



## LIGO Music Wire Specification

AUTHOR(S)	DATE	Document Change Notice, Release or Approval
Jeff Lewis (D. Coyne update and Calum Torrie update)	14 Feb 2024	see LIGO DCC record Status

## 1 Scope

This document defines the requirements for music wire to be supplied for use in LIGO suspension systems.

## 2 Requirements

### 2.1 General

- Material: Music Wire per ASTM A 228/A 228M chemical only
- Material: Bare music wire no coating<sup>1</sup>.
- Temper: Stress Relieved
- Minimum Tensile Strengths: Refer to table on 1 on page 2 of ASTM A 228/A 228M.
- Further on Minimum Tensile Strengths: for typical LIGO wire diameters in the range 0.0078 inches [0.2mm] up to 0.0394 inches [1 mm] the following can be used as a guide:

Diameter		Minimum Tensile Strength <sup>2</sup>	
inches	mm	ksi	Gpa
Typical LIGO wire diameters in the range 0.0078 [0.2mm] up to 0.0394 inches [1 mm] can use the following <sup>2</sup> .		290	2.00

- Diameter tolerance (inches):
  - 0.0030 to 0.0109 +/-0.0001
  - 0.011 to 0.019 +/- 0.0003
  - 0.020 to 0.050 +/- 0.0005
- Minimum 8 inch cast at 12-inch length.

<sup>1</sup> Industry coats **Music Wire** with phosphate for corrosion resistance and lubricity. Phosphate is bad for LIGO's ultra-high vacuum, hence why it is important to call out bare music wire no coating.

<sup>2</sup> LIGO specification based on typical numbers in ASTM A 228/A 228M across range specified.

**LIGO Music Wire Specification****2.2 Processing**

- Clean gloves must be worn at all times. (No bare hands touching the wire)
- Wire must be fresh drawn within 2 weeks of shipment
- Wire must be free of oil and grease and must not be used during the manufacturing process

**2.3 Inspection and Documentation**

- Wire shall be free of rust, scale, corrosion, spotting artifacts, die marks, pits, and scratches visible at 10X magnification
- Provide Material Certifications
- Provide Certificate of Conformance to Purchase Order requirements

**2.4 Packaging**

- Wire shall be shipped on 12 inch diameter spools
- Wire shall be sealed in a container with a molecular sieve desiccant consistent with LIGO specification E1300075
- Desiccant shall be added inside plastic shipping bag
- Purge plastic shipping bag with inert gas before sealing
- Double bag

**2.5 Selecting wires for suspensions [Internal to LIGO]<sup>3</sup>**

- Generally music wire used in a suspension is selected for use at 1/3 (one-third) of the Minimum Tensile Strength\* or Breaking Stress of the wire. Refer to the DCC for further details and examples of use.

\*Note that the Minimum Tensile Strength value should be used even if the music wire has an Ultimate Tensile Strength higher than the Minimum Tensile Strength.

- Take care when designing the associated clamping mechanism; refer to existing LIGO clamp (clamp-wire-clamp) designs) on the DCC.

<sup>3</sup> Internal LIGO documents refer to [LIGO-E1100187-v5](#) and [LIGO-T1100120-v2](#).