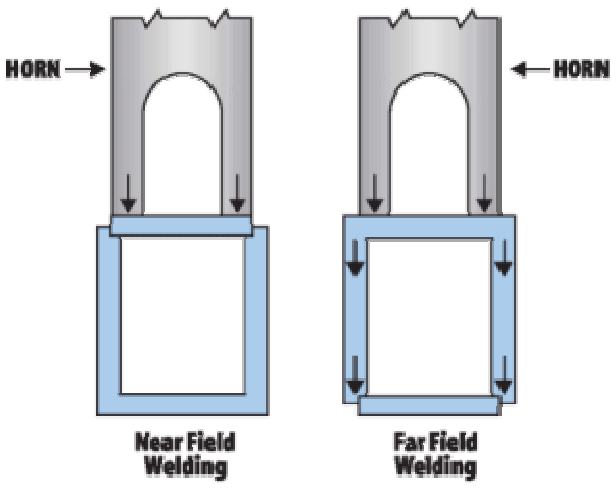
Ultrasonic Assembly Process

In Ultrasonic welding, high frequency sound energy is used to bring the joining surfaces of two thermoplastic parts to a molten state where they can be permanently welded together.

1. The horn, under pressure from the assembly stand, contacts one of the two mated plastic parts.
2. Vibrational energy from the horn causes the contacted plastic part to vibrate against its mate.
3. The mechanical vibration of one part against the second causes frictional heat, which melts the plastic parts at their interface and allows the two surfaces to molecularly fuse together.
4. After a short cooling time, a permanent, homogeneous weld results.

Ultrasonic Weld Types



Near Field Weld (Direct): Refers to a weld where the contact surface of the horn is 1/4" or less away from the joint surface. It is important that the horn fits exactly the contour of the part to be welded.

Far Field Weld (Indirect): The distance between the contact surface of the horn and weld between the contact surface of the horn and weld joint is more the 1/4". Ultrasonic energy is transmitted through the upper portion of the part to the joint surface.

Weldability in Ultrasonics

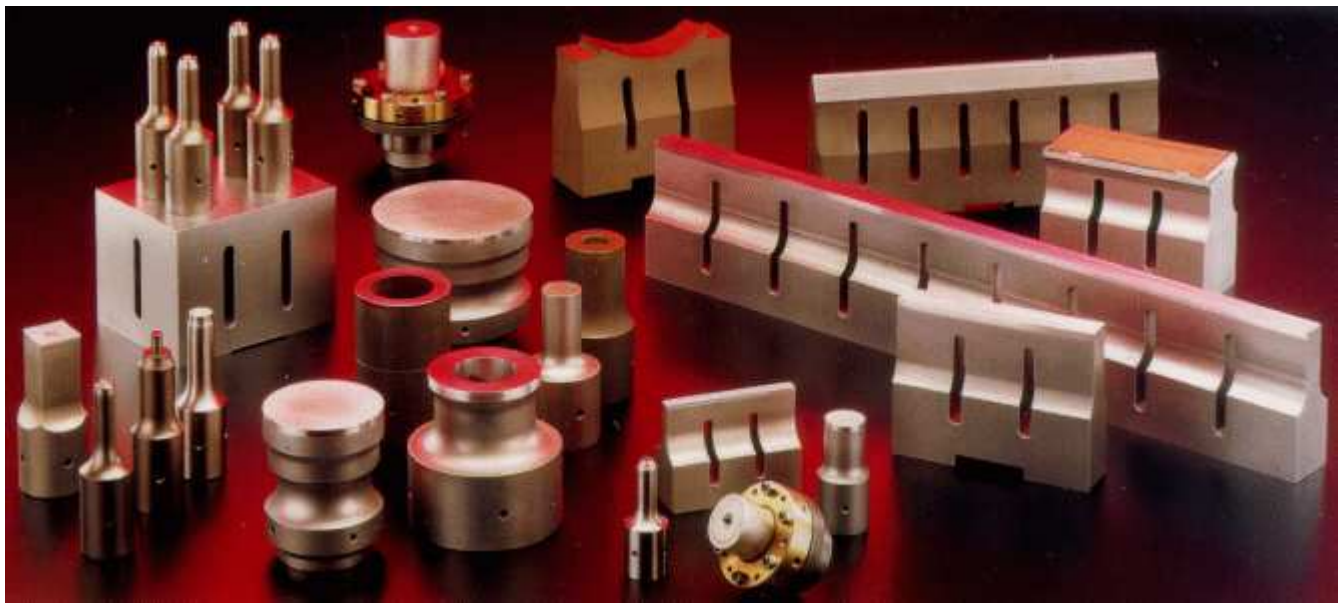
Factors Influencing Weldability in Ultrasonics

