 40, up to the smaller Mini 6.50 class.

To face the hardest competitions, Armare and its cooperators have travelled for many miles and acquired a lot of experience throughout the years. Professionals like installers, technicians, sailmakers and designers all over the world choose composite cables designed and made by Armare for the rigging of Sailing Yachts produced in the best shipyards worldwide, as well as to improve the races of the boats destined to races like ORCi, IRC or even to professional circuits like Melges and other One Design classes.

References

Here below only a few of the many boats Armare equipped:

ALLURE 45
BALTIC 66
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TP 52
VISMARA 47 - 50 - 62 - 67 - 80
VOR 70
X-YACHTS X35 - XP44 -XP50
WALLY 60 - 80 - 95

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Sling construction in continuous winding

THE INTERNAL FIBER, WHICH ENSURES THE SPECIFIC PERFORMANCE OF THE CABLE, IS PRE-TENSIONED STARTING FROM BOBBINS AND IS WRAPPED, WITH A TECHNIQUE CALLED “SLING”. THIS PROCESS IS BASED ON CONTINUOUS WINDING OF THE FIBER, BETWEEN TWO FIXED POINTS, UNTIL THE REACHING OF THE DESIRED NUMBER OF FILAMENTS.
SUCCESSIVELY THIS LOOP IS JOINED, CONSOLIDATED AND PROTECTED BY TWO DIFFERENT LAYERS OF SPECIAL TAPE, WHICH WARRANTS STABILITY AND PROTECTION AGAINST EXTERNAL AGENTS.
FINALLY, A STRONG BRAID IN DYNEEMA® COVERS THE ENTIRE CABLE, GIVING TO IT THE DEFINITIVE APPEARANCE, WHILE THE TWO TERMINALS IN RESIN ARE MELTED AT THE ENDS OF THE CABLE, WITH THE PERMANENT INCLUSION OF THE TECHNICAL FIBER LOOPS.

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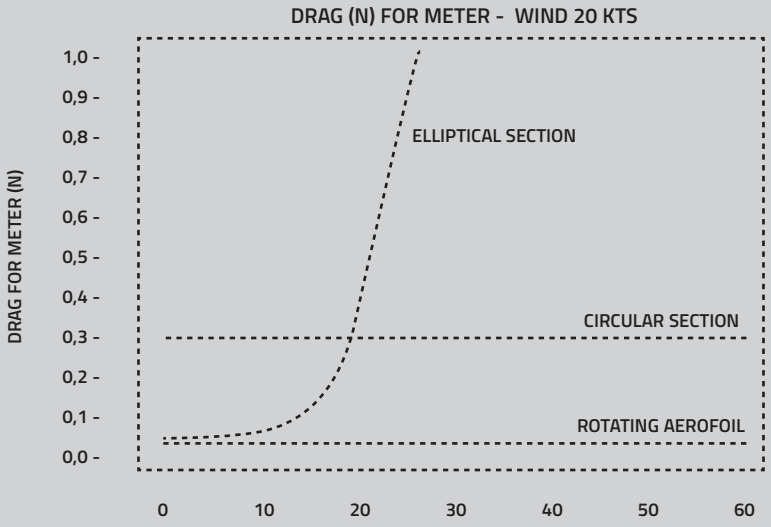
Aerodynamic aspects

During the sailing, the wind hits the cable and produces a negative friction power for the performance of the boat: the higher is the front-surface of the cable, the greater is the friction. In the years, many cable solutions have appeared on the market, with an asymmetric aerodynamic section, following the consideration that a form, more aerodynamically efficient, ensure lower friction. This is generally correct, but only if the aerodynamic section is oriented as regards the apparent wind angle (AWA). Various studies have proved that in case of AWA above 25°, cables with asymmetric section start to generate more friction than the cables with circular section, and that the friction grows exponentially at the increasing of AWA.
All composite cables, produced by Armare, have a circular section. The graph shows the trend of the curves of the three considered profiles, as to say elliptical, circular and rotary section. The profitable trend of the cable with elliptical section is limited to a range of AWA below 20 Kts, over which the wind resistance increases exponentially, and makes them disadvantageous compared to cables with a circular section.

Rif: “Aero-Idrodinamica della Vela C_A_Marchaj”



Cables construction

The processing of continuous multifilament high modulus fibres, is currently the most technologically advanced construction in the world for the production of fiber cables.

Armare has developed a complete line of products to be used on racing/cruising boats and super yachts. The construction process of the Softrig cables is named “Sling”. This process is based on continuous winding of the fiber between two fix points placed at the required distance. The result is an extremely safe single cable, with inimitable mechanical characteristics. This special construction, accurately controlled with sophisticated equipment, produces the highest modulus of stretching and the maximum lightness. It allows the cables to get exceptional breaking loads both under static and dynamic loads, and to face unforeseen peaks of stress.

The continuous development of construction techniques allows Armare to produce perfectly balanced cables, which are extremely safe and have an excellent durability. Intensive tests and exhausting sailing session, such as the participation to Vendee Globe, confirm the absolute reliability of our products, both in cruising and racing sailing boats of different sizes.

Molded terminal

Pin or lash terminal

Dyneema® braid

The cover in Dyneema® protects the cable from each external mechanic action

Protection layer

It defends the technical fiber from U.V. rays

Structural layer

It is the most inner layer and it protects the cable from the penetration of moisture, water, salt and external agents

PBO®/ Kevlar®/ Dyneema® fiber

The technical fiber is wrapped up on the terminals using the construction technology in continuative filament called “sling”

Cable fibers: PBO-Zylon® Kevlar® Dyneema®

ARMARE COMPOSITE CABLES ARE MANUFACTURED USING THE LATEST FIBERS AVAILABLE ON THE MARKET. FOR EACH SPECIFIC APPLICATION YOU CAN CHOOSE FROM THREE TECHNICAL FIBERS, ACCORDING TO THE EXPECTED PERFORMANCE OF THE CABLE.

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Different cores for different applications

CORE	PBO	KEVLAR®	DYNEEMA® SK99
CHARACTERISTICS	High resistance Minimal stretch Zero creep High stability under constant loads	Minimal stretch Low creep Good price	Very high resistance Low stretch Very light Best durability
DIAMETER	■□□□□□	■■□□□□	■■■□□□
WEIGHT	■■□□□□	■■■□□□	■□□□□□
RESISTANCE	■■■■□□	■■□□□□	■■■■■□
PRICE	■■■■■□	■■■■□□	■■□□□□
STRETCH	■□□□□□	■■■□□□	■■■■■□
CREEP	□□□□□□	■□□□□□	■■■■□□
APPLICATIONS			
FORESTAY	■■■■■□	■■■■□□	■■□□□□
BACKSTAY	■■■■■□	■■■■□□	■■■□□□
RUNNER/CHECKSTAY	■■■■■□	■■■■□□	■■■□□□
TORSIONAL	■■■■■□	■■■■□□	■□□□□□
BOBSTAYS	■■■■■□	■■■■□□	■□□□□□
STAYSAIL	■■■■■□	■■■■□□	■■■□□□
VERTICAL RIGGING	■■■■■□	■■■■□□	□□□□□□
LOCK STROPS	□□□□□□	□□□□□□	■■■■□□
FORESTAY STROPS	■■■■■□	■■■■□□	■■■□□□

Three technical fibers

The fibers used for the construction of the cables and for high performance rigging applications are identified by PBO®, Aramid and UHMW-PE initials, from which originate the commercial names of PBO-Zylon®, Kevlar® and Dyneema®.

