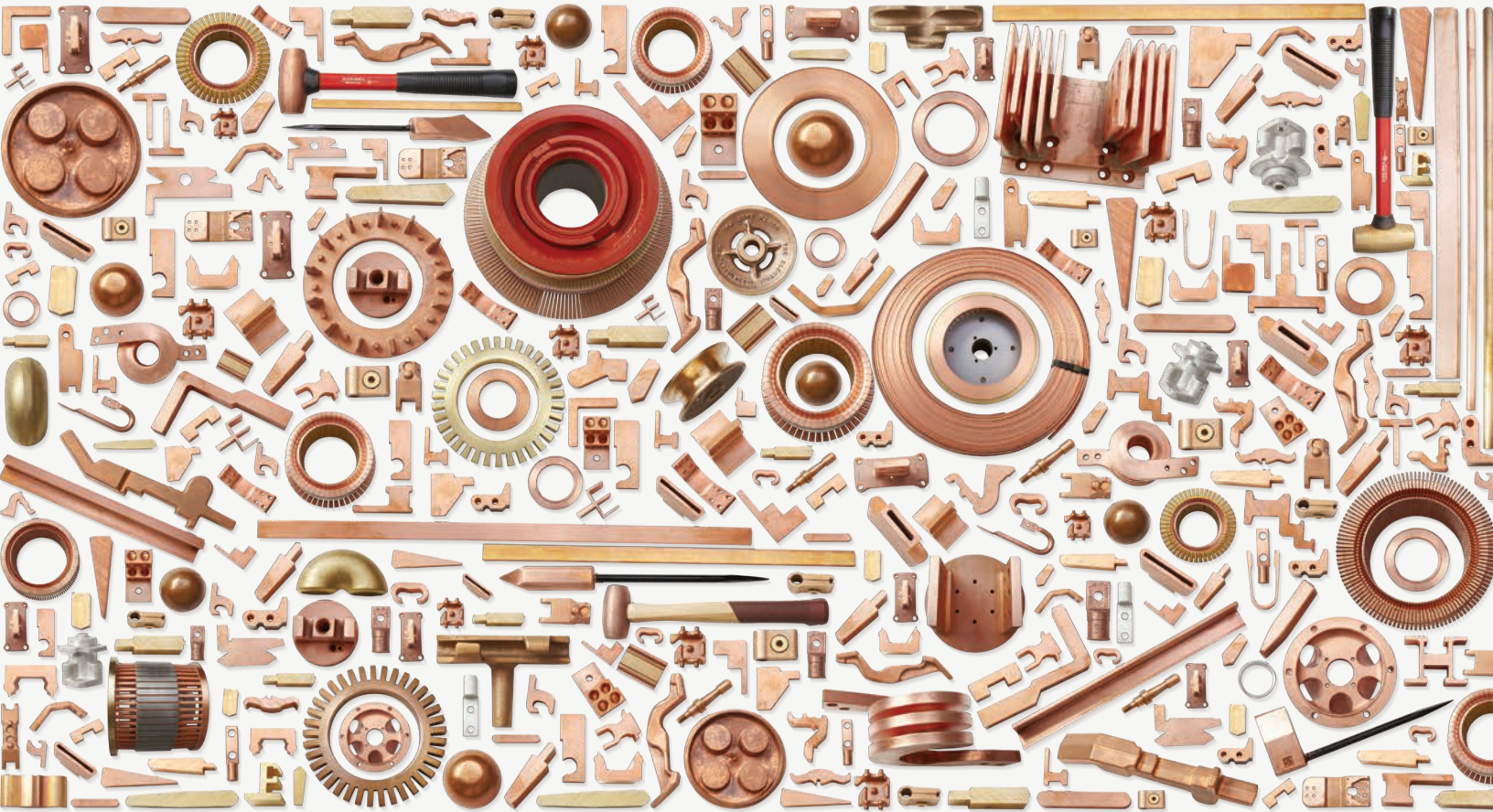


# The Worldwide Leader in **Custom Copper Products & Commutators**



**THE ELECTRIC MATERIALS COMPANY**

COMMUTATORS~EXTRUSIONS~ROTOR BAR~CASTINGS~FORGINGS

1915



2015

A UNITED STARS CO.



## FOR 100 YEARS

Since 1915 The Electric Materials Company, a specialty copper mill in North East, Pa., has manufactured copper products for some of the most demanding applications. Our unique advantages make us the worldwide leader in custom copper products and commutators, featuring vertical integration, fast turnaround and more than 51,000 active drawings.

