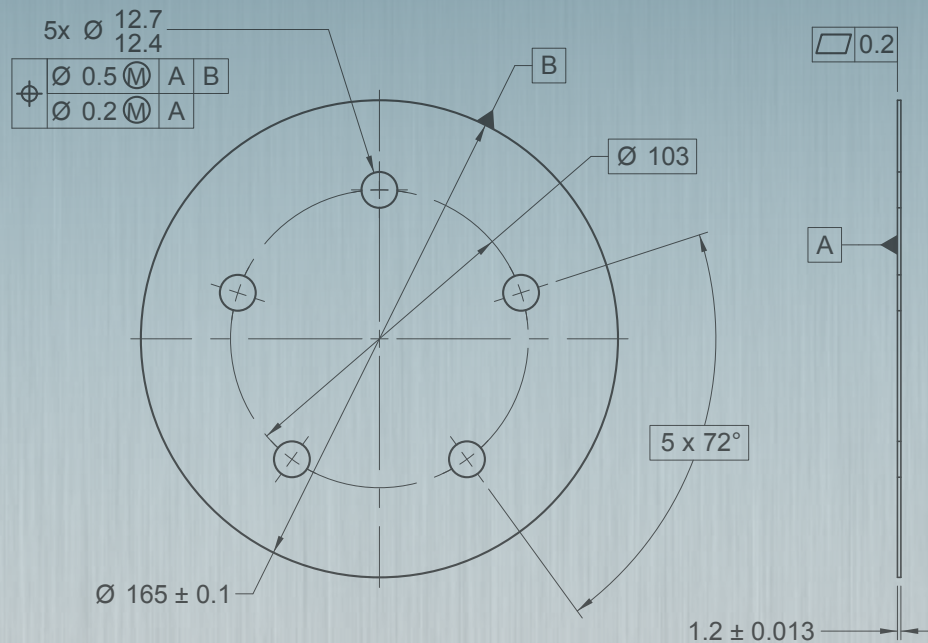


SPIROL[®]

PRECISION SHIMS





THE SPIROL CONCEPT

WE ARE THE SHORT-RUN SPECIALISTS!

Our objective is to provide our customers with the highest quality, short run Shims — delivered on time at the lowest price. To achieve this, we offer the following:

- We maintain state-of-the-art production technology with an aim of eliminating costly tooling while improving product quality and dimensional consistency.
- We use our expansive internal secondary process capabilities focused on shortening lead times, reducing costs and gaining internal control over total quality.
- We have standardized tooling, materials and processes to lower costs and improve response time.
- We have a total commitment to quality — to consistently anticipate and exceed our customers' needs and expectations at the lowest cost. This commitment is supported by a company-wide continuous improvement process.
- Our emphasis is to perform as many functions as possible in-house to reduce external transaction costs, to control quality, to shorten lead time and to pass these benefits on to our customers in the form of lower prices and improved performance.
- We have achieved a variety of third party quality certifications that demonstrate the proficiency of our systems to exceed market expectations.

CUSTOMER SATISFACTION IS OUR PRIMARY DRIVING FORCE.

Our differentiation is excelling at:

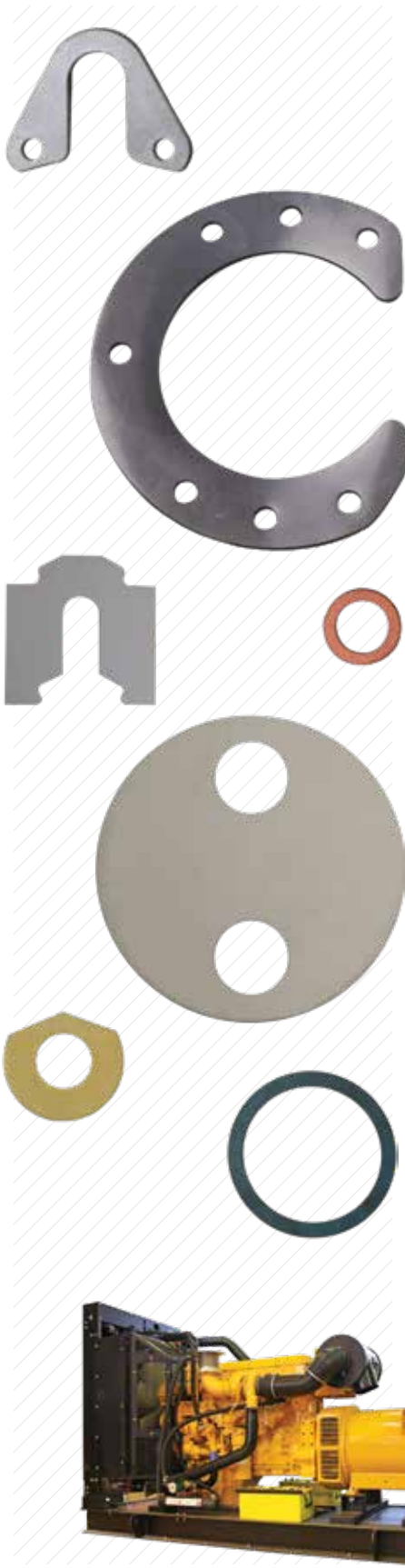
- Thin Shims produced with little or no tool cost.
- Stocking a wide variety of materials and thicknesses for rapid response.
- Heat treated and close toleranced parts.
- Quality certifications and documentation that meet the most critical customer requirements.
- Delivery performance that exceeds our customers' expectations.
- Technical know-how in the design and application of the products we produce.

SPIROL Application Engineering at Work

INDUSTRIAL EQUIPMENT

SPIROL supplies **Precision Shims** and **Thrust Washers** to the leading Industrial Equipment manufacturers. Our products are used for prototyping and full production in a variety of industrial applications including production machinery, pulp & paper, oil & gas and material handling equipment.

SPIROL provides options to increase flexibility for design and manufacturing engineers. From technical support to specialty products such as **Edge Bonded Shims** and other kitting options, we help take cost and complexity out of your assemblies.



SPIROL's Precision Shim product line includes: **Specialty Shims, Thrust Washers, Laminated and Edge-Bonded Shims** in configurations ranging from simple OD/ID shapes to complex geometries. Products are custom-made to customer specifications from a comprehensive inventory of raw materials in thicknesses from .001" (0.02mm) to .750" (19mm).

Manufacturing processes and value-added services are performed in-house under the direct influence of SPIROL's quality system registered to ISO 9001, AS 9100 and IATF 16949 as well as the Nadcap accreditation for passivation and laser beam machining (LBM) and cutting. We can provide product — including prototypes — in quantities ranging from one piece to thousands. We also have qualified subcontractors for special requirements outside our capability.

PRIMARY OPERATIONS

- Manual and automatic conventional stamping
- SWAT™ (Stamping Without a Tool) — a proprietary stamping process
- Large format fiber lasers
- State-of-the-art high speed machining centers

SECONDARY OPERATIONS

- Heat treating
- Machining
- Grinding
- Lapping
- Micro polishing/deburring
- Edge bonding
- Part marking
- Specialty packaging

TOOLING

- Standard tooling manufactured with CNC precision

MATERIALS

- Global industry standard shim, sheet and coil stock, laminated materials and specialty metals in both inch and metric gauges

FINISHES

- Passivation
- Black oxide
- Other finishes available upon request
- Zinc plate
- Anodized
- Cadmium plate
- Color coated

SERVICE

- 24-hour quote turnaround
- EDI communications
- PPAPs and FAIRs
- APQP (process flow, control plan, FEMA)
- SPC data
- Real-time order tracking
- Special packaging and labeling
- Speed shop
- Blanket orders with stocking programs

SPIROL Application Engineering at Work

AEROSPACE

SPIROL manufactures **Precision Shims** from laminated and solid material to the most demanding specifications in the Aerospace industry. Our **Aerospace Shim** products are literally used from the nose to the tail of the plane, in landing gear and everywhere in between. We custom manufacture **Shims** specifically for use in aircraft component assemblies meeting exacting commercial, military and aerospace standards to provide reliable performance in harsh environments.



Our strength is cost-effective production of short run stampings. We can deliver product in thicknesses from .001" (0.02mm) up to .750" (19mm) with quantities ranging from one piece to thousands. To meet our customer needs of process control, minimal tool investment, long-term part repeatability, prototypes, and low unit cost, we utilize a variety of stamping methods.

