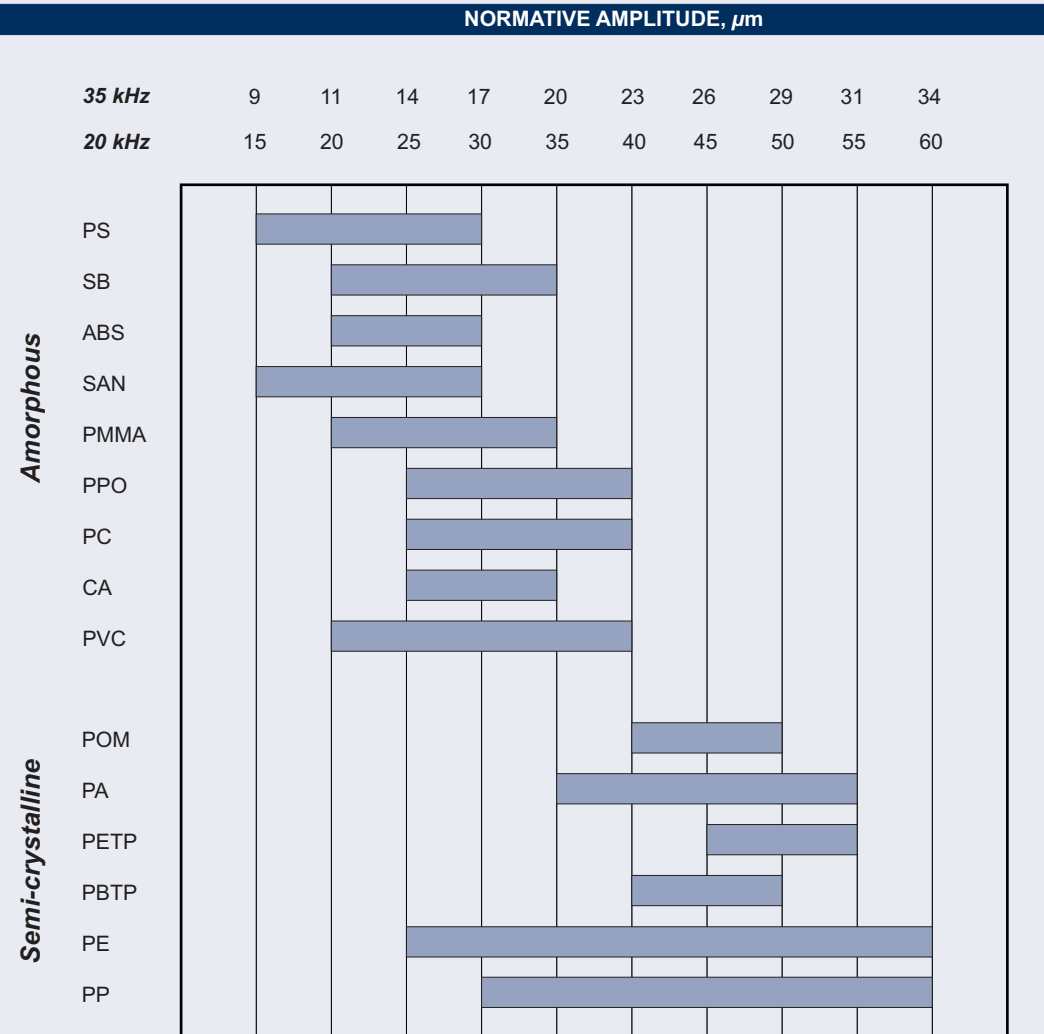




# Material compatibility, normative amplitude and construction guidelines

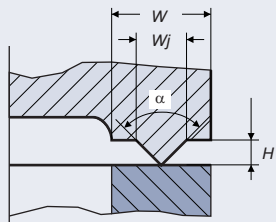
ULTRASONIC WELDING COMPATIBILITY		Amorphous														Semi-Crystalline											
		ABS	ABS/PC	ABS/PVC	Acryl PMMA	Styrene-butadiene SBR	Polymer PI	PC	PC/PET	Polyester-PET	Polyethersulphone PES	Polystyrene PS	Polysulfone PSU	PPO (Noryl)	PVC	SAN-ASA	Acetal POM	Cellulose CA	LCP	PEEK	Polyamide PA	Polyester PST	Polyethylene PE	Polyphenylene sulfide PPS	Polypropylene PP	PTFE Mod.	
Amorphous	ABS	Good	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	ABS/PC	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	ABS/PVC	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	Acryl PMMA	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	Styrene-butadiene SBR	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	Polymer PI	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	PC	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	PC/PET	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	Polyester-PET	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	Polyethersulphone PES	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	Polystyrene PS	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	Polysulfone PSU	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	PPO (Noryl)	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	PVC	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
	SAN-ASA	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited
Semi-Crystalline	Acetal POM	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	
	Cellulose CA	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	
	LCP	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	Limited	Limited	
	PEEK	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	Limited	
	Polyamide PA	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	Limited	
	Polyester PST	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	Limited	
	Polyethylene PE	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	Limited	
	Polyphenylene sulfide PPS	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	Limited	
	Polypropylene PP	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good	
	PTFE Mod.	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Limited	Good



We completely solve problems in the field of the ultrasonic associated with joining and cutting of parts provided by our customers

## Energy director

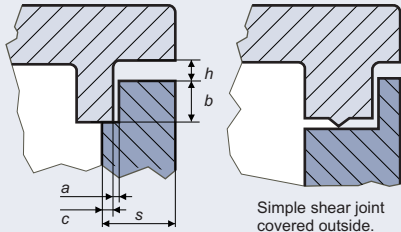
	Amorphous (1)	Semi-Crystalline (2)
$W_j$		
Min.	0,25 mm	0,4 mm
Max.	1,3 mm	1,3 mm
Abs. min.	0,13 mm	0,3 mm
$H$		
Rec. min	0,25 mm	0,5 mm
Max.	0,6 mm	1,1 mm
	60° - 90°	60°



