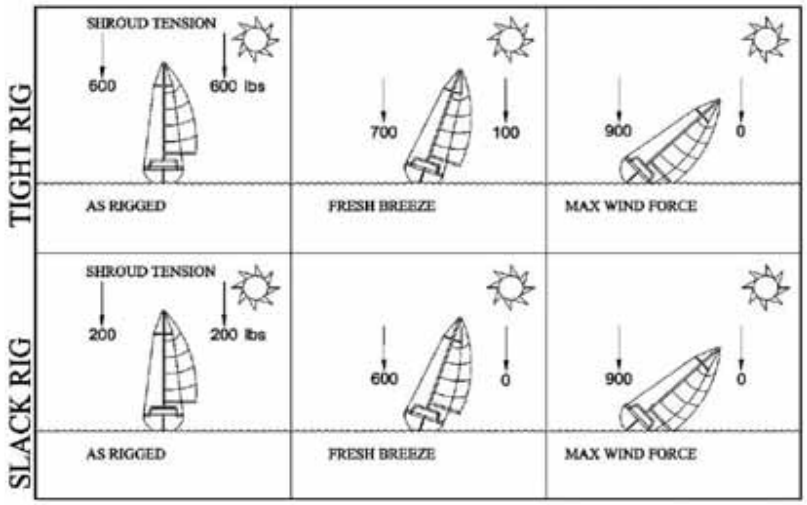
Benefits of Correct Rigging Tension

Contrary to popular thought, a slack rig is more punishing on a hull than a properly adjusted, tight rig. Insufficient tension will not reduce the loads transmitted in the hull. Slack rigging will punish the spar and rigging needlessly by allowing excessive movement, chafe and shock loading. Modern fiberglass hulls should not be damaged by a properly adjusted, tight rig.

Figure C lists the rigging tension under different conditions for a typical boat with a properly tuned rig and with a slack rig. It will be noted that the maximum load is the same. However, for properly tuned rig the leeward shrouds will not go slack under normal sailing conditions.
The lateral stiffness of the mast and the fore and aft stiffness of the spreaders is reduced by a factor of 2 when the leeward shrouds go slack. This important structural characteristic is not generally recognized.

Rigging tension is becoming more important as a result of the trend toward the use of mast bend to control mainsail shape under different wind conditions. Mast bend will also affect the shape and trim of the jib, since mast adjustment generally affects forestay tension. The expert skipper will benefit by maintaining consistent rigging tension while developing the optimum sail shape and sailing tactics.

Figure C



LOOS & CO. INC.
CABLEWARE® DIVISION

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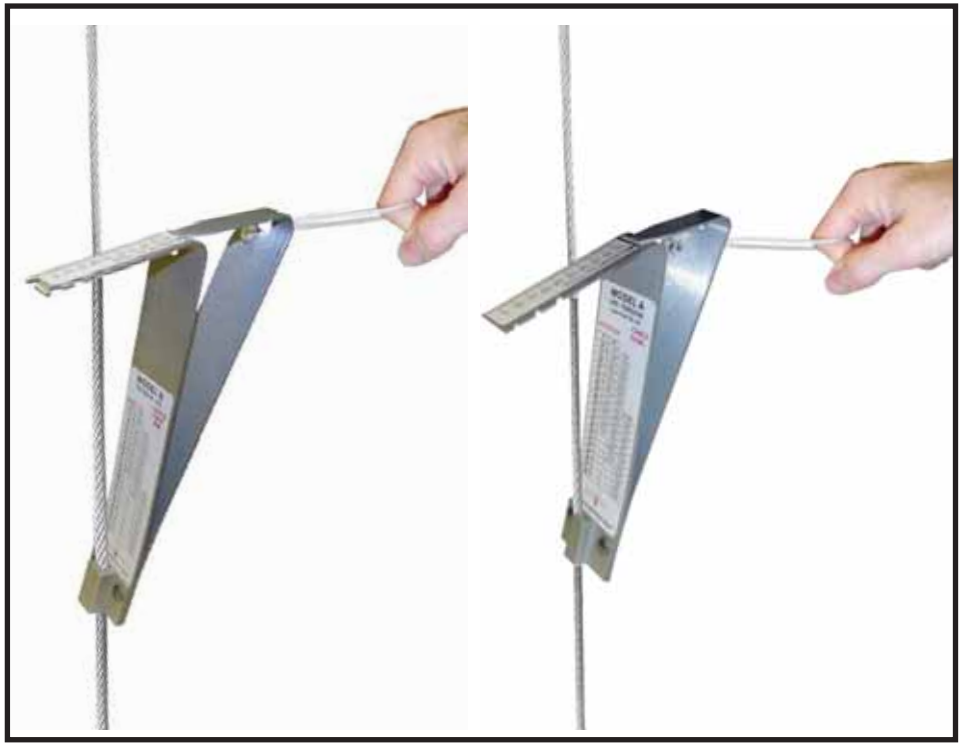
LOOS TENSION GAUGE

The Loos tension gauge takes the guesswork out of cable tension adjustment. It's especially designed for accurate, repeatable tuning of a sailboat's standing rigging.

Manufactured of rugged anodized aluminum, the gauge is corrosion-resistant and will provide years of service. Please read these detailed operating instructions carefully to ensure complete accuracy.

