

I N T E R N A T I O N A L



MILCO
MANUFACTURING



WELFORM
ELECTRODES INC.

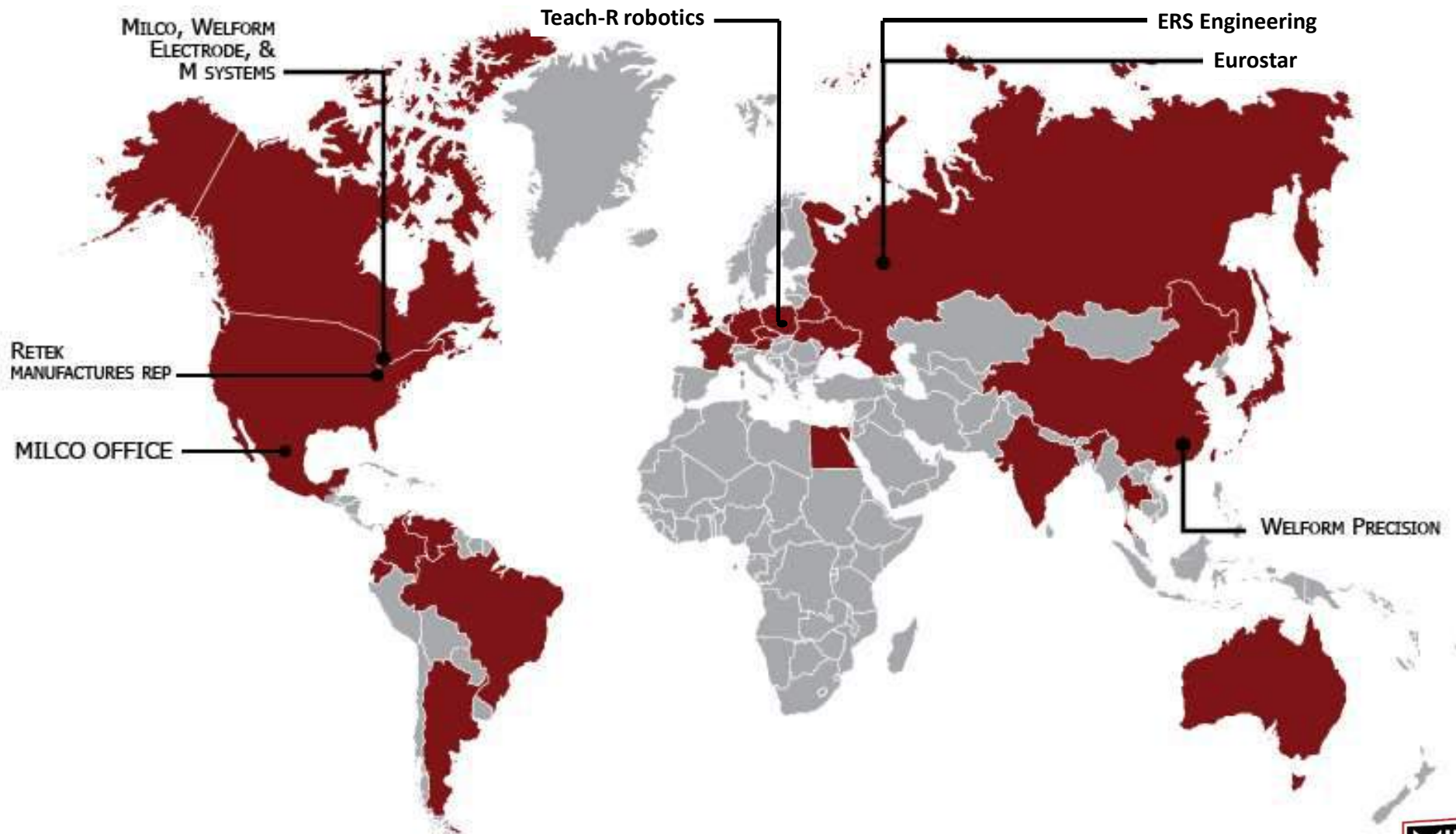


WELFORM
PRECISION



SYSTEMS
Flexible Automation Applications

GLOBAL REACH



WELFORM ELECTRODES INC.

1979

Welform was founded by Milco ownership

2018

Major capital investment of \$1.0 million allowed for increased productivity



2007

Formed Welform Precision LTD. in Hangzhou China

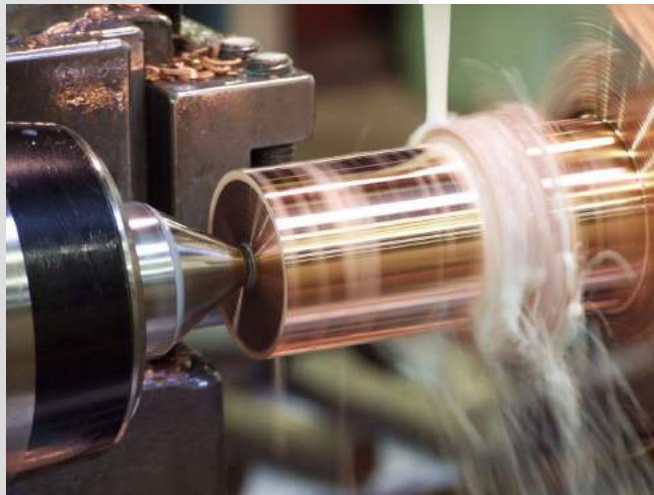


WELFORM ELECTRODES INC.

OLD WORLD CRAFTSMANSHIP

MEETS NEW WORLD DEMAND

- Custom Manufacturer
- Any global spec
- When you need it



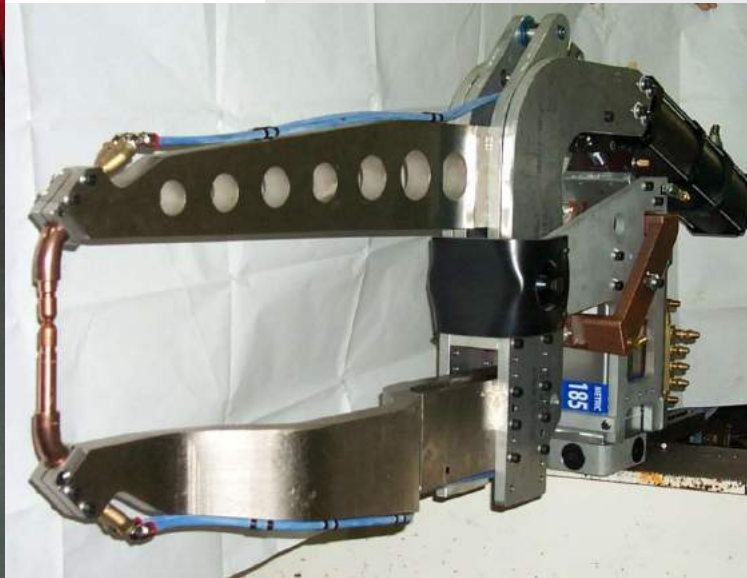
WELFORM ELECTRODES INC.

Our product line includes:



MILCO MODULAR GUN SYSTEM

Milco modular gun arms



WELFORM PRECISION INC.

Welform in Asia

- Founded 2007
- Located Hangzhou China
- Manufacture for Asia

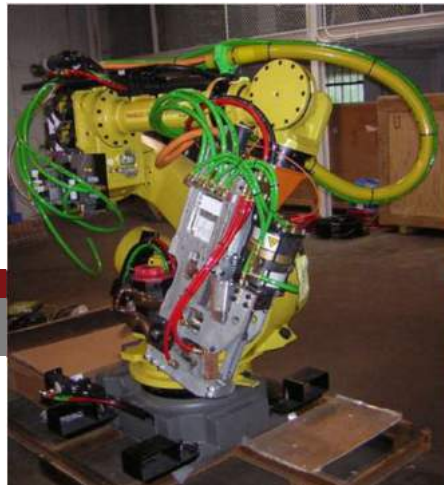


M SYSTEMS, INC.

History

- 2005 - Formed by Milco Ownership
- 2013 - Dressed 1700 robots

Flexible Automation Applications



The background of the slide is a grayscale photograph of an industrial manufacturing environment. On the left, a robotic welding arm is visible, positioned over a worktable. The right side of the image shows more industrial machinery and structural elements, creating a sense of a busy factory floor.

MILCO MANUFACTURING

A TRUE MANUFACTURING PHILOSOPHY

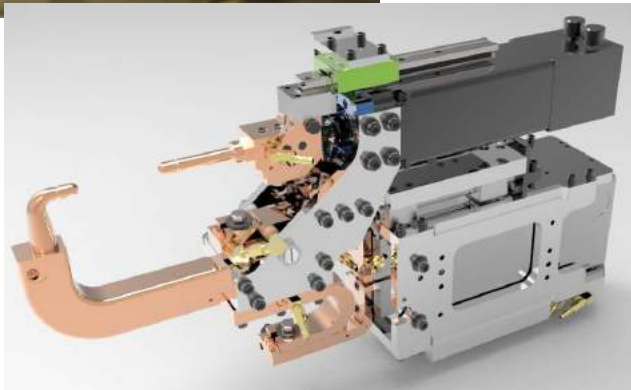
- Established 1950
- Million dollar investment 2018

OUR CORE BUSINESS

- Modular and conventional weld guns
- Perishable components
- Pneumatic cylinders
- Servo gun technology
- Nut and stud welding & assembly machines
- Robot associated services

MILCO MODULAR GUN SYSTEM

A welding system made to fit your process...

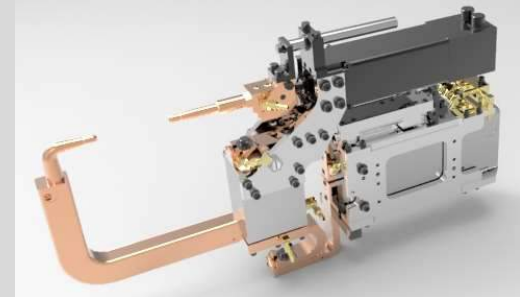


Milco modular gun systems

- Milco Standard (Servo/Air)
- **XR – Servo Gun (Servo)**
- Delta - Aluminum (Servo)
- MLS - Lightweight (Servo)
- Titan – X Large throat
- Projection - Nut/Stud weld

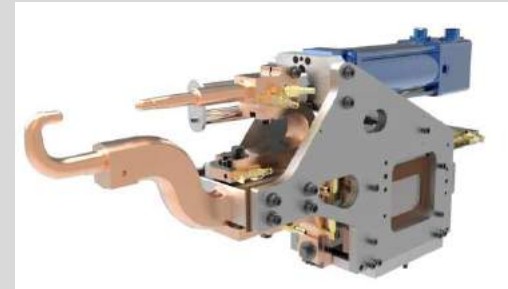
STANDARD MODULAR FAMILY

- **“C” Gun –**
(avg. weight 98kg)
- **Pinch Gun –**
(avg. weight 105kg)
- **Scissor Gun –**
(avg. weight 107kg)



XR MODULAR FAMILY

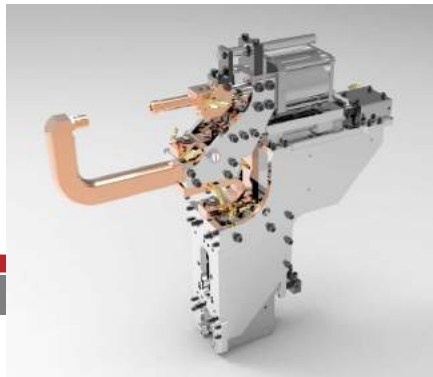
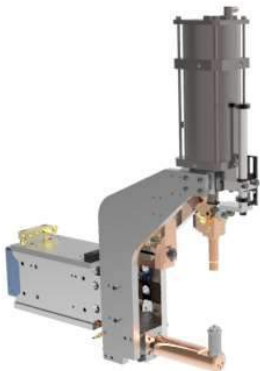
- **“C” Gun –**
(avg. weight 87kg)
- **Pinch Gun –**
(avg. weight 99kg)
- **Scissor Gun –**
(avg. weight 101kg)



SPECIALIZED MODULAR SYSTEMS

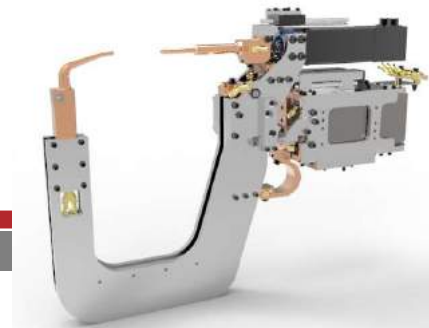
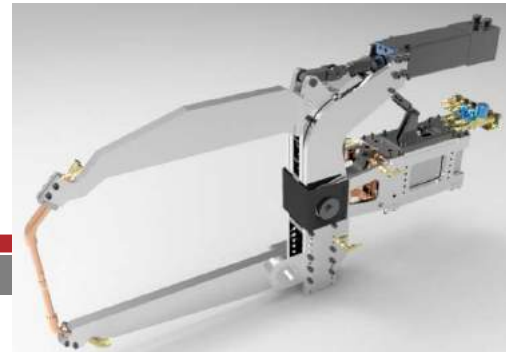
Nut/ Stud Welding Series

