

# YACHT RIGGING

MADE IN SWITZERLAND  
SINCE 2000

DNV TYPE APPROVED  
AS 9100D AEROSPACE & DEFENCE CERTIFIED

1. Carbo-Link rigging solutions
2. Why CL SOLID?
3. CL SOLID terminations
4. Project portfolio samples
5. Lightning strike resistance
6. Contact



## 1. ABOUT

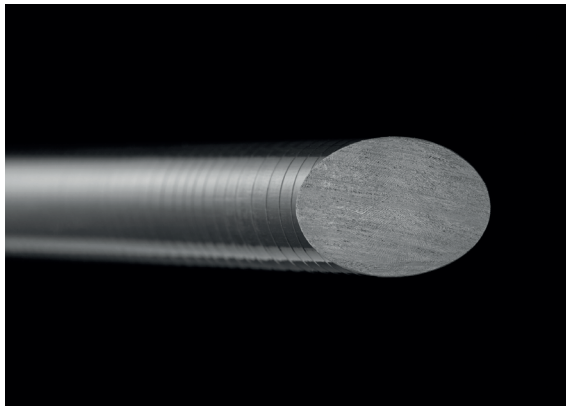
Carbo-Link has been supplying carbon rigging solutions since 2001.

CL SOLID carbon rigging is an evolution of bundled carbon solutions first developed by Carbo-Link's management at EMPA between the 1970's & late 1990's. CL SOLID's superior stiffness, enhanced resistance to chafe & impact, and reduced cross-section combined with minimal service requirements makes CL SOLID the optimum rigging choice.

CL SOLID rigging is made from continuously wound, unidirectional prepreg carbon fibre tape embedded in a toughened resin matrix. CL SOLID rigging is cured into a solid cable, either round or elliptical (CL ELLIPSE). All prepreg tape is made in-house in accordance to Aerospace certified processes; optimizing fibre type & tape width whilst ensuring the perfect fibre alignment. CL SOLID features fully integrated titanium terminations custom engineered & manufactured in-house.

CL SOLID, CL ELLIPSE & CL HYBRID rigging is DNV GL Type Approved.

## SOLUTIONS



### CL SOLID

Smaller, stiffer, lighter, tougher. All with minimal service at a low cost of ownership.



### CL TORQUE

The most efficient forestay furl with zero torsional degradation over time.



### CL ELLIPSE

All the value of CL SOLID rigging plus an elliptical profile for a reduced drag coefficient.



### CL HYBRID

Flexible carbon where required, solid carbon elsewhere in a continuous cable.

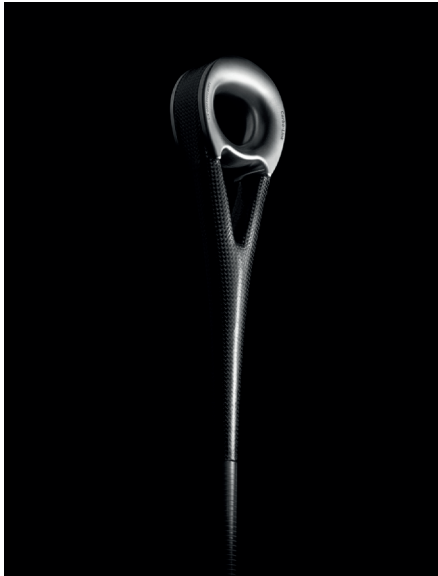
## 2. WHY CL SOLID?

- 1 REDUCED COST OF OWNERSHIP**
  - Never need to send rigging away for a service or recovering
  - 15+ plus lifespan with proper service & maintenance
- 2 INCREASED LONGEVITY**
  - Longevity is comparable to a yachts hull
  - The original properties will be sustained over 15 years or more
- 3 SUPERIOR DURABILITY**
  - Toughened resin system results in superior chafe and impact resistance
  - No soft cover to chafe, or individual rods susceptible to damage
- 4 SIMPLE SERVICE & INSPECTION**
  - Nothing hiding beneath the cover. Visual inspections of the surface identify rigging health
  - Possible to NDT with the mast stepped or un-stepped at high-load areas and local points of interest
- 5 REDUCED LIKELIHOOD OF LIGHTNING STRIKE & SUBSEQUENT DAMAGE**
  - CL SOLID is grounded and able to unload charge > integrated fittings with a direct connection to the yachts hull
  - There is no static build-up, which in turn reduces the likelihood of being struck
- 6 SIMPLE LOGISTICS**
  - Can be delivered coiled or full length with final handover on-site
  - Simple storage with mast during refit periods > no shipping required throughout rigging lifespan
- 7 NEATEST, SMALLEST INTERFACES**
  - Fully integrated into the cable which in-turn reduces weight
  - No bonded joints or reliance on threaded fittings between cable termination and interface > no creep or bedding-in
- 8 REDUCED LIKELIHOOD OF VIBRATION**
  - Vortex shedding can occur on any tensioned cable > CL DAMPER proven to be highly effective solution if required
  - Elliptical rigging is less susceptible to vortex shedding (vibration) as proven on all existing elliptical projects
- 9 SMALLEST DIAMETER**
  - Upto 35% smaller cross-section than bundled rigging due to 100% consolidation of fibres
  - No bundled rods with gaps and no additional consolidation cover
- 10 RELIABLE & OPTIMISED ELLIPSE**
  - No structural difference between round and elliptical solid carbon rigging
  - Research, numerical analysis and sailing time prove ellipse ratio's of 2.0:1 or shorter balance all considerations
- 11 2 YEAR WARRANTY**
  - Not limited to any type of sailing – includes racing and all associated training requirements
  - See 'General Terms & Conditions' for comparison to alternative suppliers

