FORMING EXCELLENCE

WF

DEFENSE

CHIPLESS METAL FORMING
FOR THE DEFENSE INDUSTRY

Contents

Three Reasons Why Manufacturers of Defense-Critical Components Rely on WF Maschinenbau

We Are a System Partner: From Process Development to Series Production

WF Maschinenbau is not a machine supplier. We develop the complete forming process: preform design, technology selection (flow forming, spinning, necking-in, shear forming), heat treatment concept, and automation integration from a single source, tailored to your product, your production volume scenarios, and your manufacturing environment. Our inhouse R&D Center with four testing machines, induction systems, and CMM measurement technology supports defense customers from the qualification of new geometries through to a stable series production process.

We Master Your Materials: Precise Forming of High-Strength Alloys

The materials used in the defense industry, particularly maraging steel and high tensile strength material alloys, require forming machines and process expertise far beyond conventional machine building. We have mastered the cold forming and hot forming of these materials, including forming under a protective atmosphere for oxidation-sensitive alloys. Near-net-shape processes reduce material consumption and downstream machining effort.

We Ensure Production Readiness: From Prototype to Automated Production Line

Our systems are designed for automation from the outset: Robotic cells, induction systems, and fully integrated CNC control enable a seamless transition from pilot production to a series production line without machine changes and without process interruption.

Precision Manufacturing for the Defense Industry

Rocket nozzles, motor cases, seeker sections, warheads, mortar barrels, shells, or bomb shells: WF Maschinenbau develops and builds manufacturing systems that produce these components reliably, material-efficiently, and in high production volumes. The technologies used are chipless metal forming processes that surpass conventional machining and forging in terms of cost efficiency and precision: flow forming, spinning, and neckingin.

The defense industry is seeking partners with proven process expertise for specific components. Know-how and experience are decisive. WF Maschinenbau offers both.

Current Requirements in the Defense Industry

Material efficiency	Near-net-shape forming reduces material consumption. This is particularly relevant for cost-intensive materials such as maraging steel
Precision and process stability	Complex rotationally symmetrical hollow components with the highest requirements for dimensional accuracy and repeatability
Industrial scalability	Automation through robotic cells as a strategic factor for capacity expansion
European manufacturing	Increasing importance of sovereign European manufacturing capacities. Stable supply chains ensured by the high manufacturing depth of German and European suppliers
Process continuity	Expansion of existing production lines without fundamental process modifications. Established processes for new production sites
High-strength alloys	Forming of demanding materials and high-strength alloys, including under a protective atmosphere

WF Maschinenbau's Approach to Finding Solutions

Challenges in the Defense Industry

Rotationally symmetrical hollow components made of high-strength alloys, such as motor cases, artillery components, rocket nozzles, and mortar barrels, are expensive and material-intensive to manufacture using conventional machining processes. They are also difficult to scale. Forging requires high tooling investments, while welding weakens structural integrity. At the same time, the defense market demands absolute dimensional accuracy and repeatability.

The WF Maschinenbau Solution

WF Maschinenbau develops and builds manufacturing systems for chipless forming of defense industry components, tailored to the end product, the required production volumes, and the local production conditions. Whether a standalone machine or a fully automated production system, WF Maschinenbau delivers the solution you require. Because:

At WF Maschinenbau, the result is always the central focus. Every solution is tailored to the workpiece, production volume scenario, and local production environment.

What This Means for You

- You do not receive a standard solution, but a manufacturing system that reliably produces your specific component in the required quality and production volume
- You benefit from decades of know-how for defense-related components
- You work with a partner that considers the complete manufacturing chain: from preform design and forming technology through to commissioning

Advantages of Chipless Metal Forming for the Defense Industry

Material	Significant savings in raw material through optimized preform design and near-net-shape forming technology
High-strength alloys	Forming of materials that are difficult to machine conventionally, with additional advantages through the utilization of strain hardening
Tight tolerances	Dimensions and wall thicknesses reproducible within tight tolerances, reliably and repeatably in series production
Reduces machining effort	Minimal post-processing effort through precise preform design and near-net-shape manufacturing

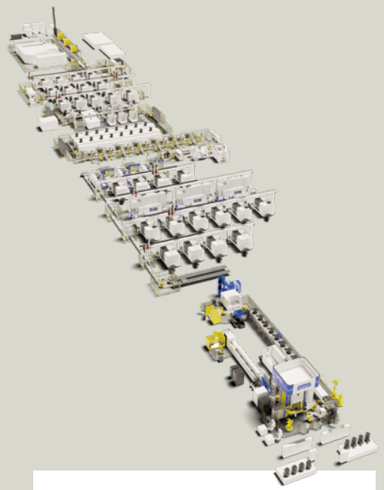
Core Competencies in the Defense Industry: Missile and Rocket Components

