How to Determine Which Booster Ratio to Use

20kHz
Transducer amplitude x Booster gain x Horn gain = STACK AMPLITUDE
Stack Amplitude ≥ resin amplitude requirement

A stack consists of a transducer, a booster, and a horn.

Start with what is known:

Transducer amplitude .... .0008 inches (20 microns)
Resin amplitude requirement .... (i.e. Polycarbonate) .004 inches (100 microns)
Horn gain factor* .... (.5" diameter exponential) 4:1

Then simply plug in the numbers and do the math to solve for booster gain:

.0008 x Booster gain x 4 = .004
.0032 x Booster gain = .004
Booster gain = .004/.0032
Booster gain = 1.25:1

* For your horn gain ratio, contact the tooling engineers at Dukane. Have your horn serial number ready. Gain is determined by the ratio of mass above the nodal point vs. below the nodal point.

40kHz NOTE: To determine the amplitude for a 40kHz application, divide the 20 kHz amplitude by two and add 20%:

Example - Nylon at 20kHz
60 - 125 microns
At 40kHz = 60 - 125/2 + 20%
= 30 - 63 x 1.2
= 36 - 76 microns

NOTE: Due to certain stack limitations, it may not be advisable to achieve the ideal amplitude as noted in the reference chart. Contact Dukane Tooling Department for confirmation of appropriate stack combination.

Thermoplastic 20 kHz Amplitude Reference

Amorphous Resins	Microns	Thousandths
ABS(Cycolac)	30-70	1.2-2.8
ABS/Polycarbonate (Cycoloy, Pulse)	50-125	2.0-5.0
Phenylene-Oxide (Noryl)	50-90	2.0-3.6
Polycarbonate (Lexan)	50-100	2.0-4.0
Polycarbonate/Polyester (Xenoy Macroblend)	50-100	2.0-4.0
Polyetherimide (Ultem)	60-125	2.4-5.0
Polymethyl Methacrylate (Acrylic, Plexiglass)	40-70	1.6-2.8
Polustyrene	60-65	1.2-2.6
Polysulfone (Udel)	65-100	2.6-4.0
Polyvinylchloride (Rigid PVC)	40-75	1.6-3.0
SAN/NAS	30-65	1.2-2.6
Styrene Block Copolymers (K-Resin)	40-90	1.6-3.6

Semi-Crystalline Resins	Microns	Thousandths
Acetal (Delrin, Celcon)	75-125	3.0-5.0
Liquid Crystal Polymers (Xydar)	60-125	2.4-5.0
Polyamide (Nylon, Zytel)	60-125	2.4-5.0
Polyester PBT (Celanex, Valox)	60-125	2.4-5.0
Polyester PET (Rynite)	60-125	2.4-5.0
Polyetherether Ketone (PEEK)	60-125	2.4-5.0
Polyethylene P/E	70-125	2.8-5.0
Polymethypentene (TPX)	70-125	2.8-5.0
Polyphenylene Ether/Oxide (Prevex)	60-125	2.4-5.0
Polyphenylene Sulfide PPS (Ryton)	80-125	3.2-5.0
Polypropylene P/P	70-125	2.8-5.0

Applications	Microns	Thousandths
Welding	30-125	1.2-5.0
Staking	75-125	3.0-5.0
Swaging	75-125	3.0-5.0
Inserting	25-65	1.0-2.6
Spot Welding	50-125	2.0-5.0
Degating	75-125	3.0-5.0

Trademarked names appear in parentheses.

NOTE: The information contained in this slide chart is for reference only. Contact your material supplier or Dukane regarding your individual project.

Application Set Up Guidelines

Frictional heat to melt thermoplastic material is created by vibratory motion (amplitude), clamping force (pressure) and dwell time (time, distance, absolute distance, energy, peak power) localized at the joint interface. The graphs below provide a guideline and initial starting points for force, trigger settings and weld time. Material, weld strength, weld area and joint design are important when determining the initial process parameters.

