MANUFACTURING CAPABILITIES

RF & MICROWAVE COMPONENTS, ELECTRON TUBES, VACUUM DEVICES

FROM CONCEPT TO RELEASE

Our in-house manufacturing and turnkey capabilities include design, development, sourcing, manufacturing and testing.

Richardson Electronics

POWER & MICROWAVE TECHNOLOGIES

RELLPOWER.COM

Richardson Electronics
POWER & MICROWAVE TECHNOLOGIES

RICHARDSON ELECTRONICS IN-HOUSE MANUFACTURING CAPABILITIES INCLUDE:

- Air-Wound Inductors & RF Coil Testing
- Brazing, Welding & Joining Operations
- Custom & Specialized Assembly
- In-House Machining/Tool and Die
- Plating, Chemical Processing & Finishing
- Electrical Testing/High-Power & High-Voltage Testing
- In-House Testing Capabilities & Services
- RF, Microwave and Vacuum Tube Products

FROM CONCEPT TO RELEASE

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To learn more about how we can help you design and build a custom solution to meet your specific requirements, contact a Richardson Electronics sales engineer.

Richardson Electronics (NASDAQ: RELL) is a leading global provider of engineered solutions, power grid and microwave tubes and related consumables; power conversion and RF and microwave components; high value displays and replacement parts for diagnostic imaging equipment; and customized display solutions.

Our manufacturing facilities produce a wide variety of RF and microwave components, as well as electron tubes and vacuum devices and high value diagnostic imaging components with capabilities that extend from concept to final release, including design, development, sourcing, manufacturing and testing.

We provide turnkey solutions to customers needing quick turnaround and rapid prototyping.

Richardson Electronics is ISO 9001:2008 certified and is committed to providing the highest level of service.

Our global engineering team enables us to provide engineering and technical support anywhere in the world.

240,000-square-foot Corporate Headquarters

RICHARDSON ELECTRONICS, LTD.

Wide Range of Manufactured Products

In order to meet our customers' stringent requirements, Richardson Electronics utilizes its unique manufacturing processes and equipment, technical expertise, and design-in support capabilities to manufacture and add value to a wide range of products, including:

- Capacitors
- Electromechanical devices
- Electron tubes and vacuum devices
- Electro-optics
- Fabricated products
  - Enclosures
  - Stampings
  - Formed
  - Finished
- High-energy transfer products
- High-voltage power supplies
- Inductors
- Laser consumables parts
- RF microwave power sources
- Magnetrons
- Microwave measurement devices
- Passive devices
- Power amplifiers
- Power semiconductors
- RF coils
- RF filters
- RF matches
- RF microwave oscillators
- RF shield cable assemblies
- RF splitters (distribution plates)
- SCR heatsink assemblies, interverters, converters
- Wave guides and wave guide components

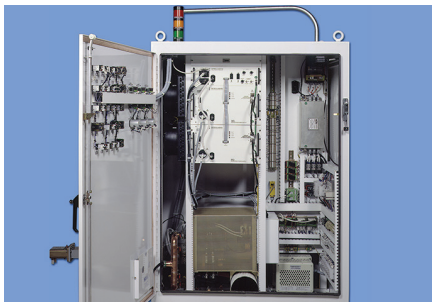
Our extensive in-house knowledge of materials, RF & microwave and high-voltage applications, combined with our outstanding quality control and customer-specific manufacturing capabilities, make us an ideal vendor-of-choice for many applications.

APPLICATIONS

- Broadcast transmission
- Dielectric heating
- High-energy transfer
- High-voltage switching
- Induction heating
- Laser cutting
- Linear accelerator
- Medical imaging
- RF microwave
- RF microwave amplification
- RF microwave processing/heating
- Plasma
- Power conversion
- Radar (commercial, avionics, marine)
- Radiation oncology
- Rectification

Extensive Knowledge of Materials, RF & Microwave and High-Voltage Applications

CUSTOM & SPECIALIZED ASSEMBLY SERVICES



Expertise in Processes, Products and Manufacturing

We build a wide variety of custom and specialized items to customer specifications, either with processes developed in-house or by following the customer's assembly instructions. All processes are documented and saved to facilitate repeatability and faster lead times. **We have the most flexible, highly trained and expertly qualified work force in the industry, with no compromise in quality control.**

