MINCO

Voyager II, shown in this NASA photo, launched in 1977 with Minco heaters aboard.

Company Overview

MINCO

Building Ultra-Reliable Components Since 1956

For over 60 years, Minco Products has been designing and manufacturing advanced products for some of the world's most demanding applications. We offer a variety of temperature sensing and control solutions, thermal heating solutions, and flex circuits–as well as integrated products that combine all of our areas of expertise into one cost-efficient solution.

Superior Design Solutions

Minco works diligently to provide the best heating, flex, temperature sensing, and instrumentation solutions for your application. We have hundreds of off-the-shelf solutions to meet your immediate requirements, and have designed thousands of custom packages to seamlessly operate in a wide range of applications.

Minco builds from start to finish, with all stages from design to prototyping to manufacturing handled in-house, ensuring exceptional product quality. As a company, we strive for cost-effective solutions through efficient design and easy installation. This allows you to save time and money without sacrificing accuracy and reliability.

In addition to our design and manufacturing expertise, we strive to push our technological capabilities by studying new techniques, materials, and ideas. Minco's engineers test out new procedures, evaluate the latest tools, and author white papers exploring a variety of topics related to our areas of expertise.

Minco Today: Global and Growing

Minco's engineering and manufacturing facilities employ over 600 people worldwide. More than 300,000 ft^2 (27,900 m^2) of manufacturing space provides the capability and infrastructure to support a variety of applications for global customers in diverse markets.

Our seamless operational capabilities allow us to design and manufacture integrated components from prototype to production, which simplifies the supply chain and improves our response time.

Minco Fast Facts

Founded: 1956

Organization: Privately held

Headquarters: Minneapolis, Minnesota, USA

Worldwide employees: 600+

Revenue: $100M/Year

President and CEO: Dana Schurr

Offering: Heaters, flex circuits, sensors and instruments, integrated products, assembly

Customers and markets: Medical diagnostics, aerospace, defense, semiconductor, power generation, oil and gas, rotating machinery, medical impants, building automation, industrial and commercial

Major Certifications: AS9100 (registrar: TÜV), CENELEC, CSA, DIN 43760, IECEx, NADCAP, UL

1956 ▶Thermal Ribbons **1959▶Stator Winding Detectors** **1961▶Thermofoil Heaters**

Industries We Serve

For more over 60 years, Minco has been designing and manufacturing advanced products for some of the world's most demanding applications. Our customers come from a variety of industries from around the world, each with a unique set of needs and expectations. We stand behind our products with a dedication to quality, reliability and performance.

Aerospace
Minco custom designs highly exact components to maintain accurate performance for aerospace industry customers' satellite and commercial aircraft applications.

Defense
Minco helps defense industry customers improve military missions with smart component designs that offer rugged, secure reliability and that save space and weight.

Industrial & Commercial
Minco has been a leader in many industrial and commercial applications ranging from high voltage induction motors to forced air HVAC systems.

Medical
From In Vivo and In Vitro diagnostic devices (IVDs) to surgical applications – Minco is a Tier I supplier providing flexible circuit, thermal, sensing, and control solutions for the Fortune 100 top Medical OEM's globally for over 60 years. Our solutions prove themselves when accuracy, repeatability, reliability and compact size are vital.

Oil and Gas
Drilling equipment experience high pressures and rugged environments. Measuring temperature can save equipment from major damage and prevent costly down-time for repair.

Power Gen
Motors, generators, pumps, compressors, and gearboxes experience rigorous conditions when used in some of the world's most demanding environments.

Process Control
Optimizing process yield is critical to increasing capacity and reducing costs, and the right thermal solution can be critical to process yield.

Semicon
Minco is an expert in thermal simulation and designing components for the semiconductor industry. Integrated, reliable and uniform heating and cooling are critical factors in both front and back end processing. Our flexible heater technology and expertise helps you achieve your thermal goals as the industry requires more precise thermal control in a cost effective and space efficient package size.

Telecom
Minco custom designs heaters for telecom industry, from cabinets, enclosure heating to fusion splicer heating needs. Minco knows the business and challenges and is committed to developing new technologies to meet your heating requirements while lowering energy consumption.

Transportation
Railway transportation is picking up speed around the world, especially in the way of high speed passenger rail. Increasing expectations for reliability and safety place a high standard of performance and reliability for these vehicles and their instruments.