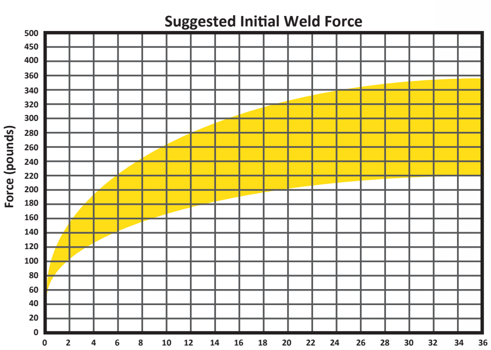
Amorphous resins typically require less energy then semi-crystalline resins, therefore, less pressure, trigger force and weld time is necessary. Likewise, greater surface area requires higher pressure, trigger force and weld time. Optimization of welding parameters can be achieved using computerized process control.

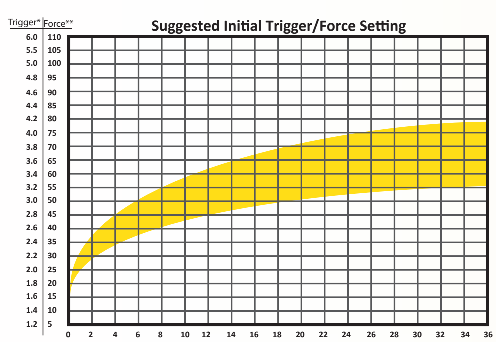
This guide is used for reference. Experimentation and testing will be necessary to optimize the weld parameters.

To use these charts:

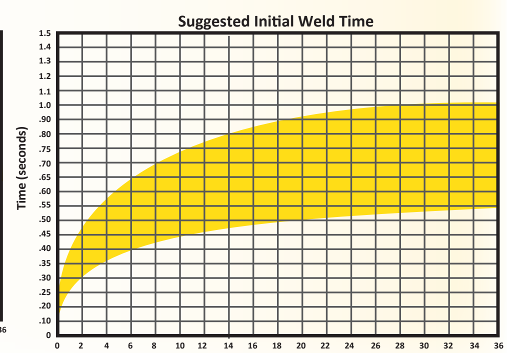
1. Measure or approximate the length of linear weld joint. **2.** Find the corresponding number on the horizontal axis of each graph. **3.** Follow the number up into the appropriate range.

Example: A part with 8 linear inches would read the following ranges - Weld Force = 150-240
- Trigger Setting = 2.6-3.2 (40-55 lbs.)
- Weld Time = .40 sec.-.65 sec.





* Dynamic trigger setting used on standard press/thruster) 2.5" dia. air cylinder
** Trigger force (lbs.) used on press/thruster equipped with load cell) 2.5" dia. air cylinder



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Thermoplastic Compatibility Guide

