

Friction Stir Welding – A New Joining Method

Mazda Motor Corporation has introduced a new type of welding process to the automotive industry that does not use resistance to create heat. Instead, pressure and friction are used to create the heat necessary to fuse two pieces of metal. This type of welding is called friction stir welding.

Friction stir welding uses a pin that rotates at very high speeds and high pressure to create enough friction to melt metal. This type of welding process uses a non-consumable pin tool, requires no filler metal, and no shielding gas (see Figure 1).

When friction stir welding, the pin tool runs the length of the required weld area, stirring and forging the two pieces together by heat and force (see Figure 2). The rotational speed of the pin varies from a few hundred revolutions per minute to several thousand. The specialized welding gun holds both sides of the metal in place with a welding tool. The welding tool then spins while force is applied. This creates the frictional heat required to melt the metal.

Currently, Mazda uses this process on hem flanges on the aluminum rear doors

and hood of the 2004 RX-8, their new four-door, rotary engine sports car. One of the major advantages to the type of welding process is the considerable reduction in the amount of electricity required to weld a panel. Due to aluminum's ability to quickly dissipate heat when resistance welding, a large amount of current is required to instantaneously pass through the aluminum. Mazda states that energy consumption has been reduced by about 99 percent when compared to resistance welding aluminum and around 80 percent compared to resistance-welding steel. Mazda prefers this method over riveting, because of the expense of rivets, and mechanical clinching, which requires large equipment.

Currently, the only parts being friction stir welded are the hood and rear door panels on the 2004 Mazda RX-8 (see Figure 3 and 4). Door skin damage that is not repairable will require replacement of the door shell—the door skin will not be serviced separately. The same holds true for the hood assembly. However, as the use of this welding process increases, we may be seeing potential repair procedures if this welding process is used in the assembly of the vehicle structure.



Figure 1—Mazda's new friction stir welder making a weld on a body assembly.



Figure 2—Mazda's new friction stir welder making a weld on a body assembly.

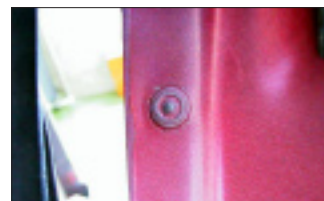


Figure 3—The front side of a friction stir weld.



Figure 4—The back side of a friction stir weld.