Minco's Product Areas: Heaters, Sensors, Instruments, and Flex Circuits

Minco's long history and vast institutional knowledge makes for a wide range of capabilities, and the company brings its unique engineering knowledge and manufacturing experience to each of these areas. We work closely with customers to meet the most demanding challenges, both quickly and cost-effectively. Minco focuses its expertise on three product areas:

Core Certifications

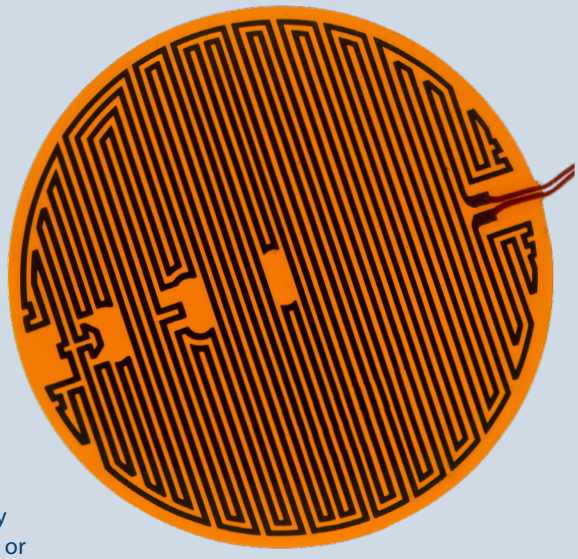
Minco's Quality Management System complies with a variety of market-specific standards. Minco's experience in each of our market areas enables us to understand their unique quality requirements and what it takes to meet them. We work closely with national and international standards bureaus to develop manufacturing and quality assurance procedures

Our Quality Management System has been audited and certified compliant with these internationally recognized standards. In addition, individual products also possess a variety of product-level certifications and accreditations. To view all certifications that Minco carries, please visit our list on Minco.com.

Minco's core quality certifications are noted below:

AS9100/EN9100: 2016
ISO 9001:2015
Nadcap: Electronics AC7119 and AC7119/2
ITAR

Thermal Solutions



Minco's strength is working with our OEM customers to develop innovative integrated solutions that solve thermal management challenges. Our success has been exhibited across a wide range of industries such as medical, aerospace, defense, semiconductor, telecommunication and analytical instrumentation. Our diverse product portfolio in the conductive heating space provides solutions in areas where customers desire to stabilize an environment, thermal cycle quickly for improved product throughput, or heat a fluid to enable an accurate and consistent reaction.

Our heaters include Polyimide ThermoFoil™, All-Polyimide, Mica, and Silicone Rubber, as well as our Thermal-Clear transparent heaters and SmartHeat SLT™, a unique heater that requires no sensor or controller to maintain its setpoint.

We offer both standard and custom versions of our heaters. In the latter case we can tailor the resulting component to fit perfectly into your system, including profiling the elements to deliver more or less heat to a given part of the assembly.

- Integrated heating, cooling, sensing, interconnect, control and packaging
- Direct collaboration with experienced thermal engineering team
- Design, simulation, testing and comprehensive project and supplier management
- Broad assembly capabilities for integrated plug-and-play solutions
- Profiled and distributed wattage output
- Thin flexible materials/substrates
- Proprietary factory mounting techniques
- Factory bonding of heaters to heat sinks to ensure fast heat transfer and high reliability
- Distributed watt density from zone-to-zone provides optimal surface temperature uniformity to ensure consistency from lot-to-lot or test-to-test performance
- Integrated temperature sensors prevents over-shooting control temperature to provide reliable results and efficient use of power budgets
- Superior edge to edge uniformity on your processing surface (±1°C)

1982▶Flex-Coils **1984▶Mica Heaters** **1988▶Thermal-Clear Heaters**

Temperature Sensing and Control Solutions

Minco works diligently to provide the best temperature sensing solutions available today. We build sensors from start to finish with a focus on exceptional product quality. Whether you need a custom designed sensing package or an off-the-shelf option, Minco has sensors for your application. Over the years, we have designed thousands of custom sensing packages to seamlessly operate in a wide range of applications.

Minco sensors can be found in applications in a variety of industries including medical, aerospace, power generation, rotating machinery, oil & gas, semiconductor, industrial and commercial. We have earned a reputation for having the highest quality temperature sensors and sensors built to withstand hazardous environments.

Most temperature sensor types can be made with thermocouples, thermistors, integrated circuits or resistance temperature detectors (RTDs), including PT100 and PT1000 platinum elements.

