

A photograph of a hot stamping process in a factory. A glowing orange-red metal sheet is being formed by a large industrial machine with heavy rollers and a pressing arm. The scene is dimly lit, with the primary light source being the heat of the metal.

# Hot Stamping Experience



and Tech Tour

**November 29-30, 2022**  
Novi, MI

PRODUCED BY



**MetalForming**  
Magazine

# BEST PRACTICES



Fastener Welding to HSBS

Fastener Welding to HSBS

# REDACTED PRESENTATION

We apologize for not being able to provide the complete presentation presented during the November 2022 PMA Hot Stamping Experience. Most of the Case Study material we presented is highly proprietary and cannot be shared without proper NDA agreements. If you have questions, please contact us directly and we will assist with obtaining the necessary Non-Disclosure Agreements so we can share more in-depth information. Thanks

# DEFINITION

## Definition of *best practice*

: a procedure that has been shown by research and experience to produce optimal results and that is established or proposed as a standard suitable for widespread adoption

# 16 Years Research and Development

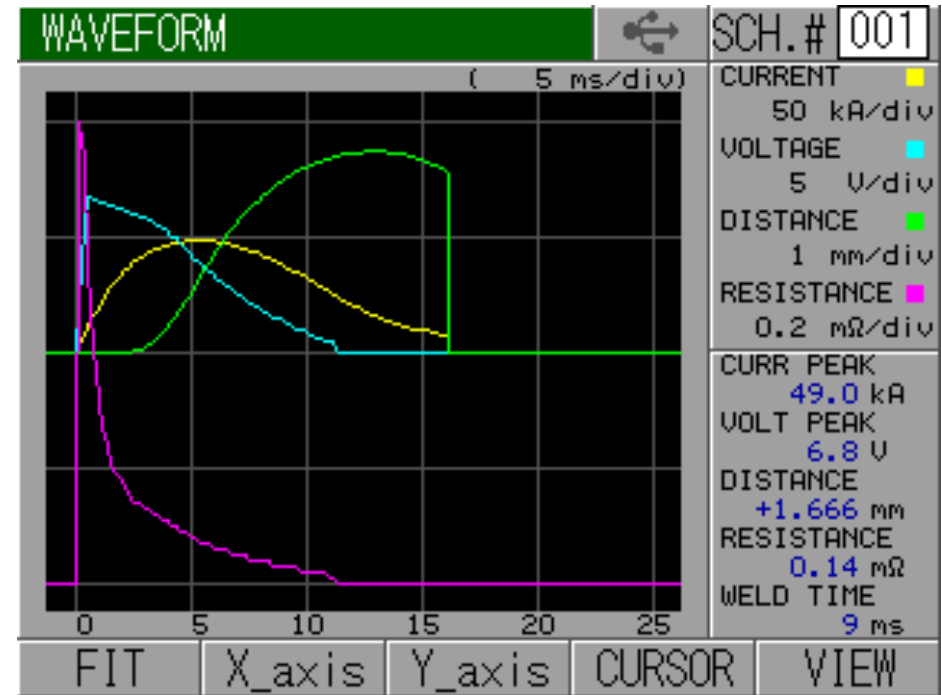
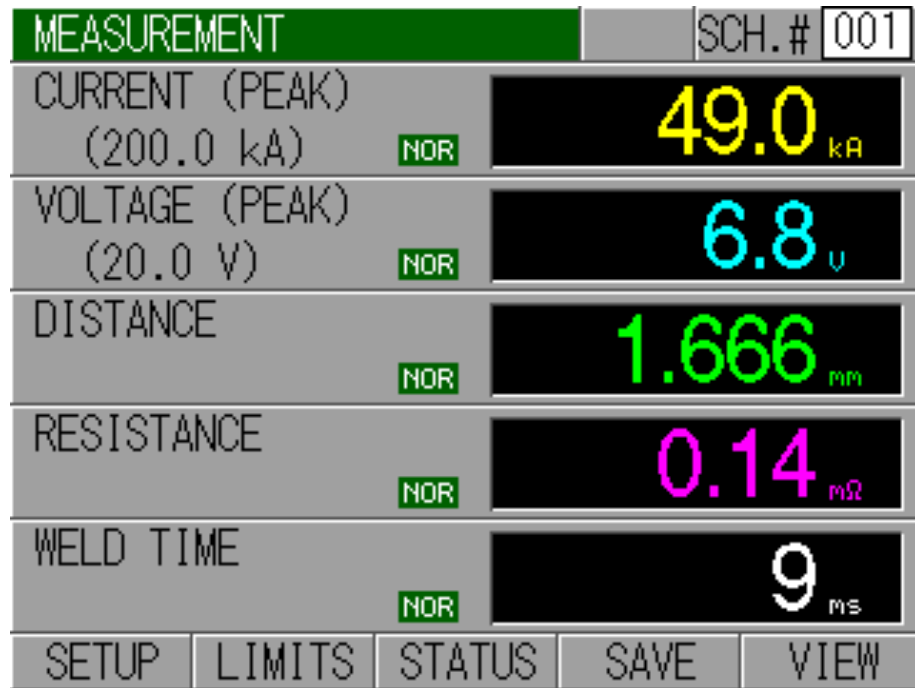
- 2006 First WSI CD Welder Designed and Built for HSBS
- 2010 WSI Releases Version 2.0 CD Welder for HSBS
- 2016 WSI Weld Fastener Experiments for HSBS
- 2018 WSI Releases Version 3.0 CD Welder for HSBS
- 2019 WSI Installs CD and MFDC FRT Identical Lab Welders
- 2020 WSI HSBS Material Study/Contact Resistance