- Amorphous vs. Semi-crystalline resins
- Mold release agents
- Moisture content
- Lubricants
- Pigments
- Plasticizers
- Resin grade
- Fillers

Ultrasonic Weldability of Plastics

EASE OF WELDING	EASY	MEDIUM	COMPLEX	DIFFICULT
Resin	Polystyrene/PS Acrylic ABS SAN PMMA PC-ABS Blends	Polycarbonate/PC PC-ABS Blends PPS Polysulfone/PSO PVC ASA	PPO PC-PBT Blends Polyester Ryton PET Polyamide Co-polymer (Nylon 6-3-T) Valox	Polyamide/Nylon 6 Polyamide/Nylon 6/6 PBT PP PE Polyacetal Ultem
20kHz Peak to Peak Amplitude	35 to 45 microns	45 to 55 microns	55 to 80 microns	80 to 100 microns
Joint Design	Energy Director 90 - 0.7 mm	Energy Director (60 /0.8mm) For low strength mechanical assembly only Shear Joint (0.5 - 0.6 mm) - (1 - 2 mm) for higher strength or hermetic assembly	Shear joint 0.4 mm wide - (0.8 - 1.4 mm)	Shear joint 0.4 mm wide - (0.8 - 1.4 mm)

Ultrasonic Horns



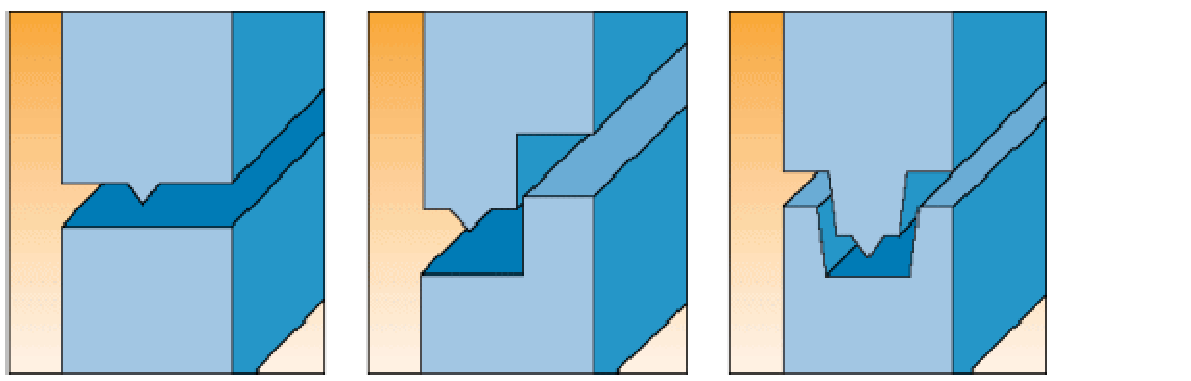
The design of the horn is determined by the amplitude required, the type of welding process, and the material selected. We design each horn to specific application requirements.

Ultrasonic Joint Designs

The basic requirement of any ultrasonic joint design is a small, uniform initial contact area.The design varies with each application and depends on factors such as type of plastic resin to be bonded,part geometry and requirements of the weld.

