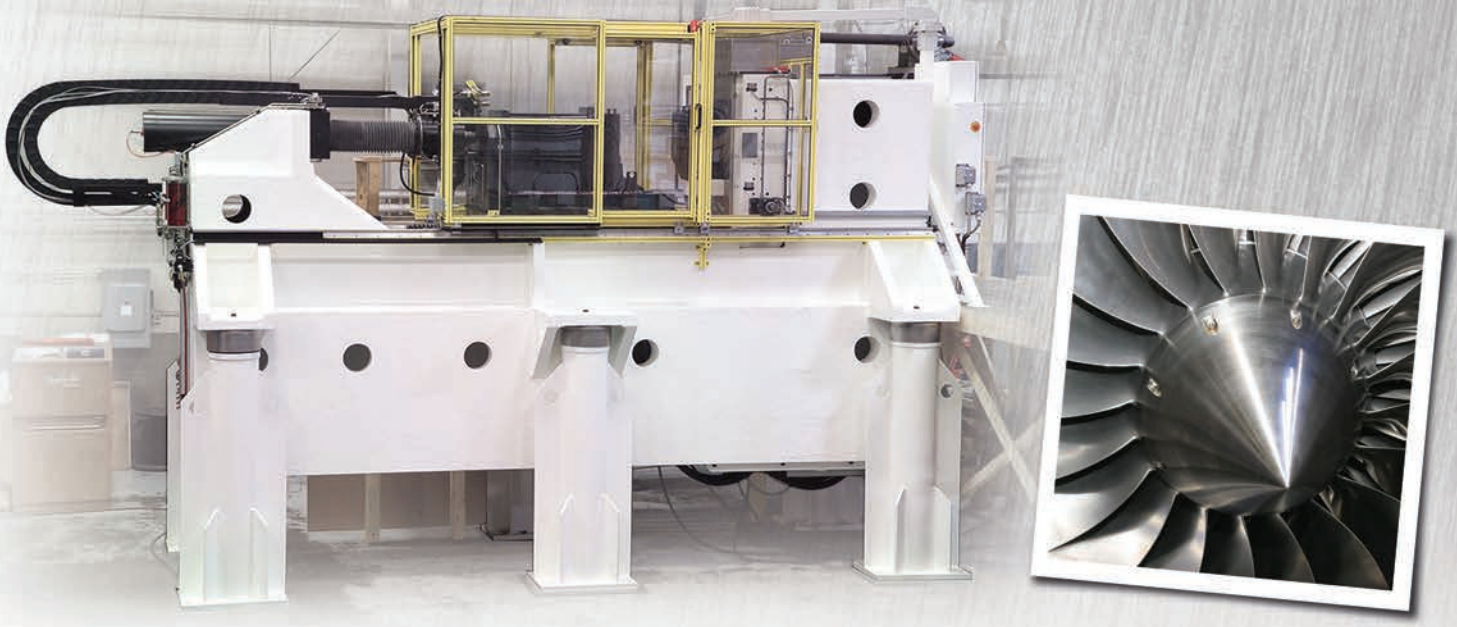
LINEAR FRICTION WELDING

MANUFACTURING TECHNOLOGY, INC



MTI offers the widest range (10-ton to 100-ton forge force) and most cost-effective welding machines in the world — providing reduced OEM manufacturing costs and lighter weight components.

WHAT IS LINEAR FRICTION WELDING?

Linear Friction Welding equipment is very similar in principle to other Rotary Friction Welding machines. The main differences are that Linear Friction Welding machines use Servo-Hydraulic Actuators to create relative motion on a linear path instead of a rotational path, and they allow for the forge force to be applied through multiple forge angles.

WHY LINEAR FRICTION WELDING TECHNOLOGY?

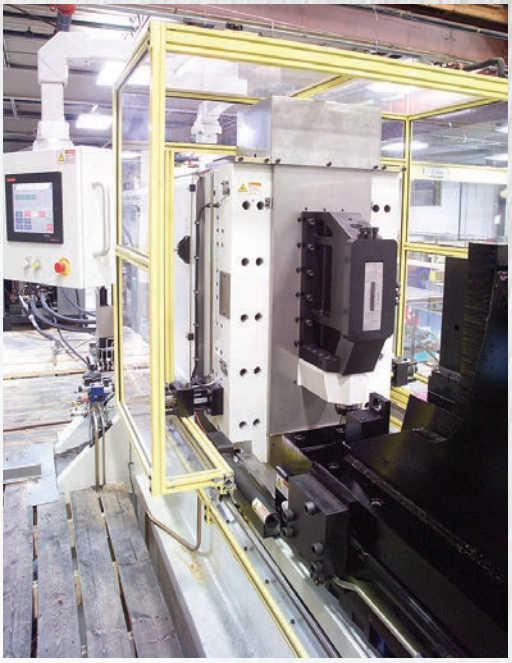
Linear Friction Welding was developed in 1959. For five decades, this technology has been refined and expanded, allowing it to be an effective solution for a broad range of new applications. Today, it is being recognized as a rapid, low-cost fabrication process for manufacturers in many industrial markets.

UNIQUE ADVANTAGES

- Odd shaped components can be welded effectively because they do not need to be rotated.
- Process scalability is only limited by the amount of mass that can be moved under servo-hydraulic power.
- Welded structures of forged quality can be created by welding multiple small components into an assembly.
- Positional accuracies of parts (relative to one another) can be controlled very closely.

TOP TEN ADVANTAGES:

1. Dissimilar metals can be joined — even some considered incompatible or unweldable.
2. The process can be up to 100 times faster than other welding techniques.
3. Versatility allows for joining a wide range of part shapes, materials, and sizes.
4. Joint preparation isn't critical— machined, saw cut, and even sheared surfaces are weldable.
5. Resulting joints are of forged quality, with a 100% butt joint weld through the contact area.
6. The machine-controlled process eliminates human error—weld quality is independent of operator skill.
7. It's ecologically clean—no objectionable smoke, fumes, or gases are generated—exhausts are not required.
8. Consumables are not required—no flux, filler material, or shielding gases.
9. Up to 20% lower power consumption than that of conventional welding processes.
10. No melting means no solidification defects, like gas porosity, segregation or slag inclusions.



PRODUCTION AND LABORATORY MACHINES

PRODUCTION

MTI Production Machines have a large tooling opening to accommodate parts of varying sizes. They also accommodate specimen tooling for the coupon samples used in material testing. Both the production and sample tooling cavities are supplied with welding area ranges appropriate for the forge force capacity. Production machines, for the joining of full-sized parts for production, can have different directions of oscillation.

LABORATORY

MTI Laboratory Machines have smaller tooling areas to accommodate specimen parts only. These machines weld coupon samples with welding range areas appropriate for each machine's forge force capacity.

Servo-Hydraulic and Mechanical Oscillator Actuators

There are two main types of Oscillator Actuators that can be used in Linear Friction Welding machines: High Speed Servo-Hydraulic and Mechanical.

MTI uses High Speed Servo-Hydraulic Actuators from Team Corporation, which specializes in high-frequency vibration testing equipment.

Our Mechanical Actuators use Electric Servo-Spindle Drive Motors to convert rotary motion into linear motion and drives the oscillation for welding.

Machine Capacities

- Forge Capacity: Up to 100 tons (larger machines can be designed)
- Frequency of Oscillation: Up to 100 Hz (higher frequencies can be achieved)
- Amplitude of Oscillation: 20mm (larger amplitudes can be achieved)
- Forge Stroke: Application/machine specific
- Data Acquisition System: Acquisition rates up to 2.5 kHz for Servo-Hydraulic loop closure and data recording

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