PBO-Zylon®

In the last years PBO® has achieved excellent levels in terms of performance and durability, when is employed to build the core of the cables for rigging use.

Thanks to the incomparable dimensional stability of its oriented fibres, PBO® is the top in terms of performance under statics loads. It represents the best choice for the manufacturing of high performance standing riggings, because it assures maximum lightness together with minimum possible diameter, steadiness, resistance and zero creep.

Armare suggests choosing PBO® for standing rigging, for forestay and backstay, and for torsional cables, where high performance are always required.

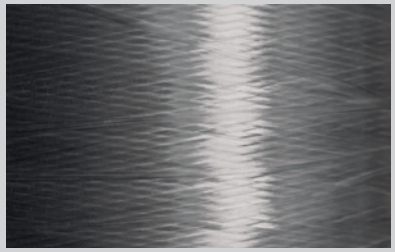
Kevlar®

Armare also produces cables made with Kevlar® 49 core, using the same Sling technology, the equal assembly methods and the identical materials as for the production of PBO® cables.

The performance of Kevlar® 49 cables is lower compared with cables made with PBO®, but have the same high durability, high breaking loads and low stretching, maintaining reasonable diameters and reduced weight.

The price makes these cables more accessible, in particular on cruising boats, when better performances are required for backstays, to lighten the runners, checkstays, staysails and torsional cables.

Dyneema®



The excellent dynamic resistance, the low elongation and the lightness of Dyneema® turn it to the perfect choice for the construction of backstays, runners and strops.

Thanks to its extreme resistance to torsional cycles and to load/unload stress, this fiber can also be used to produce torsional cables. Even if Dyneema® is lighter than PBO®, it is about 10% heavier and it has a diameter 25% thicker, in comparison with the dimensioning of a cable under the same stretch.

Dyneema® has a higher creep than other technical fibers, tough it is unsuitable to be used as standing rigging. It is available in two versions: SK99 and DM20.

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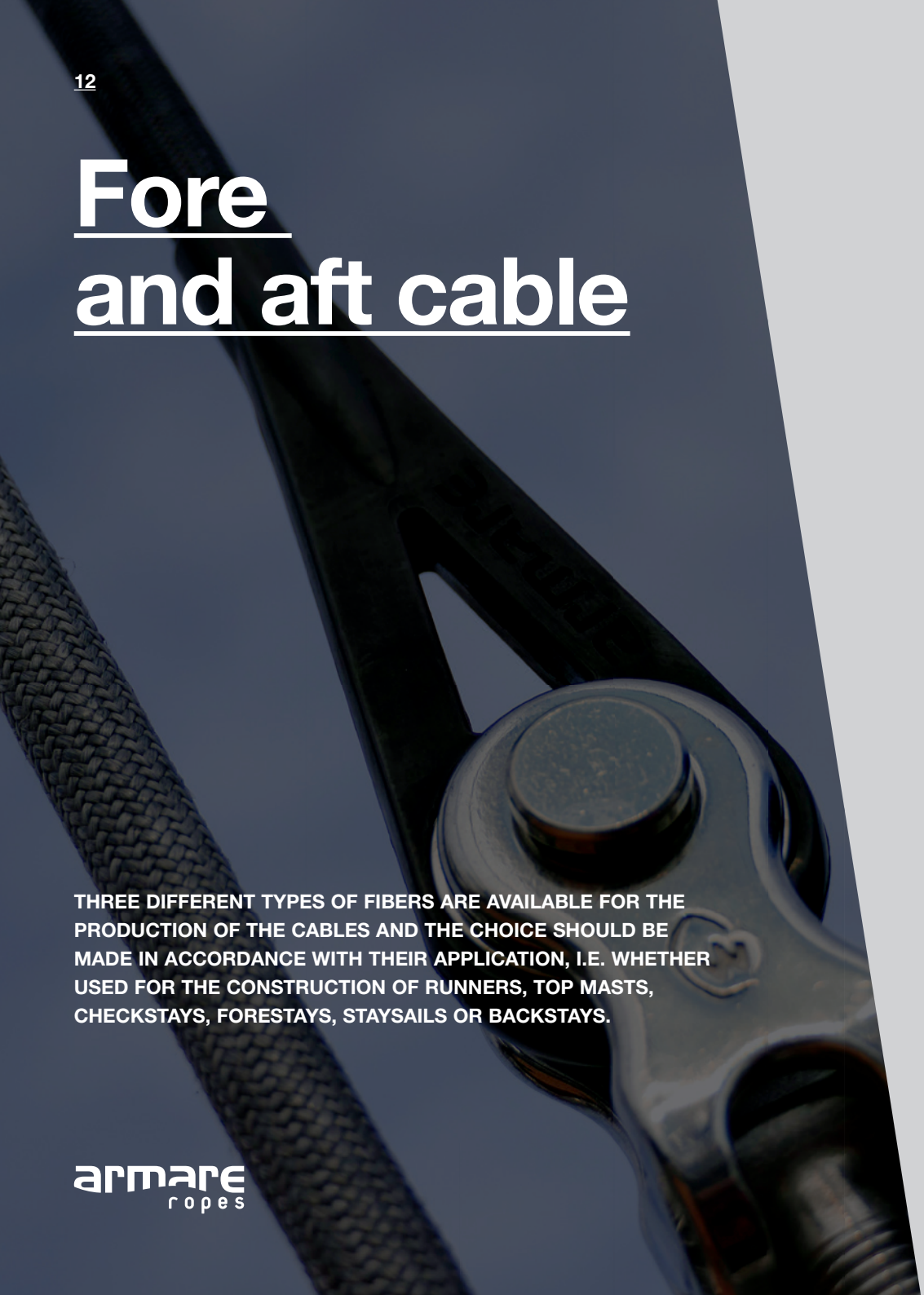
Fore and aft cable



THREE DIFFERENT TYPES OF FIBERS ARE AVAILABLE FOR THE PRODUCTION OF THE CABLES AND THE CHOICE SHOULD BE MADE IN ACCORDANCE WITH THEIR APPLICATION, I.E. WHETHER USED FOR THE CONSTRUCTION OF RUNNERS, TOP MASTS, CHECKSTAYS, FORESTAYS, STAYSAILS OR BACKSTAYS.

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Light, safe and durable

Dry constructed Armare PBO cables have a 50% higher safety ratio than ROD cables and their weight reduction reaches 80%. The PBO cable is lighter and safer even when compared to other types of composite rigging. The adoption of PBO textile rigging provides different benefits to the performance of any kind of sail boat.