OPERATIONAL PROCESSES

This method employs the use of standard tools, jigs, fixtures and technical skills to produce low-volume product where each feature of the part is manufactured using a separate process. It is an excellent way to manufacture special parts with minimal or no tool cost.

COMPOUND TOOLING

For products with an extended life expectancy, we recommend one-hit compound tooling. This guarantees dimensional repeatability over the life of the product and offers the lowest unit cost of all tooling methods.

OD/ID COMBO

Over the years, **SPIROL** has accumulated thousands of OD/ID combination tools. We can produce a variety of precision OD/ID parts without a tool charge from one piece to thousands.

SWAT™ — STAMPING WITHOUT A TOOL

We stamp thin metal parts, statistically capable, with one-hit and no burr. This proprietary stamping method can be used on parts less than .010" (0.25mm) thick. It is ideal for dimensional repeatability and low-volume production without the need to invest in tooling.

TOOLING — DESIGN AND PRODUCTION

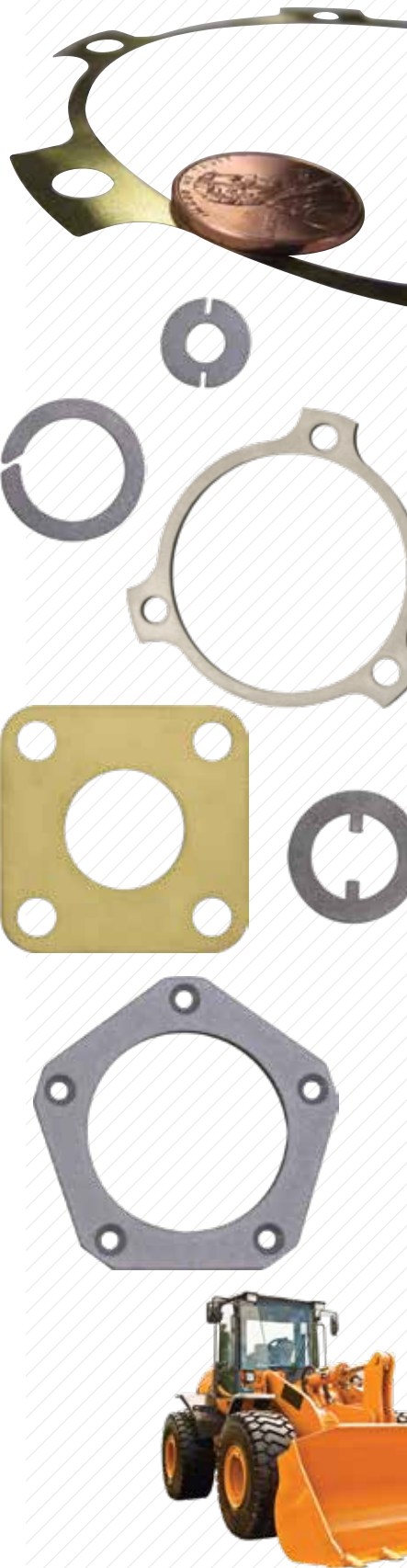
SPIROL's die shop produces quality tools utilizing the latest CNC and EDM production technology. We design around a standard module concept to reduce costs and shorten lead times. All components are qualified on state-of-the-art inspection equipment, and we statistically monitor tool wear to guarantee finished product dimensions. We only manufacture tools for internal use so our customers receive top priority.

SPIROL Application Engineering at Work

AGRICULTURE/HEAVY EQUIPMENT

As a trusted supplier to some of the largest Agriculture & Heavy Equipment OEMs in the world, SPIROL manufactures **Precision Shims**, **Edge Bonded Shims** and **Shim Sets** to meet the strenuous demands of equipment used in agricultural and farming, construction, mining and transportation equipment. Our products are used to support prototype, production and after-market requirements.

SPIROL's years of experience, combined with our wide range of production technologies improve ease of assembly, increase reliability and lower overall costs.





SPIROL's machining capabilities offer production methods that eliminate tool cost while improving product quality and consistency. We produce low-volume machined components complete, or we combine stamping and machining operations to reduce total product cost and deliver precision tolerances. We can provide product in thicknesses of .001" (0.02mm) and up on quantities from one piece to hundreds of thousands.

