

Scale Length

By Evan Brito

The scale length of a guitar, sometimes referred to simply as 'scale', is a distance measurement, usually expressed in either inches or millimeters. This measurement represents the distance between the face of the nut (edge of the nut adjacent to the fingerboard) and the center of the 12th fret on a guitar multiplied by two.



Figure 1: Formula for Scale Length Measurement

How to Measure Scale Length on a Guitar

To measure the scale length of a guitar, you simply measure the distance from the edge of the nut to the center of the 12th fret and multiply that measurement by two.

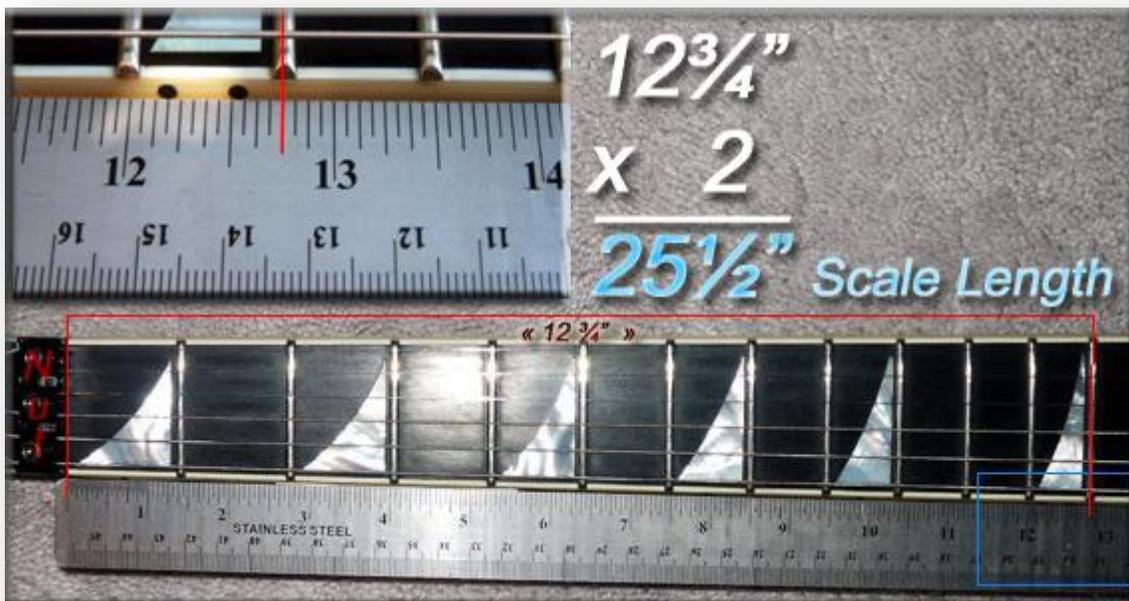


Figure 2: Measuring the Scale Length of Jackson Soloist Note: When taking this measurement, the ruler should be perpendicular to the frets and nut. In this illustration, the ruler has been placed parallel to the edge of the neck for clarity.

Common Scale Lengths of the Electric Guitar

The most widely used scale lengths on the electric guitar are 25 ½" (647.7mm) –the traditional scale length of the Fender Stratocaster- and 24 ¾" (628.65mm) –the scale length of a Gibson Les Paul. In addition to the two most common scale lengths, many guitars have been built using other scale lengths as well.

The Difference between Scale Length and String Length

String length is simply a different measurement from scale length. String length is the distance between the points where contact between a string and the nut ends and where that same string makes initial contact with its bridge saddle. This is also the vibrating length of the string when played open without fretting it. String length is sometimes also referred to as the 'speaking length' of a string. The string length of a given string on an electric guitar is always slightly longer than that particular instrument's scale length, due to the implementation of a concept known as *compensation*.

Influence of Scale Length on Instrument Performance

Fret Placement

Scale length is the key variable in the formula used to determine fret placement. Increasing the scale length will result in larger distances between the frets.

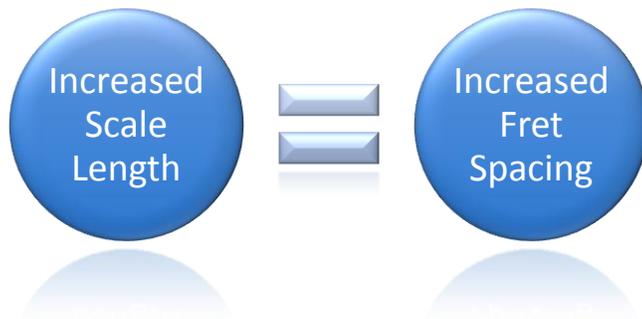


Figure 3: Relationship between Scale Length and Fret Spacing

String Tension

Scale length has a direct influence on string length. The three most critical factors which control the pitch produced by a string are string length, string tension and string mass (weight). Therefore, scale length also has a direct relationship with the amount of tension and mass required for a string to produce a given pitch. On the guitar, different string gauges are used to vary string mass.