Increased stability

The weight of textile rigging is definitely lower than the weight of ROD. This weight reduction is even more evident in the up section of the stay, at two thirds of its length. The consequence is a clear reduction of the pitch and a considerable decrease of the luff banding.

Better performance

Composite cables allow better wind ward and quicker manoeuvres. Using them, the boat pitches less against the weaves, and sails lighter, faster and more powerful. Armare obtains cables with minimum diameters and consequent advantage in the decrease of windage, thanks to the non-use of resin in the construction of cables and the optimization of the production process.

Easy to install and maintain

With the support of our technicians, the replacement of steel cable with textile standing rigging can also be performed in retrofit on any yacht. The durability of composite cables is long and their maintenance is simple and rapid. Any substitution can be easily done in short time.

Comparison between PBO-Zylon® Cables and Nitronic 50

CODE	MAX WORKING LOAD	BREAKING LOAD	DIAMETER	WEIGHT PBO®	EA	STRETCH EQUIVALENT DASH	BREAKING LOAD N 50	DIAMETER N 50	WEIGHT N 50
	[Kg]	[Kg]	[mm]	[Kg/m]	[MN]		[Kg]	[mm]	[Kg/m]
PB 3.0	750	3.000	5,8	0,043	2,20	**-3**	-	-	-
PB 3.7	925	3.700	6,2	0,047	2,70	**-4**	2.130	4,37	0,12
PB 4.0	1.000	4.000	6,3	0,050	3,00	**-5**	-	-	-
PB 4.5	1.125	4.500	6,5	0,054	3,50	**-6**	2.860	5,03	0,16
PB 5.3	1.325	5.300	7,0	0,058	4,20	**-7**	-	-	-
PB 6.2	1.550	6.200	7,6	0,063	4,95	**-8**	3.720	5,72	0,20
PB 7.5	1.875	7.500	8,0	0,072	6,10	**-10**	4.670	6,35	0,24
PB 9.2	2.300	9.200	9,4	0,080	7,72	**-12**	5.670	7,14	0,31
PB 10.3	2.590	10.360	9,7	0,086	8,56	**-15**	6.460	7,52	0,35
PB 12.9	3.237	12.950	10,5	0,105	10,94	**-17**	7.940	8,38	0,43
PB 17.3	4.340	17.360	11,7	0,130	13,74	**-22**	10.200	9,53	0,56
PB 22.4	5.602	22.410	13,6	0,162	18,66	**-30**	13.600	11,10	0,76
PB 28.1	7.037	28.150	15,2	0,197	24,43	**-40**	17.200	12,70	0,99
PB 35.3	8.837	35.350	17,1	0,250	30,85	**-48**	21.800	14,27	1,25
PB 49.6	12.402	49.610	19,5	0,350	42,55	**-60**	27.200	16,76	1,73
PB 57.3	14.325	57.300	21,0	0,401	48,59	**-76**	34.500	17,91	1,98
PB 67.2	16.800	67.200	22,8	0,470	57,66	**-91**	40.800	19,51	2,34
PB 86.3	21.575	86.300	25,7	0,597	74,83	**-115**	52.200	22,23	3,04
PB 112.0	28.000	112.000	29,5	0,770	97,74	**-150**	68.000	25,40	3,98

PBO-Zylon® Cables

CODE	B. L.	MAX W.L.	DIAMETER	WEIGHT
	[Kg]	[Kg]	[mm]	[Kg/m]
PB 05	5.000	1.250	6,9	0,059
PB 10	10.000	2.500	9,5	0,085
PB 15	15.000	3.750	11,0	0,119
PB 20	20.000	5.000	12,3	0,148
PB 25	25.000	6.250	14,0	0,176
PB 30	30.000	7.500	15,2	0,205
PB 35	35.000	8.750	16,9	0,249
PB 40	40.000	10.000	17,9	0,290
PB 45	45.000	11.250	18,9	0,325
PB 50	50.000	12.500	19,7	0,379

Kevlar® 49 Cables

CODE	B. L.	MAX W.L.	DIAMETER	WEIGHT
	[Kg]	[Kg]	[mm]	[Kg/m]
K49 05	5.000	1.250	9,0	0,075
K49 10	10.000	2.500	12,0	0,123
K49 15	15.000	3.750	14,5	0,165
K49 20	20.000	5.000	16,2	0,210
K49 25	25.000	6.250	17,5	0,260
K49 30	30.000	7.500	19,0	0,320
K49 35	35.000	8.750	20,0	0,350
K49 40	40.000	10.000	21,1	0,400
K49 45	45.000	11.250	22,5	0,450
K49 50	50.000	12.500	23,7	0,510

Dyneema® SK99 Cables

CODE	B. L.	MAX W.L.	DIAMETER	WEIGHT
	[Kg]	[Kg]	[mm]	[Kg/m]
DYN 05	5.000	1.250	8,5	0,054
DYN 10	10.000	2.500	11,8	0,082
DYN 15	15.000	3.750	14,0	0,115
DYN 20	20.000	5.000	15,9	0,147
DYN 25	25.000	6.250	17,0	0,173
DYN 30	30.000	7.500	18,7	0,207
DYN 35	35.000	8.750	19,6	0,231
DYN 40	40.000	10.000	20,3	0,263
DYN 45	45.000	11.250	22,0	0,298
DYN 50	50.000	12.500	23,1	0,327

Torsional cables / description

THE ENGINEERING DEPARTMENT OF ARMARE HAS DEVELOPED TECHNIQUES AND MACHINERY TO SUBMIT "TORSIONAL CABLES" TO AVANT-GARDE TESTS. THE EVALUATION OF THE TORSIONAL STATIC AND CYCLIC RESISTANCE ALLOWS ARMARE TO SIMULATE THE BEHAVIOUR OF THE CABLES ON BOARD, IN ORDER TO IMPROVE THE PRODUCTS AND TO PROVIDE USEFUL DESIGN DATA.

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Bottom-up and top-down torsional cables

Torsional cables have been specifically designed to be used as a means of torque transmission along the cable, without loss of speed between tack and peak of the sails, for the furling of the flying or spherical sails, as gennaker. The technological development has enabled the design and realization of a wide range of structural torsional cables, which permits the application of this technology also for the winding of luffed headsails like code zero sails, drifter, solent and staysails.

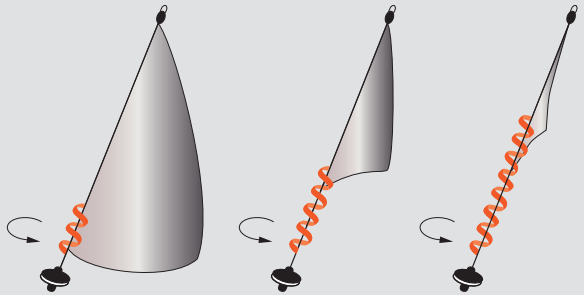
These cables are now the best technological achievement that guarantees torque transmission along the cable, flexibility and high speed furling. This allows quick and reliable operations of the sailors, with a dramatically reduction of the time of furling.

Torsional cables have now become essential on any cruising or racing boat, offering incomparable performance, higher than any other textile cable/rope.

