

JAURE®

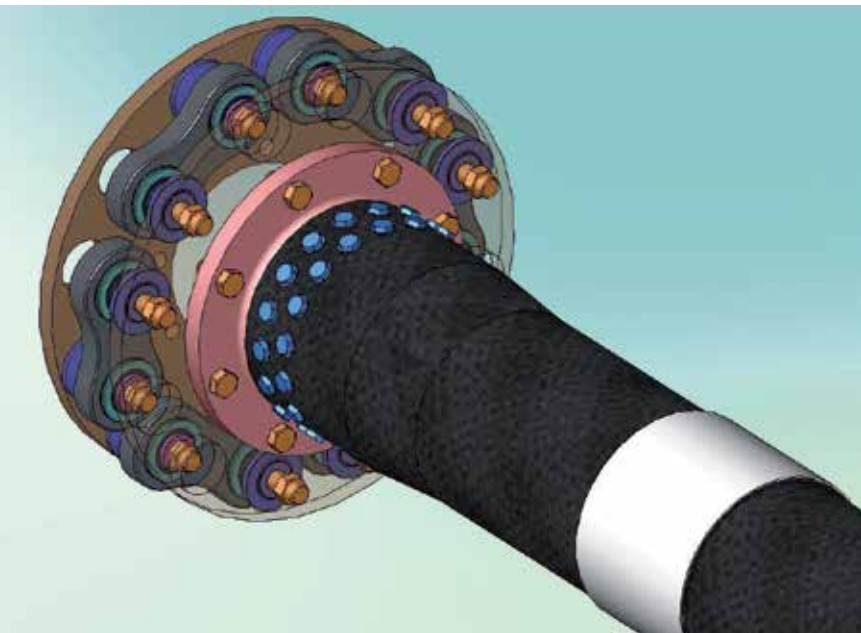
Carbon Fibre Shaftlines

JCFS



A Regal Brand

REGAL



Carbon Fibre
shaftline with
IXIFLEX coupling

JAURE® S.A. is a leading supplier of marine composite shaftlines and couplings. Experience, manufacturing programs, innovation and close cooperation with leading International companies in the marine business enables JAURE to provide solutions to our customers.

For 50 years, **JAURE®** has developed couplings for the most demanding applications in steel, marine, mineral, hoisting and windmill industries. Due to our continuous development and customer requirements, JAURE is now supplying Carbon Fibre shafts (JCFS) to these markets.

In marine business, **JAURE®** provides carbon fibre shaftlines and couplings mainly for propulsion and manoeuvring, covering the waterjet/pumpjet, propeller and thruster applications. Our customized solutions are also addressed to dredging or winch projects.

Our manufacturing program covers a complete range without boundaries in power and speed, and we continue developing new products for future challenges. The marine market is one of **JAURE**'s strategic fields of activity, and we have been fully committed to this market for many years.