- Robot carried or pedestal mount
- Channel welding compatible



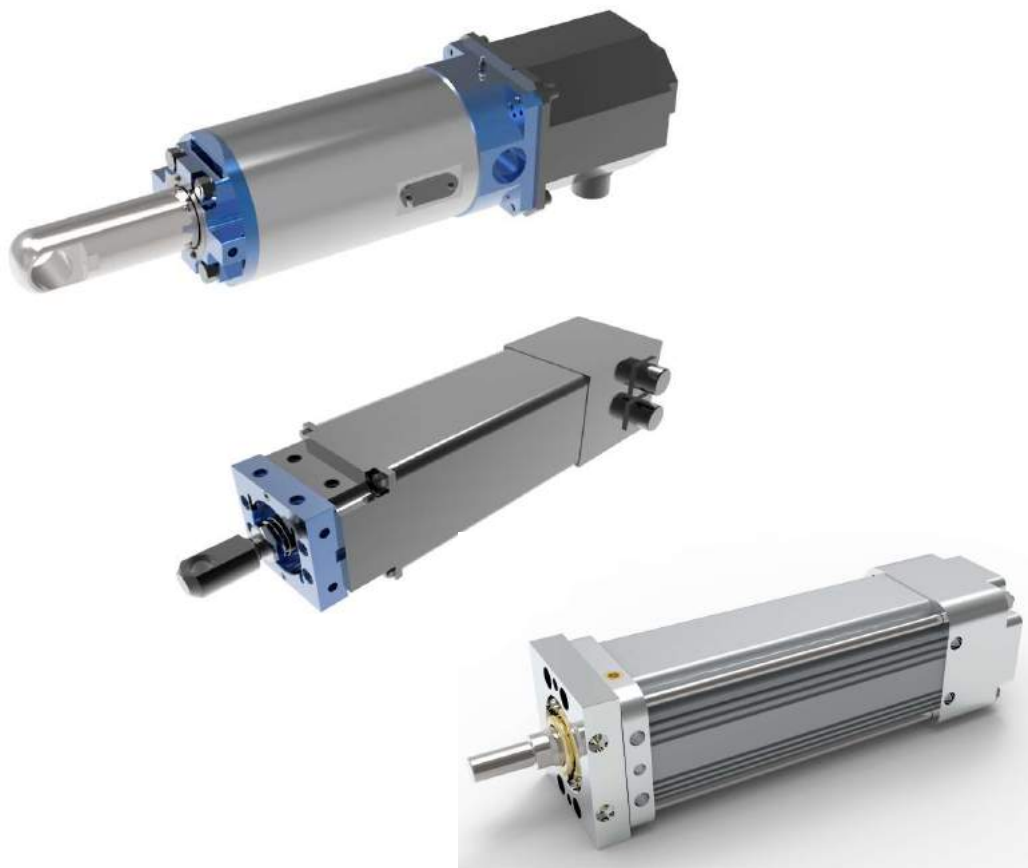
Titan Series

- X Large Throat
- Pinch and “C” Style



Servo Details

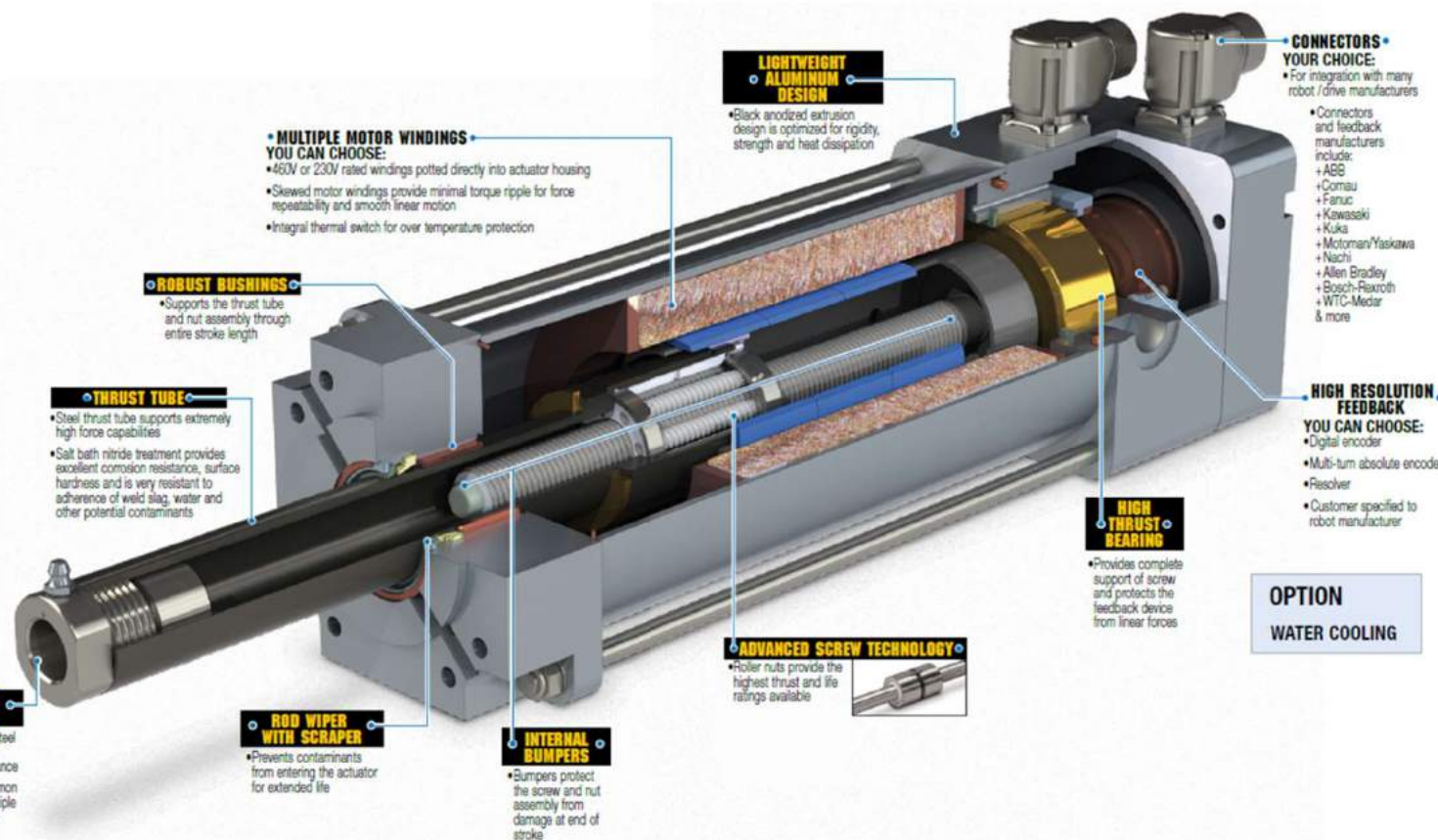
Flexible System



- Milco inline servo (ball screw) robot mfg. motor
- Tolomatic (roller screw) 3rd party motor robot feedback
- Exlar (roller screw) 3rd party motor robot feedback
- Fanuc, Yaskawa (Motoman), ABB, Nachi

MILCO MODULAR GUN SYSTEM

Tolomatic SWA Actuator



KUKA

ABB

COMAU
ROBOTICS

FANUC

Kawasaki
Robotics

NACHI
NACHI ROBOTIC SYSTEMS INC.

MOTOMAN
a YASKAWA company

Rockwell
Automation

Rexroth
Bosch Group

MEDAR
A Division of WTC

EMERSON

MILCO MODULAR GUN SYSTEM

Exlar GSX40 Design Features

T-LAM™ Brushless Servo Motor

- Segmented Stator
- Epoxy Encapsulation
- Rare Earth Magnets

Scraper and High Pressure Seal Contained within Bronze Bushing Assembly

Induction Hardened Chrome Plated Output Rod

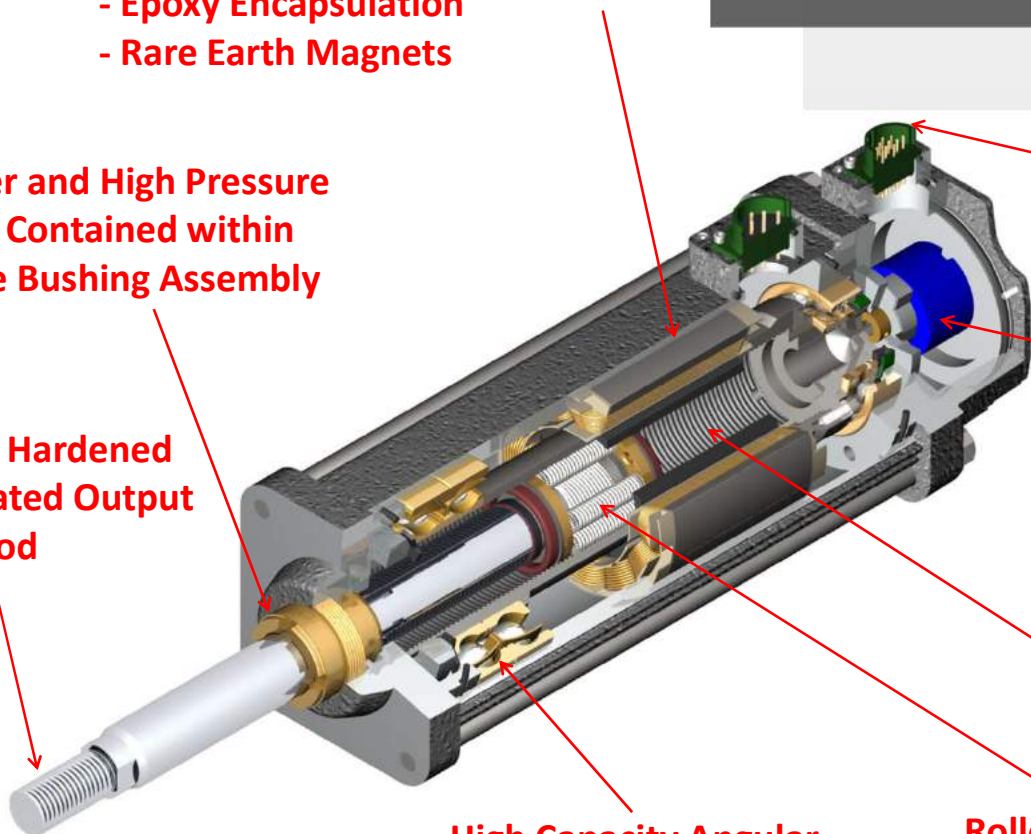
Connectors / Pinouts to Match Customer Specified Servo Amplifier Specifications

Feedback Device to Match Customer Specified Servo Amplifier Specifications

Internally threaded Cylinder

High Capacity Angular Contact Thrust Bearings

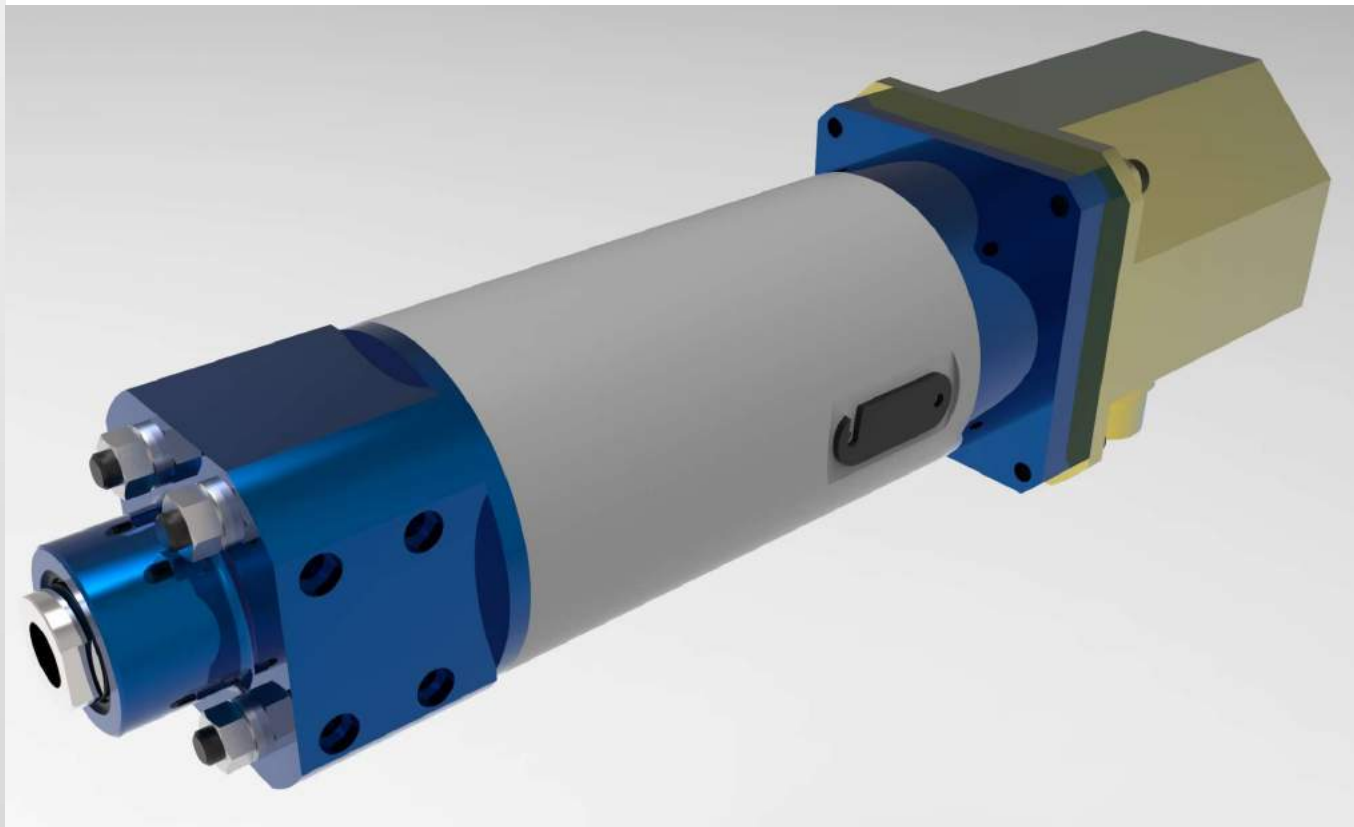
Roller Screw Nut



MILCO MODULAR GUN SYSTEM

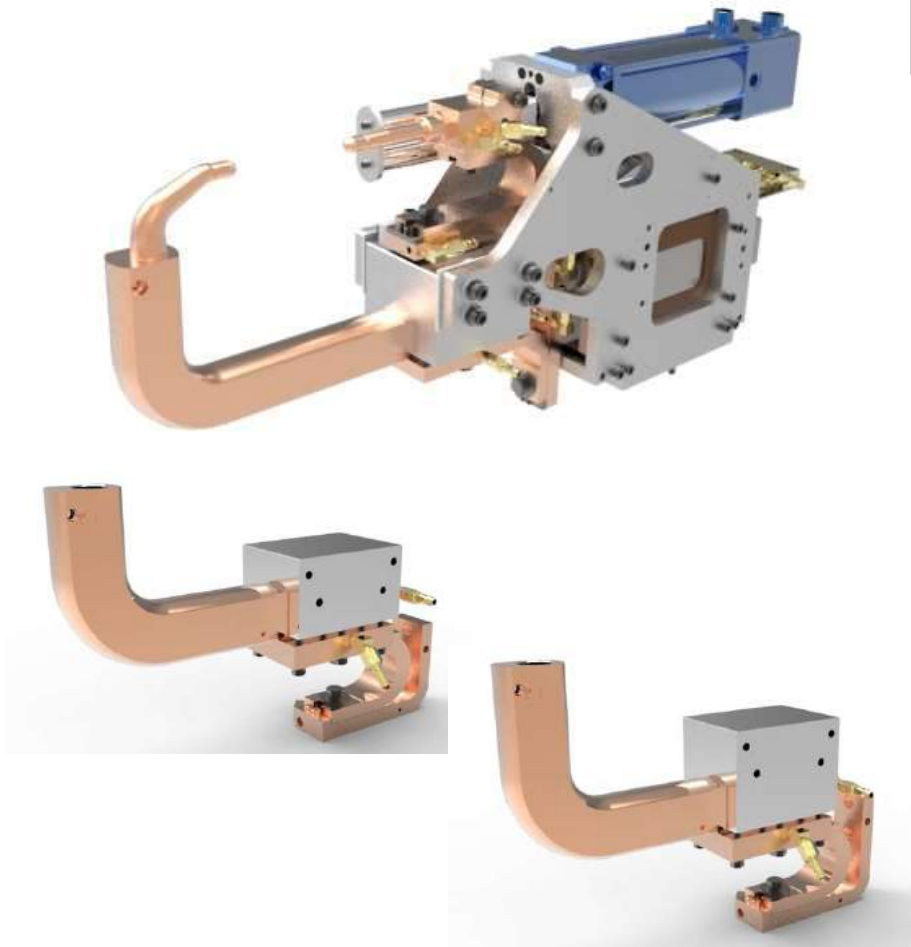
Milco In-Line Actuator

- Robot manufacturers motor
- Ball screw 5mm lead
- Non rotate
- Tie rod construction
- Front mount or trunnion
- Max force = 2600lbs. (+/- 5%)
- Duty cycle 50%
- Air cooled



