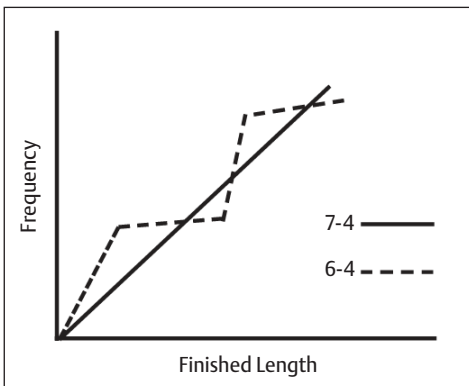


Ultrasonic Welding

Figure 1:



The Advantages of 7-4 over 6-4 Titanium for Ultrasonic Tooling

Titanium is usually the material of choice for ultrasonic tooling due to its excellent mechanical and acoustic properties. It has very high fatigue strength that enables it to withstand high cycle rates at high amplitudes. It also has a higher hardness than Aluminum, and therefore holds up better against wear.

Other benefits to using Titanium include:

- Low density, good strength, easily fabricated.
- Excellent corrosion resistance.
- As strong as steel, but 45% lighter.
- Twice as strong as Aluminum, but only 60% heavier.

Why 7-4 Titanium?

- Roughly 15% stronger than 6-4 Titanium (see Table 1).
- Higher creep resistance to heat (deformation during prolonged constant tension and compression at elevated temperatures).

- Better material consistency from heat to heat or bar to bar makes 7-4 more predictable.
 - a. Up to 10% variation in modulus of elasticity from heat to heat or bar to bar with 6-4.
 - b. Wave propagation is the direction that the ultrasonic energy travels through the tool. 7-4 material has a much more uniform wave propagation in one direction (axial).
- Due to its higher mechanical properties (and ability to withstand higher stresses), higher amplitude can be designed into a horn made out of 7-4.
- Finished tuned length is much more consistent from bar to bar and lot to lot.
- Tuning characteristics are more consistent and predictable as horn is machined into axial range (Figure 1).

Ultrasonic Welding

- Additional Aluminum and replacing Vanadium with Molybdenum in 7-4 creates more consistent elasticity and is more resistant to heat effects on a

horn (see Table 2). Heat effects include heat dissipation, heat conduction to the work-piece, and tool life.

TABLE 1

Mechanical Properties	7 Al - 4 Mo	6 Al - 4 V	D (%)
Tensile Strength, Ultimate (MPa)	1040	900	15
Tensile Strength, Yield (MPa)	966	830	13
Modulus of Elasticity (GPa)	117.6	112.4	4
Density (Kg/m ³)	4464	4430	0.8

TABLE 2

Alpha Beta Alloy, Consisting of ~ 89% Raw Titanium

7-4 Component /Wt. %		6-4 Component /Wt. %	
Aluminum	7%	Aluminum	6%
Molybdenum	4%	Vanadium	4%
Titanium	89%	Titanium	90%

BRANSON

Branson Ultrasonics Corporation
41 Eagle Road, Danbury, CT 06813-1961
(203) 796-0400 • Fax: (203) 796-9838
www.bransonultrasonics.com
e-mail: info@bransonultrasonics.com

TL-18 © Branson Ultrasonics Corporation 2011
The Emerson logo is a trademark and service mark of Emerson Electric Co.
Revised and printed in the U.S.A. 1/2012