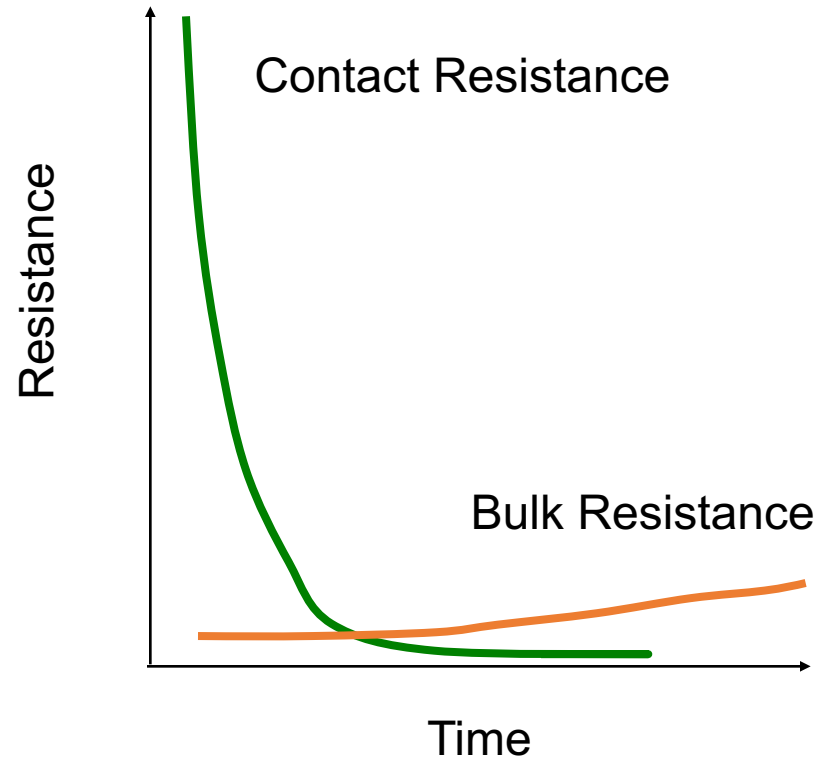
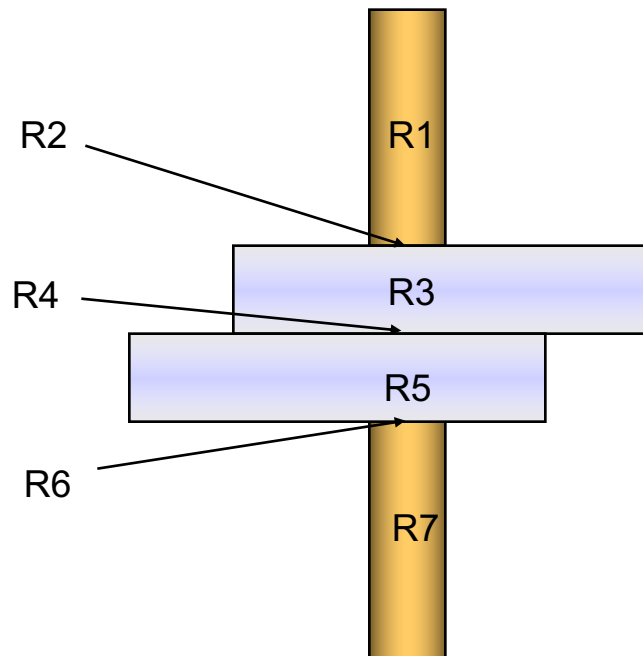
# CAPACITIVE DISCHARGE WELD CONTROLS