As the only domestic copper producer capable of extruding, casting, forging and machining copper, our advanced operation allows us to produce highly engineered copper products to exacting specifications.

From commutators measuring 12 feet in diameter to machined and plated components weighing just a few ounces, The Electric Materials Company sets the industry benchmark for quality. With more than 40 copper alloys and the ability to design, engineer and manufacture, we have the resources to produce your product from start to finish.

Known worldwide as an industry expert, The Electric Materials Company is the largest domestic commutator manufacturer. Our copper products also include AC rotors, collector rings, castings, centrifugally cast rings, extrusions, forgings, bus bar systems and components, and copper fabrications.

Maintaining a strong brand around the world, our 100 years of experience and quality ensure that, as we begin our second century, we will continue providing solutions to copper product challenges.

### Quality Engineering

With highly advanced engineering resources and an exceptional engineering team, we design from scratch or redesign products based on our customers' requirements. Our century of component design has amassed one of the industry's most extensive document libraries.

#### Our resources include

- AutoCAD® including SolidWorks
- ANSYS® Professional (finite element analysis)
- Design evaluation software
- AFS Solid Software (casting capabilities)
- Custom alloys
- Pattern design and build
- Die tooling design and manufacture (extrusion, draw, forge and punch dies)
- Specialty services including conversions for commutators
- More than 51,000 active drawings

## Product lines

- AC Rotors
- Bus bar systems and components
- Castings: sand and permanent mold
- Centrifugally cast rings
- Collector rings: new and repaired
- Commutators: new and repaired
- Copper fabrications
- Extrusions
- Forgings

## Vertical integration

- Design engineering
- Plating
- Heat treating
- Complete machining
- Brazing
- Welding
- Quality control, full metallurgical lab
- Complete secondary machining operations
- Punching
- Threading
- Drilling and tapping

## TEMCO Express

- Nonstop emergency service and expedited delivery
- Commutator repair and manufacture
- Extrusions, castings and forgings

## Certifications

- ISO 9001:2008
- MIL I 45208
- U.S. NRC 10CFR 21 and 10CFR 50, B

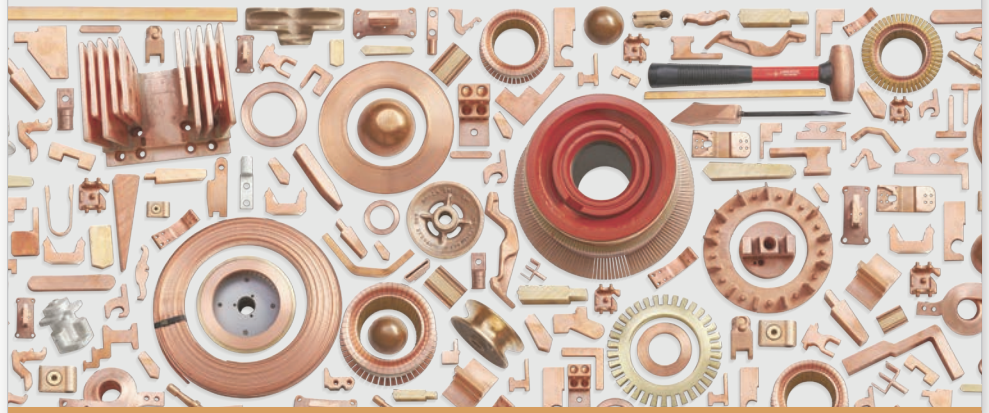
## Nuclear certifications

- ASME NQA-1
- 10CFR50 Appendix B
- 10CFR Part 21
- ANSI N45.2

# Component Manufacturing and Machining

Supplying utilities, distributors, transit authorities, OEMs and military customers, we cast, extrude, forge, braze, machine and electroplate countless components for electrical and mechanical applications. Our vertically integrated operation allows The Electric Materials Company to produce to existing design or manufacture to specific requirements.

Our metalworking capabilities — all based on CNC technology — deliver the tightest tolerances and most efficient production methods.



## Copper Castings

We use high-conductivity copper, copper alloy and aluminum castings for diverse electrical and mechanical applications.