CNC LASER TECHNOLOGY

Laser cutting technology is ideal for complex configured parts, large geometries, short runs and prototypes. We use CAD/CAM systems and can accept a wide variety of industry standard drawing formats. Setup time is minimal and there are no tooling charges. CNC controls ensure precise accuracy throughout the entire lot.

CNC HIGH SPEED PROFILE CUTTING

With cutting speeds up to 40,000 RPM, this process produces precision parts with improved product quality for both solid and laminated parts. Costs are minimized as there is no tool charge.

CONVENTIONAL MACHINING: LATHES & MILLING MACHINES

Using conventional machining technology, such as lathes and milling machines (both manual and CNC controlled), SPIROL can bore and turn Shims to achieve tight linear tolerances, radiused or chamfered edges, and can countersink and counterbore holes.



- **Precision Tolerances:** For parts that have precision OD or ID tolerances, SPIROL can turn/bore material as thin as .002" (0.05mm) with diameters ranging from Ø.500" (Ø12mm) to Ø18" (Ø450mm). We can machine annealed, hardened or laminated materials to achieve tight tolerances.
- **Chamfer:** Our flexible technology enables us to chamfer the OD and ID of parts as thin as .060" (1.5mm) at an angle from 10° degrees up to 45° with diameters ranging from Ø.500" (Ø12mm) to Ø18" (Ø450mm). We can chamfer annealed and hardened materials.
- **Countersink/Counterbore:** We can countersink or counterbore holes up to Ø2" (Ø50mm) in parts as thin as .030" (0.75mm). We can countersink and counterbore annealed, hardened or laminated materials.

SPIROL Application Engineering at Work

GOVERNMENT/DEFENSE

SPIROL has a rich history of manufacturing **Precision Shims** for the most prominent names in the Arms and Defense industries. You'll find our products in tanks, troop carriers, artillery, missiles, military aircraft/UAVs, submarines and surface vessels. When it comes to government requirements, SPIROL can provide the solutions from prototypes to packaging.

SPIROL is 1 of only 66 suppliers in the United States, and 1 of only 106 suppliers in the world Nadcap accredited for Laser Beam Machining (LBM) and Cutting.





SPIROL controls quality, lead time and cost by performing secondary operations in-house. We have modern process controls and monitoring on our equipment, and a wide variety of testing services. Our in-house secondary operations include:

HEAT TREATING

Our statistically capable internal heat treating process delivers through hardened and case hardened product with precision accuracy and minimal warpage.

GRINDING & LAPPING

For precision thickness, parallelism and flatness requirements, we employ several grinding techniques. This eliminates the need to purchase expensive small lots of material and shortens lead time.

HIGH SPEED POLISHING

Using the latest vibratory and tumbling technology, we can micropolish surfaces to an 8 µin (0.2 µm) finish at the lowest cost.

DEBURRING TECHNOLOGY

Our capabilities include vibratory, rotary, and tumble deburring with a finishing process that encompasses the application of rust preventative while accommodating special handling for delicate parts. All SPIROL products are burr-free.

FINISHING

We are aerospace/military (Nadcap) accredited to passivate in-house and have qualified vendors located close to our facility for custom finishing services.

PRODUCT IDENTIFICATION

We offer many part-identification methods (*permanent and temporary*) including:

- Bar code labeling
- Bag and tag
- Rubber and metal stamp
- Inkjet part marking
- Electrochemical etching
- Special packaging

PACKAGING

SPIROL can securely package Shims to prevent the parts from moving during the shipping process. This preserves the dimensional stability of tightly toleranced parts and micropolished finishes, and protects plated surfaces.

- **Coin Wrap:** Consists of stacking a number of round Shims, and securely wrapping them in a rolled package (*like a stack of coins*).
- **Skin Pack or Vacuum Pack:** Consists of placing a single Shim or multiple Shims on a cardboard backing, then affixing them through vacuum sealing.

KIT PACKAGING OPTIONS

SPIROL has multiple kitting options available to make it easier and more efficient for your operator at the point of assembly.

- **Edge Bonded Shims:** Multiple thicknesses of a Shim are stacked and lightly bonded on the exterior to provide an easy-to-separate Shim Set. This provides you with multiple thicknesses of a Shim without requiring multiple SKUs and inventory locations. The stack of peeled-off Shims can be saved for use at a later date. You can specify the thicknesses, quantities and the order of assembly with this option.
- **Shim Sets:** Similar to Edge Bonded Shims, except rather than being physically bonded together, the Shims are tied together. The operator simply unties the Shim Set, separates the layers and installs the required thickness into the assembly.





