



7. Rig Care

For optimum performance and life expectancy, follow the Navtec recommended rig care routines.

Navtec Recommended Rig Care

Performance, reliability, and safety depend on routine mast and rigging inspection schedules, whether you are a cruiser or an America's Cup contender. The following information and guidelines outline a recommended service schedule, are an introduction to rod, wire, and fiber rigging life expectancy, and answer some general questions regarding maintenance. **For more information, please refer to the Navtec Rigging Service Guidelines which can be downloaded from www.navtec.net.**

CATEGORY	DISPLACEMENT CHARACTERISTICS	TYPICAL PURPOSE CHARACTERISTICS	TYPICAL HANDLING CHARACTERISTICS
I	Motor Sailor/Heavy Cruiser	Ocean Going	Handled by Crew
II	Mid Displacement	Offshore	Handled by Crew, Owner or Shorthanded
III	Light Displacement	Coastal Pleasure Cruising/Club Racing	Handled by Crew, Owner or Shorthanded
IV	Ultra Light Displacement	Racing	Handled by Professional Crew

YACHT DISPLACEMENT CLASSIFICATIONS

The marine technical monitoring group, Germanischer Lloyd, has put together the following outline chart outlining yacht classifications, with input from Navtec and other mast and rigging suppliers. These different displacement categories will tend to experience different usage, mileage and sailing conditions. Full inspection intervals will vary depending on which category your yacht falls into.

CATEGORY I & II

Heavy displacement sailing vessels, (i.e. large cruising yachts or super yachts), have a different criteria for general rig inspections because they tend to accumulate many more miles than typical racing yachts. The same is true, but to a lesser degree, for mid displacement yachts. Also, the useful lives of heavy displacement sailing vessels tend to be much longer than the normal useful (competitive) life of racing yachts. For this reason, rigging design generally shifts toward longevity rather than ultimate performance concerns.

These concerns stem from the fact that these yachts generally do not bend their masts significantly to control sail shape. Many use simple marine eye and toggle terminations, which are heavier than typical high-performance fittings but have much better alignment capabilities under load. In these cases, bending stresses are minimal, and the controlling failure mode frequently shifts to simple tensile fatigue.

If failure occurs, tensile fatigue failures generally occur after a much larger number of loading cycles than bending fatigue failures. Large cruising yachts and super yachts frequently sail 15,000 to 30,000 miles per year and can reach large mileages quickly, leading to the possibility of tensile fatigue failure.

As a result, maintenance and inspection issues shift into a slightly different schedule and mindset as Safe Working Load (SWL) issues are not the primary concern.

CATEGORY III & IV

Light and ultra light displacement yachts generally have different sailing characteristics (e.g. mast bend and rake), and use higher loading scenarios with smaller rod in their rig plans than heavier displacement yachts. These working issues will potentially generate higher loads on the rod and fittings than published Safe Working Load. It is not unheard of for racing yachts to operate at 40-50% of the breaking strength of the rod.

This creates a shorter working life in the rod and fittings and should reflect in the frequency and intensity of the maintenance and inspection schedule for your yacht. Frequent inspection is necessary and will guarantee that any problems are caught before they become catastrophic.

Mast System Inspection Categories

LEVEL A Visual Inspection with Mast In	LEVEL B Visual Inspection with Mast In - Jack Down	LEVEL C Full service with Mast Out
Comprehensive general mast system visual inspection	Pre-check rig to assess service (Level A Inspection)	Pre-check rig to assess servicing schedule (Level A Inspection)
Check all fittings/terminations, rod/fiber/wire, spreaders, sheaves, halyards, headstay, backstay, mast base, partners, haylard blacks and chainplates	Un-jack mast	Un-step mast
Check for cracks, corrosion, pitting, rust	General visual inspection	Complete disassembly of mast/fittings
Service log/update schedule for next service	Check for bends/kinks in fittings and rod	Visual Inspection. Clean/polish rod, cold heads and fittings to facilitate inspection process. Visual inspection for cracks, corrosion, pitting, rust, general discoloration: remember rust indicates cracks
-	Check/lubricate all accessible fittings	Non-Destructive Testing (NDT) of Rod. Navtec recommends: Dye penetrate testing (liquid penetration testing) by authorized professional. Alternative methods: x-ray, ultrasound testing, eddy current testing
-	Properly re-tune to align and seat all cold heads and hardware, and generate proper tension/tuning	Visually inspect and Safe Working Load (SWL) pull test all fiber rigging
-	Service log/update schedule for next service	Make repairs as needed: re-head rod, replace any fittings or rigging screws
-	-	Reassemble mast system
-	-	Update service log/update schedule for next service
-	-	Re-step/re-tune mast

RECOMMENDED MAINTENANCE INSPECTIONS

Mast system inspections should be conducted regularly and schedules should be based on the size and general classification of your yacht. Controlling variables are displacement and type of usage. Heavy displacement yachts falling into Category I & II will have different inspection criteria based on tensile fatigue issues rather than those of category III & IV, which will base inspection intervals on usage and potential Safe Working Load issues. The following inspection scenarios should be implemented based on general usage and predominant sailing conditions. At a minimum, Navtec recommends a Level A mast system inspection at least once a year, regardless of yacht classification category.