JCFS Shaftline
installed on
a vessel

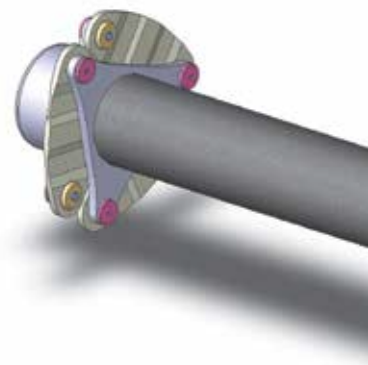


Manufacturing
CFRP tubes

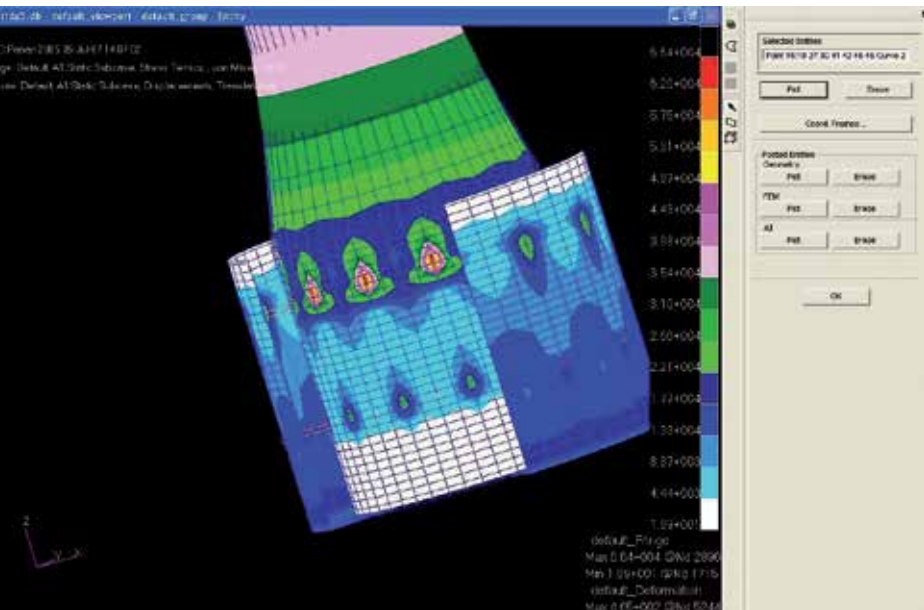
JAURE® S.A. is part of Regal Beloit America Inc.'s mechanical Power Transmission Solutions. The integration of **JAURE®** with **KOP-FLEX®** operations has strengthened **JAURE®**'s brand presence worldwide and has added application expertise benefiting both **KOP-FLEX®** and **JAURE®** customers.

KOP-FLEX® produces an extensive range of couplings and distinguishes itself in providing light weight engineered products for high speed or high performance applications.

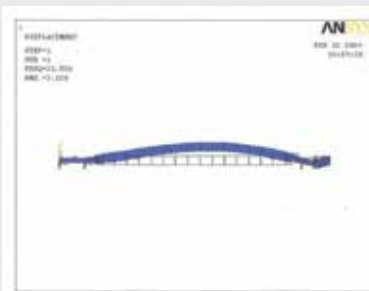
The merger between **KOP-FLEX®** and **JAURE®** further qualifies **JAURE®** to provide answers, products and service for the marine market on a global basis.



JCFS - JAURE Carbon Fibre Shaftlines



FEA of CFRP
Steel connection
and sagging



Carbon Fibre shafts, in combination with our couplings, were first introduced in fast ferries. They are now making inroads on other types of vessels such as dredgers, supply vessels, commercial and cruise ships.

The main advantages of **CFRP** shafts are:

- Weight reduction: Depending on the shaftline configuration, steel shaftlines are approximately 50-70% heavier.
- There are longer distances between the bearings, which reduces their quantity and simplifies the shaftline layout.
- Temperature stability (almost nule thermal expansion) avoids misalignment concerns on long shaftlines.

- As Carbon Fibre tubes are not affected by corrosion or wear, no maintenance is required and service life is longer.

At the same time:

- Composite shaftlines are more expensive than steel ones, but coupling and bearing quantity is reduced. For example, on really long shaftlines the number of bearings can be reduced by 50%. Therefore, apart from the direct charge of these components, the pedestal structure, installation and maintenance cost is avoided.
- Heat, fire and abrasion/impact resistance can be improved if proper coatings are provided. Please refer to **JAURE®** for any critical project.



Testing of interlaminar and intralaminar shear strength



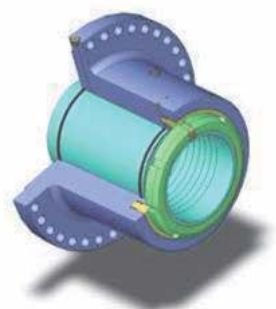
JAURE Carbon Fibre shaftlines are analysed by specific composite software which is based on FEA. Additionally, JAURE collaborates with Research & Development laboratories and Composite Engineering companies. In addition to our testing procedures, the actual shafts are also tested at our facilities in compliance with Classification Society's requirements.

During the design phase, apart from dimensioning the CFRP tube for the transmittable torque, other factors such as whirling speed, torsional stiffness, bending stiffness, composite/steel bolted connection, etc. are also analysed.