We also offer humidity detector assemblies for wall/duct, space, and outside air in a variety of configurations. In addition to being reliable and accurate, they are temperature compensated and designed to increase safety, reduce energy and improve performance.

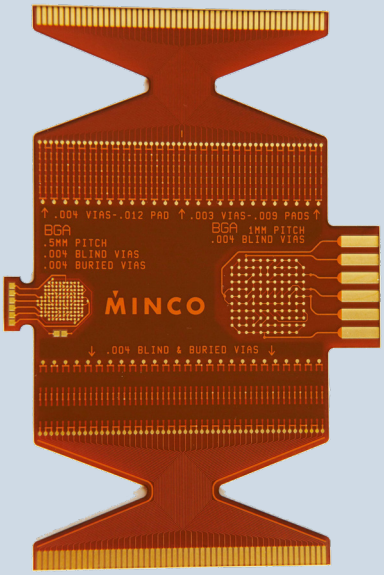
Finally, Minco offers standard and fully integrated custom control, indication, monitor and signal transmittal applications that offer a wide range of features to meet your needs. Our focus is on controllers you can trust to be accurate and reliable.

Flex Solutions

As markets trend toward miniaturization, customers rely on Minco's broad Flexible Printed Circuit design capabilities when flexibility is required for tight, small spaces. Our flex circuits offer the same advantages of Printed Circuit Board (PCB) including repeatability, reliability and high density but with the added twist of flexibility and vibration resistance.

Minco Flex circuits represent an advanced approach to total electronics packaging. They occupy a niche between ordinary printed circuit boards and round wire, and take on many of the uses and benefits of each. In essence, flex circuits give you unlimited freedom of packaging geometry while retaining the precision density and repeatability of printed circuits.

Flex circuits simpify assembly because they fit in only one way. Manufacturing time and error rates are reduced as compared with traditional wiring bundles. Total installed costs are lower, especially with volume poduction.



Under vibration and/or high acceleration, a flex circuit's ductility and low mass will reduce the impact upon itself and solder joints. By contrast, a PCB's higher vibrational mass will increase stresses upon itself, components and solder joints.

Development Support

For over 60 years Minco has provided components for advanced medical, aerospace, defense and other demanding applications. We deliver comprehensive solutions, partnering with you at every step of your product cycle. We'll work with you to understand your product vision, requirements and timeline. To ensure you meet your goals we encourage you to utilize Minco's expertise as an extension of your engineering team and enjoy defect free product deliveries from first build through production.

- Knowledgeable engineering staff with extensive experience
- Understanding of the human life dependent demands in the medical, aerospace and defense markets
- Initial upfront design and manufacturability analysis performed at the quote stage (DRC/ DFM)
- Robust NPI process to ensure every customer receives the best possible experience. Learn more about Minco's proprietary NPI process on the next page
- Forward-thinking supply chain management ensures long-running projects receive expected support
- Engineer-to-Engineer (E2E) collaboration is encouraged, identifying risks and improvements early on in the design phase
- Complete suite of simulation and analysis tools
- Wide selection of materials, connectors, and termination methods
- Integration of sensors, heaters, and flex circuits
- Broad assembly capabilities including factories in the U.S., Europe, and China
- Comprehensive, proactive design and process risk analysis to ensure robustness (DFMEA/PFMEA) and minimize delays
- Production quality parts at the prototype stage
- Quick turn options at every stage in the product cycle

Minco's New Product Introduction Process

Minco has made a name for itself producing quality sensors, instruments, heaters, and flex circuits. We've had the opportunity to build components for countless companies over the years, and we've earned their trust not only because of the quality of the components we manufacture, but also our robust and thoughtful New Product Introduction (NPI) process.

We follow these steps during the NPI:

Discovery

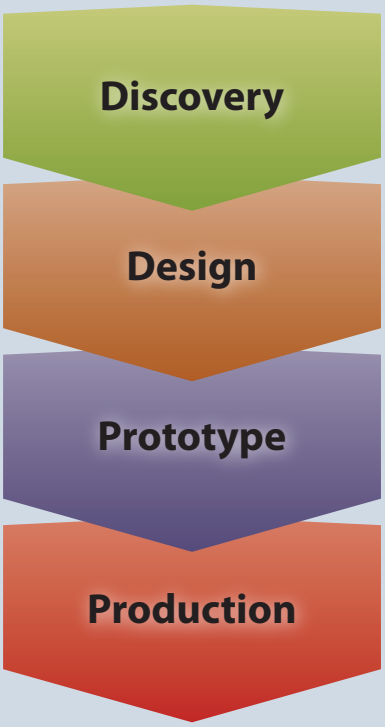
The first phase involves collaboration between Minco and our customers to gain an understanding of the application requirements and the challenges our customers face. This may include review of a quote package, or even an Engineer-to-Engineer (E2E) conference call or site visit. Minco engineering prepares a Customer Requirements Document (CRD) that establishes the parameters of the project. We also conduct a thorough documentation review, studying your specifications, Bill of Materials (BOM), and other requirements. The last step of the Discovery phase involves a thorough risk assment to identify all possible technical and logistical hurdles.

Design

The Design phase consists of several steps that guide the project toward successful production. We conduct a Supply Chain Analysis, a Design For Manufacturability analysis, material/process testing, and a regulatory compliance review. One of the most important steps involves the creation of manufacturing documents–Minco operating procedures call for revision-controlled specification drawings, manufacturing instructions, and acceptance test requirements. The final step is a comprehensive review of all specifications, drawings, processes, and other criteria relating to the design.

Prototype

We begin making the prototypes that will help fine-tune our manufacturing procedures. We develop laser and drill/route programs, die lines, PCB gerbers, and assembly/test fixtures that not only help Minco create the prototypes but will ultimately be used as part of routine production of the part. We manufacture the actual prototype, utilizing the same procedures and facilities that we'll employ during production. All prototypes receive a thorough acceptance test inspection including verification of any customer requirements. In addition, Minco has a suite of simulation programs available to help solve thermal and electrical challenges.



Production

Manufacturing begins in earnest with a first run, during which production operators will complete the first build using final manufacturing processes and equipment. The finished parts receive a thorough inspection according to Minco's quality procedures, which may include dielectric strength to verify electrical insulation or resistance measurement to verify accuracy. As the assembly challenges are sussed out, Minco identifies any final refinements appropriate for the assembly instructions and procedures. Once this step is complete, production of the part is officially launched. During the production run, Minco actively manages the supply chain to address demand fluctuations, cost targets, and part obsolescence.

Contact Minco today to learn how we can make your next New Product Introduction a success.

Let's Work Together Engineer-to-Engineer

Minco has developed a streamlined approach to project development that empowers our engineers to work directly with customer engineers without the need for multuiple layers of sales and management to be involved. We call this philosophy Engineer-to-Engineer, or E2E.

E2E offers numerous advantages to both Minco and the customer. Concept proposals and prototypes are turned around faster as engineers can focus on results, not process. At the same time, Minco engineers use good communication and classical project management templates to ensure all other roles are informed of progress, decisions, and action items.

Another advantage of E2E is that it allows customers to rely on Minco's vast institutional knowledge to make improvements to the design. If involved early on, our engineers are able to suggest alternative components and technologies to save money, ameliorate supply chain challenges, and improve manufacturability.

Let's Talk E2E
Engineer to Engineer

Contact Minco today to start working E2E with our engineers and find out how this strategy can save you time and money.

Integrated Solutions: Lower Costs and Improve Manufacturability

Over its sixty years of operation, Minco Products has come to master a diverse–but related–set of competencies. Our Temperature Sensing and Control Solutions team makes sensors and transmitters. Our Thermal Solutions group builds heaters, and Flex makes circuits. Minco's business units combine to create cost-effective, easier-to-install assemblies we call Integrated Solutions.

Many challenges brought to us require advanced expertise that spans all of Minco's engineering disciplines. Critical systems like avionics, satellites, and medical imaging devices–the purpose of which is too important to be allowed to fail–all benefit from Minco's broad array of specialties. Our application solutions are reliable, innovative, practical, and often include the integration of thermal, flexible printed circuit boards, as well as sensor and instrument design, into a single package.

Starting Simple

In many cases, customers begin by asking Minco to design a single heater or sensor assembly and we are called upon to supply engineering expertise to help complete the project. For instance, an environment may need to remain thermally stable, so they call in Minco Thermal Solutions engineers to assist.

When Minco Engineers familiarize themselves with a project they can make cost-saving suggestions. One example might be the wires or flex leads connecting the heater to other components in the enclosure. Old-fashioned wiring bundles pose installation difficulties due to their bulk and the possibility of miswiring the rig. By combining the various wires into a flat package and adding connector plugs, wiring challenges are eliminated–it's impossible to connect the plugs the wrong way.