Assembly
- PCB assembly
- Electromechanical
- Inspection/First articles
- Mechanical
- Chassis assembly, wiring
- Cable
- Kitting
- Prototype capability
- Industrial machines

Specialized Assembly & Testing
- HV electronics
- RF & Microwave matching, distribution
- Test and measurement

Contract Options (level of engineering support)
- Contract manufacturing
- Contract engineering
- Value-added engineering
- RELL product development

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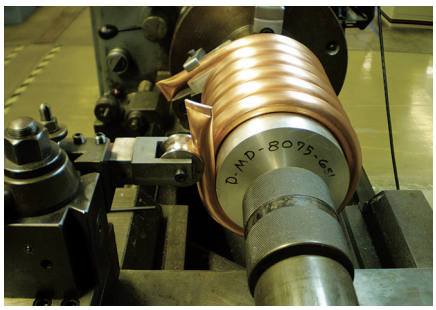
AIR-WOUND INDUCTORS & RF COIL TESTING



Custom Design and Manufacturing

Richardson Electronics offers custom, in-house testing capabilities for air-wound inductors and RF coils, including those we design and manufacture. Our in-house coil testing capabilities allow us to maintain strict quality control, resulting in repeatability, faster lead times and competitive pricing.

- **Electrical performance and characteristics**
- **Mechanical tolerance verification**
- **Plating**
- **SPC**

Typical applications for our coils include induction RF coils, pulse-forming networks, RF distribution networks, RF matches, and tuning.

Our in-house manufacturing facilities offer a variety of customized services and options for coil products.

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ELECTRICAL TESTING/HIGH-POWER & HIGH-VOLTAGE TESTING

Extensive High-voltage & High-power Expertise

Richardson Electronics can perform electrical tests on RF assemblies and components, microwave assemblies, electron/vacuum tubes, industrial power tubes, and CW magnetrons.

- **Inductor testing**
- **Microwave leakage**
- **RF leakage**
- **VSWR**

Richardson Electronics can also perform high-power/high-voltage testing on RF assemblies, vacuum tubes, capacitors, industrial power tubes, CW magnetrons and microwave heads.

- **AC and DC hipot testing**
- **Performance characteristics**
- **Power measurement**

Richardson Electronics has expertise in high-voltage assemblies, materials selection and manufacturing.

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Our manufacturing facilities are ISO 9001:2008 certified.

MANUFACTURING CAPABILITIES

RF & MICROWAVE COMPONENTS, ELECTRON TUBES, VACUUM DEVICES

In-House Machining/Tool and Die

Richardson Electronics has experienced Journeyman Tool and Die Makers working in our in-house machine shop/prototype department. We have the unique capability to take intricate machined parts from concept to finished product in a timely and affordable manner. Our machine shop personnel are highly trained in Geometric Dimensioning & Tolerancing (GD&T) and apply lean manufacturing concepts/principles to every project for fast turnaround for all high-mix and low-volume production runs.

We can also import customer designs (solid model, 2D CAD data) into MasterCam for machining, plus design and make quick-change tooling for reduced setup time and faster turaround. Our facility capabilities include machining, metal fabrication, painting, welding/soldering and plating.

Our Euromac MTX Flex 6 state-of-the-art metal punching machine allows for high productivity and part output, as well as full flexibility for smaller runs.

Machining and Metalworking (partial list)	CNC vertical machining centers (milling) CNC lathes (turning) Horizontal mills Qualified tool and die makers Non-ferrous NC cold saw Prototype-to-production management Metal forming and stamping Punch and hydraulic presses, lead forming, trimming of transistors Welding	
Materials (partial list)	Copper Brass Aluminum CRS	Stainless Molybdenum PTFE, plastics, polycarbonate
Fabrication Department	TimeSaver CNC 25-ton turret press CNC break press CNC shear	Down draft table/Finishing PEM-certer Custom software to flatten drawings Prototype capabilities

Mills

Okuma MK45-VAE
30" x 18" x 20" / 7500 RPM / 20 tool changer / 4th axis capable

Okuma V4010
40" x 18" x 20" / 12000 RPM / 20 tool changer

Haas VF4
50" x 20" x 20" / 7500 RPM / 20 tool changer / 4th axis capable

Haas Super VF4
50" x 20" x 20" / 12000 RPM / 24 tool changer / 4th axis capable

Haas Super Mini Mill
16" x 8" x 13" / 10000 RPM / 10 tool changer

Lathes

Hardinge
1.625" max through spindle / Bar feeder

Okuma Genos L300M
2.500" max through spindle / Dual spindle / Live tooling / X, Y, Z, C axis capable / Bar feeder

