## **PT Series Tension Gauges**



Model PT-1	Cable size 3/32'', 1/8'', 5/32''
Model PT-1M	Cable size 2.5mm, 3mm, 4mm
Model PT-2	Cable size 3/16", 7/32", 1/4"
Model PT-2M	Cable size 5mm, 6mm, 7mm
Model PT-3	Cable size 1/4", 9/32", 5/16", 3/8"
Model PT-3M	Cable size 7 mm, 8mm, 9mm, 10mm

## How to Measure

**1.** Hold the gauge with the left hand and place the cable between the two nylon spools as shown in Figure 1.



FIG.1

2. With the right hand pull the lanyard and extend the spring until the hook on the nylon slider can be hooked on the cable as shown in Figure 2.



**FIG. 2** 

**3.** Release the lanyard. Read the needle position on the scale. Refer to the calibration table obtain correct tension in the cable. The gauge can be left on the wire for "hands free" adjusting of the cable.

4. To assure accurate readings make sure that the slider moves freely in the frame slot and does not bind. Also, lubricate the slider slot frequently with silicone lubricant.

Note.

An extra 1/4" inch hole is provided in the frame of the instrument for an attachment of a short lanyard and snap hook (not furnished) for securing the gauge to the cable. This will prevent loss of the instrument if it becomes inadvertently detached.

#### 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 fractional, one or more spreaders, etc.), 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 America's Cup contenders, where electronic state of the art tension instrumentation is available, the standing rigging is set as tight as is structurally feasible.

Table 1						
302 / 3	04 1 X 19 Stainle	ss Steel Rigg	ing Cable			
Diam,. In.	Breaking Strength Pounds	Forestay* Pounds	Shrouds* 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	10300	1600	1000			
5/16	12500	2000	1300			
3/8	17500	2750	1800			
*Suggested initial settings.						

#### **One Design Class Racing Sailboats**

Most sailmakers who produce sails for the one design classes provide each purchaser with specific set of readings on the Loos Model A or Model B tension gauges for use when setting up the standing rigging. This assures that the sails will have the correct shape when the rig is under load.

For the convenience of sailors who wish to upgrade from our Model A or B gauges to the professional model (PT -1, PT -2, or PT -3) gauges we include below a conversion chart so that the same recommended tension can be obtained with the PT-1, PT-2 or PT-3 gauges as with the Model A or B gauges.

MODEL A	MO	DEL	PT-1		MODEL B	мо	DEL P	Т-2	MODEL PT -3
SCALE	3/32	1/8	5/32		SCALE	3/16	7/32	1/4	9/32
5	6				10	11	NA	NA	NA
10	9				15	13			
15	12	14			18	15			
20	16	16			20	16	18		
25	20	19			22	18	20		
28	23	21			24	19	22		
30		22		_	26	21	24		
35		27	25	]	28	23	25		
38		30	28		30	25	27	25	
40		33	30		32	27	29	27	
42			33	]	34	29	31	39	
44			36	]	36		33	31	
45			38	]	38		36	33	6
46			39		39		37	34	7
47			40		40			36	9
					41			37	10
					42			39	11
					43			40	12
					44				14
					45				16
					46				18
					47				20
					49				25

When no specific requirements are provided by the sailmaker, the following general comments will provide a basis for a rational procedure for tuning the rig.

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.

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 closehauled 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.)

NOTE ! THE INTENDED USE OF THIS GAUGE IS TO BE USED ON 302 / 304 1X19 S.S. CABLE IN APPROPRIATE SIZES. IF USED ON OTHER CABLE TYPES, SIZES, AND CONSTRUCTION YOUR READINGS WOULD BE CONSISTENT (REPEATABLE) BUT POUND TENSION VALUES WOULD DIFFER FROM THOSE LISTED ON THE LABEL.GAUGE MAY NOT READ "O" WHEN AT REST, AS THEY ARE CALIBRATED AT MIDRANGE OF TENSION.

NOTE ! IF FLAT SPOTS APPEAR ON NYLON SPOOLS AFTER EXTENDED USE, ROTATE NYLON SPOOLS 45°.

### 90 & 91 Tension Gauges



Model Number 91	Cable Diam. 3/32'', 1/8'', 5/32''
Model Number 90	Cable Diam. 3/16'', 7/32'', 1/4'', 9/32''

### How to Measure

To measure tension, simply hook the gauge on the cable as illustrated (see Figure A). Pull the lanyard (Blue arrow) until the pointer is positioned at the black calibration mark (red arrow), read the scale at the exact point where the middle of the cable touches the scale. For 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 gauge available on request.



FIG.A

#### 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 fractional, one or more spreaders, etc.), 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 America's Cup contenders, where electronic state of the art tension instrumentation is available, the standing rigging is set as tight as is structurally feasible.

Table 1								
302 / 3	302 / 304 1 X 19 Stainless Steel Rigging Cable							
Diam,. In.	Breaking Strength Pounds	Forestay* Pounds	Shrouds* 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.							

When no specific requirements are provided by the sailmaker, the following general comments will provide a basis for a rational procedure for tuning the rig.

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.

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.)

