MAGNETIC PULSE TECHNOLOGY
COLD, CLEAN, GREEN, STRONG & COST EFFECTIVE

WELDING
FORMING
CRIMPING
COMPACTING
HYDRO FORMING

www.magpulse.co.in
Magpulse is managed by a team of Electrical & Mechanical Engineers with vast experience in welding and has the following capabilities:

- Design, develop & manufacture of required tooling for Welding, Forming & Crimping applications.
- Dedicated to research and development for the advancement of Magnetic Pulse Technology.
- Manufacture of magnetic pulse power sources in India for Indian market.
- Design & manufacture of Automation needs for Magnetic Pulse Welding, Forming, Crimping & also other conventional joining processes.

CORE TECHNOLOGY

Magpulse core technology is based on the concept of discharging a large amount of Electrical energy stored in capacitor banks through a coil during a very short period of time, and utilizing the magnetic forces for Welding, Crimping, Forming of similar, dissimilar and non-metals. Compressing the stored energy (up to 2 MJ) and discharge in few microseconds can be utilized in two main ways:

- Creating a pulsed magnetic field to accelerate metal to ultra-high speeds
- Generating an arc by breakdown in water to form high speed shockwaves

Magpulse has four main processes for metal fabrication, using its unique technology. All methods are characterized by high speed deformation up to 1000 m/s.

MAGNETIC PULSE SYSTEMS can be used to perform the following

- **WELDING** - solid state cold welding, using principles from explosive welding
- **FORMING** - sheet metal or 3 dimensional shapes (tubes)
- **CRIMPING** - metal over metal, plastic, ceramics, composites etc.
- **COMPACTING** - Iron & steel parts, ceramics blocks etc.
- **HYDRO FORMING** - Larger sheet metal or 3 dimensional shapes (tubes)
MAGNETIC PULSE WELDING (MPW) uses electromagnetically generated forces to create a solid state cold weld between two parts at room temperature. A high current is discharged through a coil creating an induced eddy current in the conductive workpiece. The induced current and magnetic fields repel the workpiece from the coil forcing it to move away at an extremely high speed pushing the metal into a liquid viscoplastic state far beyond its normal yield strength. In the right setting (correct velocity, correct angle of impact) the surface layers at the collision point will result in a weld. The heating up and the cooling down of the welded parts are done quasi-instantaneously so that the crystallographic structure of the materials are not altered.

WELD INTERFACE

MICRO STRUCTURE

X 50  
X 100  
X 200
Welding (MPW)

APPLICATIONS

TRUCK DRIVESHAFT
Al 6061T4 / Cast Al

HVAC CANISTER
Al / Al

HIGH PRESSURE VESSEL
Al 6061T4 / Al 2014

OIL FILTER
Al / Al

METAL SHEET WELDING
Al 6061 T4 / Al 1050

CONNECTOR
Copper/Brass

KEY ADVANTAGES

Dissimilar metals
Eg: Aluminum to Stainless steel

High performance
joining using less material

No heat affected zone
Solid state cold welding
Using the principles of Magnetic Pulse Welding, Magpulse can shrink or expand elements and enable new designs with extreme mechanical properties, previously not possible.

Hermetic or non-hermetic crimping, swaging or assembling of parts is possible. Typical industrial applications of Magnetic Pulse Crimping (MPC) are cables and tube connections in the automotive, aerospace, electronic and electrical components and nuclear power industries. MPC is a technical and economic alternative to mechanical crimping processes.

The MP Crimp is more uniform with no radial nor longitudinal misalignment. Mechanical joining is made possible, eliminating the need for adhesives, riveting and welding. MPC is not limited to soft alloy structures. High-strength steel parts can also be processed.

It enables a wide range of assemblies: Metal to polymer, composite, ceramic, cast metal, glass. For cable crimping applications, zero clearness and maximum contact area provide higher conductivity, thermal transfer and heat-shock resistance. A special feature of the MPC is its ability to compress almost any tubular cross-sections (round, elliptical & rectangular). Additionally, MPC requires minimal set-up times between different work-piece geometry and offers excellent repeatability.