Standard cables are made of the same fibers used for single cables: PBO-Zylon®, or Dyneema® SK99, Dyneema® DM20, Kevlar® 49. The cables can be supplied either with a couple of terminals AT or with one terminal AT and one other specific terminal for lashings. When using a specific terminal for lashings the cable must be shorter than the sail. Then it is connected to the drum fork by a structural lashing made of Dyneema® rope of the appropriated diameter and length.

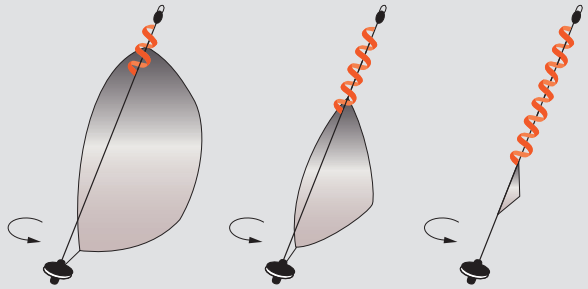
Bottom-up torsional system

It is the principle of the traditional winding: the torque transmission happens from the bottom upwards. The sail is secured with a lashing on both ends of the cable; the torsional force is applied to the drum and the textile cable transmits the torque along the cable until to the opposite end (at the top) and the sail begins to wrap from the bottom to the top.



Top-down torsional system

The tack of the sail is fixed to the drum through one free tack swivel: the torsional force applied to the drum is transmitted almost instantly to the swivel at the top and causes the winding of the sail from the top to the bottom. When the winding has been completed, the halyard can easily be released and the sail can easily be traversed and stowed.



NFC technology

NFC technology (Near Field Communication) is an APP, that can be downloaded by most of the smartphones. Using a common software and hardware protocol, this technology enables a mobile phone to communicate with TAG put inside of the terminals of composite cables. The connection happens in a short distance (maximum 2 cm) and according to protocols defined by the NFC standard: basically to use NFC you have to lay up your smartphone to the terminal, in order to get all the essential information about the cable, i.e. specific technical data and the date of production. In this way, the definition of the intervals of maintenance and service of every textile standing rigging becomes easy and safe.

Maintenance

The production of a composite cable follows strict procedures, which assure the complete quality control of each cable. From design to testing, Armare records the technical features of each cable, to be able to deliver to the customer a safe and guaranteed product; depending on the specific use of the cable, Armare contacts the registered client when it is necessary to program a cycle of inspections and service.

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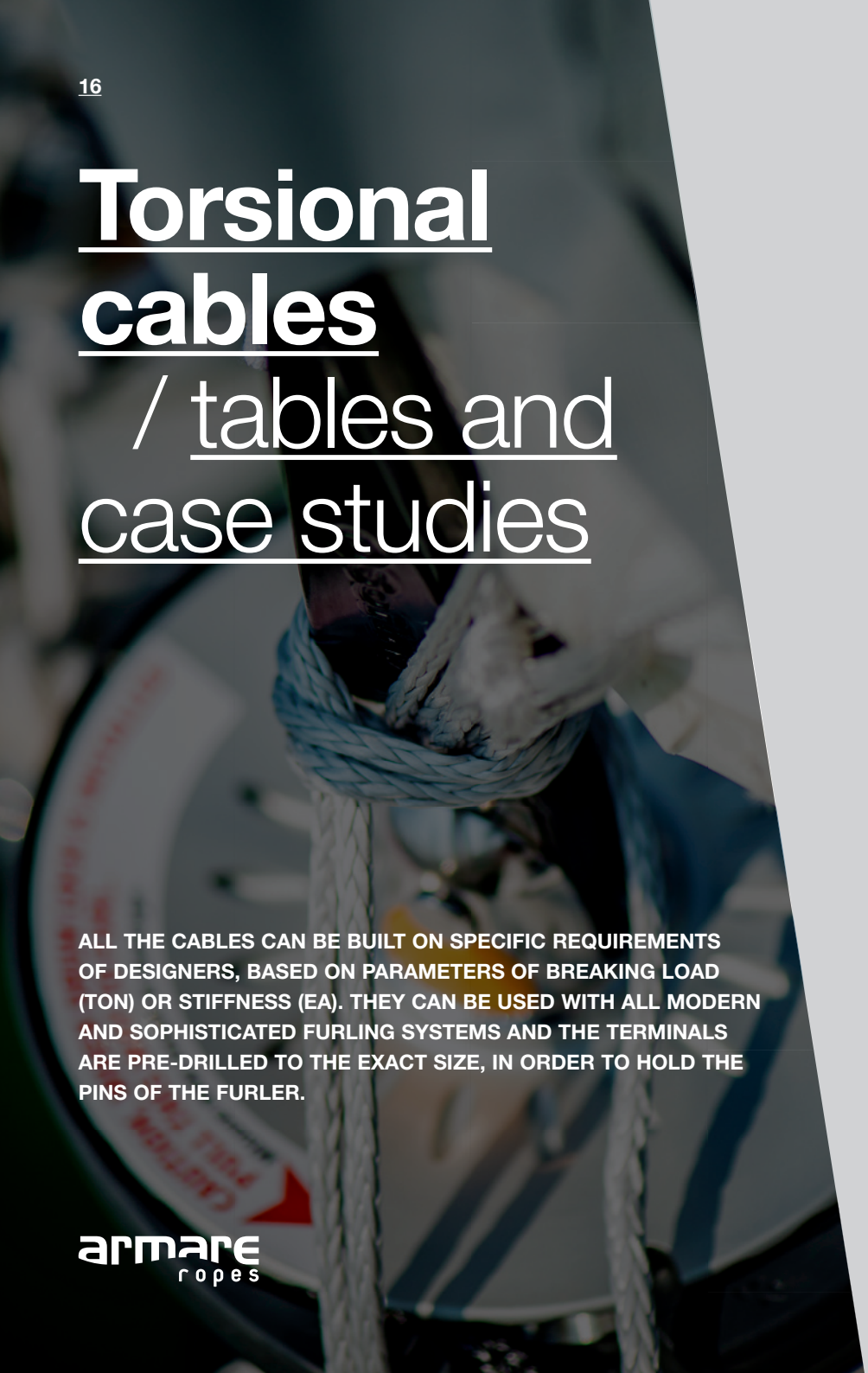
Torsional cables / tables and case studies



ALL THE CABLES CAN BE BUILT ON SPECIFIC REQUIREMENTS OF DESIGNERS, BASED ON PARAMETERS OF BREAKING LOAD (TON) OR STIFFNESS (EA). THEY CAN BE USED WITH ALL MODERN AND SOPHISTICATED FURLING SYSTEMS AND THE TERMINALS ARE PRE-DRILLED TO THE EXACT SIZE, IN ORDER TO HOLD THE PINS OF THE FURLER.