- Energy is stored in welding capacitors and not dependent on primary feed limitations
- Energy is released into a Pulse Transformer capable of handling high-current applications
- Weld time to Peak Current is achieved in about 3-6ms dependent upon the secondary load
- Weld current is self regulating in correlation to the change in resistance in the secondary circuit
- Weld time is a non-programmable value
- CD welds require a higher weld force with special design consideration in the secondary circuit

# TYPICAL CD WAVEFORM TRACE



# Contact and Bulk Resistance



$$\text{WELD HEAT} = I^2 R t - \text{THERMAL LOSS}$$



# HEAT AFFECTED ZONE (HAZ)

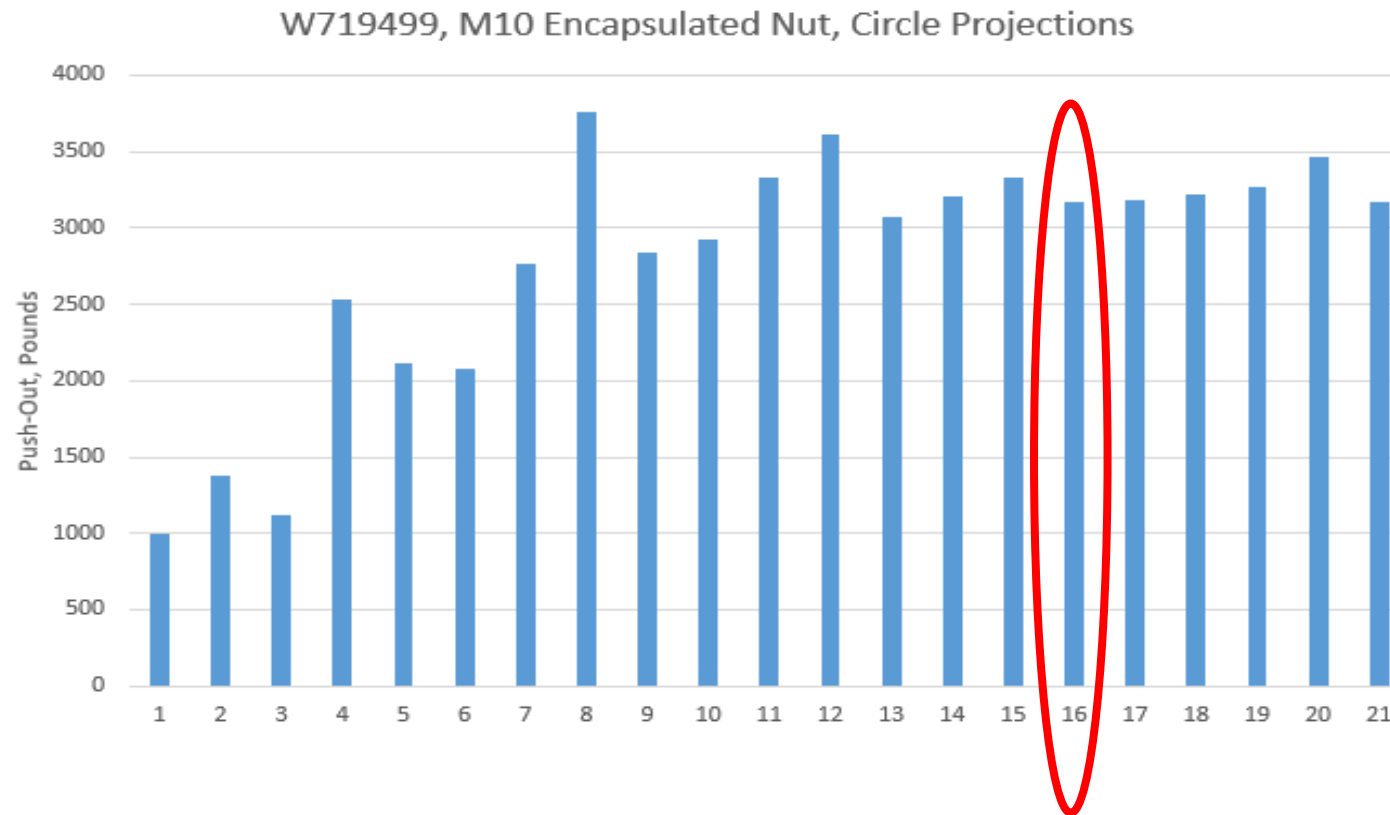


# HOT STAMPED CASE STUDY



FOUR PARTS, SAME PARTS BIN

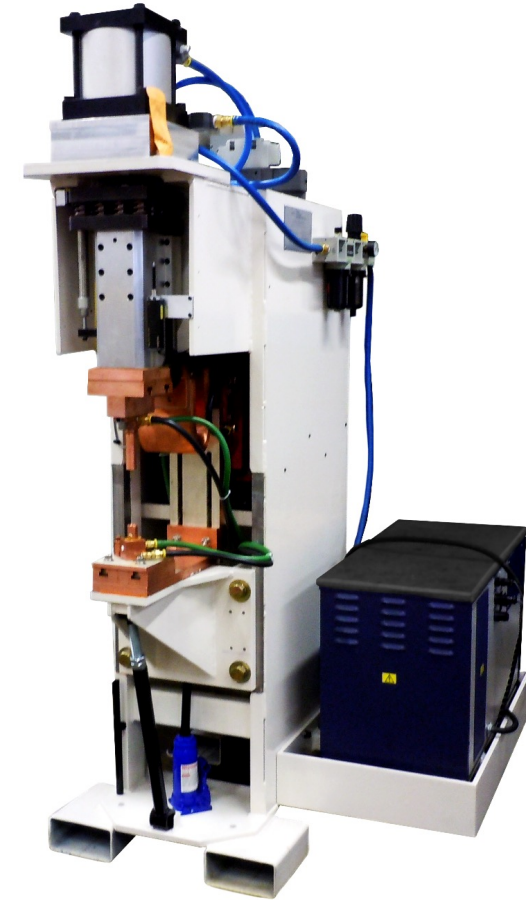
# Fastener: M10 Nut Round/Domed Projections





# MACHINE RIGIDITY AND FAST FOLLOW-UP

The shorter cycle times associated with CD welding must be supported with appropriate mechanical systems (ref. ASM 6A). Rapid rise and short cycle times inevitably lead to rapid projection collapse (as much as 30 G's). If the welding system cannot maintain force through projection collapse, expulsion is unavoidable resulting in damaged threads and weak welds.