MILCO MODULAR GUN SYSTEM

Modular “C” Gun

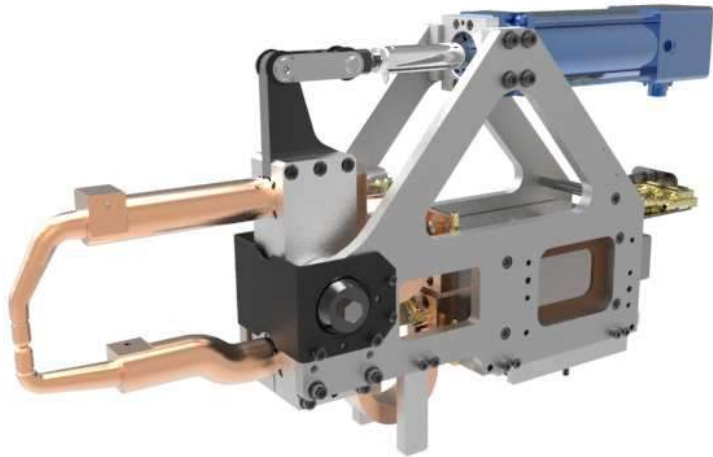
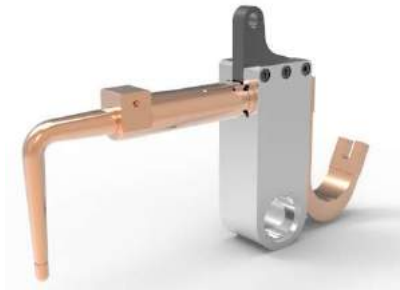


Milco modular gun systems

- 180mm Gun Option
- 205mm Option
- 230mm Option
- Only change block and buss bar

MILCO MODULAR GUN SYSTEM

Modular “Pinch” Gun



Milco modular gun systems

- 80 x 80mm Gun Option
- 3 Standard movable options
- 3 Standard Stationary options
- 80mm, 125mm, and 175mm

THE XR WELD GUN SYSTEM

**The next generation of American made
servo welding guns**

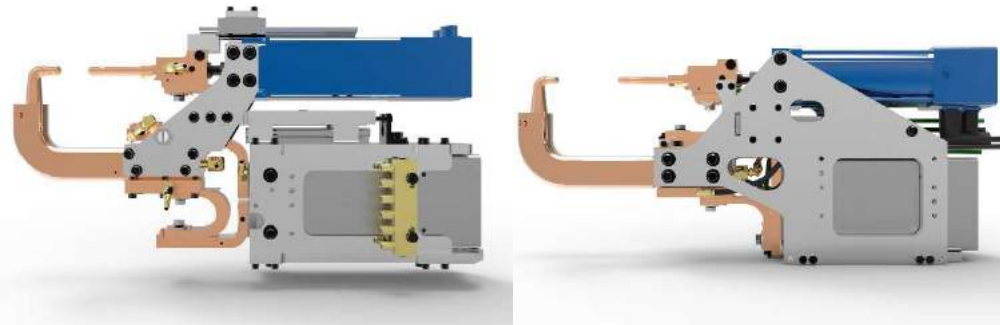
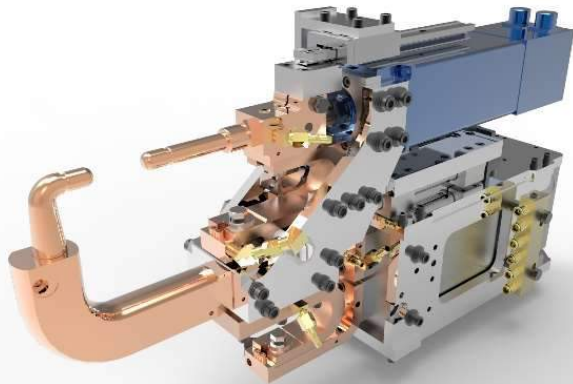


XR SERVO GUN SYSTEM

“C” Gun

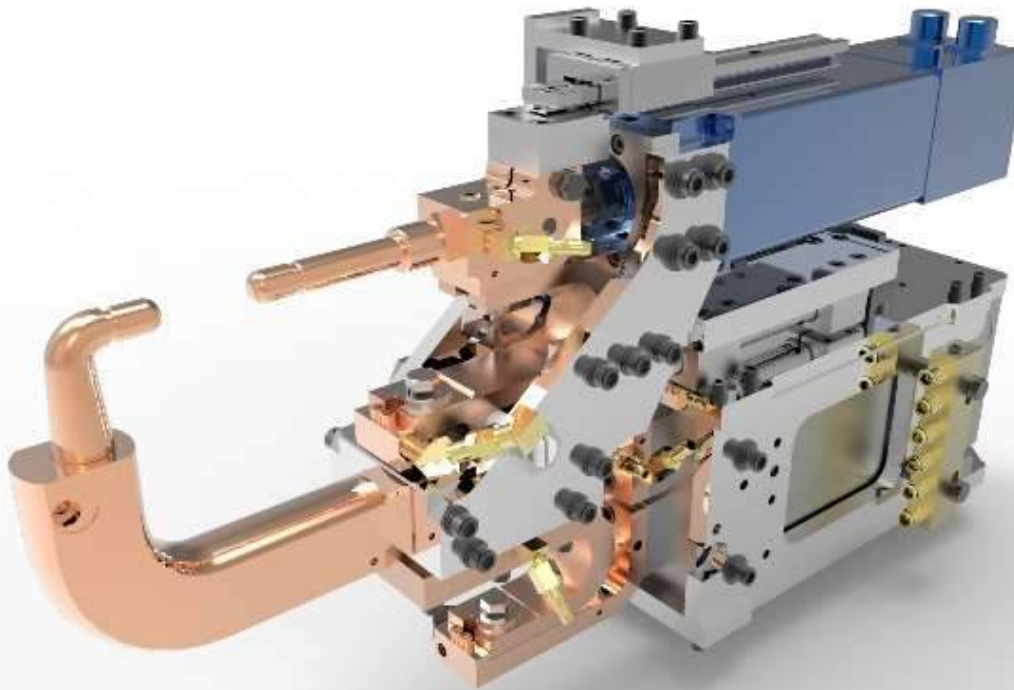
XR Servo Gun Systems

- 30% fewer parts
- 40% fewer fasteners
- 32% stronger structure
- 11% weight reduction



XR SERVO GUN SYSTEM

“C” Gun Overview

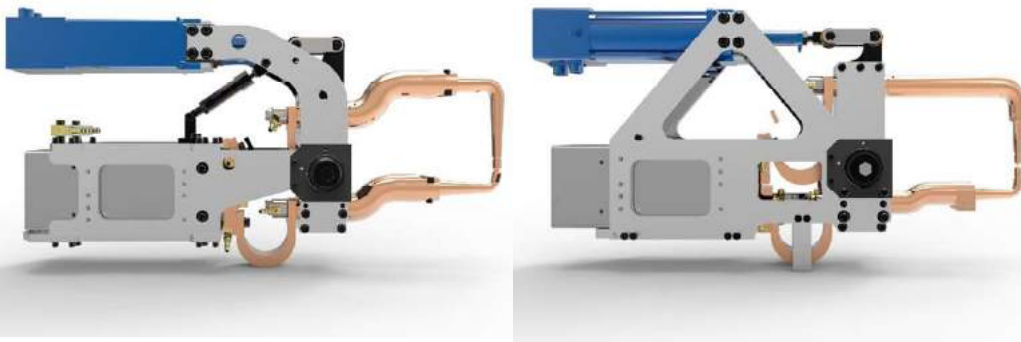
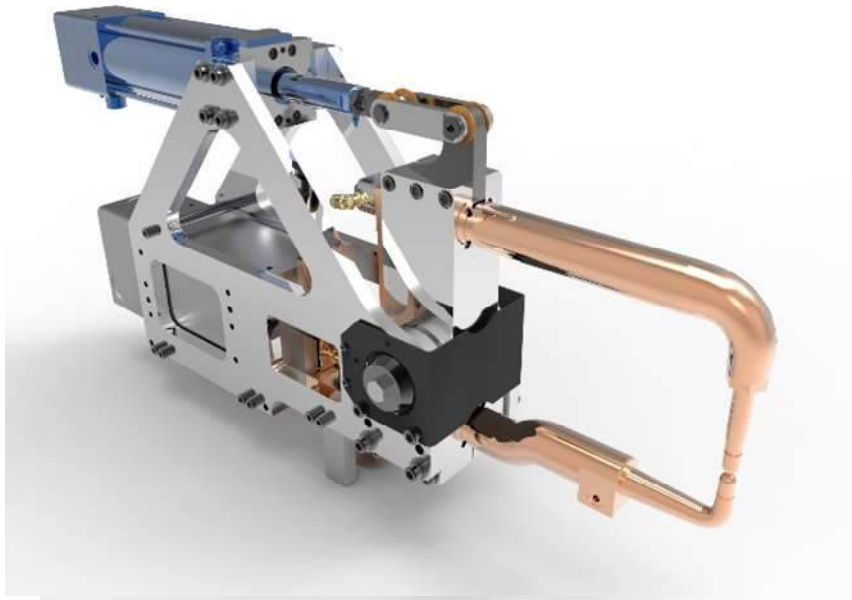


MODULAR GUN SYSTEM

Pinch Gun

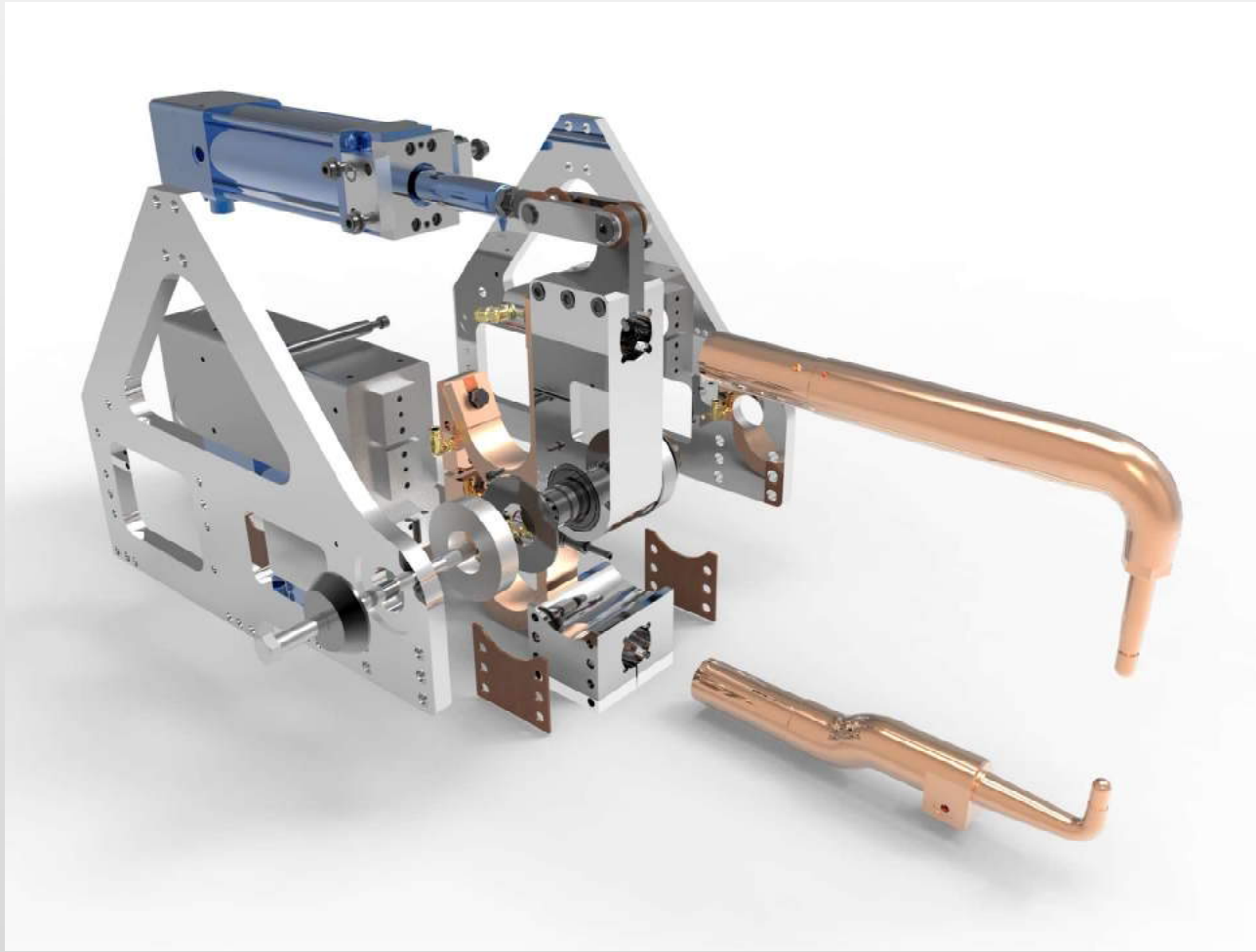
XR Servo Gun Systems

- 30% fewer parts
- 40% fewer fasteners
- 32% stronger structure
- 6% weight reduction