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Bottom-up furling composite cables / case studies

BOAT	CABLE	FIBER	W.L.	LENGTH	DIAMETER	WEIGHT
	[-]	[-]	[Ton]	[mm]	[mm]	[Kg]
XC45	Code 1	Kevlar	2,5	20000	14,0	4,0
POGO 40S2	Stay sail	Kevlar	3	11500	14,5	2,7
POGO 40S3	Structural Code Cable	Kevlar	5	16500	17,5	5,0
XP44	Code Cable	Kevlar	5	19500	15,5	4,8
EDIMETRA 65'	Code Cable	Kevlar	5	29500	16,5	8,2
NAUTA 70'	Code Cable	Kevlar	5,3	22000	19,0	8,0
SOLARIS 58	Code Cable	Kevlar	7	25000	18,5	8,8
SWAN 68	Code Cable	Kevlar	7	28000	16,0	9,2
MYLIUS 18e25	Code Cable	Kevlar	7,5	26000	18,5	9,3
VISMARA 80	Code Cable	Kevlar	8	30000	19,5	11,8
POGO 50	Structural Code Cable	Kevlar	8,3	19500	20,0	8,0
CAT 30'	Code Cable	PBO	1	15000	8,0	1,0
CLASS 40	Code 0	PBO	2,5	18000	12,0	3,0
OPEN 50	Stay sail	PBO	3	12000	13,0	2,2
CLASS 40	Struct. Forestay	PBO	4,3	16000	15,0	3,72
COOKSON 50	Code Cable	PBO	5	23400	15,0	5,52
OPEN 50'	Struct. Forestay	PBO	8	18000	15,0	4,99
IMOCA 60	Code Cable Solent	PBO	10	23500	20,0	8,37
CAT 55'	Code Cable	PBO	12	18000	19,0	7,45
SWS 82	Code Cable	PBO	12	34000	19,0	12,5

Top-down furling composite cables / case studies

BOAT	CABLE	FIBER	W.L.	LENGTH	DIAMETER	WEIGHT
	[-]	[-]	[Ton]	[mm]	[mm]	[Kg]
J122	Top Down	Kevlar	2,5	18000	13,0	3,3
X41	Top Down	Kevlar	2,5	18500	12,0	3,0
XP44	Top Down	Kevlar	3,5	19500	14,0	4,1
X50	Top Down	Kevlar	4	23000	15,0	5,7
GS60	Top Down	Kevlar	5	24500	15,5	6,2
SOLARIS 72	Top Down	Kevlar	6,5	26000	16,0	8,9
WALLY 80'	Top Down	Kevlar	7	33500	17,0	13,2
NEO 400	Top Down	PBO	5	18500	13,0	3,5

Torsional PBO® cables

CODE	BREAKING LOAD	MAX WORKING LOAD	DIAMETER	WEIGHT
	[Kg]	[Kg]	[mm]	[Kg/m]
ATPB 06	6.000	1.500	10,50	0,113
ATPB 10	10.000	2.500	12,70	0,173
ATPB 15	15.000	3.750	14,50	0,213
ATPB 20	20.000	5.000	15,60	0,248
ATPB 25	25.000	6.250	17,20	0,280
ATPB 30	30.000	7.500	18,70	0,313
ATPB 35	35.000	8.750	19,50	0,351

Torsional Kevlar® cables

CODE	BREAKING LOAD	MAX WORKING LOAD	DIAMETER	WEIGHT
	[Kg]	[Kg]	[mm]	[Kg/m]
ATK49 06	6.000	1.500	12,70	0,136
ATK49 10	10.000	2.500	14,80	0,208
ATK49 15	15.000	3.750	16,80	0,256
ATK49 20	20.000	5.000	18,70	0,298
ATK49 25	25.000	6.250	19,60	0,336
ATK49 30	30.000	7.500	21,20	0,376
ATK49 35	35.000	8.750	22,50	0,421

Torsional Dyneema® SK99 cables

CODE	BREAKING LOAD	MAX WORKING LOAD	DIAMETER	WEIGHT
	[Kg]	[Kg]	[mm]	[Kg/m]
DYN99 06	6.000	1.500	13,50	0,128
DYN99 10	10.000	2.500	15,40	0,195
DYN99 15	15.000	3.750	17,60	0,250
DYN99 20	20.000	5.000	19,50	0,272
DYN99 25	25.000	6.250	21,20	0,320
DYN99 30	30.000	7.500	23,10	0,360
DYN99 35	35.000	8.750	25,00	0,400

Standing rigging

DRY CONSTRUCTED ARMARE PBO CABLES HAVE A 50% HIGHER SAFETY RATIO THAN ROD CABLES AND THEIR WEIGHT REDUCTION REACHES 80%. THE PBO CABLE IS LIGHTER AND SAFER EVEN WHEN COMPARED TO OTHER TYPES OF COMPOSITE RIGGING. THE ADOPTION OF PBO TEXTILE RIGGING PROVIDES DIFFERENT BENEFITS TO THE PERFORMANCE OF ANY KIND OF SAIL BOAT.

armare ropes

Complete standing rigging systems in PBO® for boats up to 80 feet

Armare has developed a complete retrofit system to replace rod with textile standing rigging. It is the perfect choice for those who want to get the best from their boat, whether for a new project or a retrofit application, because it is easy to install and use, it doesn't require many interventions on the current rigging and its maintenance is simple.

The cables are made of continuous PBO-Zylon® multifilament, with the same techniques used for single cables. The apparent simplicity of these cables, hides a complex construction. Although it is always made with the "sling" system, and the production is handled by a special machine, that controls at any time tension and winding of the yarn, a considerable part of the work is done manually.
The result is a great attention to details, in particular those that are not visible, that's to say treatments, finishes, protection and processes that are an important part in the construction of the cables. Actually these details affect the durability and the overall performance of the finished product.

Easy installation and great aesthetic

The installation on board of a textile standing rigging is facilitated by the lightness and the flexibility of the cables; the use of PBO® cables allows the elimination of many parts of the additional fitting, e.g. the S.S. heads of the spreaders. The optimization of the fitting provides further reduction on the total weight of the rigging, together with a drastic decrease of the necessary time for its installation. The cleaning of textile standing rigging ensures an optimal aesthetic result.

Best righting moment

The adoption of PBO® textile rigging provides various benefits to the performance of the sail boat, which may vary, according to dimensions and the proportional reduction of weight. E.g.: on an 80 feet yacht, the weight of the traditional standing rigging reaches over 300 kg, compared to 80 kg of corresponding PBO®. This weight reduction translates into an improvement of the righting moment, which can be exploited for example by removing a weight in the keel as per 1:5 ratio (1,000 kg to remove from the keel).
The reduction of movements of the mast exceeds 12%, with an increase of boat speed and the reduction of rolling and pitching.

Better performance

Thanks to the general lightening of the rigging and the visible improvement of the righting moment, the boat can sail faster. The performance betters reaching easily 1%, which translates to a distance of 100 miles equates to a saving of about 10 minutes. The possibility to profit by an improvement in the righting moment permits the designers to change weight distribution in order to achieve the aim to improve the performance.

