

BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

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SUSPENSION STRAND
TENSIONING — USE OF
STRAND DYNAMOMETER

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1. GENERAL

1.01 This section discusses the use of the strand dynamometer in tensioning strand and in measuring the tension in existing strand. Information on the types of strand dynamometers and their maintenance is included in a Tool Section.

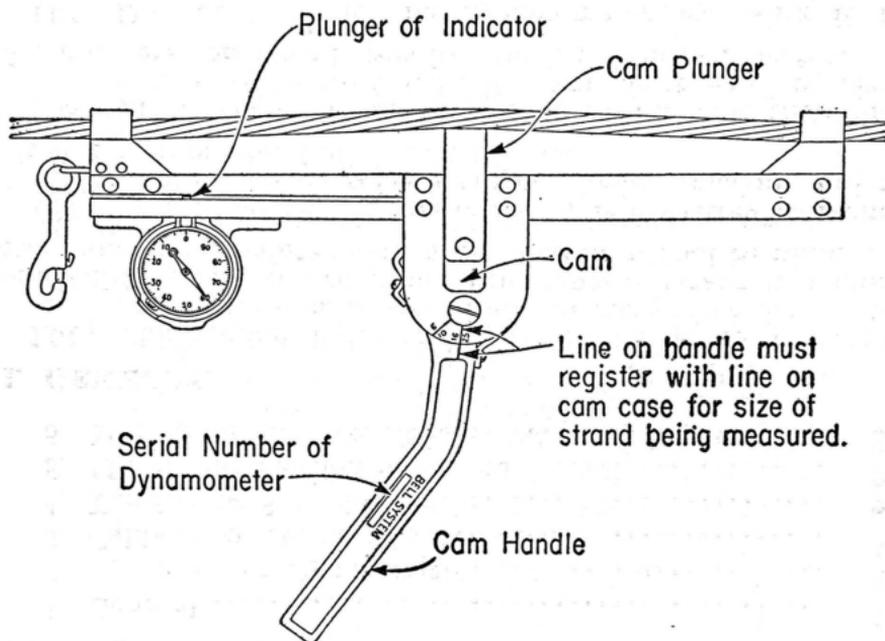
1.02 This Issue replaces Issue 1. It was rewritten to include information on revised strand placing tensions and revised Dynamometer Calibration Charts.

1.03 Each dynamometer is furnished with a calibration chart and must be used with its own chart. Do not use a dynamometer on strand sizes for which it is not calibrated.

1.04 Do not overload the dynamometer by using it for measuring tensions exceeding 10,000 pounds. Do not measure tensions in 25M strand with cable in place as these tensions usually exceed 10,000 pounds.

1.05 The dynamometer has a cam which is used to force the strand out of line. This produces a slight bending of the upper bar of the dynamometer. The amount of this bending is shown by the dial pointer, and is an indication of the strand tension.

1.06 The cam may be either of two styles. The earlier design has three notches, one each for use on 6M, 10M, and 16M strand. The more recent design has two notches, one for 6M and 10M and the other for 16M and 25M strand. Dynamometers with either style cam may be used for 25M strand, using the 16M notch, but only if the calibration chart includes tables or curves for 25M strand and only where no cable is supported by the 25M strand. The following illustration shows a two-notch dynamometer in place on 16M galvanized strand.



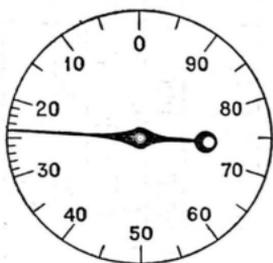
2. OPERATION OF DYNAMOMETER

2.01 **Temperature:** Using the thermometer furnished with the dynamometer, check the temperature of the air once each forenoon and once each afternoon while strand is being tensioned. Place the thermometer in the sun or shade depending on the condition which exists along most of the strand being measured. Keep the thermometer away from sources of heat such as truck radiators and metal objects which may reflect heat. Allow time for the thermometer to adjust to the air temperature before reading.

2.02 **Zero Reading:** Once a day when using the dynamometer, check the zero reading as outlined in the Tool Section on Dynamometers.

2.03 **Placing on Strand:** If cable is in place remove one ring or cable support or sufficient lashing wire to obtain about two feet of clear strand. Place the dynamometer on the strand and move the cam handle so that the line on the cam handle is opposite the proper strand size marking on the cam case. For CR strand see Paragraph 4.03 (4).

2.04 **Reading Dial Indicator:** The space between adjacent numbered divisions on the scale is divided into ten small divisions, and each of these can be divided into tenths by estimating. The following examples show readings for two pointer positions.



Reading of Pointer
= 24.0



Reading of Pointer
= 44.4

At each location take 3 readings 1/4 inch apart on the strand; discard the high and low values and use only the intermediate value as the correct dial reading.