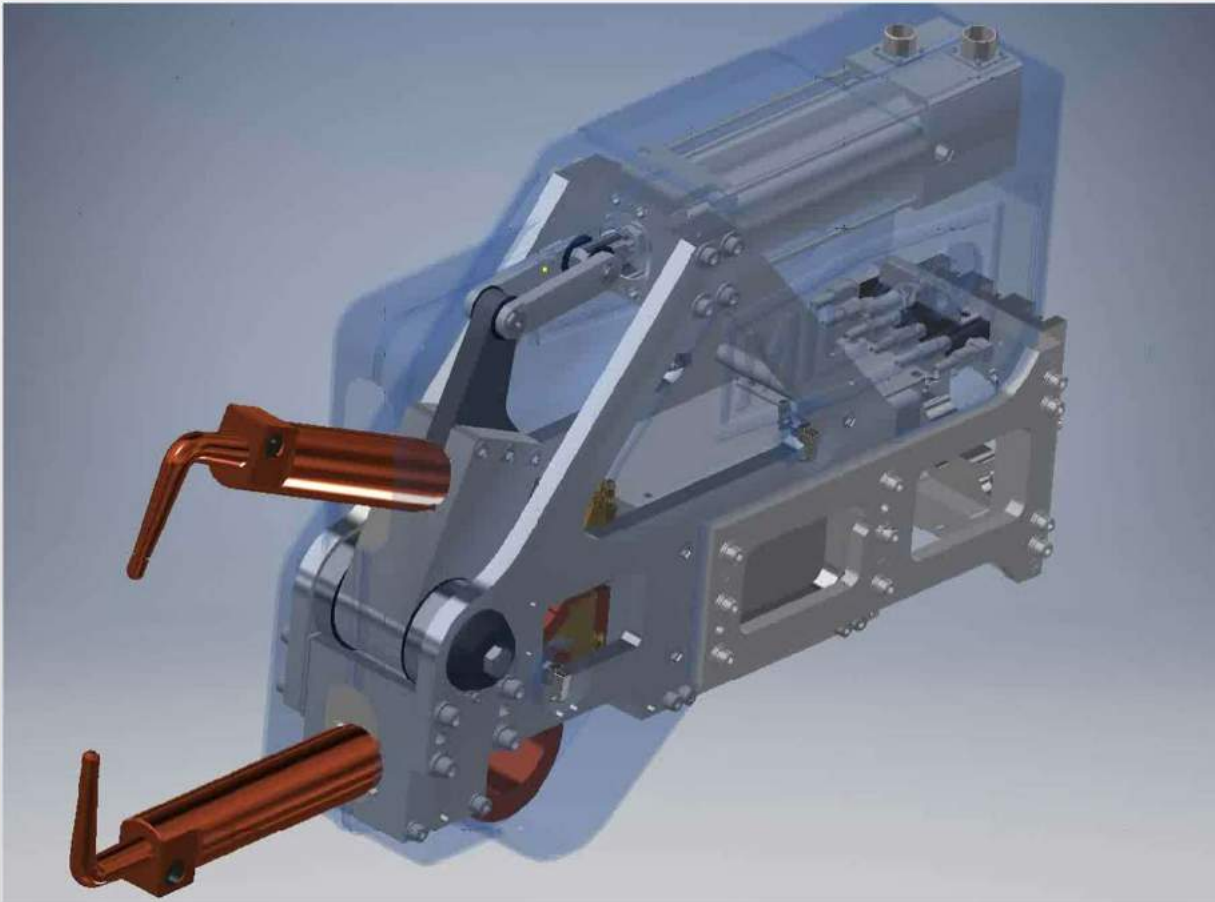
XR SERVO GUN SYSTEM

Pinch Gun Overview



XR SERVO GUN SYSTEM

Pinch Gun Overview



“C” XR MODULAR LIBRARY

■ **“C” Gun– 637-12400-07**

180mm x 345mm Basic

Offset Sta. -110mm

100KVA Transformer - 1100lbs Max TF - 80KG

■ **“C” Gun – 637-12402-15**

230mm x 225mm Basic

2 dia arms

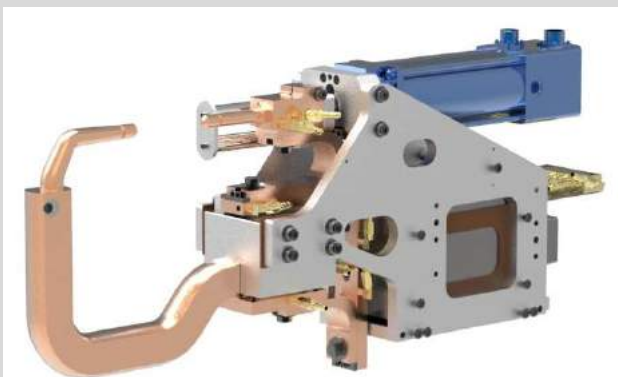
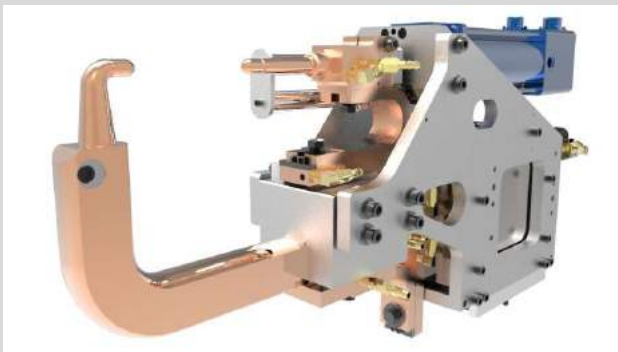
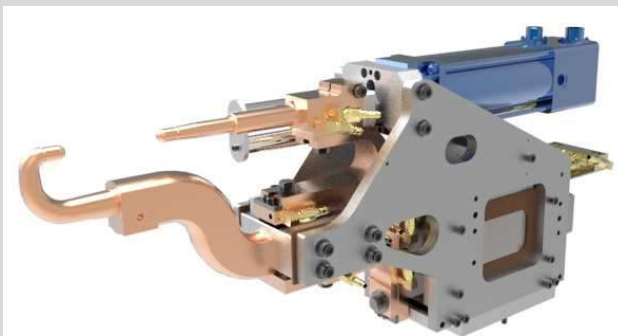
100KVA Transformer - 1100lbs Max TF - 84KG

■ **“C” Gun– 637-12402-18**

230mm x 315mm Basic

Offset Sta. +50mm

100KVA Transformer - 1100lbs Max TF - 90KG



PINCH XR MODULAR LIBRARY

■ Pinch Gun – 665-12403-02

80mm x 125mm x 375mm Basic

Offset Sta. -45mm MJ -25mm – 2 dia arms

100KVA Transformer - 900lbs Max TF - 88KG

■ Pinch Gun – 665-12404-02

125mm x 125mm x 375mm Basic

Offset Sta. +40mm MJ -15mm – 2 dia arms

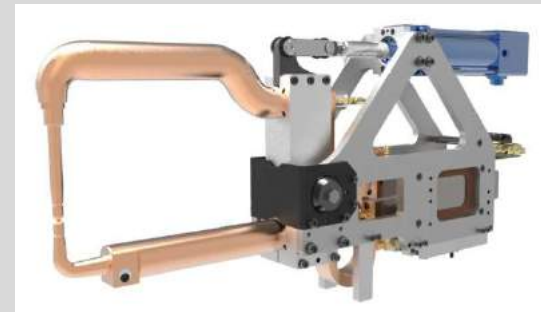
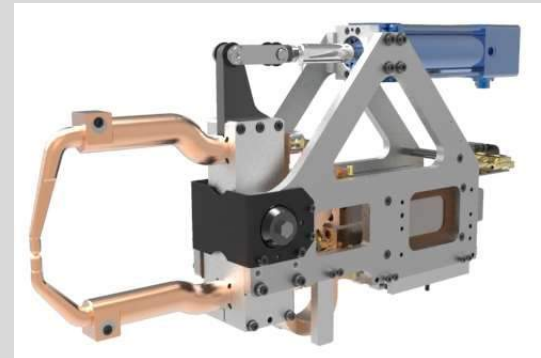
100KVA Transformer - 1000lbs Max TF - 98KG

■ Pinch Gun – 665-16404-01

85mm x 175mm x 475mm Basic –

Offset MJ +75mm – 2.5 dia. arms

100KVA Transformer - 1200lbs Max TF - 105KG



SCISSOR XR MODULAR LIBRARY

■ Scissor Gun – 665-12403-02

80mm x 125mm x 350mm Basic

Offset Sta. -25mm MJ -45mm – 2 dia arms

100KVA Transformer - 1200lbs Max TF - 88KG

■ Scissor Gun – 665-12403-xx

125mm x 125mm x 350mm Basic

2 dia arms

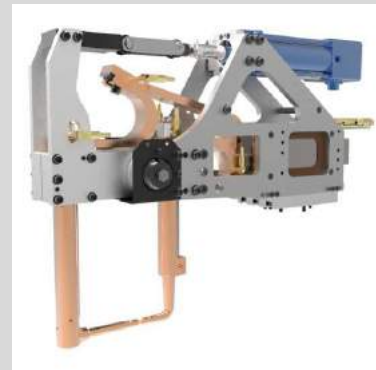
100KVA Transformer - 1200lbs Max TF - 88KG

■ Scissor Gun – 665-12404-04

125mm x 125mm x 375mm Basic

Offset Sta. -25mm MJ -45mm – 2 dia arms

100KVA Transformer - 1200lbs Max TF - 88KG



TITAN XR MODULAR LIBRARY

- **Titan Gun – 665-20400-02**

250mm x 250mm x 600mm Basic

40mm Aluminum Arms

100KVA Transformer - 1440lbs Max TF - 112KG

- **Titan Gun – 665-20400-01**

250mm x 250mm x 700mm Basic

40mm Aluminum Arms

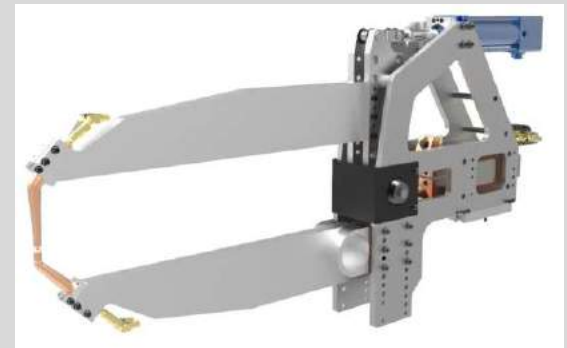
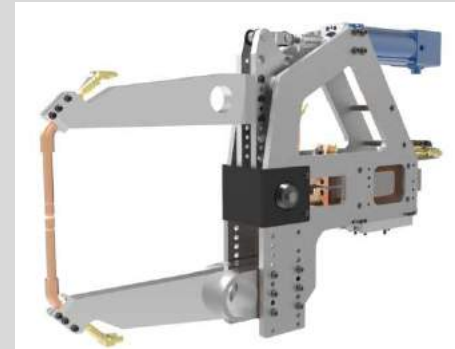
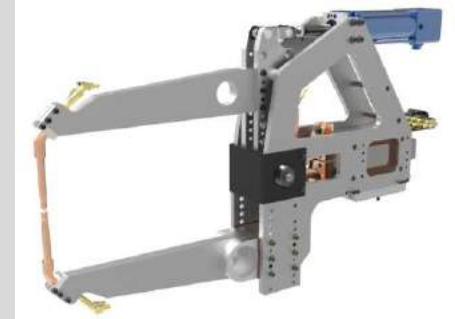
100KVA Transformer - 1200lbs Max TF - 114KG

- **Titan Gun – 665-20400-10**

150mm x 200mm x 950mm Basic

40mm Aluminum Arms

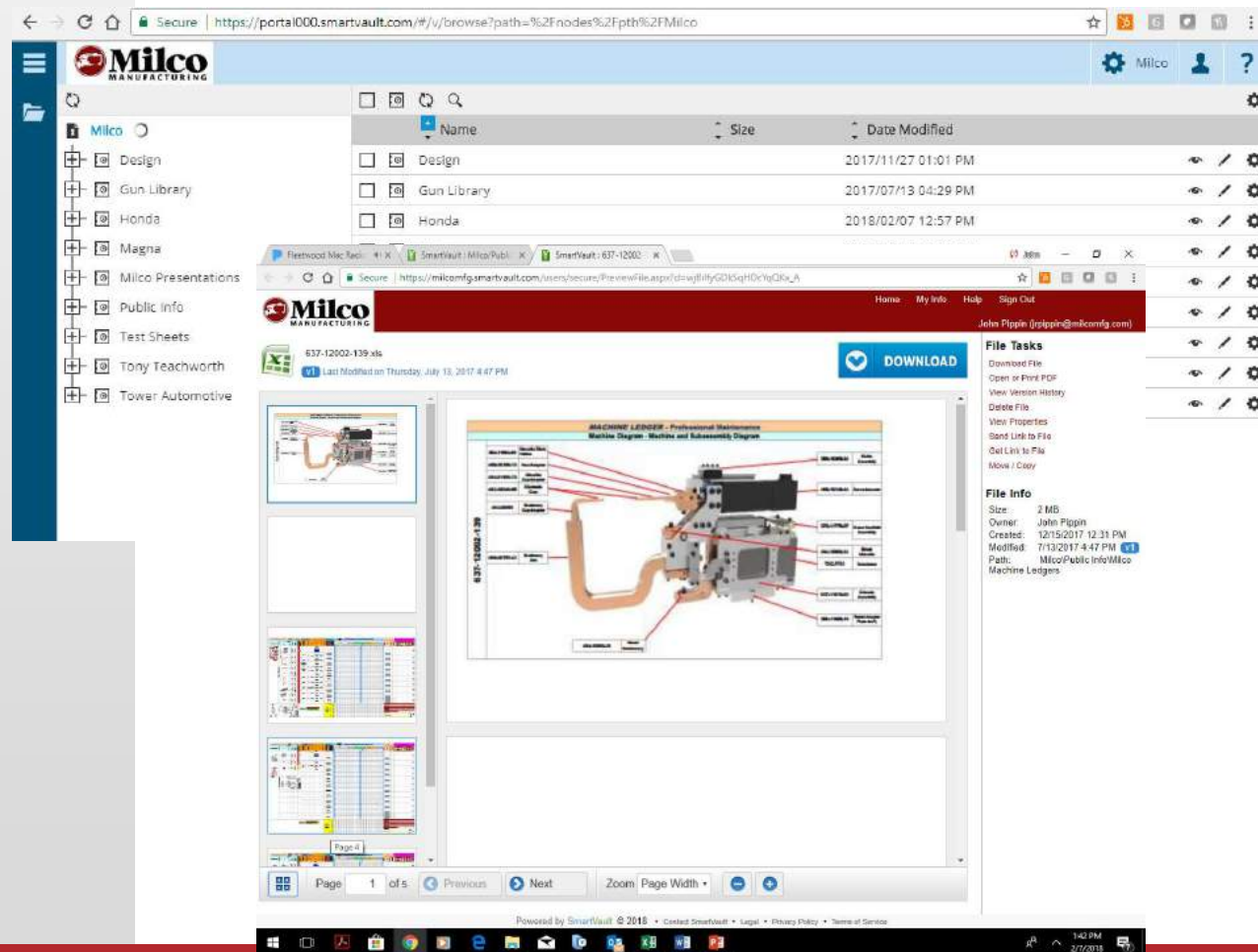
100KVA Transformer - 900lbs Max TF - 118KG



ENGINEERING CAPABILITIES

Customer Portal

- Maintenance Manuals
- Secure login
- Machine ledgers
- Design library
- Customer drawing access



ENGINEERING CAPABILITIES

Service and Technical Manual



Page 9 of 39

SECTION 5 GUN ASSEMBLY

5-1 Gun Types

There are three basic types of modular guns. They are characterized by location of the actuator with respect to the weld and weld plane. The pinch & scissors types are often referred to as Pivot guns. The selection of a gun type depends on the location of the gun mount, the tooling access, position of the robot and the geometry of the sheet metal.

1. C-type or Straight action gun: The actuator is perpendicular to the weld plane and in-line with the weld.



2. Pinch Type: The actuator is parallel to the weld plane and actual

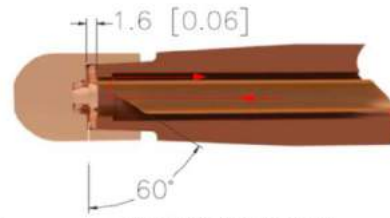


3. Titan Pivot : Larger frame pinch gun with Aluminum arms



8-1-4 Deflector Tubes

The length and angle of the deflector tube should be in accordance with defined standards. Improper geometry may cause water flow restrictions or steam pockets resulting in extreme temperatures. The recommended deflector tube end geometry is shown below.



www.milcomfg.com

Milco Manufacturing Company
2147 E. 10 Mile Road, Warren, MI. 48091 USA

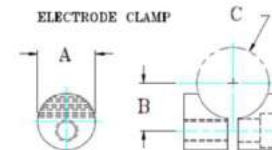


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6-1 CAP ADAPTOR REPLACEMENT WITH BARREL LOCK

The clamp assembly (barrel lock) consists of two half round barrels which lock the cap adaptor against the holder using a M10 socket head screw. The serrations on the clamp allow the clamp to bite into the cap adaptor to prevent any loosening.

