Cost Effective – Versatile Solutions using the Electromagnetic Welding Process

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Presentation Outline

- Plastic Assembly Overview
- EM Welding Process & Benefits
- Material & Design Options
- What’s New – Versatile Equipment
- Application Examples
- Q & A

New flexible power-delivery systems offer a highly efficient, compact, easy-to-integrate source of EM welding power for a wider variety of welding applications.
Plastic Part Assembly Methods

Many Options Available?

Adhesive

Electromagnetic Welding

Mechanical

Thermal

Frictional

via the Emabond® Process
Electromagnetic Welding
Process & Benefits
The Emabond® Process is for Innovative Plastic Part "Design & Assembly"

It is a Product Design and Assembly Method for Welding & Joining of Thermoplastics
 Controlled Bond-line Heating Capability

“Predictable Heating”
Induction Heating uses the interaction of High Frequency Electromagnetic Field Strength & Susceptors to generate Heat on Command

Electromagnetic High Frequency 13.56 Mhz

Susceptor Particles
FE or SS

Polymer
PP - PE - PA - PC ....
Hi-temp materials & Customized Formulations

Precise Heat @ Weld - line
During Joining
The activated coil heats the Emabond resin, causing the adjoining surfaces to melt.

After Joining
The Emabond resin has filled the gap. The process has fused the mating parts, resulting in polymer to polymer permanent bond.

The Process is Similar to Injection Molding the Joint!
Key Success Factors

1. **Part “Design”**
   - Molded Part Consistency

2. **Welding “Equipment”**
   - Fixture Design and Process Control

3. **EM Weld “Material”**
   - Formulation and Form

**Consider when joining:**
- Specialty Hi-Pressure Vessels
- Fluid Conduits
- Elastomerics
- Dissimilar Materials
- Delicate Internal Components
- Difficult Geometries
- Multiple Component Weld lines
- Large Parts
Process Benefits
Benefits of Electromagnetic Welding

Material Flexibility
- Superior Welding of PP and PE plus Engineering Resins
- Filled Polymers (Glass, Talc or other ...)

Aesthetic Appearance
- Flash Free Weld Line
- Smooth distortion free weld-line
- Eliminate Mechanical Fasteners and Molded-in Sinks
- Shear Joint Design with Gap Filling Properties
- No Particulate Generated

Process Capability
- Precise Heat Delivery @ Bond Line
- No Surface Pre-treatment required
- Near Zero Reject Capability
- Weld Process Controls
RV and Portable Toilets and Fluid Tanks

Material: Polypropylene
Joint Design: Tongue & Groove
Size: Numerous Styles; up to 11 linear feet on most models

Benefits
✓ Clean distortion free weld
✓ Replace Hotplate
✓ Highly reliable weld performance
✓ Structural & leak-proof
**Water Softener Tank**

**Benefits**

- Burst pressure +400 psi
- Highly reliable, no rejects
- Two unique products utilizing quick change tooling
- 3 molded parts into common integrated high-pressure joint

**Material:** 30% Glass Filled PP

**Diameter:** 14” diameter x 40” tall
Benefits

✓ Structural
✓ Flash-free and distortion-free bondline
✓ Elimination of fasteners
✓ Seat & Back Assembly
✓ Hidden Joint-line

The Cachet Office Chair has received several design awards

Material: Nylon Long Glass Filled
Bondline: Structural Beam – 2 joints
Consider Electromagnetic Welding

**When you are Joining ....**
- Polyolefins or Engineering Materials
- Dissimilar Materials
- Highly Filled Materials & Composites
- Bonding Flexible to Rigid

**When you have Parts with ...**
- Poor Tolerances
- Warpage ... gap filling capability
- Color Differences

**Excellente Results on**
**Difficult to Join Applications**

*When the Cost of Part Failure is High!*
Material & Design Options
Emabond offers a no charge service for evaluation of new materials including combinations not listed above

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- **Recommended Material Combination with Proven Welding Systems Available**
- **Materials are somewhat compatible. Development needed for specific applications**
- **Not compatible with Emabond Technology**
Commonly Joined Thermoplastic Materials

% of total applications specified using Electromagnetic Welding

- PE: 38%
- PP: 46%
- PC: 6%
- ABS: 4%
- PA: 4%
- Others: 2%

Material Compatibility Chart on www.emabond.com
http://www.emabond.com/material-compat.html

Typical Fillers
- Glass Fiber
- Talc, Mineral
- Non-Conductive

Dissimilar Substrates
Special Susceptor Particles and Compatible Thermoplastics

Available Forms Include:

- Extruded Profile
- Sheet
- Die Stamped Gaskets
- Slit Tape
- Injection Molded Gaskets
- Formed Rings
- Co-injection & Co-extruded
- Resin – direct dispense

The material composition used for the welding process consists of two major components – The susceptor material and the thermoplastic resin.
Part & Joint Design ‘typical joint designs’