ROD AND WIRE RIGGING LIFE EXPECTANCY

The most prominent factors that affect the longevity of rod and wire rigging are:

1. Length of time / miles that the yacht has been in service.
The more usage the yacht gets the more frequently inspections should be done.
2. Breaking strength / load ratio.
The closer the actual loads the rigging encounters are to the rated breaking strengths, the shorter the life expectancy.
3. Predominant sailing conditions.

If the yacht is frequently sailed in heavy air conditions, the life of the rod or wire will be shorter than if the boat is sailed infrequently, or in lighter wind conditions.

4. Frequency of care and maintenance

If the rigging has been periodically checked, the end fittings rinsed with fresh water, and general care and maintenance have been employed, it will last longer.

5. Environmental conditions

Where the rigging is constantly subjected to an environment with substantial air pollution, airborne contaminants will shorten the mast system's life span. Frequent cleansing and inspection is recommended.

6. Rod passes routine inspections

If the rod passes a Level C inspection, the rod may last an additional 20,000 to 30,000 miles. Navtec recommends rod re-heading and a stringent maintenance and inspection schedule.

7. T-hooks

Due to the design, the life expectancy of the T-hook is much shorter than rod or wire rigging. They should be diligently inspected and replaced.

7. Rig Care

WHAT TO LOOK FOR WHEN INSPECTING ROD RIGGING:

- Cracks, particularly in a transverse orientation. Typically cracks can be found using visual inspection.
- Rust
- Corrosion
- Pitting
- Black streaks
- Visible wear

If the rod and fittings show any of these symptoms, you should consult an authorised Navtec Service Agent.

WHAT TO LOOK FOR WHEN INSPECTING WIRE RIGGING:

- Signs of corrosion, rust, or pitting, particularly in the lower fittings.
- Cracks or corrosion on swage fittings, particularly on the inside edge where the wire exits.
- Signs of wear and/or cracks in swageless fittings.
- Rust on the wire or 'rouging', which generally comes from the fittings and bleeds down the wire.
- Broken strands or 'meat hooks' are a sign of fatigue failure. When broken strands are identified, the wire should be replaced immediately.

If the wire and fittings show any of these symptoms, you should consult an authorised Navtec Service Agent.

FIBER RIGGING LIFE EXPECTANCY

Due to the construction of fiber rigging, the factors that affect the longevity of the rigging differ from those that affect wire and rod rigging.

1. UV Damage

Where the fiber is exposed, it can degrade due to exposure to UV light and moisture. This may happen where the external jacket has been cut or chafed, for example, by contact with a jib sheet or a halyard. Any exposure to UV can cause property degradation, loss in strength, and potential failure of the fibers.

2. Humidity

Exposure of the core fibers to high relative humidity and elevated temperatures for a length of time can cause a loss in fiber strength.

PBO CABLE LIFE EXPECTANCY

Where PBO cable has been used in the application for which it is intended and has been inspected regularly as recommended by Navtec, the following life expectancy can be expected:

- If the maximum working load is less than 25% of the cable's rated strength (lateral or side rigging – stretch application), Navtec recommends changing the cable following 26,000 to 30,000 miles or 3 years of use, whichever comes first.
- If the maximum working load is more than 25%, but less than 35% of the cable's rated strength (headstay or running backstay – strength application), Navtec recommends changing the cable following 17,000 to 20,000 miles or 2 years of use, whichever comes first.

KEVLAR CABLE LIFE EXPECTANCY

Where Kevlar cable has been used in the application for which it is intended and has been inspected regularly as recommended by Navtec, the following life expectancy can be expected:

- If the maximum working load is less than 40% of the cable's rated strength, Navtec recommends changing the cable following 26,000 to 30,000 miles or 4 to 6 years of use, whichever comes first.

What to look for when inspecting fiber rigging:

- Signs of damage, abrasion points, or breaks in the external cover
- Heat shrink pulling away from end fitting or the cable. This is not unusual and will not affect the integral seal, but should be monitored.
- Severe wear, bent pins, corrosion, or cracks in metal fittings attached to terminations.
- Cracking on Z-System carbon termination covers or opening at the glue seam.
- Chafe and degradation of the cover on Z-system cable midspan.
- Cracks on T-hooks.

If the fiber cable and fittings show any of these symptoms, you should consult an authorised Navtec Service Agent.

PLEASE NOTE

- It is not necessary to open biconic terminals for internal visual inspection. Doing so will break the factory-installed seal designed to protect the internal fibers.
- As a state-of-the-art rigging solution, routine visual inspection of the jacket and termination points should be carried out frequently. On a passage and during a regatta, this should take place daily.

GENERAL INFORMATION

Maintenance Authentication

The survey and inspection of the spar and rigging system should be carried out at regular intervals, improving the chance that any potential service issues will be caught. A Photographic Log and a Data/Service Log are an important part of this inspection.