**3.  
TERMINATIONS**



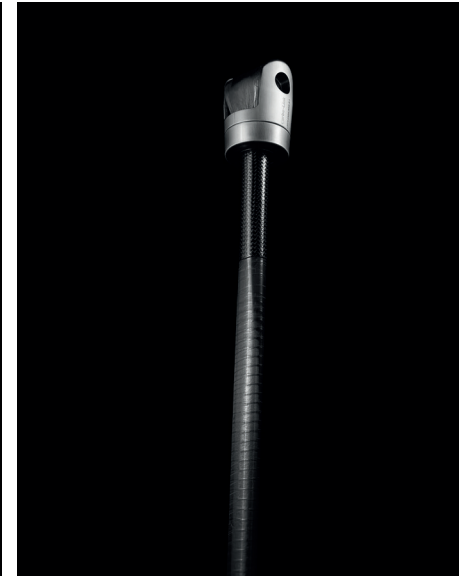
**PIN**



**LASHING**



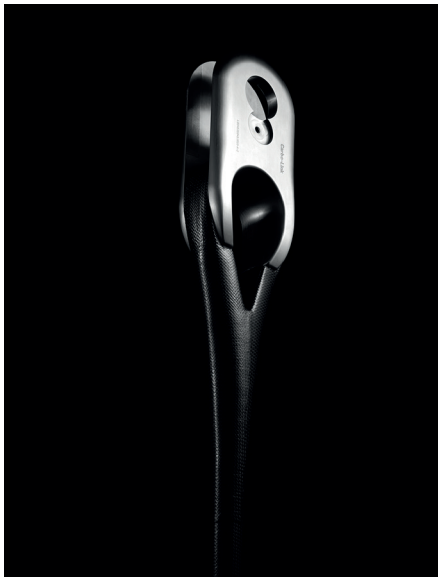
**SPHERICAL BEARING**



**BALL HEAD**



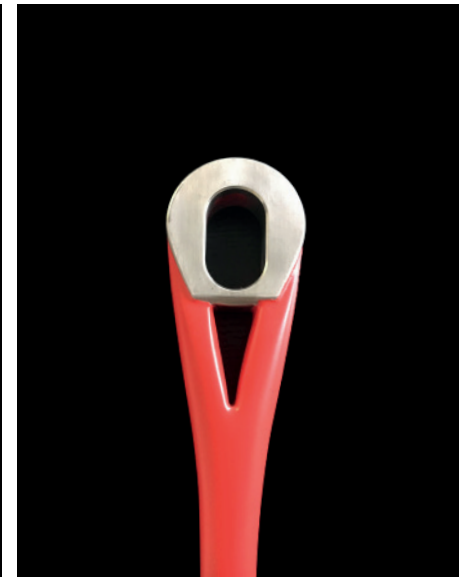
**SHIMMED**



**JAW**



**TORSIONAL**



**SLOTTED**

**4a.**  
**CL ELLIPSE  
EXAMPLES**



**'RAMBLER 88'**

Offshore specialist

- CL ELLIPSE laterals
- CL SOLID: ROUND forestay & CL STROP
- CL HYBRID ELLIPSE backstays



**'VISIONE'**

Baltic 147

- CL ELLIPSE laterals
- CL TORQUE forestay



**'CANNONBALL'**

Maxi 72

- CL ELLIPSE laterals
- CL SOLID: ROUND forestay + CL STROP
- CL HYBRID ELLIPSE backstays