3. CALIBRATION CHARTS

3.01 Each dynamometer is furnished with a calibration chart identified by the serial number of the dynamometer; no other chart should be used. If the chart is lost the dynamometer should be returned for recalibration.

3.02 Following are two partially completed calibration charts of the most recent type. This type can be identified by the statement along the right side "Strand stringing tensions are in accordance with those in Bell System Practices, Section G51.125.1, Issue 1." All instruments returned for repair or recalibration will be provided with this type chart. The first chart is the type furnished with dynamometers having two-notch cams, the second chart is for those with three-notch cams. The only differences are in the Handle Position designations. The entries on these charts are for illustration only. Earlier charts, not illus-

CALIBRATION CHART FOR STRAND DYNAMOMETER NO. _____ Date of Calibration _____

Strand Size	6M	10M	16M	25M	Tension Lbs.	6M	10M	16M	25M	Tension Lbs.	16M	25M
Handle Position	6/10	6/10	16/25	16/25		6/10	6/10	16/25	16/25		16/25	16/25
Tension Lbs.	Dial Readings				Tension Lbs.	Dial Readings				Tension Lbs.	Dial Readings	
400						2500						6200
500					2600					6400		
600					2700					6600		
700					2800					6800		
800					2900					7000		
900					3000					7200		
1000	11.3				3200					7400		
1100	12.4				3400					7600		
1200	13.4				3600					7800		
1300					3800					8000		
1400					4000					8200		
1500					4200					8400		
1600					4400					8600		
1700					4600					8800		
1800					4800					9000		
1900					5000					9200		
2000					5200					9400		
2100					5400					9600		
2200					5600					9800		
2300					5800					10000		
2400					6000							

DIAL READINGS OF STRAND STRINGING TENSIONS FOR COPPER CONDUCTOR CABLES

Strand Size	6M	6M	6M	10M	10M	16M	25M
Handle Position	6/10	6/10	6/10	6/10	6/10	16/25	16/25
Span Length	to 250'	250'-450'	over 450'	to 400'	over 400'	All	All
Temperature Degrees Fahrenheit	0						
	20						
	40	13.8					
	60	12.4	12.4	12.4			
	80						
	100						

DO NOT USE THIS CHART FOR ANY OTHER DYNAMOMETER

Strand stringing tensions are in accordance with those in Bell System Practices Section 651.125.1, Issue 1.

Sample calibration chart for Dynamometer having Two-Notch cam

DO NOT USE THIS CHART FOR ANY OTHER DYNAMOMETER

CALIBRATION CHART FOR STRAND DYNAMOMETER NO. _____										Date of Calibration _____		
Strand Size	6M	10M	16M	25M	Tension Lbs.	6M	10M	16M	25M	Tension Lbs.	16M	25M
Handle Position	6	10	16	16		6	10	16	16		16	16
Tension Lbs.	Dial Readings				Tension Lbs.	Dial Readings				Tension Lbs.	Dial Readings	
400						2500						6200
500					2600					6400		
600					2700					6600		
700					2800					6800		
800					2900					7000		
900					3000					7200		
1000		11.3			3200					7400		
1100		12.4			3400					7600		
1200		13.4			3600					7800		
1300					3800					8000		
1400					4000					8200		
1500					4200					8400		
1600					4400					8600		
1700					4600					8800		
1800					4800					9000		
1900					5000					9200		
2000					5200					9400		
2100					5400					9600		
2200					5600					9800		
2300					5800					10000		
2400					6000							
DIAL READINGS OF STRAND STRINGING TENSIONS FOR COPPER CONDUCTOR CABLES												
Strand Size	6M	6M	6M	10M	10M	16M	25M					
Handle Position	6	6	6	10	10	16	16					
Span Length	to 250'	250'-450'	over 450'	to 400'	over 400'	All	All					
Temperature Degrees Fahrenheit	0											
	20											
	40	13.8										
	60	12.4	12.4	12.4								
	80											
100												

Strand stringing tensions are in accordance with those in Bell System Practices Section G51,125.1, Issue 1.

Sample calibration chart for Dynamometer having Three-Notch cam

trated, were calibrated, in the upper table, in 200-pound increments throughout. The lower table in earlier charts was based on strand stringing tensions which are now obsolete; therefore **on all charts except the type illustrated, the lower table should not be used.**

3.03 The upper table of the calibration chart indicates the dial reading of the dynamometer when it is placed on a strand of the size indicated at the top of the column and at the tension listed in the column headed "Tension Pounds." For example, to find the dial reading which indicates 1100-pound tension for 6M strand, look in the column headed **6M** and on the line opposite **1100**. For the dynamometers calibrated on the sample charts illustrated, the dial reading would be **12.4**.

