MAGNETIC PULSE WELDING
The ultimate solution for driveshaft manufacturers
Welding the world’s greatest driveshafts

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Your car has long been an expression of who you are, what you value, and where you are in your journey.

Sometimes, this means seeking the rush of a dynamic, high-performance machine. At other times, it means preferring the solidity of a vehicle you can depend on, no matter what obstacles come your way. And yet other times, it can mean enjoying elegance and excellence, both inside the cabin and under the hood.

Above all, you demand quality – a comfortable ride, smooth responsiveness to every turn of the steering wheel, the power to take you where you want to go, and the reliability to get you there without fail.

Like other drivers, you know that a car can become an experience, much more than a product.

But, as a manufacturer, you also understand the secret behind that experience. It is the result of a combination of several objective factors, such as performance, noise, vibration, durability, efficiency and weight.

Yet, the market is always searching for fewer emissions, more power and better handling. Car makers try to meet these performance demands by tweaking efficiency and reducing weight, while simultaneously maintaining quality and keeping prices competitive. On the production floor, this means maximizing value, conserving costs, space and resources, and simplifying processes. And you’ve got to do all this while ensuring a clean-tech environment that positively represents your brand to the public.

As driveshaft manufacturers, in particular, you face significant technical, structural and safety challenges in producing a product that is both lighter and stronger, yet provides maximum durability.

The revolution that will meet all of these demands – for performance, durability and weight, at a fraction of the cost and at many times the speed – is already here. And it is clean, safe and easy to implement.
The Weakness of Welding

Traditional welding techniques used today on assembly lines involve variations on applying massive heat to the metal parts that need to be combined. However, heat distorts metal. The welded area is dramatically weaker than its constituent parts, corrosion sensitive and deformed. Arc welding, for example, while focusing the energy effectively, is notorious for introducing a large number of variables causing in-process quality issues.

Another commonly used technique is friction welding, a type of solid state cold welding that involves pressure and rotation. But this process, while involving less heat, puts the metal through immense stresses and creates an inherently unbalanced product. It also limits the manufacturer to relatively thick component materials.

Such techniques also produce radiation, smoke, gas and sparks – harmful to the environment and to employees. More advanced techniques minimize these effects, but they cannot eliminate them entirely.

In traditional welding, the only way to compensate for these deficiencies is to trade cost for performance, weight for durability, or speed for expense. Yet, even after such investment-intensive adjustments, there are structural limitations of traditional welding that are impossible to overcome.

But there is a more innovative option.

It overcomes the limitations of existing technologies and can transform the automotive sector production line.
Magnetic Pulse Welding (MPW) uses electromagnetically generated forces to create a solid state cold weld at room temperature. Taking advantage of the atomic structure of metals, this technique is demonstrably faster, cleaner, simpler and more flexible than any other.

In MPW, an electric current is run through a unique set of conductive elements and into a specially designed coil. A powerful magnetic repulsion field is thus created inside the coil, and used to accelerate one workpiece into another at extremely high speeds, creating the conditions for them to bond on the molecular level at room temperature.

Moreover, MPW requires a fraction of the traditional welding space on a factory floor. The initial investment is the same, if not less, than for traditional welding solutions and ongoing operating costs are far lower. This, as well as the higher quality end product, translates into a rapid return on investment in magnetic pulse welding.

These distinctive aspects of MPW – both in the welding process and in the final product – naturally produce fundamental changes on the production floor. Not least of these are more consistent results and higher productivity.

The Revolution: Magnetic Pulse Welding

The weld is flawless and stronger than the base metals

The process is nearly instantaneous and very green

The end product is perfectly balanced and ready to be installed immediately
The MPW Product

Weight, Durability and Performance

MPW, as the most advanced solid state cold welding technique, allows previously impossible combinations of dissimilar metals. This includes ostensibly non-weldable materials, as well as quickly fusing lighter metals with stronger ones, such as aluminum and steel.

The resulting parts exhibit the best of both metals, while the joints of the finished product are typically stronger than the constituent metals. Yet, they maintain a dramatically lighter weight.

The final product is also clean and aesthetic in appearance. No corrosion develops along the welded areas, nor is there any metal distortion or heat degradation as a result of the welding; the metal thus retains better conductivity.

The MPW Process

Speed, Precision, Safety and Low Cost

Magnetic pulse welding is an extremely high-speed process, with a typical weld completed in microseconds (10 to 100µs), while charging the system to its full load takes only 2-5 seconds; and can be even shortened if required. The only real limitation on production speed is loading and unloading the parts to be welded. This means MPW production rates are higher than any other conventional joining process in use today.