# WELD MECHANICS

CAM Roller Bearing circa 1950



# WELD HEAD FOLLOW-UP

Die Springs circa 1950

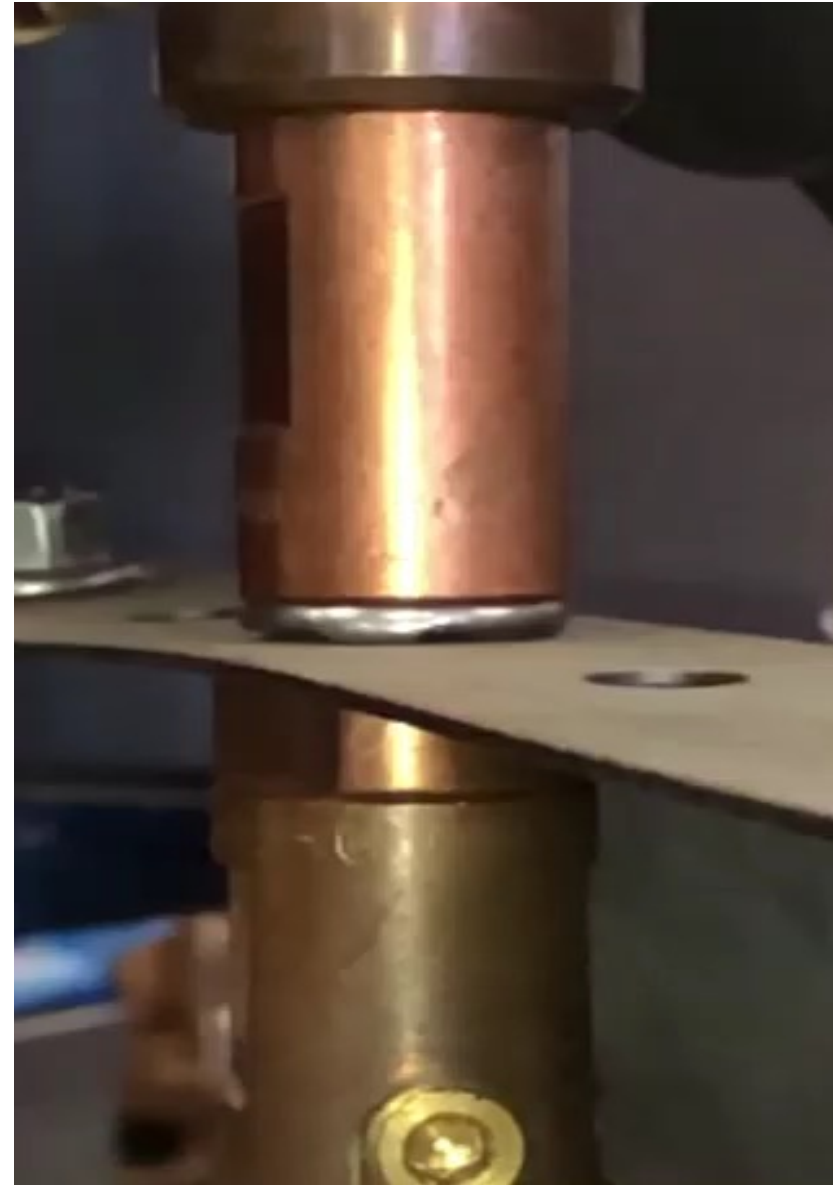




# FAST FOLLOW-UP

## 25000 Welds

### Not 500





# WSI LAB WELDERS



# Weld Process Monitor

## MM-400A Desktop Resistance Weld Monitor

- Measures Current, Force, Voltage, Time and displacement
- Envelope function
- Seam welding mode
- ISO17657 compliant measurement for current
- Built-in printer
- RS232/485 output
- Multi-language support



# DEFINITION

## Definition of *best practice*

: a procedure that has been shown by research and experience to produce optimal results and that is established or proposed as a standard suitable for widespread adoption

# Recommended Best Practices

1. Weld Development = Weld Process Development Prior to Machine Specification
2. Welding Secondary = Custom Designed Weld Secondary for CD Technology
3. Welding Power Source = Capacitor Discharge
4. Welding Mechanics = Light Weight Ram with Linear Slide
5. Weld Head Fast Follow-up = Stacked Belleville Washers
6. Advanced Weld Monitoring = Amada Weld Tech MM-400A
7. Process Verification = Benchmark Weld System Prior to Sign-Off

# 16 Years Establishing Standards

- Tier 1 implementation of CD Welding for HSBS since 2006
- Research and Development to refine the process since 2006
- Research and Development to refine WSI CD weld equipment since 2006
- 20 million dollars of CD equipment in the field since 2006
- **Over 1 million dollars invested in Lab and R&D resources since 2006**
- ZERO OEM Containment “Code Red” Events for Faulty Welds



# Contact Information

Bob Kollins  
Senior Applications Engineer  
Technical Sales & Solutions  
[bob@tsssales.com](mailto:bob@tsssales.com)  
614-560-4417

Adam Studzenski  
Operations Manager  
Weld Systems Integrators, Inc.  
[adam@wsiweld.com](mailto:adam@wsiweld.com)  
844-974-9353

Allen M. Agin  
Midwest Regional Sales Manager  
Weld Systems Integrators, Inc.  
[allen@wsiweld.com](mailto:allen@wsiweld.com)  
567-225-4594