3.04 The lower table combines the calibration data with the stringing tensions for copper conductor cables specified in Section G51.125.1 and gives the dial reading desired for each length of span and at various temperatures. For example, Section G51.125.1 shows that spans to 250 feet should be placed at 1100 pounds tension at 60°. The lower table of the chart illustrated shows that **6M** strand, in span lengths to **250'**, when placed at **60** degrees temperature will give a dial indicator reading of **12.4** which is the same as for 1100 pounds on the upper chart.

3.05 Calibration charts prepared before 1940 were in the form of curves rather than tables, a curve being shown for each size strand. Except for reading values from the curves rather than tables, these charts are used like those described in this section. The lower table is obsolete and should not be used.

4. TENSIONING STRAND

4.01 **Selection of Points for Reading Strand Tension:** Readings may be taken at any convenient point in the span. At false dead ends, measure the tension beyond the dead end. The tension should be read at one or more locations in the section as indicated below. When tension is to be read at more than one location, **measure first at the location most distant from the pulling end of the strand.** Readings should be taken at the following points:

(1) **Sections free from corners or changes in grade:**

- (a) **Less than 10 spans:** One reading; near middle of section.
- (b) **10 to 20 spans:** Two readings; two-thirds and one-third the section length, measured from pulling end.
- (c) **Over 20 spans:** Three readings; three-fourths, one-half, and one-fourth the section length, measured from pulling end.

(2) **Sections including corners or changes in grade:**

- (a) The first reading, on the far side of the corner or change in grade most distant from the pulling end, then in a similar manner at each corner or change in grade, working toward the pulling end.

Tighten bolts of the suspension clamps as the desired tension is obtained in each portion of the strand.

4.02 **Tensioning Galvanized Strand:**

- (a) Use this method with copper-conductor cable, at normal stringing tensions, and with calibration charts of the type illustrated in Paragraph 3.02.

(1) In the **lower** table of the calibration chart, in the column under the proper strand size and span length, and on the line opposite the latest air temperature reading, determine the proper dial indicator reading for the dynamometer.

(2) Place the dynamometer on the strand at the proper location, and operate the lever to the proper position.

(3) Adjust the tension of the strand until the dial indicator reads within two small divisions of the proper reading.

- (b) Use the following method under any conditions. It does not require the lower table of the calibration chart but does require that the desired strand stringing tensions be known.

(1) From Section G51.125.1, or from other instructions determine the tension at which the strand should be placed at the existing temperature.

(2) From the **upper** table of the calibration chart find the dial indicator reading opposite that tension and under the proper strand size.

(3) Place the dynamometer and adjust the strand tension to give the proper dial reading.

4.03 **Tensioning CR Steel Strand:** If the dynamometer is calibrated for CR steel strand use the CR steel strand calibration chart in the manner discussed for galvanized strand. If the dynamometer is not calibrated for CR steel strand proceed as follows:

(1) From Section G51.125.1, or from other instructions, determine the tension at which the strand should be placed at the existing temperature.

(2) Multiply this desired stringing tension by the following factor:

For **6M CR** Strand: .8

For **10M CR** Strand: .8

For **16M CR** Strand: 1.0

- (3) Using the resulting value of tension, obtain the dial indicator reading from the **upper** table of the calibration chart in the strand size column corresponding to the size of the CR steel strand being measured. (Exception: For 16M CR strand use the 10M column.)
- (4) Set the cam in the notch indicated:

<u>Size CR Strand</u>	<u>Use Cam Notch</u>
6M	6M
10M	10M
16M	10M

- (5) Adjust the strand tension until the proper dial reading is obtained.

5. MEASURING TENSION IN STRAND

5.01 Measuring Tension in Existing Galvanized Strand:

- (1) Take 3 readings 1/4 inch apart. Use the intermediate reading.
- (2) In the **upper** table of the calibration chart, in the proper column for the size of the strand being measured, locate the dial indicator reading nearest the observed reading.
- (3) Opposite this reading locate the tension of the strand in the Tension column to the left.

5.02 Measuring Tension in Existing CR Strand: If calibration charts for CR strand are available, proceed as for galvanized strand; if not, proceed as follows:

- (1) Take 3 readings 1/4 inch apart, using the cam notch indicated in Paragraph 4.03 (4). Use the intermediate reading.
- (2) Find the dial indicator reading nearest the observed reading, in the **upper** table of the calibration chart, in the proper column for the size of the CR strand being measured. (Exception: For 16M CR strand, use the 10M column.)
- (3) Opposite the reading just located, find the tension listed in the Tension column. For 6M CR and 10M CR strand, multiply this tension by 1.2; for 16M CR strand use the listed tension. This is the tension of the measured strand.

6. MEASURING GUY TENSIONS

6.01 Guy tensions are measured in the same way as those of suspension strand. Use care to prevent the dynamometer from slipping along the strand.