Increased stability

The movements of roll and pitch are definitely lower. It is calculated that, with the adoption of a textile standing rigging and stay, the pitching can be reduced by 5% and the rolling up to 30%. Consequently, the movements of the mast are lower, with the derivation of intuitable advantages, as to say much more constant and linear behaviour of the boat, especially with wave, in favour of a better quality and speed of the navigation and at list much comfort on board.

Retrofit system

THE ADOPTION OF A TEXTILE STANDING RIGGING DOESN'T IMPLY PARTICULAR PROBLEMS TO THE ORIGINAL RIGGING. THE CABLE SYSTEM IS PROVIDED COMPLETED OF FITTING ELEMENTS; ARMARE TECHNICIANS ARE ABLE TO DEFINE THE INTERVENTION AND ARRANGE FOR THE INSTALLATION ON BOARD.

armare ropes

How does the system work

As shown in the figure, the vertical (V1) and the diagonals (D1, D2, D3) are connected to the standard housing of the mast through the terminals, included in the textile standing rigging. Each steel fitting also has a regulation of about 70 mm. The vertical and the diagonals, excluding D1, are composed by a single cable, with the added benefit of a reduction of weight and complexity of the system.

External or internal spreader

There are two different techniques for the passage on the spreaders, that are called External spreader (Fig. 1 and 2) and Internal spreader / Tip Cup (Fig. 3). In this way, for example, the passage of the vertical on the third spreader is completed with a simple binding, which keep in seat the cable, while the passage on the first spreader is inner, using the existing seats (Tip Cup). Any change to the heads of the spreaders are made directly from Armare. Finally, a simple steel fitting system allow the link between the deck cable (V1) and the diagonal (D1), that are taken to the right tension through special stainless steel turnbuckles.

Simple and reliable solutions for two or three spreaders masts, with internal or external passage

Three spreader mast

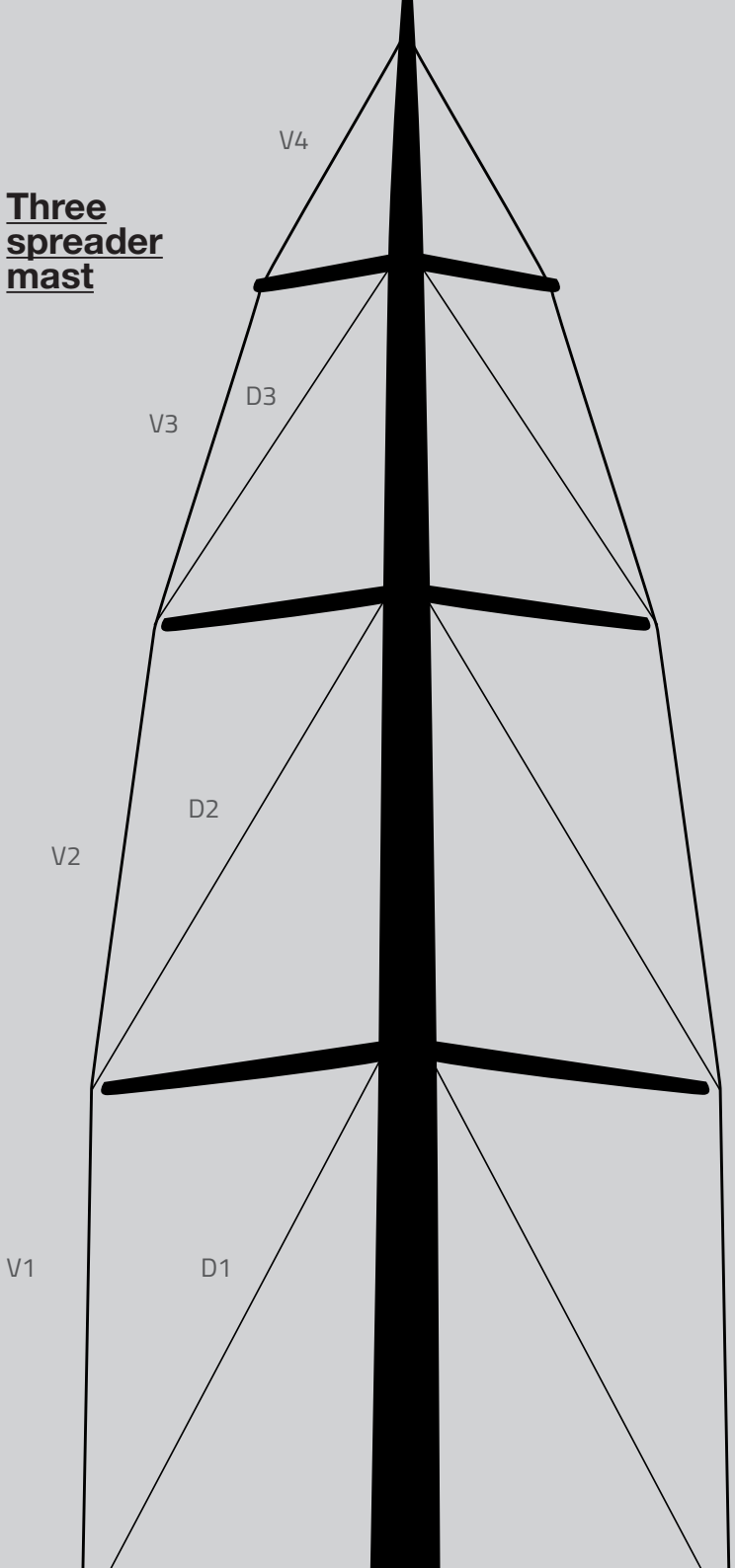
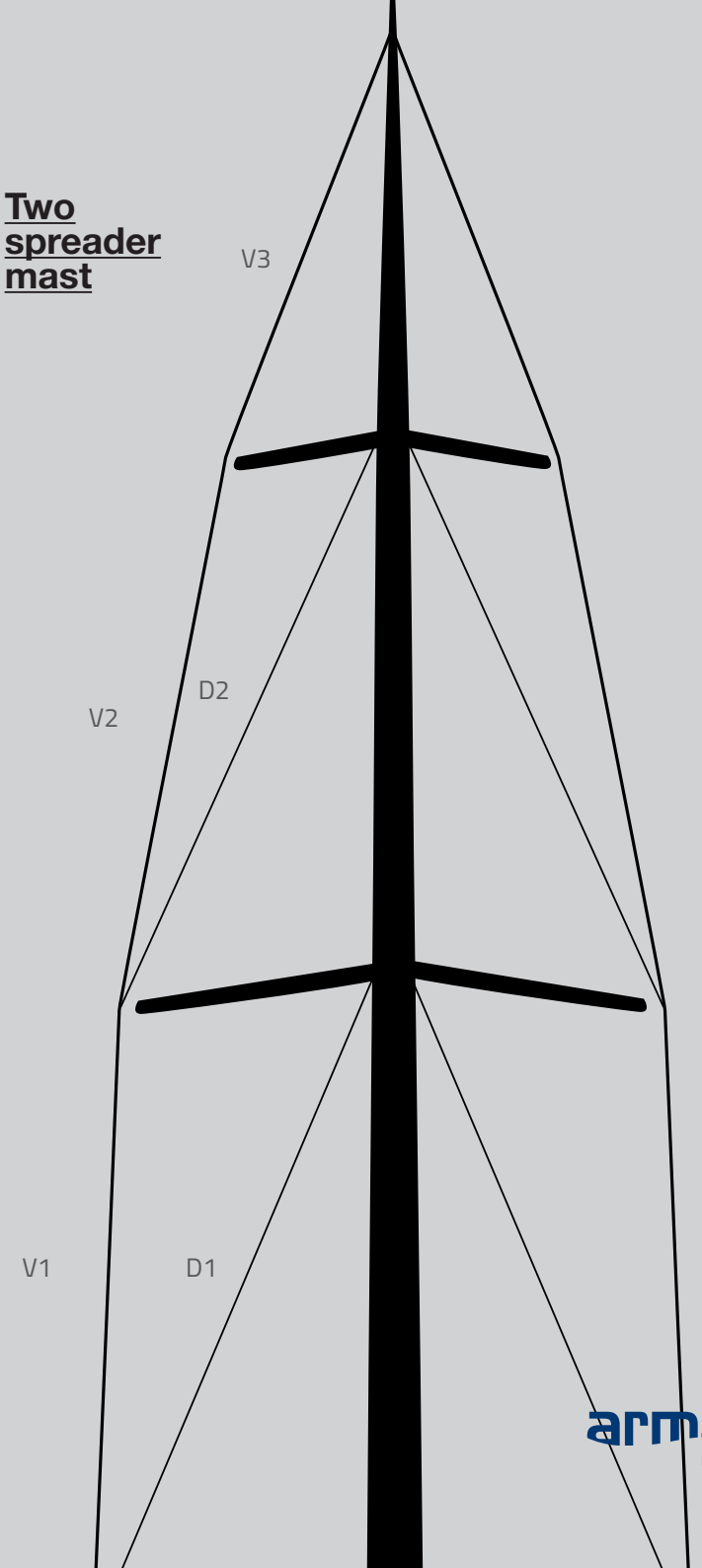