1. Unscrew the electrode clamp bolt a few turns.
 2. Lightly tap the bolt to loosen the grip of the clamp and remove cap adaptor with twist motion
 3. Check the o-ring and the deflector tube adapter for damage and replace if required.
 4. Apply a light film of conductive grease on cap adaptor for ease of installation.
- he cap adaptor ensuring the caps are aligned (within $\pm .030"$ [8 mm]).
- 1 clamp bolt to 35 ft-lb (50 Nm) once the caps are aligned.

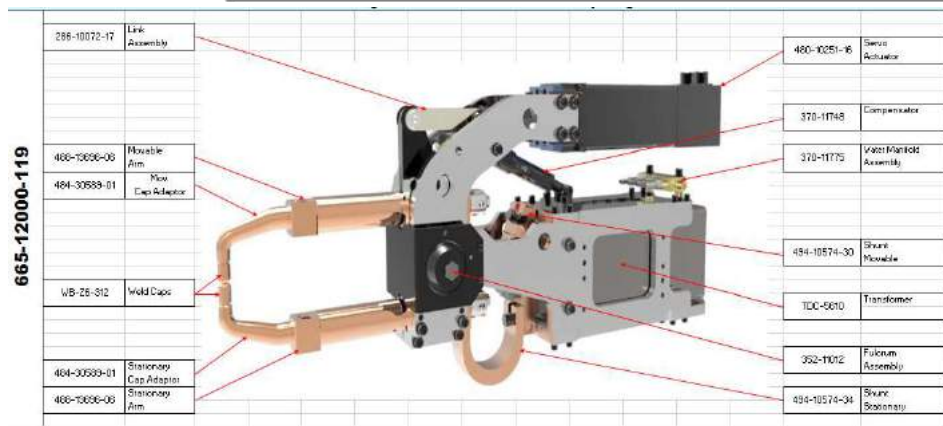


SHANK/CLAMP	O-RING	A	B	C
1.50" ARD197M/198M	2-218	81.112 [28.3]	8.812 [20.62]	8.750 [19.05]
1.24" 492-10096	2-214	8.990 [25.15]	6.66 [17.00]	R.620 [15.75]
1.24" 492-10107-02	2-214	8.990 [25.15]	6.66 [17.00]	R.620 [15.75]



MILCO MODULAR GUN SYSTEM

Maintenance support Machine Ledgers



665-12000-119

MACHINE LEDGER - Professional Electronics

665-14007-02

665-13000-08

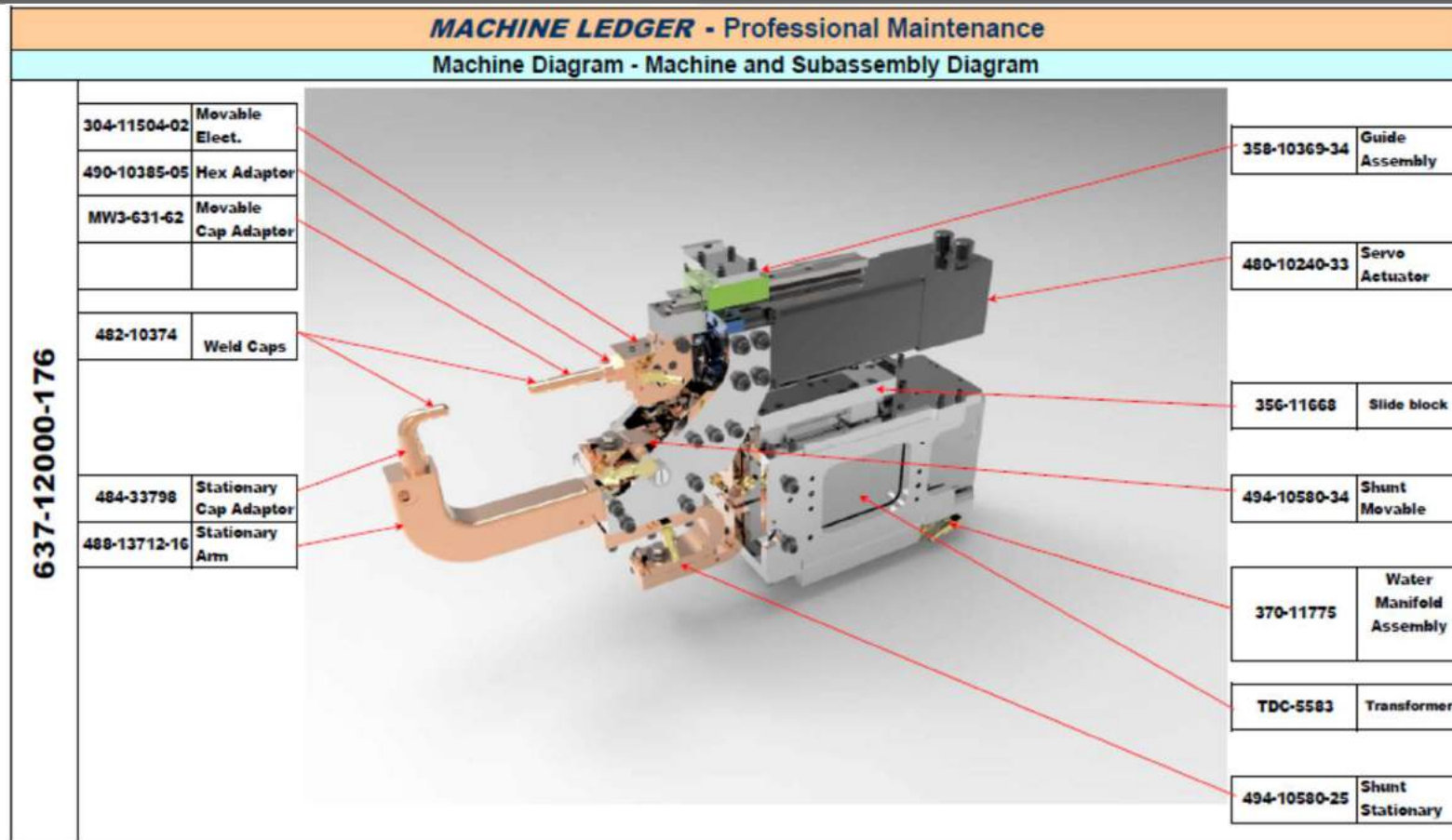
Part Number	Description	Category	Notes
1	Weld Caps	Weld Caps	Weld Caps
2	Weld Caps	Weld Caps	Weld Caps
3	Weld Caps	Weld Caps	Weld Caps
4	Weld Caps	Weld Caps	Weld Caps
5	Weld Caps	Weld Caps	Weld Caps
6	Weld Caps	Weld Caps	Weld Caps

Milco Machine Ledgers

- Complete System
- Tailored to Customers need

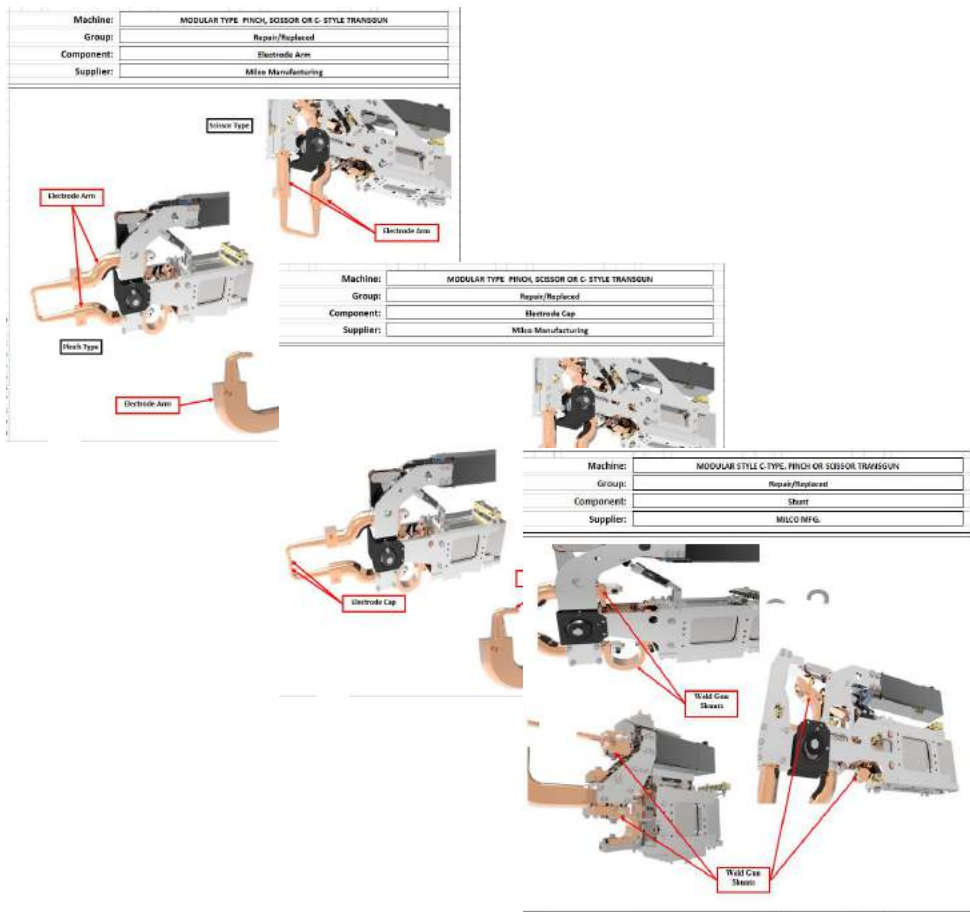
MILCO MODULAR GUN SYSTEM

Maintenance support Machine Ledgers – “C”