**'NILAYA'**

RP Nauta 43m

- CL ELLIPSE laterals
- CL TORQUE forestay
- CL HYBRID ELLIPSE backstays

**4b.**  
**CL SOLID**  
**EXAMPLES**



**'NGONI'**

Dubois 58m

- CL SOLID: ROUND laterals
- CL ROUND forestay
- CL FLEX topmast backstays



**'Sea Eagle II'**

Dykstra 83m

- CL SOLID: ROUND laterals
- CL ROUND forestay & inner forestay



**'SAUDADE'**

Wally 148

- CL SOLID: ROUND laterals
- CL TORQUE forestay



**'LIONHEART'**

J Class 44m

- CL SOLID: ROUND laterals
- CL SOLID: ROUND forestay

#### 4c. CL HYBRID EXAMPLES



#### 'VESPER'

Maxi 72

- CL HYBRID ELLIPSE backstays
- CL ELLIPSE lateral rigging
- CL SOLID forestay + CL STROP



#### 'CANNONBALL'

Maxi 72

- CL HYBRID ELLIPSE backstays
- CL ELLIPSE lateral rigging
- CL SOLID forestay + CL STROP



#### 'GALATEIA'

Wally Cento

- CL HYBRID ELLIPSE backstays
- CL ELLIPSE lateral rigging
- CL SOLID forestay + CL STROP



#### 'HIGHLAND FLING'

RP82

- CL HYBRID ELLIPSE backstays
- CL ELLIPSE lateral rigging
- CL SOLID forestay + CL STROP

#### 4d. CL TORQUE EXAMPLES



#### 'CANOVA'

Baltic 142

- CL TORQUE forestay
- CL ELLIPSE laterals
- CL HYBRID topmast backstays



#### 'SAMURAI'

Rhodes Young Design 42m

- CL TORQUE forestay & inner forestay
- CL SOLID: ROUND laterals



#### 'NAVALARIS'

ITA Catamarans

- CL TORQUE forestay
- CL SOLID shrouds & diamonds
- CL ELLIPSE martingale & CL SOLID whisker stays



#### 'SAUDADE'

Wally 148

- CL TORQUE forestay
- CL SOLID: ROUND laterals
- CL SOLID backstay



## 5. REDUCED LIGHTNING STRIKE VULNERABILITY

### #1 FULLY INTEGRATED FITTINGS

- Carbon is in direct contact with the fitting, which is in direct contact with the hull
- Resulting in a direct path of least resistance to the ground
- Any static charge caused by electrical or magnetic fields decays immediately
- There are no bonded joints to isolate the flow path

### #2 PREVENTS STATIC CHARGE

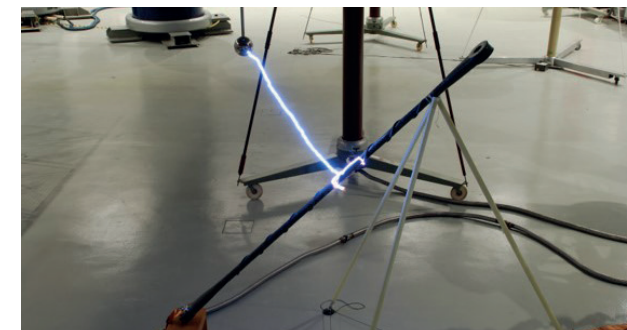
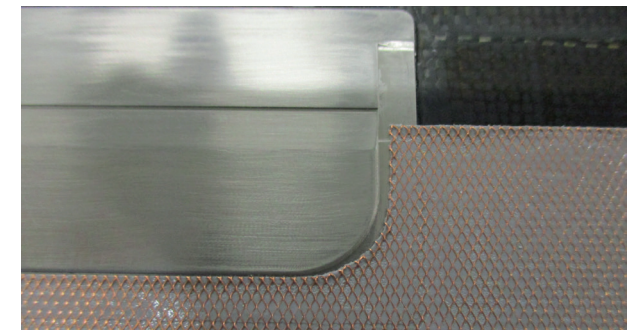
- High conductivity and direct path of low resistance
- Prevents static charge from building up in the system
- Therefore significantly reducing the probability of a strike

### #3 AERO-GRADE LIGHTNING PROTECTION CAN BE INTEGRATED

- A highly-conductive mesh layer can be laminated into the cable to further reduce electrical resistance and increase conductivity
- Carbo-Link helicopter blades featuring aerospace approved and certified lightning strike protection (shown in the right hand image)

### #4 THOROUGHLY TESTED

- Numerous laboratory tests at ETH Zurich have been carried out on solid tension members to better understand cause and effect
- Carbo-Link have supplied over 12,000 solid carbon crane cables to Liebherr, with some cranes reaching heights of 220m, with zero lightning strike issues



**6.  
CONTACT**

**JAMES WILKINSON**

Business Development  
+41 77 533 58 18  
wilkinson@carbo-link.ch

**ARNE GUELZOW**

Project Management & Engineering  
+41 58 201 25 10  
guelzow@carbo-link.ch

**MADE IN SWITZERLAND**

Carbo-Link AG  
Undermuelistrasse 25  
8320 Fehraltorf  
Switzerland

+41 58 201 25 00  
info@carbo-link.ch