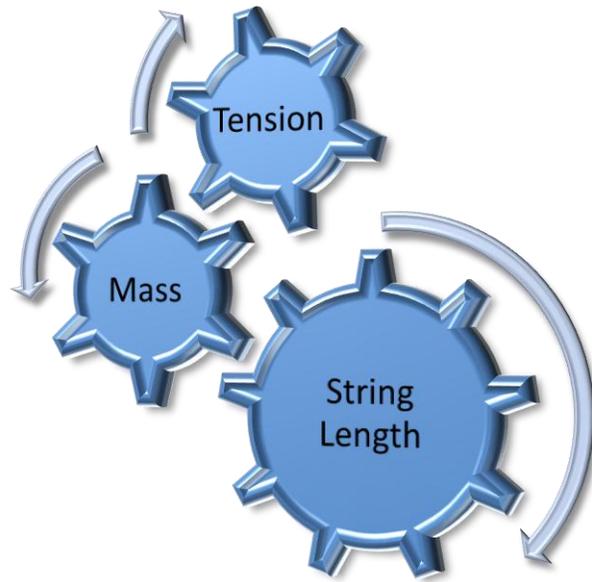


Figure 4: Three major factors that govern string pitch *Note: Relationship not to scale.*

When the same strings are used on two different scale lengths and tuned to the same pitch in both cases, the longer scale length will result in higher string tension while the shorter scale length cause lower tension. For example if you were to place an identical set of strings on both a 24 $\frac{3}{4}$ " (628.65) scale Les Paul and a 25 $\frac{1}{2}$ " (647.7mm) scale Stratocaster, using the same tuning on both guitars, the Les Paul would have lower string tension on each string than the Stratocaster. It is common for the guitarist to use slightly heavier gauge strings on guitars with shorter scale lengths to adjust for the difference in string tension. For example, many Les Paul guitars come from the factory with a set of .10 gauge strings, and many Stratocasters come with .09 gauge.

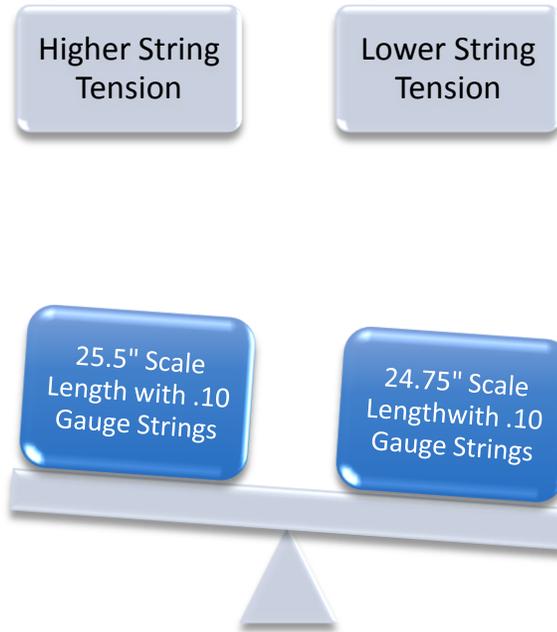


Figure 5: Example of the Effect of Scale Length on String Tension

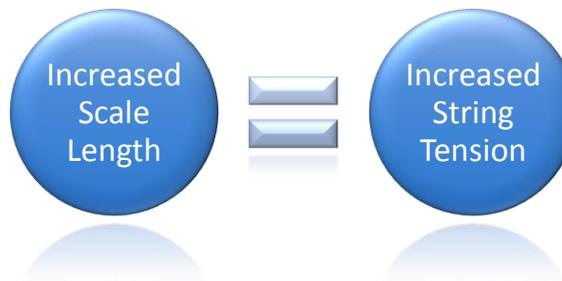


Figure 6: Relationship between Scale Length and String Tension when String Gauge and Pitch is kept Constant

Playability

Different scale lengths are characterized by different string tension at a given pitch. String tension directly influences multiple factors which contribute to the basis of a guitarist's subjective perception of a particular guitar's playability. The amount of effort required when fretting or bending notes, the likelihood of string breakage, and the ability to set the guitar up with the desired playing action without unacceptable levels of string buzz are among playability factors linked to string tension.

The effect of scale length on the physical dimensions of the neck is also responsible for an array of playability factors. Among these factors are: the amount of reach required when performing wide interval stretches and the distance the hand must travel when performing large position shifts (such as when shifting from fret 3 to 15).

Tone

String tension, directly influenced by scale length, has several effects on tone which include: pitch stability, sustain, amplitude (volume), and dynamic envelope ('*punch*' or attack and decay). Additionally, the string gauge used has various impacts on both the acoustic and electromagnetic

aspects of guitar tone. Scale length is among the factors that must be considered when selecting a string gauge.

Alternate Tunings

When alternate tunings are used on the guitar, the resulting variations in pitch require adjustments in either string gauge selection, string tension, or a combination of the two. Guitarists who use significantly lower tunings than standard tuning have traditionally favored longer scale lengths such as 25 ½" or more. Longer scale lengths allow the guitarist to retain sufficient string tension to maintain acceptable playability without being forced to resort to string gauges so large that they cannot be installed on the guitar or negatively impact playability.