- **Flat to Flat**
  - ✔ Structural & low pressure leak-proof

- **Flat to Groove**
  - ✔ Structural & low pressure leak-proof

- **Tongue and Groove: (most versatile)**
  - ✔ Higher pressure and leak proof

- **Step**
  - ✔ For applications with limited space, usually small cylindrical shapes
Key Features of Tongue & Groove Joint Detail

- Radius and tapered tongue directs flow
- Vertical ribs on groove outside wall promotes consistent positioning & strand retention
- Pre-bond engagement of joint
- Design includes flow channel & a physical stop
- Correct joint – Emabond resin volume relationship

Area (\(e\)) Emabond Material = 105% of the Area (\(v\)) Joint Void
Cost Effective Versatile Solutions
New Technology Overview – Flexible Power Delivery

**Equipment**
- Solid state power supplies – flexible power
- Wide power ranges available
- Single platform – many solutions
- Process control feedback capability
- Data acquisition

**Design**
- High temperature materials
- Internal metal components
- Uniform heating of irregular shapes
- Multiple Weld-lines

**Materials**
- Wide range thermoplastics
- High performance susceptors

*Application Design Flexibility ..........*  
*Problem Solving using Innovative Solutions!*
OEM Welding System – Low Cost Entry - Versatile

1 - HF Generator
2 - Pneumatic Press
3 - Control System
4 - Water Cooling
5 - Specific Tooling

Flexible Configuration
- Power; 1,000 to 3,000 watts
- Weld Tooling
  - 1 – Up welding
  - 2 – Up welding
  - Tank rotation

Integrated to Meet Specific Requirements
Food Service Whip Topper Wafer Assembly

Application Highlights

✓ Talc Filled PP
✓ Tooling Single up
✓ Two welds simultaneously
✓ High Internal Pressure
✓ Must be Clean Weld line
  ✓ No particulate
OEM Welding System – Single Part Weld Fixture

**Configuration**
- ✓ Power; 2,000 watts
- ✓ Tooling Single up
- ✓ Cycle time = 15 seconds
  - ✓ Both welds completed at the same time

**Economics**
- ✓ System Cost, Complete
  - ✓ $70,000 to $80,000
Application Highlights

✓ Talc Filled PP
✓ High Burst Pressure
  ✓ > 500 psi
✓ Two Filter Assemblies Simultaneously
✓ NSF Certifications
**Configuration**

- Power; 3,000 watts
- Tooling for Two Parts
- Cycle time = 15 seconds total for 2 Units
- Interchangeable for Multiple Sizes

**Economics**

- System Cost, Complete
  - $80,000 to $90,000
Application Highlights

✓ Glass Filled PP
✓ 9.5” Diameter
✓ 350 PSI Burst
✓ High Volume > 500,000
✓ Required low cost system due to multiple manufacturing locations
Configuration
- Power; 3,000 watts
- Tooling for Large Pressure Tank
- Cycle time = 30 seconds total

Economics
- System Cost Complete
  - $100,000 +
- CE Mark operational, US, Asia & Europe World-wide
Application Examples
Water Meter RF Transmitter

Key Features
✓ Delicate metal transmitter contained within housing
✓ Requires 20 year service life in severe environment
✓ Clean Flash Free Weld Line
✓ PC/ABS
✓ Utilizes Emabond “Formed Ring”

Application Example

Perimeter Weld

4 in. diameter

Robust structure to capture delicate sensor
Office Seating – Innovative Elastic Design

Value Delivery

✓ Complex 3D Geometry
✓ Flexible to rigid – dissimilar material
✓ Two separate weld sequences
  ✓ Back-Upper
  ✓ Back-Lower
✓ Allows creation of a truly “flexible seating design”

Material: Flexible Hytrel Elastomer to Glass Reinforced Polyester

Weld Line: Upper and Lower Seat Back Totaling 70”
Value Delivery

- Joining of upper flexible portion of chair back
- Flexible design supports multiple postures
- Contoured 3D geometry
- Aesthetic weld line

Material: Santoprene
Elastomeric to PP

Weld Line: 27” long
Value Delivery

- Domes are 100% Airtight
- Domes inflated to 2.5 PSI with zero pressure decay over 100,000 test cycles
- Structural and Durable

Center Column 8” Diameter

2 Elastomeric Domes 17.25” Diameter
Upper and Lower

Black  Red  Grey  Green  Sky Blue  Yellow

Blue
Humanscale Ballo Stool

**Material:**
Polypropylene to TPV Dome to Cone
Cone to Column PP to PP

**Weld line:**
3 Weld Lines
Upper and Lower Domes and Center Column

17.25” Diameter
Solutions for Demanding Applications
Plastics have revolutionized the way parts are made ...

Consider the Emabond® Process as an option for your next Design for Assembly challenge
Open Discussion – Questions?

THANK YOU

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