Photographic Log

Building a visual library creates a point of reference from which to start inspections and plan future inspections, as well as forming a body of evidence should any questions or insurance claims arise.

Data/Service Log

A good data log includes part numbers, dimensions, a record of their condition, and how they are serviced. This helps in the planning of future inspections and enables shared knowledge between service technicians. The more information you have about your mast system, the better you will be able to maintain it.

Lubricant / Grease

Navtec recommends the use of a thin layer of lanolin-based waterproof grease on all fittings with dissimilar metals. For fittings with stainless bodies and screws, Navtec recommends a dry lubricant containing Molybdenum Disulphide. Please note that careful application is required, as the aerosol spray or liquid is black and can cause staining.

Loctite

Navtec uses Loctite Retaining Compound RC 680 (Green). Ensure surfaces are clean, free of debris/oil, and prepared with a Loctite primer before bonding. Please note that the high temperatures required for the removal of this compound render it unsuitable for use with Navtec insulators or in areas that are heat sensitive. In this application, a low temperature compound such as Loctite 242 (blue) should be used. Once the Loctite has set, test rigging fittings and set screws for locking. Please note that Loctite is not appropriate for use with fittings that may be tensioned or adjusted.

Rigging Tape

Navtec recommends using a non-adhesive tape in rigging applications. Navtec Rig Wrap is a white self-amalgamating tape which will leave no residue and forms better chafe protection than an electrical tape.

Limited Warranty and Key Terms of Supply by Navtec

Navtec warrants that in normal usage and with proper maintenance its products will conform with their specification for a period of three years from the date of purchase by the end user, subject to the conditions, limitations, and exceptions listed below. Any product, which proves to be defective in normal usage during that three-year period, will be repaired or, at Navtec's option, replaced by Navtec.

A. CONDITIONS AND LIMITATIONS

- I. Navtec's liability shall be limited to the repair or replacement of any parts of the product which are defective in materials or workmanship.
- II. Responsibility for the selection of products appropriate for the use intended by the Buyer shall rest solely with the Buyer and Navtec accepts no responsibility for any such selection.
- III. Navtec shall not be liable in any way for Product failure, or any resulting loss or damage which arises from:
 - a. use of a product in an application for which it was not designed or intended;
 - b. corrosion, ultra-violet degradation, or wear and tear;
 - c. a failure to service or maintain the product in accordance with Navtec's recommendations;
 - d. faulty or deficient installation of the product (unless conducted by Navtec);
 - e. any modification or alteration of the product;
 - f. conditions that exceed the product's performance specifications or safe working loads
- IV. Product subject to warranty claim must be returned to the Navtec outlet which supplied the product for examination unless otherwise agreed by Navtec in writing.
- V. This warranty does not cover any incidental costs incurred for the investigation, removal, carriage, transport, or installation of the product.
- VI. Service by anyone other than authorised Navtec representatives shall void this warranty unless it accords with Navtec guidelines and standards of workmanship.
- VII. Navtec's products are intended for use only in the marine environment. Buyers intending to use them for any other purpose should seek independent professional advice as to their suitability. Navtec accepts no liability arising from such other use.

B. EXCEPTIONS

Cover under this Warranty is limited to a period of one year from the date of purchase by the end user in the case of any of the following products or parts of products:

- Electric motors and associated electrical equipment
- Electronic controls
- Hydraulic pumps, valves, and actuators
- Weather seals
- Products used in "Grand Prix" racing applications

C. LIABILITY

- I. Navtec's liability under this warranty shall be to the exclusion of all other warranties or liabilities (to the extent permitted by law). In particular (but without limitation):
 - a. Navtec shall not be liable for:
 - Any loss of anticipated turnover or profit or indirect, consequential, or economic loss;
 - Damages, costs, or expenses payable to any third party;
 - Any damage to yachts or equipment;
 - Death or personal injury;

Some states and countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

- b. Navtec grants no other warranties regarding the fitness for purpose, use, nature, or satisfactory quality of the products.
- II. Where applicable law does not permit a statutory or implied warranty to be excluded, then such warranty, if permitted by that state or country's law, shall be limited to a period of one year from the date of purchase by the end user. Some states and countries do not allow limitations on how long an implied warranty lasts, so this limitation may not apply to you.

D. PROCEDURE

Notice for a claim for service under this warranty shall be made promptly and in writing by the end user to the Navtec outlet which supplied the product or to Navtec, 351 New Whitfield Street, Guilford, CT 06437, USA.

E. SEVERANCE CLAUSE

If any clause of this warranty is held by any court or other competent authority to be invalid or unenforceable in whole or in part, the validity of the remaining clauses of this warranty and the remainder of the clause in question shall not be affected.

F. OTHER RIGHTS

This warranty gives you specific legal rights, and you may also have other legal rights, which vary, from state to state and country to country.

In the case of European States a Consumer customer (as defined nationally) has legal rights under the application national law governing the sale of Consumer Goods; this warranty does not affect those rights.

G. LAW

This warranty shall be governed by and read in accordance with the laws of England or the state or country in which the first end user is domiciled at the time of purchase of the product.