SERVICE



WORLD CLASS CUSTOMER SERVICE

We will be an active participant of your team starting in the design stage – through the qualification stage – until the product is launched successfully to ensure that your quality, performance and assembly objectives are completely satisfied!

FAST QUOTATIONS

Our quotation process is entirely focused on meeting your expectations. Our goal is to respond to your inquiry within 24 hours.

COMPETITIVE PRICES

SPIROL supplies high quality product and excellent service at a competitive price. Given the flexible manufacturing options that we have, our team will work with you to determine the most cost-effective method of producing your Shims based on current and future volume requirements.

SPEED SHOP

We have processes and resources in place to provide expedited delivery to get you product when you need it.

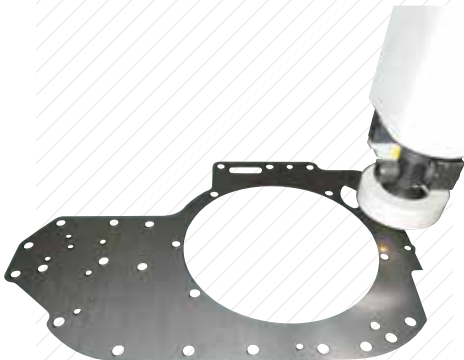
VIDEO CMM

Utilizing state-of-the-art production equipment requires precise inspection devices. Our Video CMM accepts DXF and IGES drawing files and inspects to accuracies better than .0003" (0.008mm).



QUALITY

SPIROL maintains complete quality control over the entire production process — from custom design through secondary finishing operations. Our quality control systems and procedures have been approved by the leading aerospace, agricultural/ heavy equipment, automotive powertrain, government/defense and industrial equipment manufacturers. We control every step of the process from stamping & machining to finishing, including special marking and packaging. With strategically located modern plants, we can fulfill virtually any simple or complex design requirement in small, medium and large volumes. Our total in-house capabilities and comprehensive control get you the products you need, when you need them, at the most competitive price.



Demonstrating our commitment to quality, SPIROL has acquired the following certifications:

- IATF 16949
- ISO 9001
- AS 9100
- Nadcap Chemical Processing - AS7108
- Nadcap Laser Beam Machining - AC7116

SPIROL's standard raw materials used to manufacture **Shims** meet the requirements of Directive 2011/65/EC Restriction of Hazardous Substances (RoHS), Directive 2000/53/EC End-of-Life Vehicles (ELV), and (EC 1907/2006) Registration, Evaluation, Authorization and Restriction of Chemical substances (REACH).

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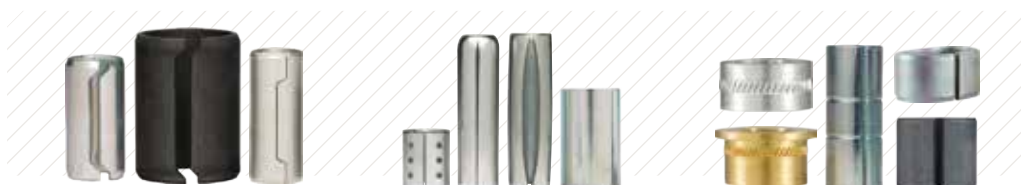
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Coiled Spring Pins

Slotted Spring Pins

Solid Pins



**Alignment Dowels /
Bushings**

**Spacers & Rolled
Tubular Components**

**Compression
Limiters**



**Threaded Inserts
for Plastics**

Disc Springs

**Machined Aerospace
Components**



**Precision Shims, Washers
& Metal Gaskets**

Laminated Shims

Parts Feeding Technology



**Pin Installation
Technology**

**Insert Installation
Technology**

**Compression Limiter
Installation Technology**

Please refer to **SPIROL.com** for current specifications and standard product offerings.

SPIROL offers complimentary Application Engineering support! We will assist on new designs as well as help resolve issues, and recommend cost savings on existing designs. Let us help by visiting **Engineering Assistance** under Special Services on **SPIROLShims.com**.