MILCO MODULAR GUN SYSTEM

SMP-Standard Maintenance Procedures

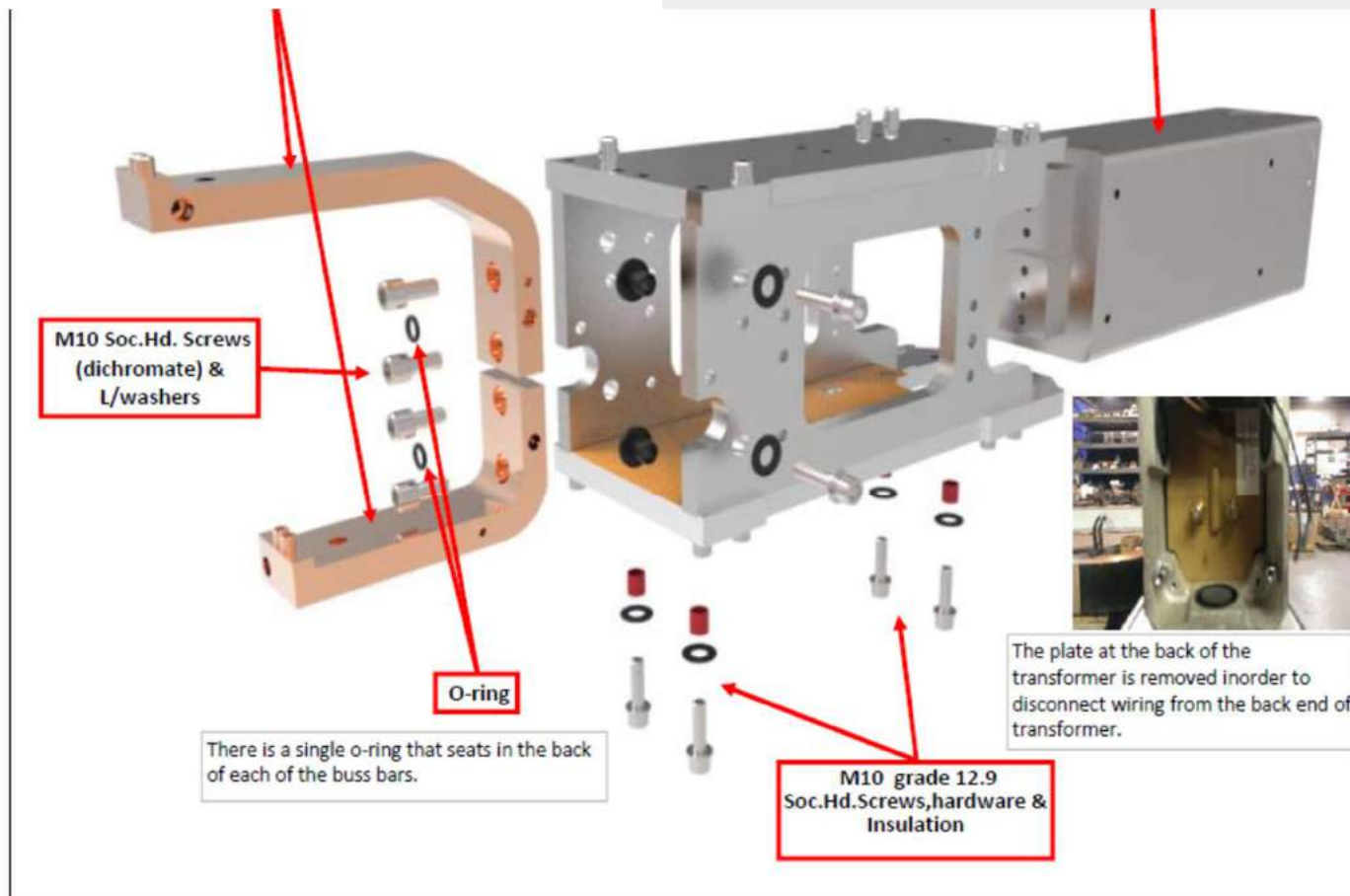


Standard Maintenance Procedures

- Electrode Arm Replacement
- Electrode Cap Replacement
- Shunt Replacement

MILCO MODULAR GUN SYSTEM

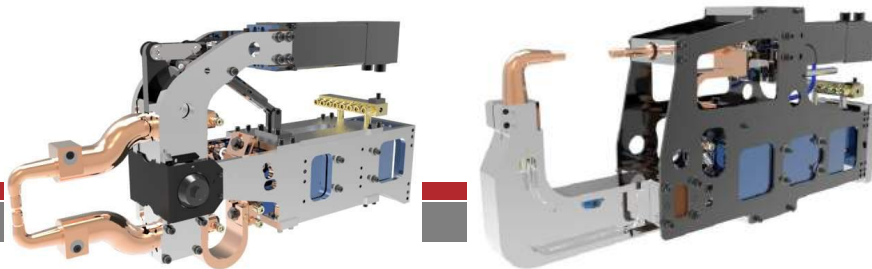
SMP-Standard Maintenance Procedures



SPECIALIZED MODULAR SYSTEMS

Delta Series

- Designed for Aluminum Welding
- High current and water flow



MLS Series Gen 2

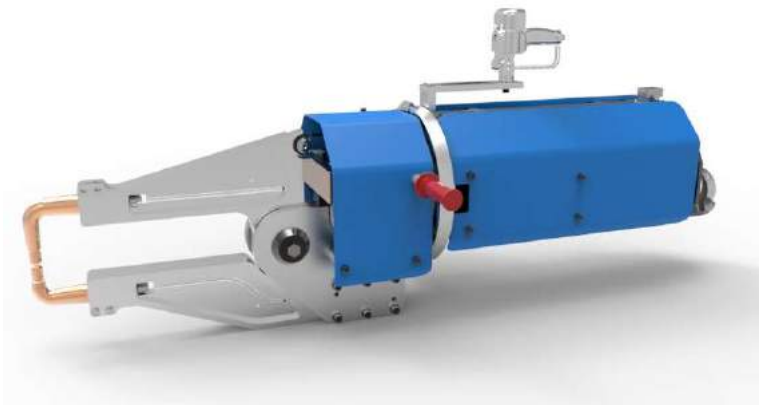
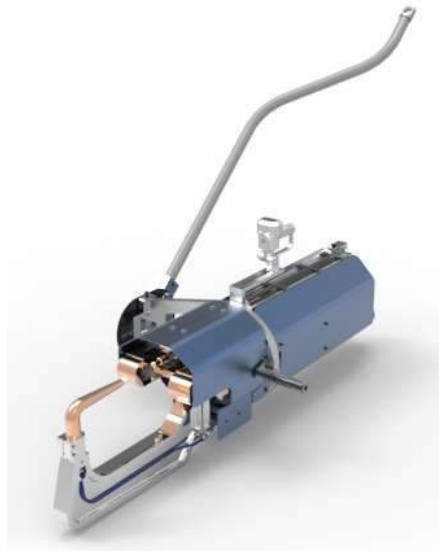
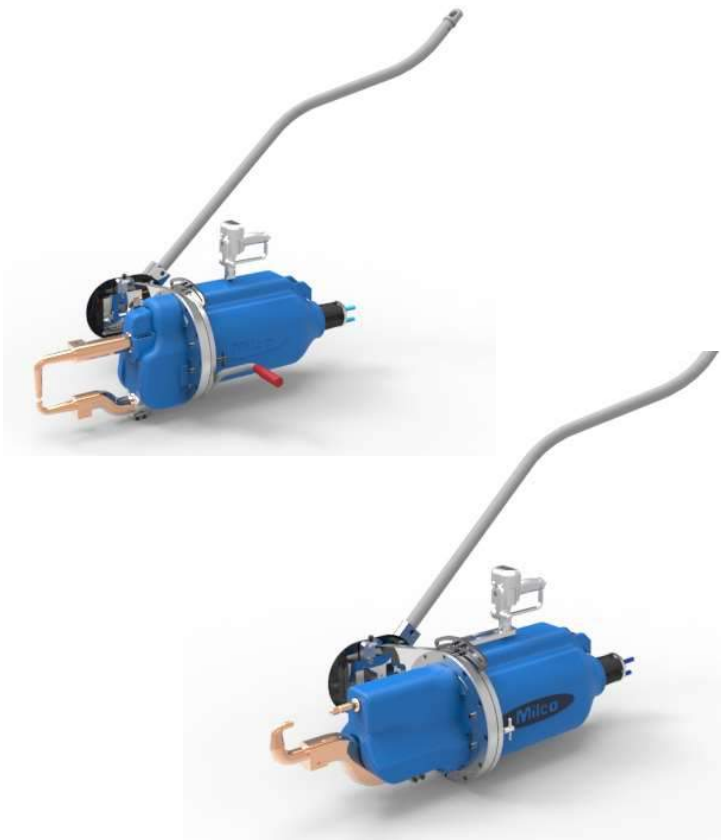
- One Frame Pinch & “C”
- Under 70 kg up to 1800 lbs tip force



MANUAL GUNS

Complete Systems Customized to Fit Your Needs

- Guns to turn-key systems
- Proto type or production ready
- Delta series available



SPECIAL CARTS

Portable weld stations



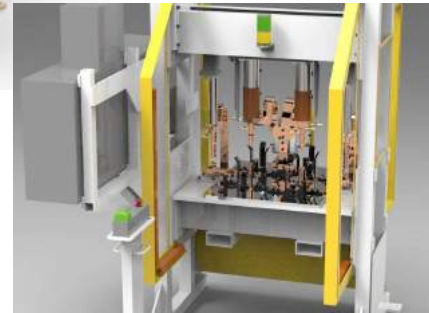
- Production ready
- Self contained
- Plug and play

SPECIAL MACHINES

CABLE GUNS

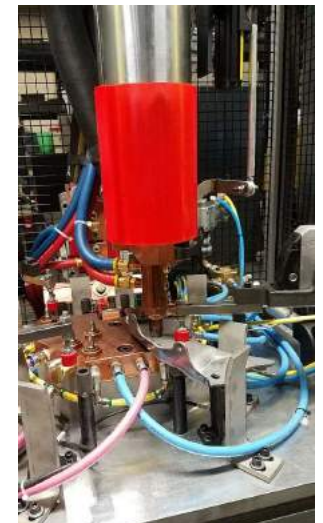
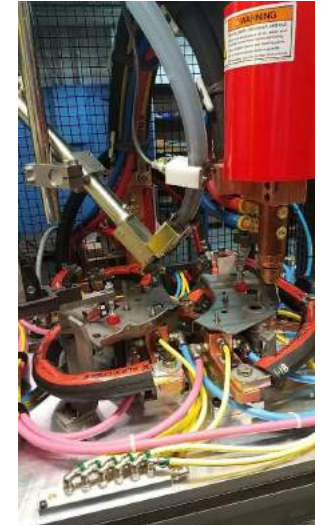
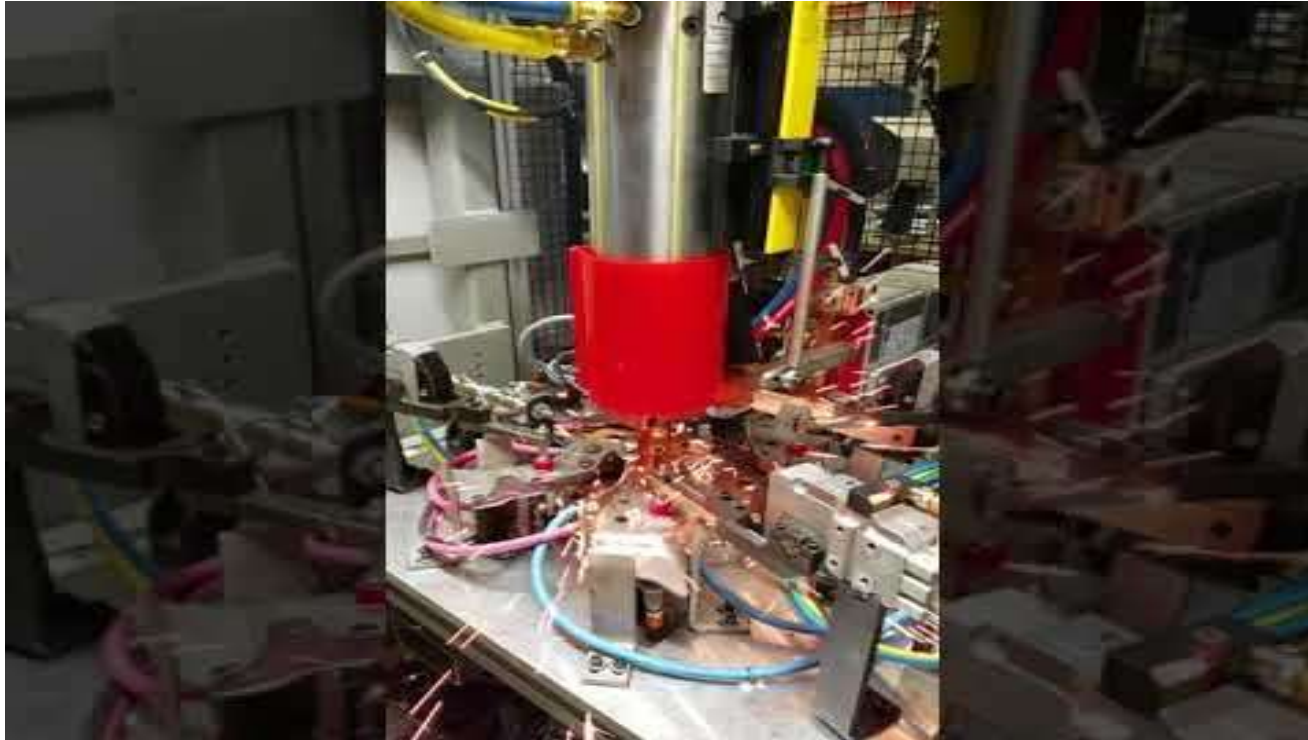


NUT/STUD WELDING GUNS



MACHINE TYPE

SPECIAL MACHINES



MACHINE TYPE

SPARE COMPONENTS

Keeping Your Business Operational



- Cylinder and Servo actuators for all brands
 - Milco Modular
 - Senn
 - Servo Pneumatic
 - Legacy
- Servo actuators offered:
 - Milco
 - Tolomatic
 - Exlar
 - Parker

MACHINE CAPABILITIES

Take a look inside our facilities...

90,000 sq. ft. manufacturing facility

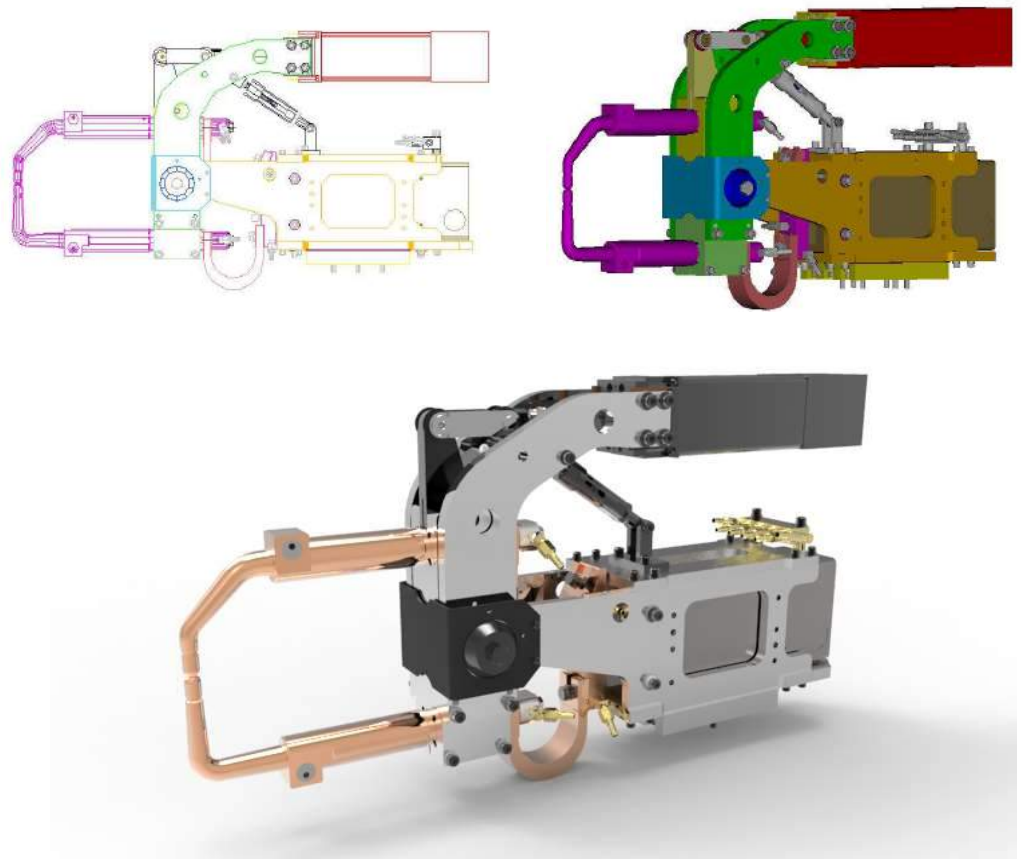
- Machine Shop
- Fabrication
- Assembly and test
- R&D



ENGINEERING CAPABILITIES

Parametric Modeler

- Allows for quick turnaround when new design is required
- Can control options to reduce holders and adaptors used
- Creates shared components
- Reduces engineering cost





Speed. Precision. Cost Effective. Choose *Three*.

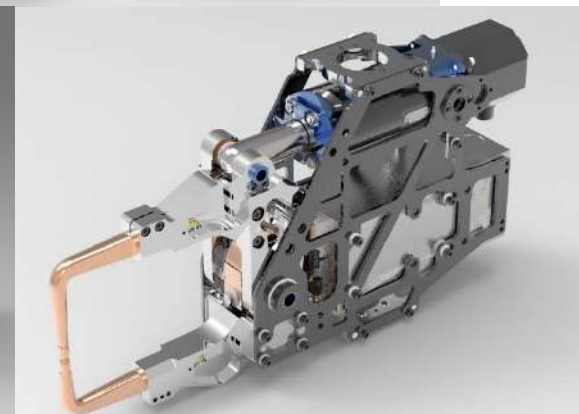
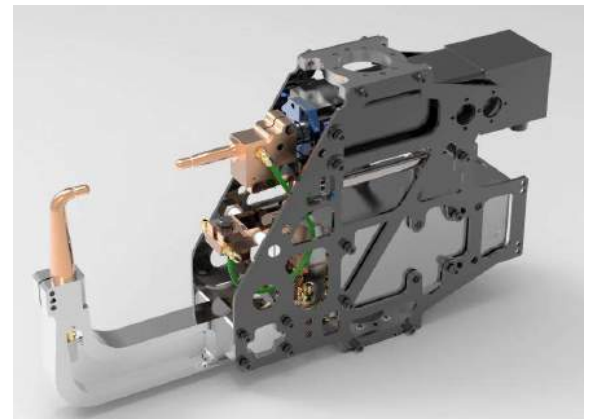
- True manufacturing craftsmanship
- World Class Manufacturing (WCM)
- Strong heritage...over 65 years!
- Flexible capacity
- Commitment to service