Fig. 1 External Spreader

Fig. 2 External Spreader

Fig. 3 Internal Spreader

Two spreader mast



armare ropes

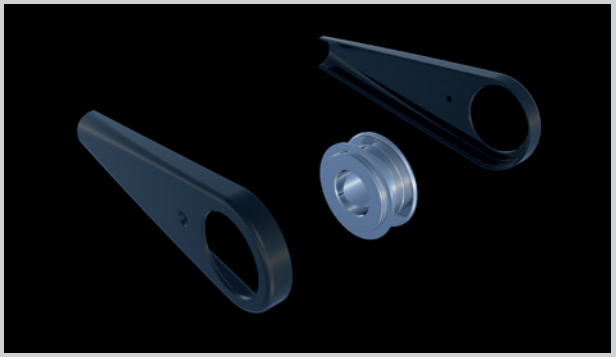
Fittings / terminals for single cables and torsional cables

TERMINALS FOR PIN OR FOR LASHING, ALSO IN THE VERSION THAT CAN BE OPENED TO FACILITATE CRITICAL OPERATIONS OF INSTALLATION.

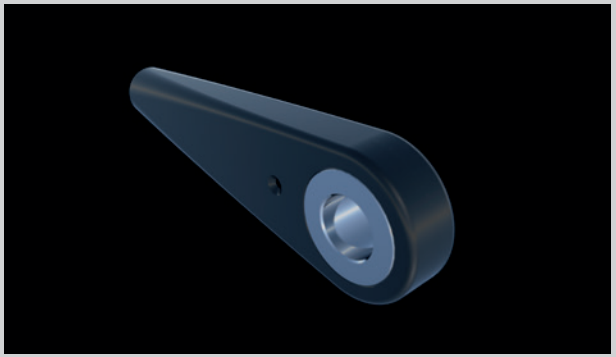
armare ropes

Pin or lashing terminals

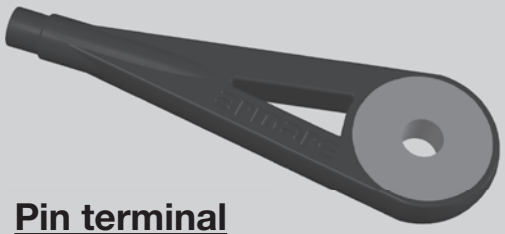
Many products, that are sold on the market, apply systems of friction/ cone/plug, which require the use of metal fitting with a consequent increase of complexity and weight. Armare suggests the simplest and most effective solution for the terminals of the cable, thanks to the direct encapsulation of technical fibers and the steel terminal, on which the resin covers are molded. There are two available versions of terminals: the Pin and the Lash, the first for the use with fixing pins (or with fork), the second by a lashing with Dyneema® without cover.



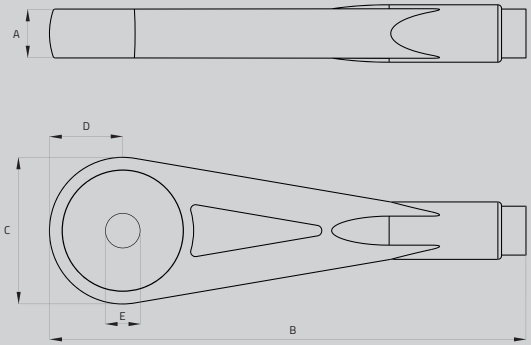
Openable terminal - Exploded view



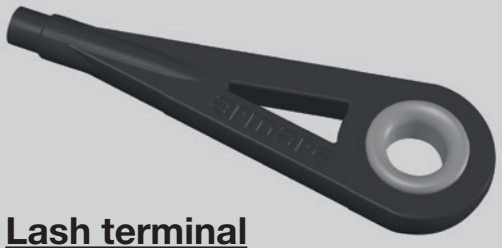
Openable terminal - Closed view



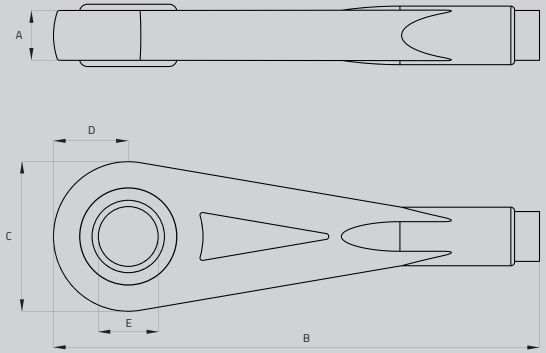
Pin terminal



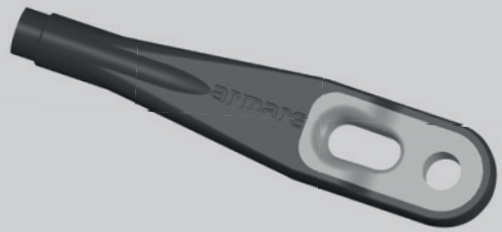
PIN TERMINAL	A	B	C	D	E
CODE	[mm]	[mm]	[mm]	[mm]	[mm]
AA (All shape)	7,70	60,00	26,00	13,00	10,00
A	9,50	102,20	34,50	17,30	12,00
Bz12	12,00	137,80	45,50	22,80	16,00
Bz14	14,50	137,80	45,50	22,80	16,00
C	17,00	159,00	52,00	26,00	22,00
D	20,00	185,00	60,00	30,00	26,00
E	23,00	218,50	70,00	35,00	30,00
F	27,00	233,70	76,00	38,00	35,00
G	33,00	282,00	86,00	43,00	38,00