MPW is also an extremely high-precision process, with an adjustment of the magnetic field yielding stable and extraordinarily fine calibration. And with a computer-monitored and controlled process, downtime and rejects are negligible and any precision weld is infinitely repeatable. Traditionally necessary balancing adjustments and re-work are essentially eliminated, thanks to the inherent quality of the process itself.

This level of reliability is the gold standard for high-volume production, drastically reducing quality assurance costs.

As the MPW process is electromagnetic non-contact welding, there is no need for pre- or post-weld deburring, cooling or cleaning. Nor is there a need for filler wire or shield gases; and magnetic pulse welded parts can be physically handled with bare hands. In fact, no special certification is necessary for operating MPW equipment.

Producing no heat, radiation, gases, smoke or sparks - while taking up a fraction of the energy - magnetic pulse welding is a model green technology.
A Magnetic Pulse Welded Driveshaft
Lighter, Stronger and Ready to Go

As every car manufacturer knows, the more efficient, economical and reliable a driveshaft is, the more satisfying the ride. Magnetic pulse welding is a natural fit for creating automotive driveshafts that combine the strength of steel and the light weight of aluminum for the best in performance and durability.

Using magnetic pulse welding, a hybrid driveshaft – consisting of an aluminum tube welded to steel yokes – is pounds lighter than a standard driveshaft. It is perfectly balanced, and it requires no cleaning, straightening or dynamic balancing.

Moreover, the welding process is fast, clean and efficient, perfectly designed for large-series production with quick turn-around time. A single MPW system can easily weld one million parts a year, with extremely low maintenance costs and down time. The process can also be easily recalibrated, as needed, with just a short setup.

A Special Case:
Magnetic Pulse Crimping for Driveshafts

Magnetic pulse crimping (MPC), using the same principles as magnetic pulse welding, enables new designs with extreme mechanical properties, using crimping as a strong alternative to welding. As MPC creates a mechanical connection without any spring-back or stress, the right geometry of interface will provide better performance than a welded product and allow novel designs. Such designs can include the use of high-strength steel and a combination of non-metallic elements or non-weldable metals (e.g., aluminum of the 7xxx family).

Unlike any other mechanical crimping, MPC applies force in perfect 360-degree uniformity, in a split second and with micron-level precision. In addition, driveshafts formed using the MPC process display no uneven joints (with no sealants required).
MPW Requires
Minimal Infrastructure & Equipment

Speed, precision, simplicity and performance. That’s the MPW revolution.

The only infrastructure required for magnetic pulse welding machines is a three-phase electrical power source. However, air pressure lines may be required to operate tooling.

The magnetic pulse machine charges an internal bank of capacitors, releasing the electrical energy into the welding coil. The equipment involved in this process is computer controlled, with production parameters precisely measured and monitored at all times. For the perfect weld, specially defined process parameters include the coil geometry/material, coil resistance/inductance, machine characteristics, materials to be welded and the energy level. This data is used to set the peak magnetic pressure, frequency, impact velocity, machine size, impact timing and weld length required to produce the driveshaft. All of these measurements are integrated into the MPW set-up design and process control module.

Notably, coil design is a major influence on the parameters of the MPW process. Different coil designs can produce very different results with the same input parameters. For this reason, as well as improved quality control, the magnetic pulse is always monitored and a built-in diagnostic system evaluates the data.

Typically, the magnetic pulse weld takes less than 100 µsecs, while recharging takes from 2-5 seconds, depending on the energy level (although the system can be charged under a second, if required for a high repetition rate). This means that, with automated MPW, it is possible to reduce the cycle time to a few seconds, depending on the capabilities of the driveshaft parts feeder.
We shape your future

We constantly push the envelope, creating possibilities that help customers to achieve their corporate vision.

Bmax is the market leader in advanced Magnetic Pulse metal processing solutions.

We are the world’s first and only engineering company offering a complete set of services for Magnetic Pulse solutions and technologies. Our scope of activity begins from concept, design and simulation, through prototyping and pilot production, until final system delivery. This includes both manual standalone and full-scale automated production units.

In partnership with our customers, we create advanced metal processing solutions, from initial concept to commercially viable product, plus, our teams are dedicated to system installation and round-the-clock customer support.

Our systems are deployed around the world in the automotive, aerospace and packaging industries, among others.