NOTE ! THE INTENDED USE OF THIS GAUGE IS TO BE USED ON 302 / 304 1X19 S.S. CABLE IN APPROPRIATE SIZES. IF USED ON OTHER CABLE TYPES, SIZES, AND CONSTRUCTION YOUR

READINGS WOULD BE CONSISTENT (REPEATABLE) BUT POUND TENSION VALUES WOULD DIFFER FROM THOSE LISTED ON THE LABEL.

#### ADDITIONAL SCALE READINGS LBS. TENSION

# Standard

[	CALIE	BRATION	PLATE	Π	CALIB	RATION	PLATE	Γ	C	ALIBRAT	ION PLAT	Έ
	N	ODEL PT	-1		M	ODEL PT	-2			MODE	L PT-3	
SCALE	3/32	1/8	5/32	Π	3/16	7/32	1/4		1/4	9/32	5/16	3/8
5	70			Π					550			
6	80			Π					600			
7	90			Π					700			
8	100			Π					770	500		
9	110			Π				Γ	830	550		
10	125				180				900	600	320	
11	135			Π	250				1000	650	380	
12	150	100			270				1100	720	440	
13	160	110			300				1200	780	500	
14	170	125			330				1300	830	550	
15	185	135		Ц	370				1400	900	600	200
16	200	150		Ц	420				1500	1000	680	230
17	220	165		Ц	450			L	1650	1080	740	270
18	240	180		Ц	500			L	1800	1150	800	290
19	260	200		Ц	540			L	2000	1220	870	330
20	280	220	140	Ц	590	320		L		1300	950	360
21	300	240	155	Ц	640	360		L		1420	1050	380
22		260	170	Ц	700	410		L		1540	1130	420
23		280	185	Ц	770	450	300	L		1660	1210	480
24		300	200	Ц	840	500	350	L		1800	1300	530
25		320	220	Ц	920	560	400	L		1960	1400	570
26		345	245	Ц	1030	630	450	L		2130	1500	600
27		370	265	Ц	1110	680	500	L		2300	1600	650
28		390	300	Ц	1240	740	550	┡		2500	1700	720
29		420	320	Ц		820	600	⊢			1850	800
30		450	335	Н		890	660	⊢			2000	870
31		475	360	Н		970	720	┡			2200	930
32		500	390	Н		1060	780	┝			2400	1000
33	+	<u> </u>	420	Н		1180	840	┝			2700	1100
34	+		450	Н		1300	900	⊢			3000	1200
35			480	Н		1480	1000	┝				1300
30			520	Н		1680	1100	┝				1400
20	+		610	Н			1200	⊢				1650
20	+		700	Н			1600	⊢				1770
40	+		800	Н			2000	⊢				1000
40	+		000	Н			2000	⊢				2100
41	+			Н				⊢				2230
43	+			Н				⊢				2400
44				H				⊢				2620
45				H				H				2850
46				H				H				3100
47				H				F				3400
48				H				F				3700
49				H				F				4100
50				H				F				4500

# Metric

[	CALIB	RATION	PLATE		CALIB	RATION	PLATE	C	ALIBRAT	ION PLAT	E
	MODE	L PT-1 M	ETRIC		MODEL PT-2 METRIC		MODEL PT-3 METRIC KILOGRAMS			GRAMS	
	к	ILOGRAN	AS		K	LOGRAM	IS	_			
SCALE	2.55mm	3mm	4mm	Η	5mm	pmm	7mm	7mm	8mm	9mm	10mm
8	50			Η							
9	54			Η							
10	58			Η				300			
11	62			Π	95			330			
12	66			Π	110			360	200		
13	70			Π	120			400	220		
14	75			Π	140			440	240		
15	82	70		Π	150			480	270		
16	90	75		Π	170			515	300		
17	100	82		Π	180			550	330		
18	110	90		Π	200			590	360		
19	120	100		Π	220			630	400		
20	130	110		Π	240			680	430		
21	140	120	70	Π	260			730	460		
22		130	76	Π	280	160		790	500		
23		140	83	Π	310	180		840	540		
24		150	90	Π	340	200		900	590		
25	1	160	100	Π	370	210		1000	630	370	
26	1	170	115	Π	400	230		1100	680	410	
27		180	127	Π	440	250			720	440	
28		190	140	Π	490	270			770	480	
29		210	150	Π	550	290			850	520	
30		220	160	Π	620	320	220		920	560	
31		235	170	Π		350	240		1000	590	
32		250	180	Π		380	270		1100	630	
33			195	Π		420	290		1240	700	
34			210			460	320		1400	750	400
35			225			510	350			810	430
36			240			570	370			870	460
37			260			640	400			940	500
38			280			730	440			1020	540
39	Ĭ		320				470			1100	590
40			360				510			1190	63 <b>0</b>
41							550			1300	680
42							620			1420	730
43										1600	790
44											870
45											940
46											1000
47											1090
48											1180
49											1270
50											1360
51											1500
52											1640
53											1800

### UNIT CONVERSION TABLES

#### Speed

Convert from	То	Equation
Meters Per Second (mps)	Miles Per Hour (mph)	mps x 2.24
Miles Per Hour (mph)	Meters Per Second (mps)	mph x 0.447
Knots	Miles Per Hour (mph)	knots x 1.15
Meters Per Second (mps)	Kilometers Per Hour	mps x 3.6

#### Length

Convert from	То	Equation
Meters	Feet	meters x 3.28
Feet	Meters	feet x 0.305