NEW PRODUCTS

MLS GEN II Gun System

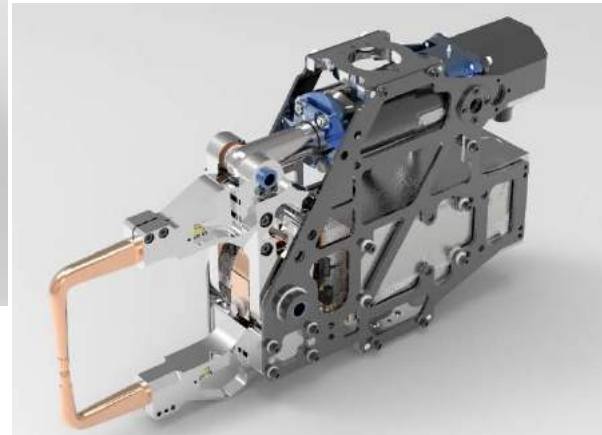
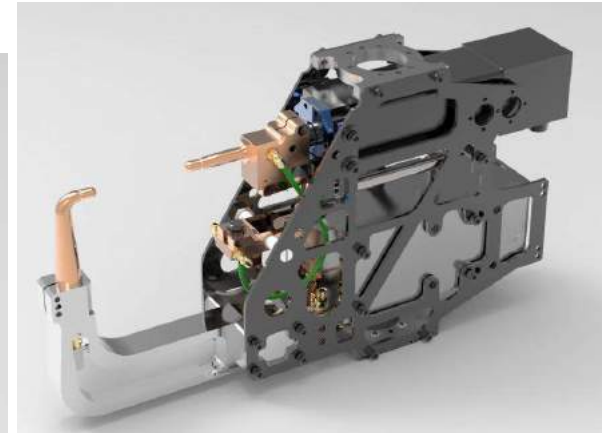
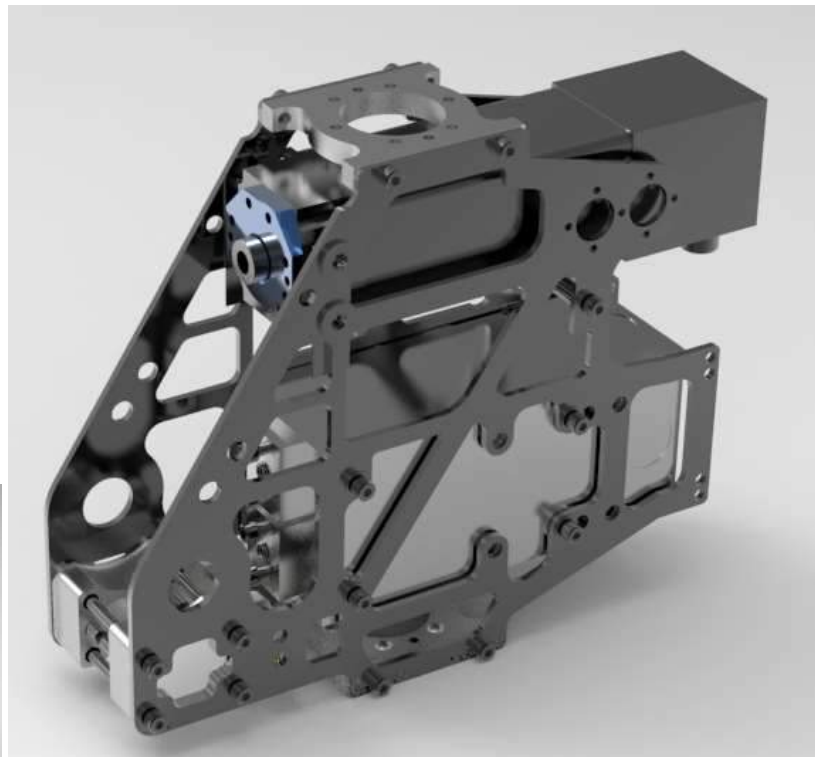
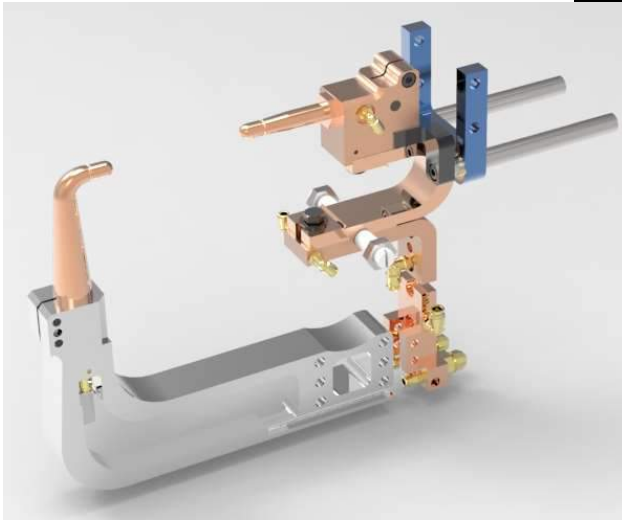
Milco Lightweight Series

- One compact universal servo chassis (C-type guns and Pinch type guns)
- 70 kg or less, and up to 1750 lbs. tip force
- All mounting options standard
- MFDC Transformer 1000/1200/1800 Hz



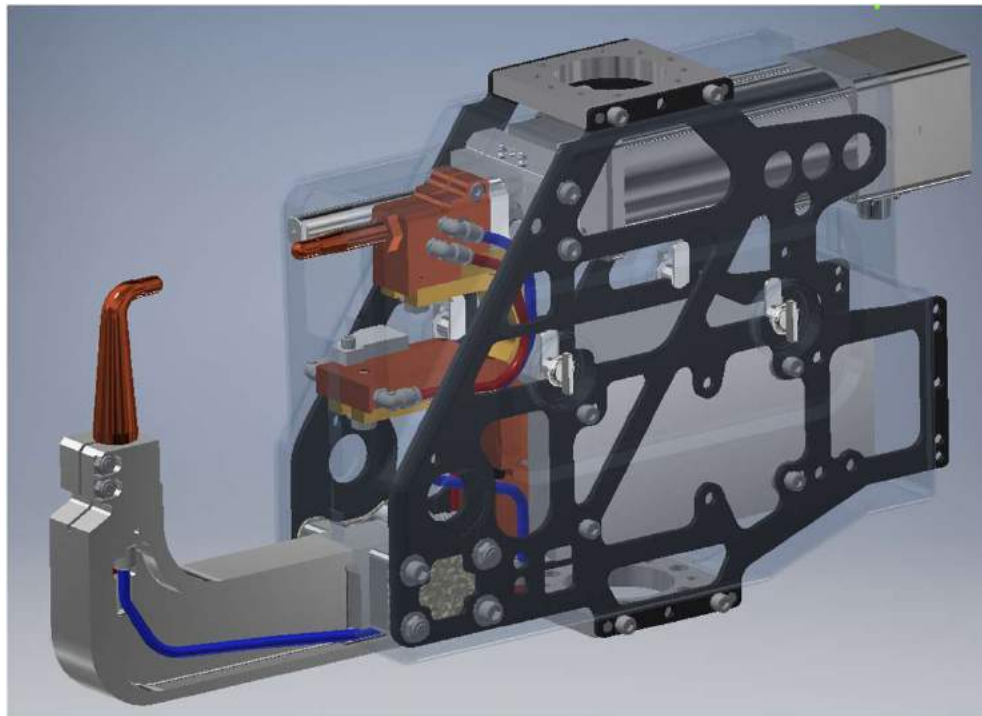
NEW PRODUCTS

COMPACT UNIVERSAL SERVO CHASSIS



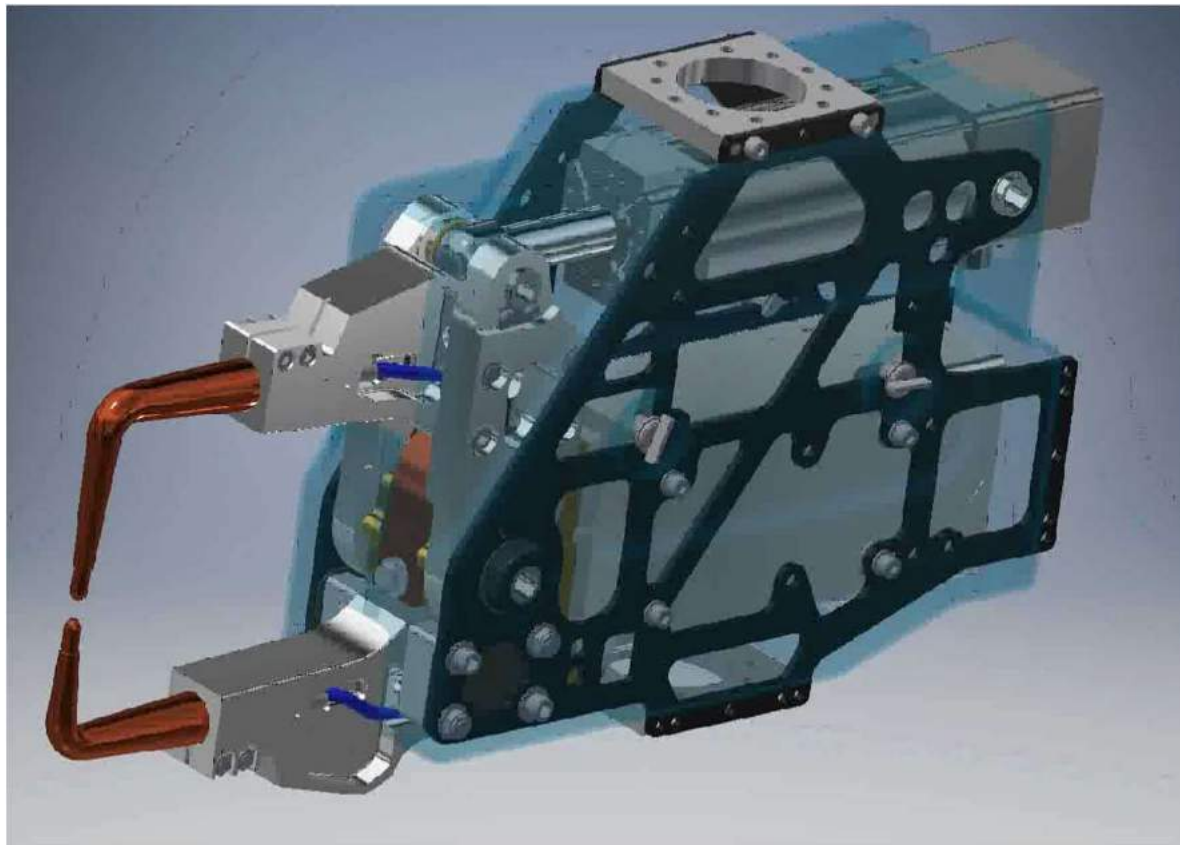
NEW PRODUCTS

COMPACT UNIVERSAL SERVO CHASSIS



NEW PRODUCTS

Movie

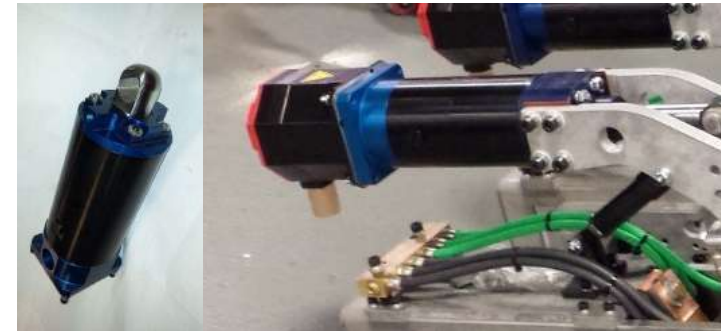
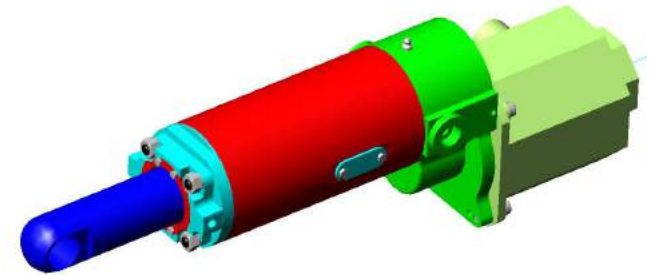


NEW PRODUCTS

Milco Servo Actuator System

Milco High Speed Series

- Screw 12mm .8m/sec @4000rpm
- Thrust up to 2400 lbs
- High speed
- Non – rotate built into actuator
- Works with all robot manufactures Motor
 - Fanuc
 - Nachi
 - ABB
 - Kuka



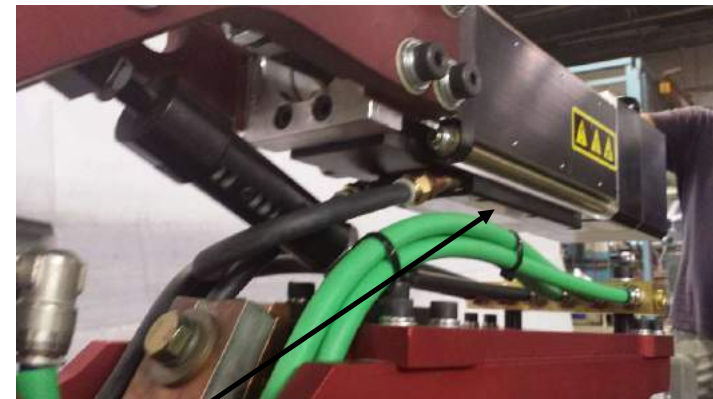
NEW PRODUCTS

Tolomatic Servo Actuator System

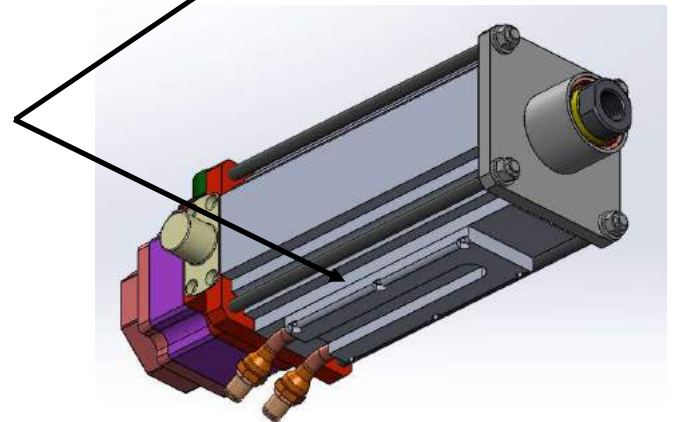
Water Cooling improved duty

Water Cooling Servo:

- Increases output approximately 50%
- No change in robot dress
- No effect on gun cooling requirements

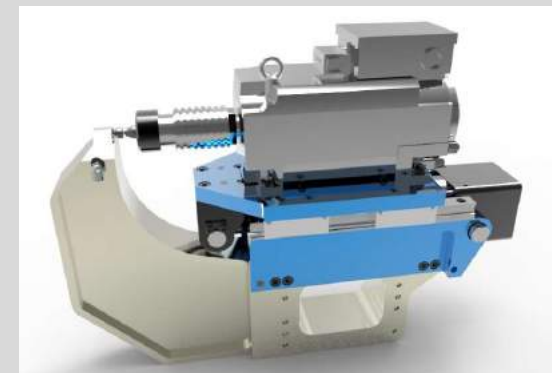
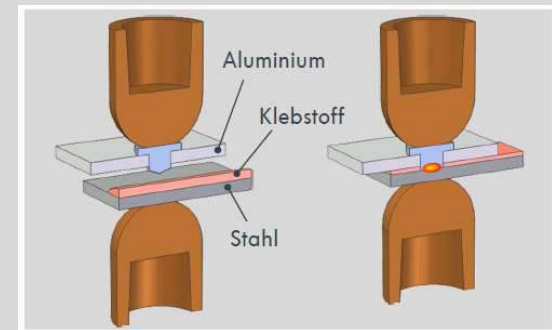
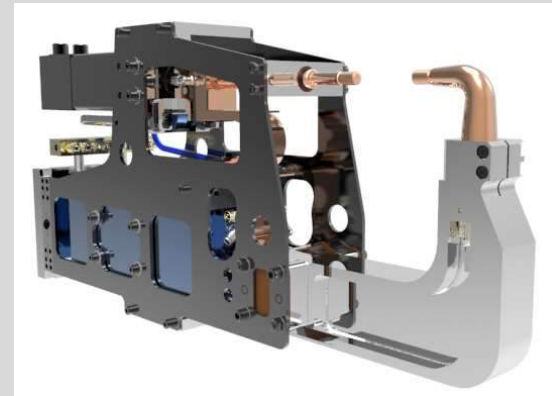
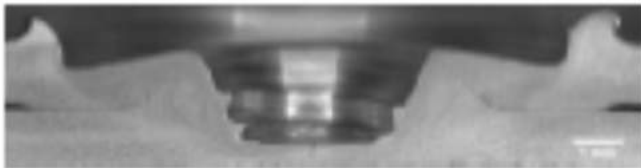