### Sand castings

- Electrical or mechanical applications up to 600 lbs.
- Special cores, pads, fins and studs easily accommodated
- Produced by green sand and no-bake equipment



### Centrifugal castings

- Collector rings, slip rings and rotor end rings
- Improved mechanical properties
- Free from porosity and impurities
- Produces a dense casting with uniform grain structure vs. static casting



### Permanent mold castings

- Semi-automatic molding equipment
- Greater strength and near net shape
- Improved surface finish and wear finish



## Copper, Bronze and Brass Extrusions

As leading producer of custom and standard-shaped copper extrusions, The Electric Materials Company manufactures high-quality extruded shapes, rods and bars produced from billets cast in-house. Capable of custom tooling, our extensive inventory includes several thousand dies.

Our products include copper extrusions for bus bars, commutators, rotor bars, coils, anodes and forging stock, electrical bronze extrusions for rotor bars and other electrical applications.

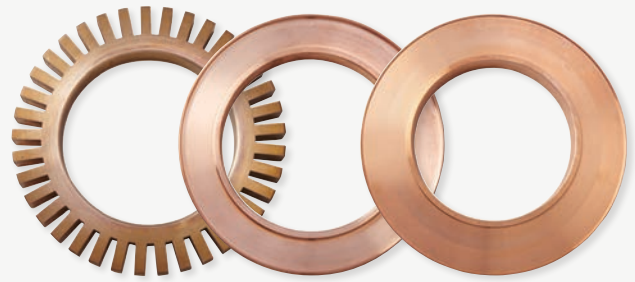
### Features

- Short cycle times
- Capable of intricate punching
- Ability to punch narrow slot into thick bar
- In-house lab ensures precise alloy composition
- Cut to mill lengths and custom lengths

### Routine testing

- Tensile
- Emission spectrometer
- Rockwell hardness
- Conductivity
- Resistivity
- Hydrogen embrittlement
- Oxygen PPM analysis
- Atomic absorption spectrometer
- Grain size evaluation

## Copper Forgings



## Collector and Electrical Rings

We design, engineer, manufacture and repair all styles of ring assemblies for any application. From the core to the final dynamic balance operation, all processes are monitored as part of our ISO 9001:2008 quality system.

### Collector rings

Our full array of collector rings start with outer diameters from 3". Assemblies with larger diameters use the multi-segment split-ring design and are cast in our foundry, finish machined and outfitted with hardware. This allows installation and removal without having to remove the entire assembly.

- Premium alloys, mica and insulating tape offer optimum electrical efficiencies and performance
- Custom engineering available for established collector ring models and modified designs
- All materials inspected during every phase of manufacturing

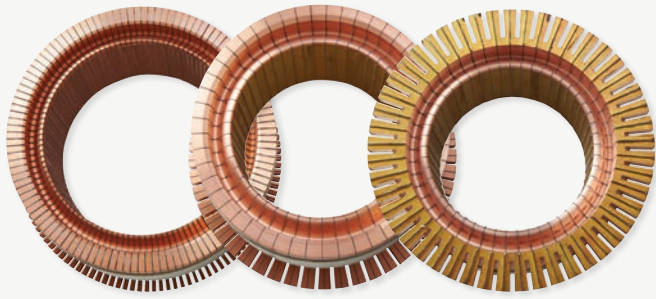
### Electrical rings

- High-performance collector ring assemblies, slip rings and rotor end rings
- Metallurgically certified alloys and conductivity ranges from 6" to 55" diameter
- Conventionally cast up to 55" or centrifugally cast up to 44" to meet customer requirements

The Electric Materials Company's full-service forging capabilities include high-quality forgings in high-conductivity copper, chrome copper (conforming to RWMA Class II), and brass and bronze.

### Capabilities

In-house production of forging stock, complete metallurgical lab testing and certifications, brazing and welding, 50 non-ferrous copper alloys, 800- to 3,500-pound drop hammers, tin and silver electroplating, as well as forging, trimming and coining dies to produce up to maximum die block of 24" x 24"



## Commutators

As one of the world's largest manufacturers and rebuilders and the only domestic manufacturer of large commutators, we use fully extruded and drawn copper bars rather than milled bars for more precise tolerances and build commutators as large as 12' in diameter.

