

DEFORMATION RESISTANCE WELDING™



**A revolutionary new process.
Exciting new possibilities.**

SPACEFORM

Developed with funding by NASA for its Man on the Moon and Man to Mars projects, Deformation Resistance Welding brings new design flexibility and cost savings to the manufacturing process.

What is DRW?

Deformation Resistance Welding (DRW) is a revolutionary new metal-joining technology that delivers reliable, repeatable welds at significantly lower cost than conventional welding solutions. The DRW process allows the welding of similar and selected dissimilar materials as well.

DRW forms a near instantaneous, full strength, leak-tight weld. Unlike conventional welding methods, DRW heats metal surfaces only to the point of softening followed by rapid, engineered compression of the joint. The process automatically bonds metals and creates solid-state joints through the heating and deformation of mating surfaces. The result is a full thickness, superior, solid-state weld that gives designers new freedom to create lean structural assemblies using tubular components.



What are the benefits of DRW?

The DRW process can reduce cycle time and the cost of making a variety of structures using hollow members. Typically, a manufacturing operation using DRW can realize benefits in the following areas:

- Lower materials and capital cost
- Reduced welding cycle time by up to 79%
- Solid-state weld flexibility
- Geometry-independence
- Automation friendly
- Joining of dissimilar materials and shapes
- Leak tight welds
- A weld that is stronger than the parent metal
- Elimination of tube thinning and porosity
- Extended product service life
- No filler material required
- Localized heat application

What manufacturing areas can use the DRW process?

DRW has broad application to all areas of manufacturing. Because of its unique ability to handle tube-to-tube and tube-to-sheet welding, DRW literally changes the game with regard to any type of tubular product manufacturing.



The advanced DRW process was originally developed by Delphi Corporation as a way to cut costs, improve material performance and optimize the welding process. SpaceForm was set up by Delphi Technologies, Inc. (DTI), which is a wholly owned subsidiary of Delphi Corp., to commercialize this patented technology in the mobile structures market.



Shock



New Joint Design



Trailer Hitch



Heat Exchanger

DRW is ideally suited for:

- load-bearing structural applications
- mobile medical products
- automobiles
- bicycles
- motorcycles
- commercial vehicles
- recreational vehicles

Because of the exceptional strength and leak tightness associated with DRW, the process shows outstanding application opportunities for tubular spaceframes, exhaust systems and other fluid based mechanical systems using a tubular component.

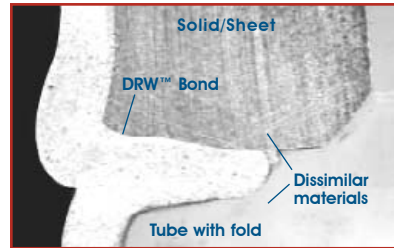
How can I put DRW to work in my operation?

SpaceForm will work with you to provide design services and commercial access to

DRW technology. We will maintain and coordinate a central knowledge base that will benefit all users of DRW.

SpaceForm has formed a strategic alliance with Edison Welding Institute (EWI) in Columbus, Ohio, to offer customized product development services to customers in the manufacturing and automotive industries. As a DRW customer you will have access to the extensive resources and staff of EWI to design and carry out feasibility, prototype and validation studies.

To learn more about the unique opportunities available through the revolutionary DRW process and how SpaceForm will work with you to put this time and money-saving welding technology to work for you, call SpaceForm at 877.501.3400, or e-mail us at info@spaceformtech.com.



Cross-section shown at 20X magnification.

TYPICAL WELDING METHODS COMPARISON

SpaceForm has validated the impact of the DRW welding process on a variety of tube-to-tube/sheet/solid materials. The results are representative of the DRW process for welding various pieces, and we will be happy to share our findings with you.

The comparison examples shown below are based on welding the inlet/outlet tube to the fuel tank cover for a typical automotive application.

FEATURE	BRAZING	ARC WELDING	DRW
Process	Batch	Line	Line
Total Cycle Time	Several minutes	>20 sec	<6 sec
Material Limitations	Yes	Yes	Currently assessing
Join Length Dependent	No	Yes	No
Utilities	Gas, Water, Electric	Gas, Water, Electric	Water/Electric
Filler Weld Material	Copper/other filler	Filler wire, shielding gas	None
Material Strength Loss	Yes	Yes	No

ASME CERTIFIES DRW Deformation Resistance Welding has been certified by the American Society of Mechanical Engineers (Approval #2463) as a nationally recognized manufacturing process for tube-to-tubesheet welding.

Deformation Resistance Welding is being rigorously tested and has been shown to produce strong, uniform and leak-tight welds for a wide variety of applications and materials.



Suspension Link



Tube to Block



Fuel Filler Cap



Catalytic Converter



TC Actuator



Damper



Fuel Rail



Spindle



Shock & Strut Rod



Hydraulic Valve Lifter



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