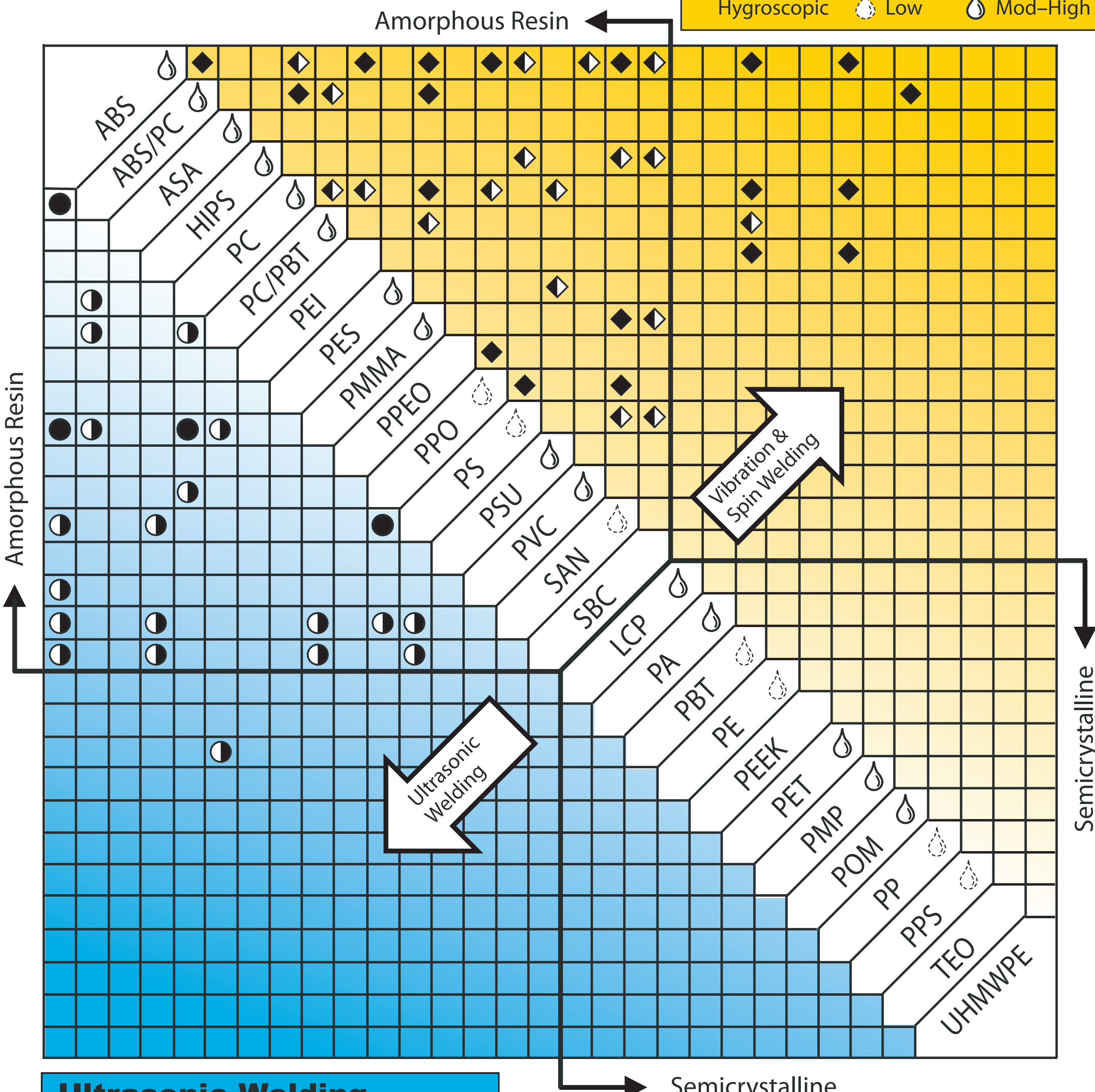
For Ultrasonic Welding use the lower left side. For Vibration and Spin Welding use the upper right portion. Then select the two materials and find their intersection. For example: Spin Welding ABS to PEI – Move to the right from the ABS label and up from the PEI label to determine these materials have good compatibality (◆ symbol). Moving to the left from PEI and down from ABS we find this pair is not compatible for Ultrasonic welding.

Vibration & Spin Welding

◆ Good Compatibility

◆ Compatibility Based Upon Material Composition

Hygroscopic Low Mod–High



Ultrasonic Welding

● Good Compatibility

◐ Compatibility Based Upon Material Composition

Hygroscopic Low Mod–High

For Ultrasonic Welding use the lower left half. For Vibration and Spin Welding use the upper right portion. Then select the two materials and find their intersection. For example: Spin Welding ABS to PEI – Move to the right from the ABS label and up from the PEI label to determine these materials have good compatibality (◆ symbol). Moving to the left from PEI and down from ABS we find this pair is not compatible for Ultrasonic welding (blank intersection).

Actual compatibity is based on individual application requirements, material, part evaluation and testing.

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www.dukane.com/us

Dukane IAS, LLC • 2900 Dukane Drive • St. Charles, Illinois 60174 USA • TEL (630) 797–4900 • FAX (630) 797–4949