### Custom commutator production

- Built to existing model specifications with all-steel parts, V-ring, glass-band and shrink-ring designs
- Wire-banded assemblies, commutator bar packs, mica V-rings

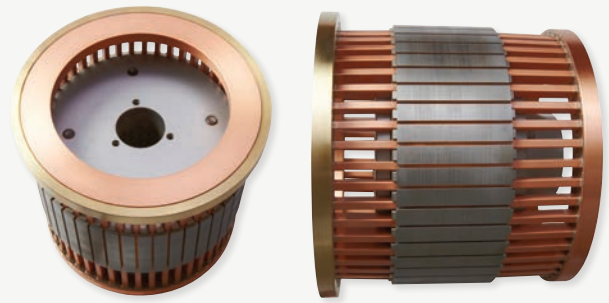
### Capabilities and processes

**Sizes** Up to 116" brush diameter, up to 144" radial diameter

**Types produced** V or arch bound, diaphragm, glass-banded (grooved and banded), shrink-ring (external and internal)

### Types supplied

- OEM: All new steel, copper, mica
- Refilled: Existing steel, new copper, mica
- Assembled: New copper, mica, machined and wire-banded ready for customer installation on steel components
- Reinsulated: Existing steel and copper with new mica (except for shrink-ring or glass-banded types)
- Spin seasoning: Up to 100" radial dia., speed to 10,000 rpm
- Heat curing: Electric ovens up to 14' dia., temps to 500° F
- Pressing: Hydraulic pressing up to 300 tons
- Profiling: Ensures stability
- Undercutting: Up to 124" brush dia., 24" bar length
- Mica ring fabrication: Sectional or finger type
- Brazing: Butt, lapp and insert-brazed risers
- Welding: Shell fabrication and repair certified to ASME codes and military standards
- Machining: Complete CNC metalworking capabilities
- Testing: Complete mechanical, electrical and metallurgical testing and certification equipment



## AC Rotors

Our high-quality AC rotors are manufactured on custom tooling and dedicated equipment. From the initial stacking operation for the core to the final dynamic balance operation, all processes are monitored as part of our ISO 9001:2008 quality system.

- Custom fixturing produces a built-up core of precise uniformity and trueness
- Induction brazing produces a far superior connection vs. torch brazing
- Non-contact temperature monitoring controls and adjusts brazing process for uniform temperature control around the ring
- High-quality braze joints provide exceptional electrical and mechanical performance

### AC motor components

#### Rotor bars

- From initial cast billet production through the extrusion and draw processes
- Cut to length per customer specifications
- Small-lot quantities reduce cost and speed turnaround

#### Retaining rings

- Made from a copper alloy known for high mechanical strength
- Stainless steel retaining rings manufactured per customer specifications

#### Copper end rings

- Many centrifugally cast in our in-house foundry
- Machined to precise dimensional tolerances
- Centrifugal casting process produces:
  - Alloys free from impurities, oxygen, porosity and inclusion
  - Refined grain structure exceeding static cast ring strength



## Alloys

The Electric Materials Company's specialty mill works with wrought copper alloys to produce highly engineered rods, bars and extrusions in an unlimited variety of shapes, sizes and lengths. Copper alloy, cold rolling, punching and other custom services are available. In-house tool design and manufacture ensure rapid service and quick design changes and increase product throughput, improve quality and reduce overall product costs.

- Component manufacture from billet production, extrusion and cold-working processes to finish machining and electroplating as required
- Metallurgical lab analyzes chemical composition for adherence to established standards
- Alloys checked at regular intervals by the in-house quality program

Specializing in both sand casting and permanent mold casting, our high-conductivity copper alloys and custom-blended alloys are available for a wide variety of electrical and mechanical applications.

- Excellent thermal and electrical conductivity
- High resistance to corrosion
- Excellent mechanical strength
- Small- and large-volume orders for parts weighing a few ounces to 600 lbs.

## A Rich History

*The Electric Materials Company was founded in 1915 by O.C. Hirtzel. In the early 1900s O.C. recognized the nation's trolley business was thriving, so with help from others, he raised \$100,000 to establish The Electric Materials Company in North East to manufacture street railway repair parts, trolley wheels, commutators and specialty high-grade copper, bronze and brass castings.*

*Since then, thousands of employees and multiple generations of families have been part of The Electric Materials Company team, manufacturing specialty copper products in what now is our 420,000-square-foot facility.*



## Legacy Products

### Copper and Brass Hammers

- Manufactured in a range of sizes and furnished with wooden (hickory) or fiberglass handles from .5 lb. to 16 lbs.

### Forged-Style S Soldering Coppers

- Style S type assures maximum metal density and heat retention by forging the head from drawn electrolytic copper rod (99.92% pure).
- Hatchet type is made in Style S only and in 3-, 4-, 6- and 8-lb. per-pair sizes; other custom configurations available.

### Electric Brand™ Trolley Wheels

- Trolley wheels are manufactured for long life and minimum wire wear. Custom designed to precise specifications, they are available in 11 types featuring V, U and special grooves, and brushed and plain bores.

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ISO 9001:2008 certified

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