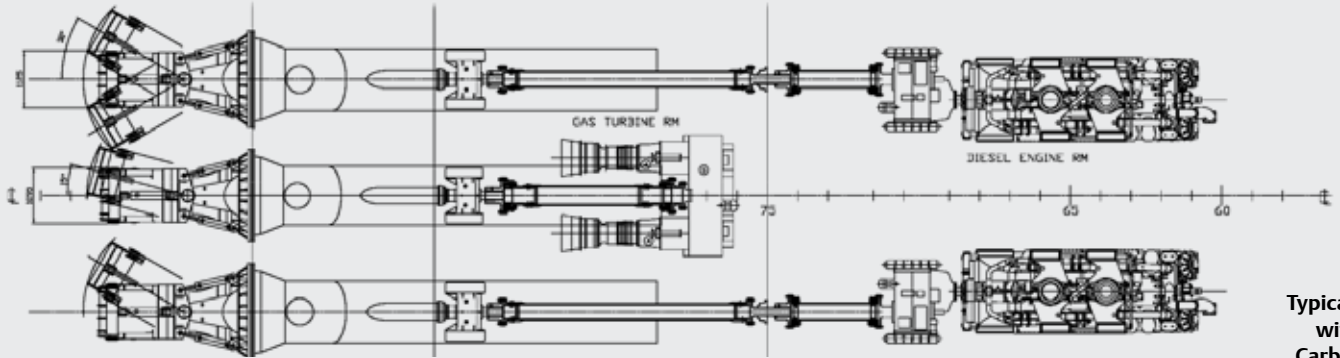
JAURE Carbon Fibre shaftlines usually include flexible and rigid couplings, which offer a complete package to fit specific project requirements.

Our brand names are recognized worldwide in the coupling market:

- LAMIDISC®: Non-lubricated and high torque capacity disc-pack couplings. Torsionally stiff.
- MT / HA: Compact design gear couplings valid for most marine applications, including underwater solutions.
- IXILFLEX®: Rubber joint link-type couplings. Bidirectional coupling for high misalignment.
- COMPOLINK®: Maintenance free composite link-type flexible couplings. Combination of high misalignment capability with excellent service life.
- JHC: Easy installation hydraulic rigid couplings for shaft connection.



JCFS - Applications

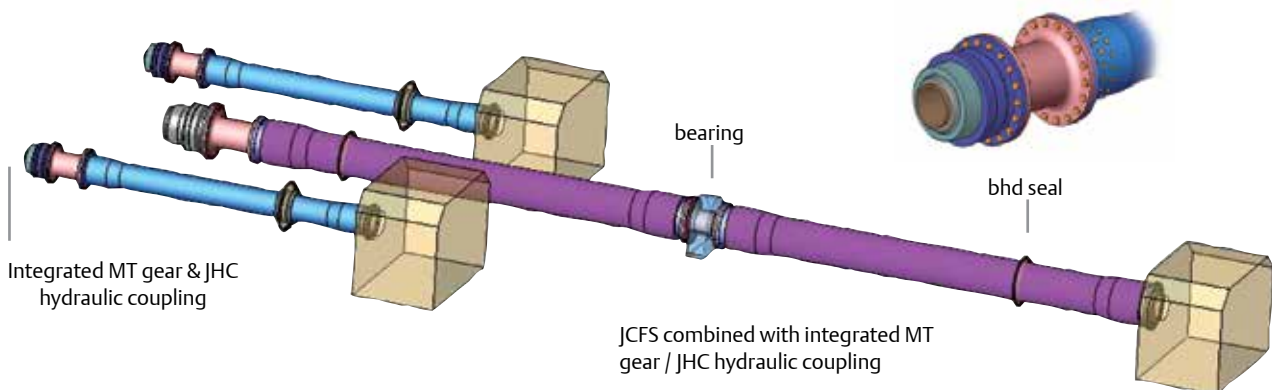


Typical layout with Jaure Carbon Fibre shaftlines and Jaure Couplings



JAURE® Carbon Fibre Shaftlines have been supplied to many different types of vessels. Even when used mainly for propulsion shaftlines, their advantages are also profitable for other applications within marine and other markets.

JCFS shaftlines are running on high speed vessels and ferries (monohull and catamarans); navy ships and patrol boats; pleasure boats and luxury yachts; commercial vessels; crew boats; and multipurpose vessels.

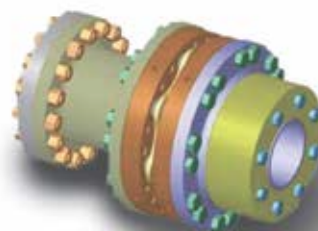




JCFS combined with LAMIDISC coupling



Classification is a key factor in marine business. **JAURE®** has delivered composite shaftlines approved by most of the Classification Societies such as: **ABS, BV, DNV, GL, KR, RINA**, etc.



Tube Selection

Different material combinations allow customized solutions for each project, which is important for cost and weight purposes. But JAURE® Carbon Fibre shaftlines are also supplied as standardized products.