Model Number **91** - For Cable Diameters: 3/32", 1/8", 5/32"
Model Number **90** - For Cable Diameters: 3/16", 7/32" 1/4", 9/32"
Model Number **91M** - For Cable Diameters: 2.5, 3.0, 4.0mm
Model Number **90M** - For Cable Diameters: 5.0, 6.0, 7.0mm



U.S. Patent No. 4,135,393

How To Measure

Figure A

To measure tension, simply hook the gauge on the cable as illustrated (**Figure A**). Pull the lanyard until the pointer is positioned at the black calibration mark on the inner end of the scale (Point B) . With the pointer at the black calibration mark, read the scale at the exact point where the middle of the cable touches the scale (Point C). For the best accuracy, the gauge should be held so that the scale barely touches the cable, thus eliminating friction. A word of caution, however: excessive pull on the lanyard, which pulls the pointer beyond the calibration mark, may permanently bend the spring and damage the gauge.

To convert the scale reading to actual tension in pounds for each wire diameter, see the conversion table on the gauge. Metric tension scale label is available on request.

Figure B

Safety and Performance

SAFETY - The failure of a fitting, shroud or stay could damage your boat, buckle the mast or even cause personal injury. To avoid such failure of the cable and fittings from fatigue or shock loading, it is important to set up your standing rigging with the proper tension. Too little tension in the shroud will permit the leeward shroud to go slack, only to fetch up with a jolt when the boat rolls or pitches. A less common problem is excessive tension. This can cause permanent stretch to the cables and possibly damage the mast.

PERFORMANCE - The actual set of sail under load is determined by the cut of the sail and the shape of the structure which supports the sail. Rigging tension plays an important part in determining the set of the sails.

When the boat has been tuned for peak performance, the measured cable tension should be recorded. The stainless steel used to make the rigging can stretch a little bit over time under high loading. Thus, marking turnbuckles, etc. cannot guarantee that subsequent adjustments will provide the desired tension. Only by gauging is it possible to repeat the initial tuning or improve it.

Limiting the sag of the forestay is perhaps the most important benefit to performance from having the proper rigging tension. Forestay sag permits the jib luff to fall off to leeward, tightening to leech and seriously degrading the performance to windward.

Tension in the upper and lower shrouds will influence the mast bend and set the mainsail. This is especially important on modern, fractional rigs where the mast bend is used to depower the sail in heavy winds.

If the shrouds are not set up with enough tension, the leeward shrouds will go slack when the boat is sailing to windward. This can result in fore and aft pumping of the mast in a head sea. This mast movement will change the shape of the mainsail and can cause performance loss as well as possible structural damage. Specific tension requirements for your application must be obtained from the boat, mast, or sail manufacturer or the manufacturer of the product on which the cable is used.

TABLE 1
1 X 19 Stainless Steel Rigging Cable

Diam. In.	Breaking Strength Pounds	Forestay* Pounds	Shrounds* Pounds
3/32	1200	180	120
1/8	2100	320	240
5/32	3300	500	350
3/16	4700	750	500
7/32	6300	1000	700
1/4	8200	1300	850
9/32	9900	1500	1000

* Suggested initial settings.

How Much Tension?

Table 1 recommends an initial tension setting, but there is no simple solution since the optimum rigging tension will be a function of the boat design, the rig (masthead or fraction, one or more spreaders, ect.), and even the cut of the sails. Many skippers use insufficient tension because of a fear of “breaking something.” It should be noted that on 12 meters, where good tension instrumentation is available, the standing rigging is set as tight as is structurally feasible.

Forestay Tension - Masthead Rig

On the masthead rig it’s almost always advantageous to set the forestay tension as high as possible within the limits of structural strength. Generally, it’s possible to use 15% of the breaking strength of the cable. Thus, a forestay tension of 1,000 lbs. is a reasonable place to start with a 7/32” diam., 302/304 1x19 stainless steel cable. (To check the cable diameter, use the milled end **Figure B**, to determine the proper cable size). Backstay tension would, of course, have to be adjusted to maintain a straight mast with the desired forestay tension. Since the backstay makes a greater angle to the mast, the backstay tension will be lower than the forestay tension.

NOTE! Roller Furling can only be set by back stay tension.

Forestay Tension - Fractional Rig

In a fractional rig the forestay does not go all the way to the masthead and forestay tension cannot be directly balanced by tension in the backstay. Therefore, some mast bend is generally accepted and the mainsail is cut to fit the bend. A forestay tension of at least 15% of the cable strength is desirable. However, if this results in excessive mast bend it will be necessary to back off a bit. On some fractional rigs, diamond shrouds are used to reduce mast bend.

Upper and Lower Shroud Tension - Masthead Rig

There is a simple criterion for shroud tension. The initial rigging tension should be high enough that the leeward shrouds do not go slack when sailing close-hauled in a reasonably brisk breeze. The proper value for your boat can be found by a few trial runs under sail. Once the correct tension is known, the gauge can be used to maintain the value. For many boat designs a shroud tension of 10% to 12% of the breaking strength of the cable is adequate. Thus, for 7/32”, 302/304 1x19 stainless steel cable , the upper and lower shrouds would be set to 600 to 700 lbs. tension. On some rigs it may be desirable to carry more tension in the uppers than in the lowers.

Upper and Lower Shroud Tension - Fractional Rig

For most fractional rigs the correct shroud tension is the same as that for a masthead rig, i.e., a tension setting that will keep the leeward shrouds from going slack. However there is one exception. On certain fractional rigs, the upper and lower shrouds lead to chainplates that are aft of the mast. The spreader is swept back. For such a rig most of the forestay tension is balanced by the upper shrouds. A shroud tension of approximately 20% of the cable strength may be required to achieve the desired forestay tension. Never exceed 25% of the cable breaking strength. (Refer to the breaking strength chart **Table 1**.)