(1)  $W \leq 4W_j - 5W_j$ ;  $H = 0,5W_j(x) - 0,966W_j(x)$  = soft semi-crystalline  
 (2)  $W = 4W_j - 5W_j$ ;  $H = 0,5W_j$

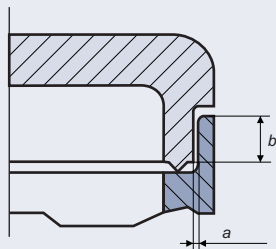
## Shear joint

Shear joint tolerance  
 $a = 0.025$  to  $0.05$  mm  
 Positioning height  
 $b = 1.0$  mm min.  
 Penetration  $h = s/3 - 1.5 s$   
 Overlap =  $s/10 - s/5$



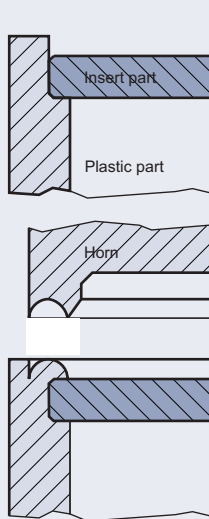
## Mating of parts to be welded

Tolerances of Mating Parts:  
 $a = 0.025$  to  $0.05$  mm;  
 $b = 1.0$  mm, minimum

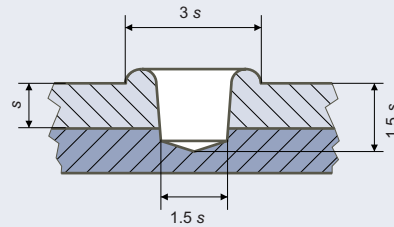


## Flanging

Typical flanging connection.  
 Radii prevent notch effects!

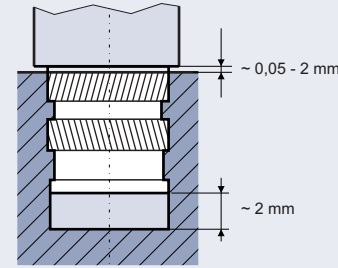


## Spot welding



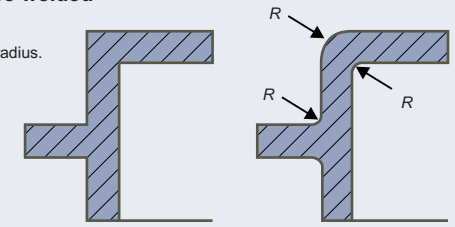
## Embedding procedure

The insert is pushed in by ultrasonics and firmly encased in the molten plastic.



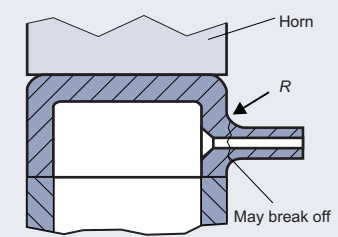
## Design of parts to be welded

All corners should have a radius.



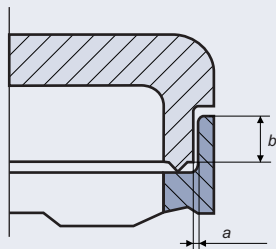
## Potential troubles in part welding

Ultrasonically induced vibrations of extended parts.

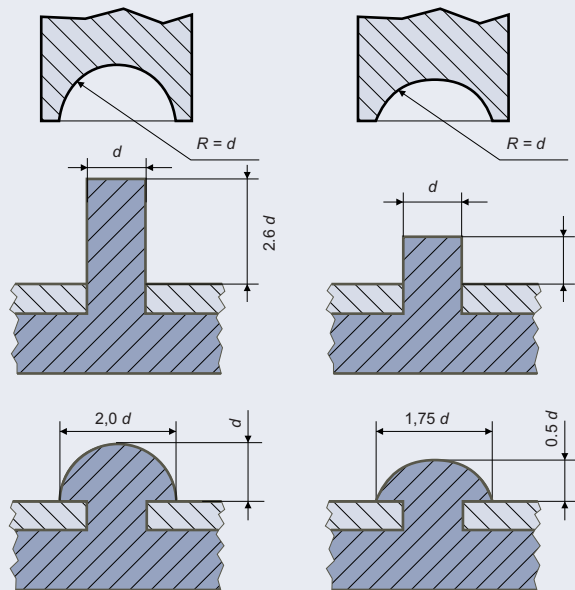


## Mating of parts to be welded

Tolerances of Mating Parts:  
 $a = 0.025$  to  $0.05$  mm;  
 $b = 1.0$  mm, minimum

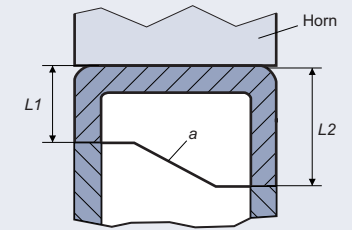


## Riveting



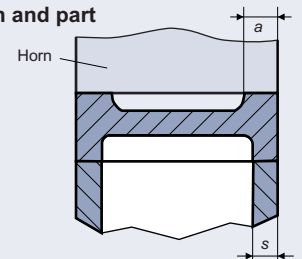
## Position of joint surface

Unequal distances  $L1$  and  $L2$ ; zone "a" not at right-angle to horn surface.



## Contact surface between horn and part

Horn surface area of contact should be as large as possible; for instance, "a" should be larger than "s" if possible.



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