Depending on the application ratings, two series are available:

- 1-L series:** Suitable for long distance between bearings and high speeds
- 2-T series:** Developed for high torques (above 65 kNm)

All JCFS shaftlines must be confirmed by JAURE. However, the following **JCFS L Series** and **T Series** charts may be used as guidance.

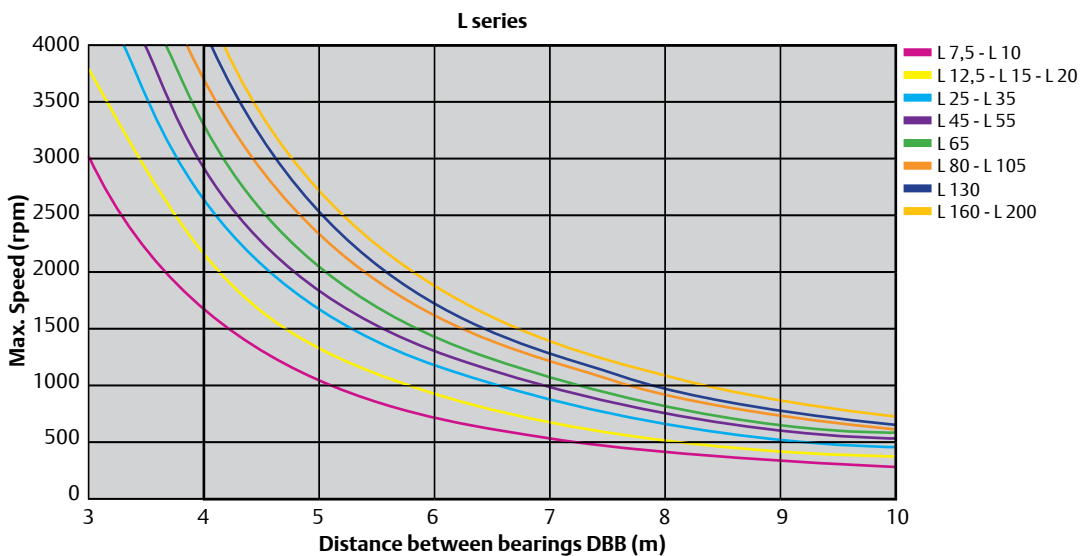
The torque and speed ratings shown on the charts include the corresponding safety factors.

Selection example:

- Power: 6200 Kw Speed: 600 rpm
- Nominal torque: 98,7 kNm
- Distance between bearings: 8m

JCFS - L SERIES for high speeds

JCFS size	Nominal Torque [kNm]	JCFS tube				Bearing / Bhd-seal	
		Tube Diameter [mm]	Mass per meter length [kg]	Inertia per meter length [kgm ²]	Torsional tiffness per meter length [MNm/rad]	Bearing shaft diameter [mm]	Bulkhead seal diameter [mm]
L7,5	7,5	138	5,3	0,034	0,228	85	190
L10	10	171	6,6	0,044	0,289	95	190
L12,5	12,5	213	6,7	0,072	0,477	100	230
L15	15	214	7,3	0,078	0,517	105	230
L20	20	216	8,4	0,09	0,60	120	230
L25	25	256	10,0	0,15	1,02	125	280
L35	35	259	11,9	0,19	1,23	140	280
L45	45	282	13,7	0,25	1,68	160	300
L55	55	285	15,8	0,30	1,96	170	300
L65	65	322	17,2	0,42	2,76	180	340
L80	80	359	20,9	0,63	4,18	190	380
L105	105	361	22,7	0,69	4,56	210	380
L130	130	396	26,9	0,98	6,50	220	410
L160	160	430	31,3	1,35	8,93	240	450
L200	200	434	35,6	1,55	10,27	250	450



The JCFS size refers to the maximum application torque rating. For torques above 65 kNm, the **T series** chart should be used as it is more cost effective. The suitable tube for 98,7 kNm is therefore **T105**.

On a second step, whirling speed must be checked. Maximum admissible speed for **T105** and **8m** long tube is 440rpm, so the **L series** chart should be used. Maximum speed for **L105** and **8m** is 900 rpm, which is above the application speed.

Selected tube designation is: **JCFS L105 – 8m**.

Concerning the standardized design parameters:

- Torque ratings: Although standardization

covers up to 900 kNm, there are no restrictions for higher ratings. JAURE has supplied Carbon fibre shaftlines for 112,2 kNm torque, which are powered by 8400 kW gas turbines.