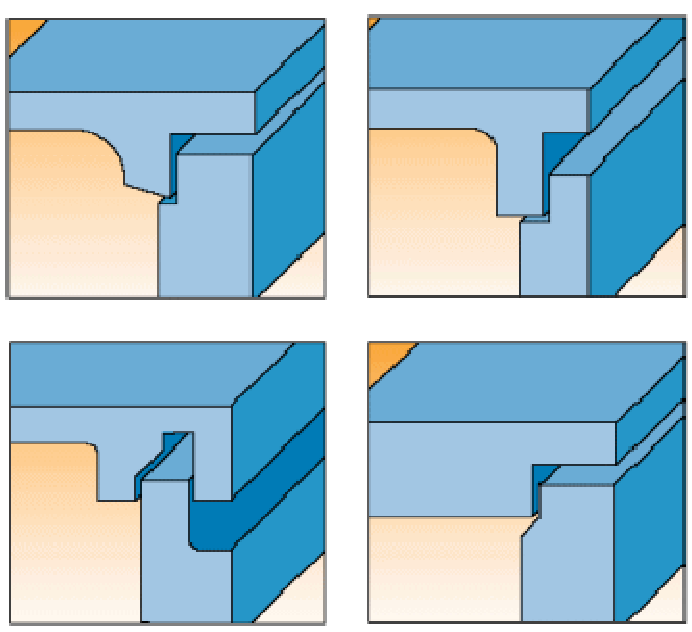
Energy Director

Normally a triangular section on the joint that serves to concentrate ultrasonic energy and rapidly initiates melting of the joining surfaces. Common joints, which incorporate the use of an energy director, include: butt joints, step joints, and tongue and groove joints.



Shear Joints

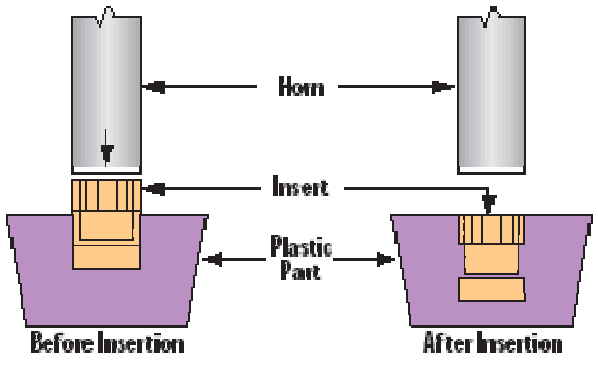
This type of joint is preferred for parts that require a hermetic seal or for plastics that change rapidly from a solid to molten state over a very narrow temperature range.



Other Applications for Ultrasonic Welding

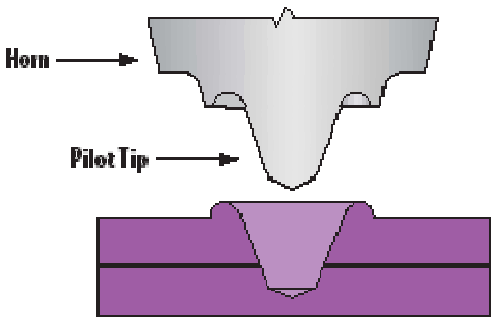
INSERTING

Threaded inserts, grub screws or other parts can be ultrasonically embedded in thermoplastics.



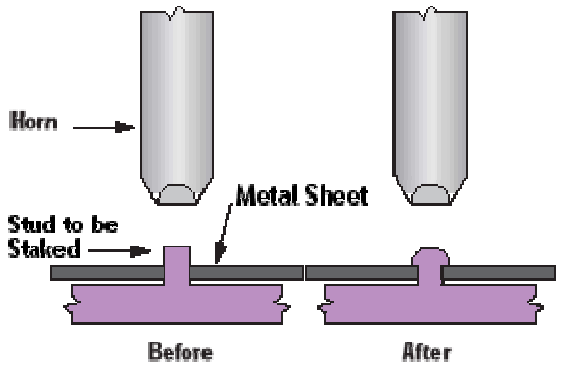
SPOT WELDING

Used for joining two thermoplastic parts with no pre-formed hole or energy director. This technique is particularly suited to large parts or parts with complicated geometry and thermoformed or blow-molded parts without a joint.



STAKING

Melting and forming of a plastic stud to retain or lock another material, often dissimilar, in place.



SWAGING

Used to capture another component of an assembly by melting and reforming a ridge of plastic around the component. The ridge locks the second component in place without welding the materials together.