Okuma Captain L370M
2.500" max through spindle / Live tooling / X, Z, C axis capable / Bar feeder

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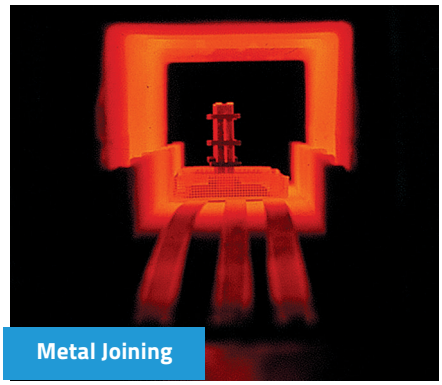
Unique Manufacturing Processes and Equipment

BRAZING, WELDING & JOINING OPERATIONS



Metal Joining

Brazing	Soldering, Bonding and Epoxy	Additional Capabilities
Dip brazing, aluminum	Bonded fin heatsinks	Glass-to-glass sealing
Furnace brazing	Soldering of electronic assemblies	Glass-to-metal sealing
Hydrogen atmosphere	Solder dipping	Glassblowing
Inert atmosphere		Metal-to-ceramic sealing
Torch brazing		Metal-to-ceramic brazing
Vacuum brazing		Metal seal welding
		Vacuum processing

Richardson Electronics is a Certified Member of IPC.

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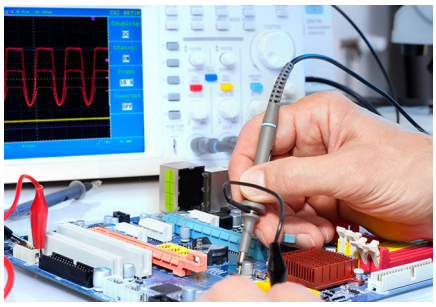
IN-HOUSE TESTING CAPABILITIES & SERVICES



Full Range of Specialized In-house Testing

To meet the stringent and unique requirements of each customer, Richardson Electronics provides a variety of tests designed to your exact specifications, including:

- Frequency
- Forward and reflected power
- Harmonics, load tuning
- High-power/High-voltage testing
- Impedance and attenuation/Coupling measurements
- Network analyzer testing
- Peak and average power
- Performance verification
- RF and microwave leakage testing
- RF and microwave power verification
- Rise time/Fall time
- Power measurement
- Pressure and leak testing
- Vector network analysis of RF and microwave components from 100 KHz to 9 GHz
- Xray film testing for plating verification
- Performance characteristics
- Power measurement

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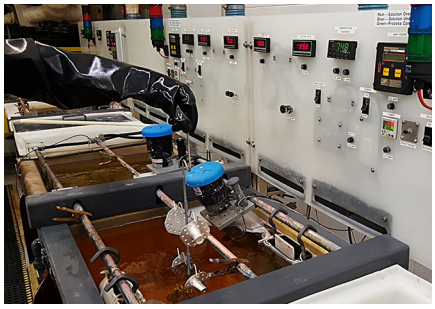
PLATING, CHEMICAL PROCESSING & FINISHING



In-house Custom Finishing

Our own in-house custom finishing operations complement the manufacturing processes, resulting in better process control and shorter delivery times.

- Silver plating for RF conduction
- Nickel electroplating
- Tin plating
- Plating on aluminum
- Chromate conversion of aluminum (Equivalent to CHEMFILM®, IRIDITE® and Alodine®)
  - Yellow
  - Clear (RoHS-compliant coating)
- Xray film verification for plating
- Electro-polishing of stainless steel
- Painting
- Custom cleaning (cold solvent cleaning, drying, packaging)

Richardson Electronics offers a wide array of custom finishing capabilities.

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Richardson Electronics is dedicated to providing products and services of the highest quality. Our manufacturing facilities are ISO 9001:2008 certified and we maintain our own Corporate Quality Management System.

Ready to learn more or need a custom product? Contact the Richardson Electronics Manufacturing Team at edg@rell.com.

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