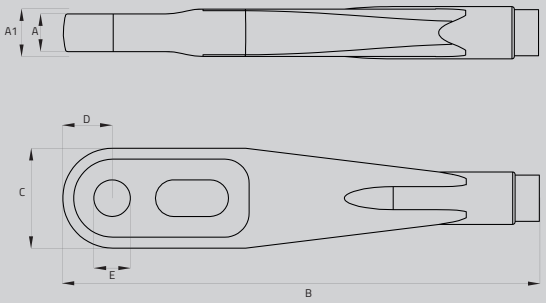
Lash terminal



LASH TERMINAL	A	B	C	D	E
CODE	[mm]	[mm]	[mm]	[mm]	[mm]
00 (All shape)	7,70	60,00	26,00	13,00	8,00
0	9,50	112,20	34,50	17,30	10,00
1	14,50	147,80	45,50	22,80	17,00
2	17,00	169,00	52,00	26,00	21,00
3	20,00	195,00	60,00	30,00	24,00
4	23,00	228,50	71,00	35,50	26,00
5	27,00	233,70	76,00	38,00	28,00
6	33,00	282,00	86,00	43,00	32,00



Torsional terminal



TORSIONAL TERMINAL	A	A1	B	C	D	E
CODE	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
AT2	15,5	19,5	165,6	40	20	On Request - Max PIN 15
AT3	18,5	24,5	235	54	27	On Request - Max PIN 25
AT4_Z18	18,0	33,0	315,0	90,0	35,0	On Request - Max PIN 20,5
AT4_Z 27	27,0	42,0	315,0	90,0	45,0	On Request - Max PIN 28,5

armare ropes

Maintenance and service

THE LIFE OF THE COMPOSITE CABLES DEPENDS ON DIFFERENT FACTORS LINKED TO THE TYPE OF FIBER THAT HAS BEEN CHOSEN, THEIR USE ON BOARD UNDER STATIC, DISCONTINUOUS OR TORSIONAL LOADS, THEIR WORKING LOADS AS WELL AS THE EXPOSURE TO ATMOSPHERIC AGENTS. MOREOVER, EVERY COMPOSITE FIBER REACTS IN A DIFFERENT WAY DURING ITS LIFETIME.

THANKS TO THE TESTS MADE IN DIFFERENT AND REAL SAILING CONDITIONS ON BOARD OF BOATS HAVING HIGHLY DIFFERENT PERFORMANCES, ARMARE CAN GUARANTEE THE DURABILITY OF ITS COMPOSITE CABLES IF PROPERLY USED. THEY CAN LAST IN PERFECT WORKING CONDITIONS FOR MANY YEARS, EVEN LONGER THAN THE CORRESPONDING STEEL CABLES, FULFILLING THE SAILOR'S EXPECTATION OF PERFORMANCE.

armare ropes

Constant loads

For vertical rigging, forestays and fixed backstays, the best choice is PBO®, thanks to its exceptional resistance under constant loads. Over the years, PBO® cables are proving to be extremely durable and resistant, even more lasting then the corresponding cables in Nitronic or in steel rod.

Load / off-load

Diagonal and backstays are subject to very intensive loads, than they are fully downloaded or even go negative (e.g. the rigging downwind sailing upwind). Even for this items, PBO® is the best fiber, but are suggested reduced intervals of inspection and maintenance.

Torsional load (running/torsional)

Although the torsional cables can be structural, they need particular device in the construction, because it is necessary to provide excellent transmission of the torque along the cable, while maintaining good flexibility and possibility of traverse. These cables are made of PBO®, Kevlar® or Dyneema® and are more and more common and used. Armare torsional cables, structural and non-structural, have always proved characteristics of high efficiency and durability.

Cable life guideline

While cruising the weight/diameter optimization is secondary to longevity and the cable life may be decided since the design process. After 3 to 4 years (for race boats) and after 4 to 6 years (for cruising boats), Armare recommends to send back all the cables to the factory for an inspection service and testing cycle: the results of these tests provide guidance on whether or not, rigging elements need to be replaced. The Engineering Department of Armare is composed by a group of highly qualified technicians that offer permanent technical assistance for the cables and if necessary they can also do the inspection on board. The terms here below are indicative and split, depending on the use and the navigation features the cable is usually subjected to. Generally speaking, a visual inspection should be made once a year as well as deeper inspections at suggested intervals. E.g. cables that are subjected to torsion need intervals of maintenance that are three times longer than the cables that are put under constant loads.

Control intervals*

Maintenance action	Race Yacht	Cruising Yacht
Annual visual inspection	1 year	1 year
Runners, checks, torsional cables	2 years	3 years
Diagonals, forestay, backstay	3 years	4 years
Verticals	4 years	6 years

Maximal durability**

Limit of duration of composite cables in PBO: 4 years
Limit of duration of material in K49: 4 years

(*) The term of control is the period after which the cable must be sent to Armare for a complete inspection in order to assess its conditions and redefine the limits of life. It does not represent in any way a guarantee of durability of the cable, which may require an earlier replacement, due to the real working conditions and the type of use.

(**) The time limit is the maximum useful life of a cable, in normal working conditions, after which the cable must be replaced or sent to Armare for a complete control, in order to assess a possible extension of duration. It does not represent in any way a guarantee of durability of the cable, which may require replacement, due to the previous real working conditions and the type of use.

armare ropes

Custom loops and strops

IN ADDITION, AS A COMPLEMENT TO FURLING CABLES, FORESTAYS AND SHROUDS, ARMARE DESIGNS AND BUILDS CUSTOM LOOPS, USING DYNEEMA® FIBER. DYNEEMA® IS PROPERLY TREATED AND COVERED BY A PROTECTIVE BRAIDED COVER ALSO MADE WITH A DYNEEMA® ANTI-CHAFE CONSTRUCTION.

ALL LOOPS ARE HAND-MADE, FOLLOWING THE TECHNICAL SPECIFICATIONS OF THE SINGLE PROJECT, IN ORDER TO ENSURE OPTIMAL PERFORMANCE IN TERMS OF LIGHTNESS, DURABILITY, FLEXIBILITY, MAXIMUM WORKING LOAD AND STRETCH.

armare ropes

Forestay strops

These Strops are used for the connection between the textile forestay and the deck. They are particularly practical, and allow an optimum adjustment whether using structural- or furling stays.

Single strops with T-Bone

The use of steel fitting (T-Bone) together with Dyneema® loops or strops solves many problems on board, e.g. the connections between deck and sails instead of using padeyes.

Custom Loops

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