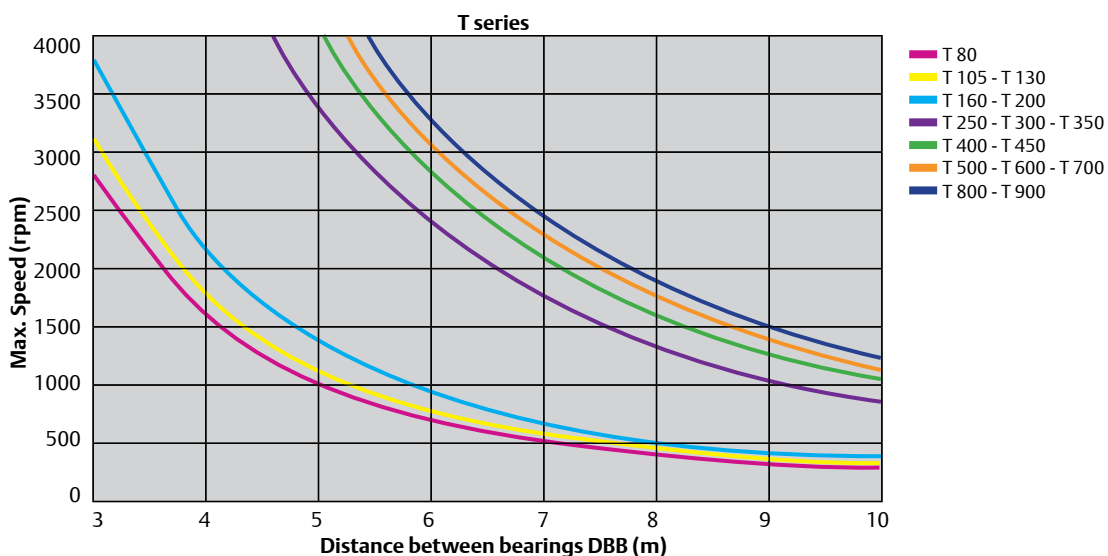
- Speed: Speed limitations depend on the length and manufacturing process. JAURE composite shaftlines up to 6000rpm have been supplied for industrial purposes.
- Length: 14m long tubes can be manufactured. However installation and logistic issues must be taken into consideration .

JCFS - T SERIES for high torques

JCFS size	Nominal Torque [kNm]	JCFS tube				Bearing / Bhd-seal	
		Tube Diameter [mm]	Mass per meter length [kg]	Inertia per meter length [kgm ²]	Torsional tiffness per meter length [MNm/rad]	Bearing shaft diameter [mm]	Bulkhead seal diameter [mm]
T80	80	330	23,8	0,59	10,04	190	350
T105	105	362	27,8	0,83	14,20	210	380
T130	130	366	31,5	0,96	16,26	220	410
T160	160	434	35,6	1,55	26,29	240	450
T200	200	438	40,0	1,76	29,82	250	450
T250	250	532	41,5	2,77	18,30	270	560
T300	300	536	46,9	3,15	20,83	290	560
T350	350	540	52,3	3,54	23,42	310	560
T400	400	638	59,1	5,67	37,51	320	660
T450	450	642	65,6	6,33	41,87	330	660
T500	500	692	70,8	7,98	52,82	340	704
T600	600	694	74,3	8,40	55,58	360	720
T700	700	698	81,3	9,25	61,19	380	720
T800	800	748	87,3	11,46	75,83	400	770
T900	900	752	94,9	12,52	82,85	420	770



Balancing of JCFS



JAURE reserves the right to make technical modifications in this catalogue without notice and no liability can be accepted for updating previously supplied components.

Some vessels with JAURE Carbon Fibre Shaftlines





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APPLICATION CONSIDERATIONS

The proper selection and application of power transmission products and components, including the related area of product safety, is the responsibility of the customer. Operating and performance requirements and potential associated issues will vary appreciably depending upon the use and application of such products and components. The scope of the technical and application information included in this publication is necessarily limited. Unusual operating environments and conditions, lubrication requirements, loading supports, and other factors can materially affect the application and operating results of the products and components and the customer should carefully review its requirements. Any technical advice or review furnished by Regal Beloit America, Inc. and its affiliates with respect to the use of products and components is given in good faith and without charge, and Regal assumes no obligation or liability for the advice given, or results obtained, all such advice and review being given and accepted at customer's risk.

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