BRANSON

Technical Information VW-1

Designing Parts for Linear Vibration Welding

General Description

This bulletin provides guidelines to aid the designer during the initial concept and design of a new product. All designs should be used for *guidelines purposes only*, since the specifics of your application may require variations. If you have questions or need assistance in designing your parts, contact your local Branson representative, regional technical center, Branson in Honeoye Falls, NY, or Branson headquarters in Danbury, Connecticut.

Primary Factors Influencing Joint Design

All of the following basic questions must be answered prior to the design stage to gain a total understanding of what the weld joint must do:

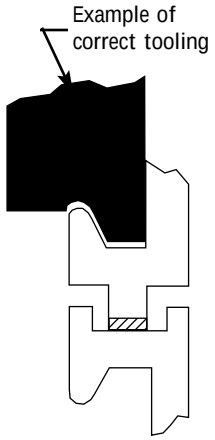
- What type of material(s) is to be used? Does it contain a filler?
- What is the overall part size and configuration including tolerances?
- What are the final requirements of the part?
  - Is a structural weld desired? If so, what load forces does it need to resist?
  - Is a leak-tight seal required? If so, to what pressure?
  - Does the assembly require a visually attractive appearance?
  - Is visual flash or loose particulate objectionable inside and/or outside?
  - Any other requirements?

Key Design Considerations

The following points need to be addressed when designing parts for vibration welding:

- There must be enough clearance between the two parts for the vibration motion (0.080" [2.0mm] total, ± 0.040" [1.0 mm] off centerline).
- The weld bead or tongue should be equal to the nominal wall thickness for unfilled materials, and at least 1.25X the nominal wall thickness for filled materials, depending on weld strength requirements.
- The part walls must be stiff enough to prevent flexure or bending during welding. In many cases this may require adding flanges.

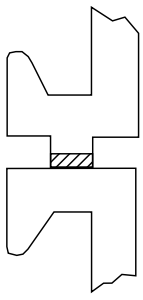
Figure 1, a tongue and groove design with grip tabs, is the ideal vibration welding joint. It securely holds the flange in the tooling, aligns the mating parts to each other before welding, applies the weld force directly over the weld area, and hides flash both internally and externally. The grip tab need not be continuous. A raised tongue is provided on one part to provide material to melt and flow in the joint during vibration. In reality, material is displaced from both parts during welding, but convention usually adds weld material only to the tongue.



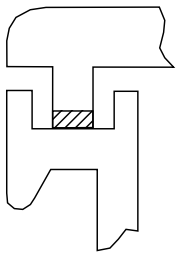
1 Tongue and groove with grip tabs

Figure 2 shows a flange with grip tabs, and has all the features of the joint in Figure 1 except it does not contain flash. Narrower flanges may be possible and the fit between the two parts is not as critical.

Figure 3 shows a variation of the tongue and groove joint that is used when a shallow or flat cover is to be welded.



2 Flange with grip tabs



3 Tongue and groove variation

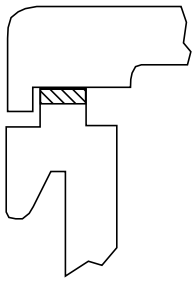
Applied Technologies Group

41 Eagle Road
Danbury, CT
06813-1961
(203) 796-0349
fax (203) 796-9838
email: info@bransonultrasonics.com

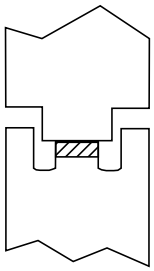
BRANSON

A skirt joint, shown in Figure 4, is used to contain exterior flash and provide a visually attractive appearance.

A double tongue and groove design (Figure 5) is used where maximum strength and flash containment are required, such as in automotive air intake manifolds.

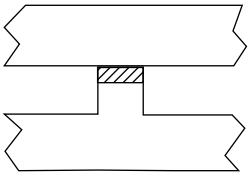


4 Skirt joint



5 Double tongue and groove

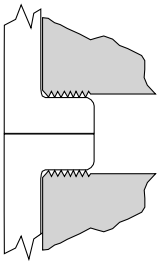
A basic butt joint, Figure 6, can be used with rigid plastics and short walls when flash containment is not a concern.



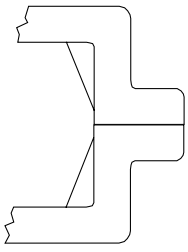
6 Butt joint

There are many times when part design, space limitations, and mold function restrict the weld details that can be incorporated into a joint design. If grip tabs cannot be designed in the part, then the tooling can have knurled details to hold the parts during welding (Figure 7). The knurls may leave small impressions in the flange area, and they will not take out any part warpage (which a grip tab does).

Internal gussets, shown in Figure 8, can stiffen some designs enough to eliminate the need for knurls.

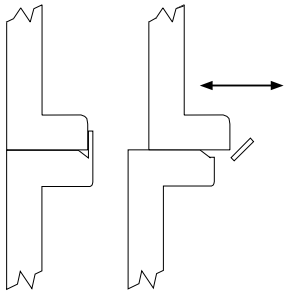


7 Knurled fixtures

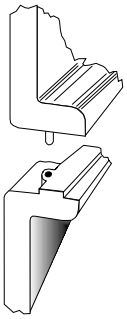


8 Internal gussets

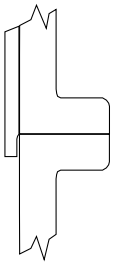
Another important consideration when designing parts for linear vibration welding is alignment of the two halves prior to welding. Figure 9 shows the use of a prealignment tab, which can be designed to deflect or break off during welding. Figure 10 illustrates the use of a pin and socket feature where the pin breaks off into a blind hole during welding. For walls parallel to the welding motion internal tabs (Figure 11) can be used for alignment, for example welding a lid to a tank where the tank walls warp inward and the cover is rigid enough to hold the walls out.



9 Alignment tabs



10 Alignment pins



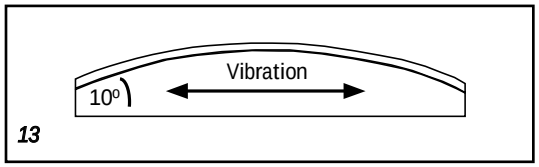
11 Internal tabs

Part Configuration

It is a common misconception that vibration welding joints must be in a flat plane. Many parts are welded with all types of joint shapes. As long as there remains one axis of motion, the parts are candidates for linear vibration welding. As an example, refer to the automotive air intake manifold shown in Figure 12, where the vibration motion is left to right.

12

Small angles in the direction of vibration (shown in Figure 13) can also be welded.



13

Branson

41 Eagle Road
Danbury, CT
06813-1961

475 Quaker Meeting House Road
Honeoye Falls, NY
14472
(585) 624-8000
Fax (585) 624-2682
info@BransonUltrasonics.com

VW-1