Cooling plate



New Technology

- Aluminum Welding
Delta Gun
- Lift - Lightweight Innovations
for Tomorrow
 - Rivet weld
 - FSSW – Friction Stir Spot
Welding



Aluminum Welding

Overview



- By 2025, nearly 27% of vehicle body and closures will be aluminum, a 20% increase over today.
- Consistency is of fundamental importance since aluminum's electrical and thermal conductivity requires 2.5 to 3 times the current, but only one-third the weld time of steel.
- Methods commonly used in steel that extend the cycle time in order to produce a weld are not effective for aluminum.
- The weld system must be able to deliver higher current levels in a time window 50 to 66% shorter than what is commonly employed for steel

Weld Gun Considerations

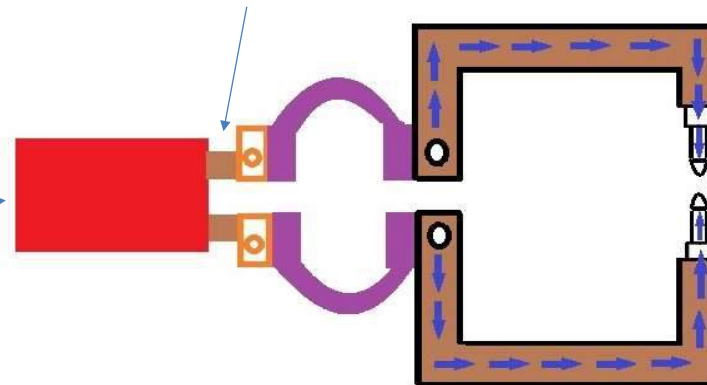
Calculate ECTC of Gun

- Assure all current carrying components meet ECTC requirements. Larger cross sections required.
- Joules Law must be considered.
- $\text{Heat} = I \times I \times R \times T$ (2-3 times sec. current means exponential heat rise in secondary)
- Shunt, arms, shanks, etc.
- Avoid water-cooled cables

*NOTE – size of the primary conductors will be larger and need more clearance and a larger bend radius

EMF Effects

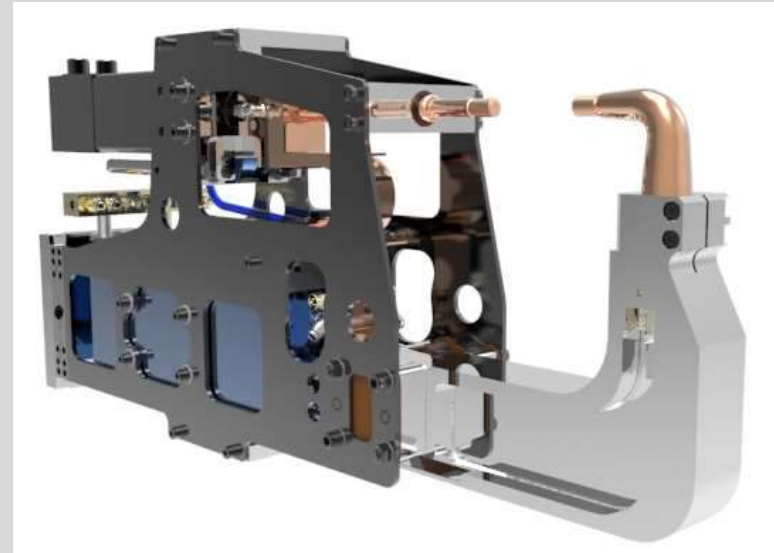
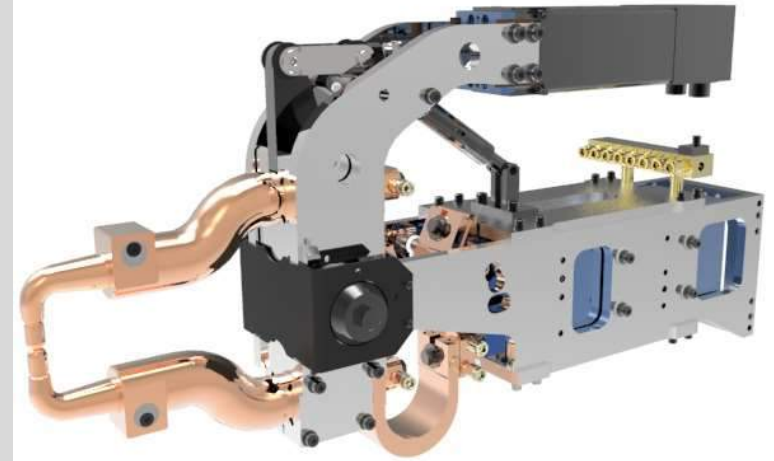
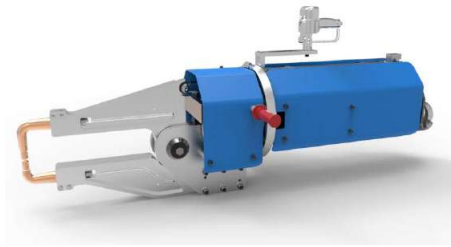
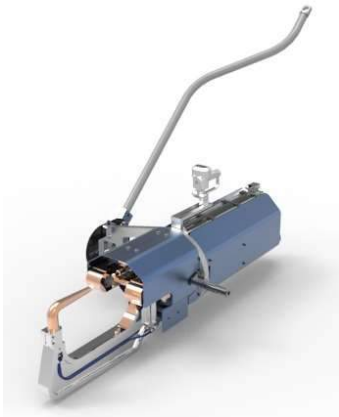
- Higher secondary currents create higher EMF (Electro motive force)
- Consider EMF affects on servos, guides, slides, shunts, etc.
- Bolt down (reinforce) shunt adapters to avoid transformer secondary pad damage



DELTA SERIES

Aluminum Welding Gun System

- Size 4 & 6 transformers
- Increased water flow
- Reinforced buss bar system
- Wider shunt for increased current flow
- Robust design reduces deflection
- “C” Gun with 3 point guide system
- Optional load cell available



Aluminum Welding

Review

DO NOT use “steel guns” to weld aluminum

1. Insufficient H₂O to electrodes
2. Insufficient stiffness / robustness for long life and consistent weld quality
3. Shunts / Adapters are too small constant maintenance issues

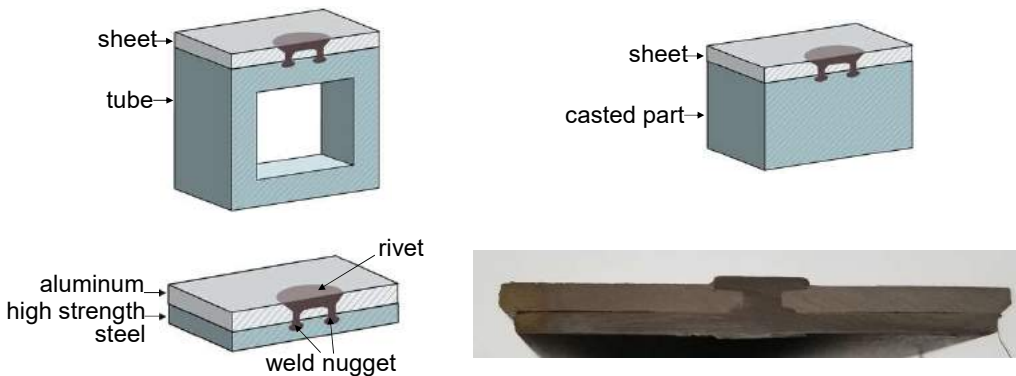
Pay Attention to:

- Increased H₂O rate
- Correct electrodes “geometry consistent”
- Robust “stiff guns”, alignment is critical
- Consistent force
- Changes to robot dress-power, water
- High current / short time
- Plan for tip dressing 2 to 3 times more
- Consider plant power and water facilities
- Plan for 2 to 3 times maintenance
 1. Time
 2. Component replacement

New Technology

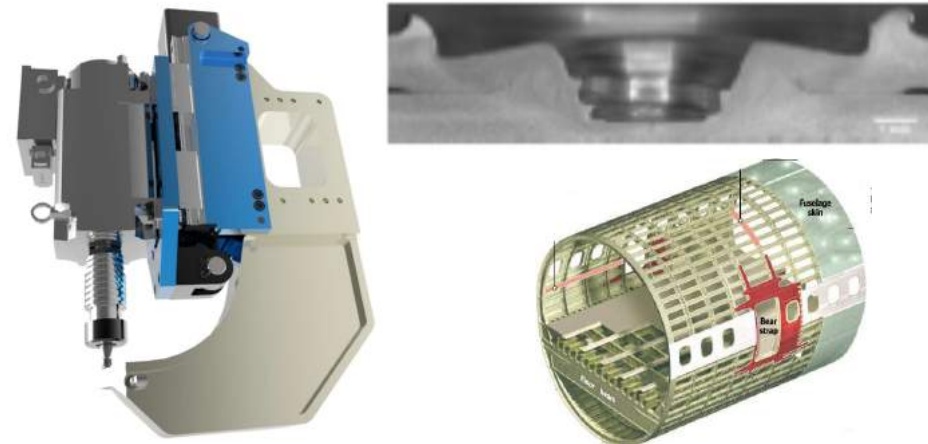
Rivet-Weld Technology

- Aluminum to steel, and boron steel welding
- Single sided welding



FSSW Friction Stir Spot Weld

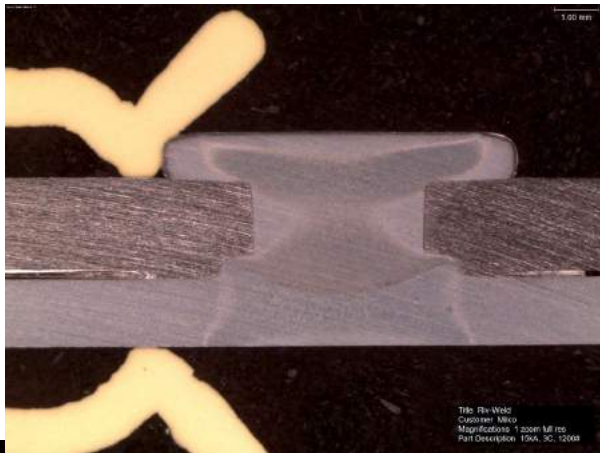
- Aluminum and Titanium welding for Aerospace



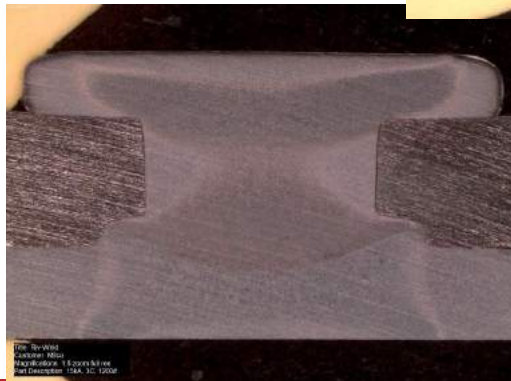
New Technology

Rivet-Weld Technology

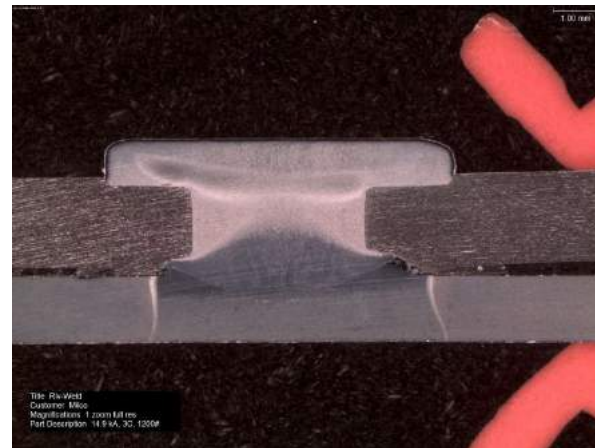
- Aluminum to mild Steel



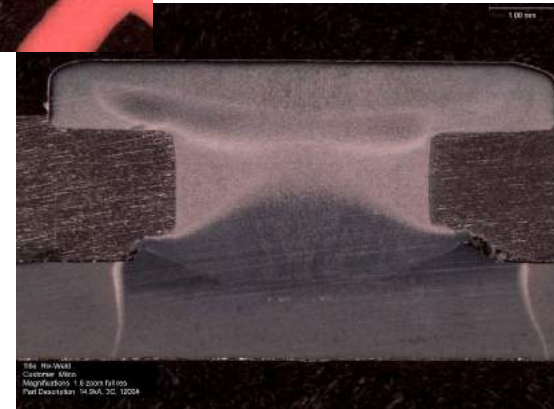
15k @ 3 cy



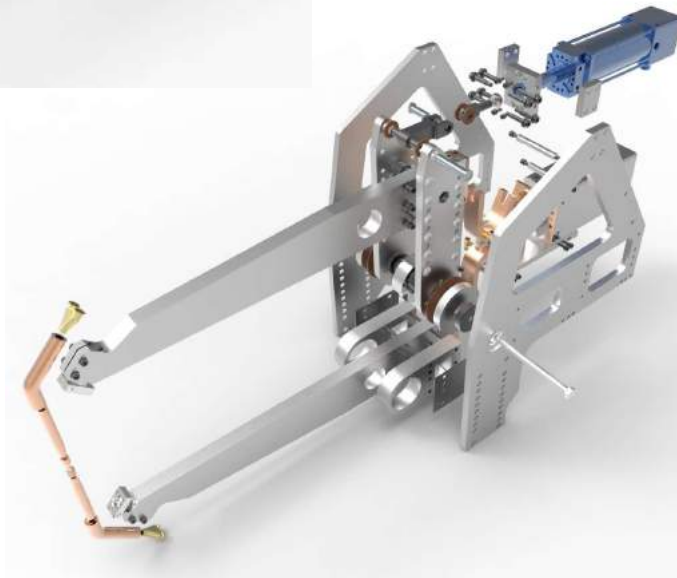
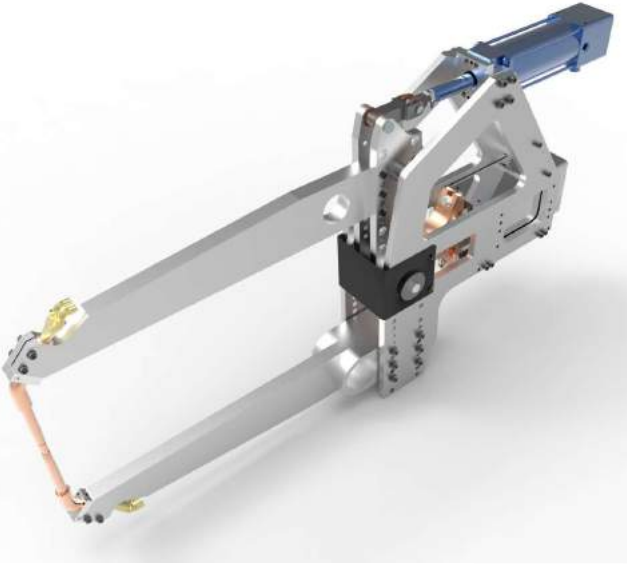
- Aluminum to Boron Steel



14.9k @ 3 cy



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