The next step after creating the circuit involves adding components and electronic packages. We have the capability to build in through-hole and surface-mount pads, stiffeners for component assembly, and heaters to maintain temperature in certain parts of the enclosure. We can even install induction coils for communication telemetry. Our unsurpassed capabilities allow us to integrate any combination of our high-quality flex circuits, heaters, sensors, and control electronics.

The most appealing feature of Minco's Integrated Solutions might be their ability to simplify assembly. Minco offers a wide array of built-in connectors–including High Density Interconnects–making miswiring nearly impossible. In addition to streamlining the assembly process, Minco's integrated components simplify the supply chain, enabling our customers to get to market faster and reduce their direct costs. Put simply, Minco's high reliability Integrated Solutions reduce time-to-market and assembly costs for our customers.

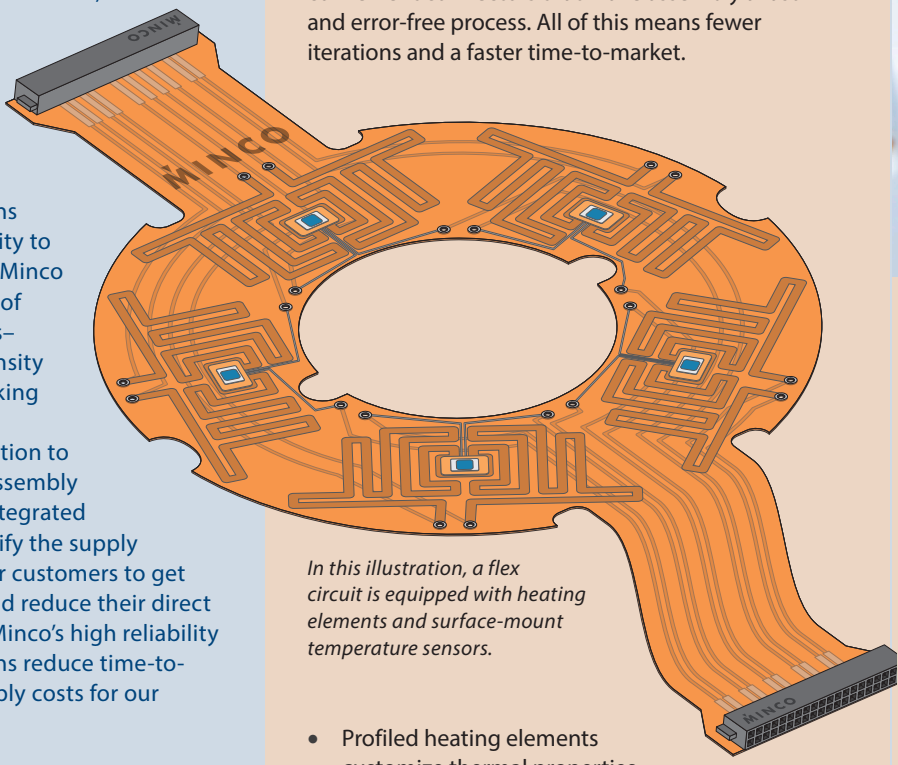
Involve Minco Early

While we often arrive late in a project, it benefits our customers to involve Minco in the beginning of the design phase. Most of the cost savings from Integrated Solutions involve designing the circuit early in the process. If we've entered the picture long after all the design decisions have been made, it's harder for us to find synergies and efficiencies.

Greater space efficiency and lower costs make Integrated Solutions a winner in most projects. Contact Minco to learn how our diverse capabilities can be put to work for you.

Example of an Integrated Component

In the illustrated example below, Minco was able to combine our Thermofoil heaters with platinum RTDs, all on a two-layer flex circuit equipped with convenient connectors that make assembly a fast and error-free process. All of this means fewer iterations and a faster time-to-market.



In this illustration, a flex circuit is equipped with heating elements and surface-mount temperature sensors.

- Profiled heating elements customize thermal properties for each part of the assembly
- Sensors and other sturface-mount components can be embedded on either side of a stiffener-equipped Flex or Rigid-Flex circuit.
- Distributed watt density from zone-to-zone provides optimal surface temperature uniformity to ensure consistency from lot-to-lot or test-to-test performance
- Minco offers a wide array of connectors to ensure that the integrated component can be installed without the chance for wiring errors and other installation problems that can affect manufacturability and time to market. Contact Minco to learn more.

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