**MACRO SECTIONS OF CU TERMINAL WITH AL CABLES**

(Mag x 10)  (Mag x 21)  (Mag x 32)
Crimping (MPC)

APPLICATIONS

Expansion
Al / Steel

MPC
Steel Connecting rod

MPC
Al / Composite

MPC
Copper Band on Shell

MPC
Al / SS

MPC
Al Lugs

Mechanical Crimping for construction / lift applications

Crimping of Components for electric companies

Testing set-up used for bridging between batteries of electric utility vehicles / forklifts

KEY ADVANTAGES

Mechanical Joining
Eliminating the need for adhesives, riveting and welding

Wide range of assemblies
Metal to Polymer, Composite Ceramic and Cast metal

Higher conductivity
Heat-shock resistant
Zero clearance and maximum contact area
MPF uses the magnetic induction effect. A coil is placed near a metallic work-piece and pulsed via the discharge of pre-stored electrical energy.

A magnetic field is therefore generated between the coil and the work-piece, creating an eddy current and a repulsive magnetic pressure on the work-piece that is proportional to the magnetic flux density squared.

The magnetic pressure pulse accelerates the work-piece to ultra high velocity. This kinetic energy drives the material into the die, causing forming on impact.

APPLICATIONS

KEY ADVANTAGES

- **Use one sided die**
- **Achieve higher formability** joining using less material
- **No Spring-Back** Good material distribution
The Electro-Hydro process allows the forming of parts up to a few square meters in size.

Electro-Hydro Forming is an unconventional process that has only recently been made available on an industrial scale. Electro-Hydro Forming is based on ultra-high speed deformation of metal using shockwaves in water.

It is generated by an electric arc, discharged into the liquid, converting electrical energy into mechanical energy to drive the metallic work piece into viscoplastic phase, enabling forming of complex forms at high speeds in cold conditions. The sub-second process is not limited by size as an array of electrodes can be placed over a large work piece, using a one sided die to create complex shapes and fine details.

APPLICATIONS

- **OIL DEFLECTOR IN AIRCRAFT**
  - Al 6061 T4
- **WASHING MACHINE PART**
- **DEEP FORMING-COPPER**
  - 400mm diameter
  - 3mm thick

KEY ADVANTAGES

- Fine details and sharp lines can be easily formed
- Forming of male and female shapes (negative and positive)
- Only one sided die is required
- Extremely deep forming, much more than in conventional stamping
- Even distribution and higher strength of thin material
- Extremely fast
- Equipment has small footprint
- No need for a press – the forming chamber is a self balanced system
In Magnetic Pulse Powder compacting method powders are filled in a conductive container (armature) placed in the bore of a high field coil. The coil is pulsed with a high current to produce a magnetic field in the bore that, in turn, induces currents in the armature. The induced currents interact with the applied magnetic field to produce an inwardly acting magnetic force that collapses the tube, thereby compacting the powder.

The launched armature accumulates a large kinetic energy during compaction and is brought to rest by the powders within a few microseconds. The powders are pressed to full density via the transmitted impact energy with the entire compaction cycle occurring in less than one millisecond.

**APPLICATIONS**

- Transmission gear
- Ceramic Block
- SS part with high L/D ratio

**KEY ADVANTAGES**

- Higher green density
- High aspect ratio (L/D)
- Preserve special micro structures including ultra-fine grain size
- Higher tensile and yield strength closer to the properties of cast material.
- No binders or lubricants are required
- Net shaped parts can be compacted
Without accurate simulation technologies, it would be impossible to achieve the short development cycles required by modern engineering and design. To ensure we can simulate all our magnetic pulse and electro-hydraulic processes with the same precision as one would expect from our systems, we’ve invested heavily in further developing the best simulation software on the market today. Developed through extensive testing, the inherent multi-physics models can simulate the performance of products far beyond the conventional range of mechanical engineering. For example, only our software is modeled to predict the dramatic, non-linear change in a magnetic field caused by a fast-moving metal element.

**APPLICATIONS**

- SIMULATION (Wireframe)
- SIMULATION (textured)
- PRODUCED PART (photography)

**KEY ADVANTAGES**

- Optimization of process parameters for welding, crimping, forming & Electro hydro forming
- Development & optimization of energy suitable for applications
- Time saving & cost reduction on trials
- Estimation of the stresses generated on parent materials and dies at the point of impact
Product Range
MPW 5™, MPW 10™, MPW 12.5™, MPW 20™, MPW 25™, MPW 30™,
MPW 35™, MPW 40™, MPW 50™, MPW 75™, MPW 100™ and can be
customized up to 2000KJ at 9KV and 25KV