End products	Rocket nozzles	Motor cases	Seeker sections	Warheads	End products
Applications	• Rocket nozzles for civil aerospace applications • Nozzles for solid and liquid propulsion systems, all rocket stages • Control nozzles for satellites	• Multiple launch rocket systems • Surface-to-air missiles (SAM) • Anti-ship missiles (ASM) • MANPADS	• Seeker housing for missiles	• Warhead housings for missiles and rockets	Applications
Benefits	• Significant reduction in manufacturing costs through elimination of weld seams and joining processes, including their extensive pre- and post-processing operations, as well as reduced machining effort • Maximum engine thrust through highly precise internal contour and accurate focal point geometry • A single machine covers all technologies, variants and diameters	• Variable wall thicknesses with circumferential or longitudinal stiffening ribs • Process development from preform design and forming to heat treatment	• Highly precise external geometry, seamless transition to the warhead, aerodynamically optimized • Reproducible tight tolerances	• Variable wall thicknesses with circumferential or longitudinal stiffening ribs • Process development from preform design and forming to heat treatment	Benefits
Technologies	• Spinning and shear forming • Customized processes including multiple setups and intermediate annealing	• Flow forming • Heat treatment	• Spinning and shear forming • Heat treatment	• Flow forming • Heat treatment	Technologies
Added value	• Significant cost reduction for expensive, difficult-to-machine materials • Flexible variant production on a single machine, even for small production volumes	• Cost reduction through minimal post-processing • High structural integrity through targeted utilization of strain hardening	• Cost reduction through minimal post-processing • High structural integrity through targeted utilization of strain hardening	• Cost reduction through minimal post-processing • High structural integrity through targeted utilization of strain hardening	Added value

Core Competencies in the Defense Industry: Ammunition Bodies

Core competencies in the Defense Industry: Artillery Components

	Medium-caliber shell cases	Large-caliber shell cases	Mortar barrels
End products			
Applications	• Medium-caliber shell cases • Special-application cartridge cases • Shaped charge liners (typically copper)	• Shells (e.g. 152 mm, 155 mm) • Large-caliber ammunition cases	• Mortar barrels for mortars of various calibers
Benefits	• Thin-walled precision geometries in series production processes • Material efficiency through near-net-shape manufacturing	• Coordinated process steps across the complete manufacturing chain • Reduced interface and supplier complexity • Reduced integration and coordination effort • Optimized material utilization and reduced post-processing • One integrated production concept instead of isolated standalone solutions	• Near-net-shape forming • Forming of high-strength materials for maximum load capacity • Process capability even in high-volume production
Technologies	• Flow forming of thin-walled geometries • Precise wall thickness control • Process-stable series production	• Flow forming and necking-in • Design of the preform and process sequence	• Flow forming of thin-walled geometries • Precise wall thickness control • Process-stable series production
Added value	• Dimensional accuracy • Repeatability	• Reduction of raw material consumption (depending on the variant) • Reduction of machining, heating, and cooling costs • Industrial scalability	• Cost minimization through significantly reduced material consumption and substantially reduced machining costs • Short manufacturing chains through near-net-shape-preforms



INTEGRATED TURNKEY SOLUTION

From preform to painted shell: ready to fill.

Together with our specialized partners ANDRITZ Schuler and FFG, WF Maschinenbau provides a coordinated turnkey solution for the manufacturing of large-caliber shell cases. The integrated solution covers the entire process chain from preform to painted shell.

Core Competencies in Defense Industry: Aircraft Stores

	Bomb shells	Drop tanks
End products		
Applications	• Warheads of the MK 80 series, NATO standard	• Thin-walled drop tanks and auxiliary fuel tanks made of aluminum or steel
Benefits	• Manufacturing of all MK variants on a single system with simple changeover operations • Flexible variant production	• Variable tank sizes through flexibly adaptable production
Technologies	• Necking-in in a hot spinning cell with induction system and heavy-duty robot	• Necking-in in a hot spinning cell with induction system and heavy-duty robot • Conversion to all variants through simple tooling and program changes
Added value	• Lower investment requirements compared to forging technology • High flexibility in variant production	• High flexibility in variant production

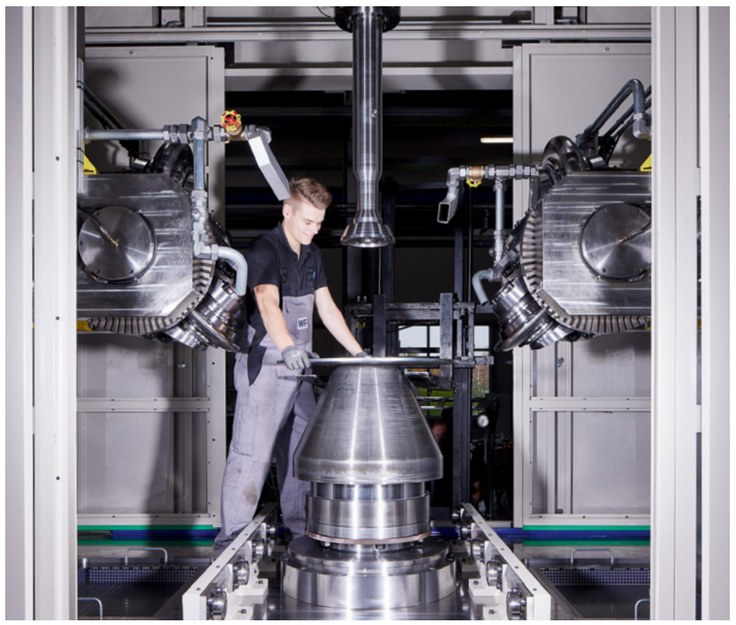
What We Offer

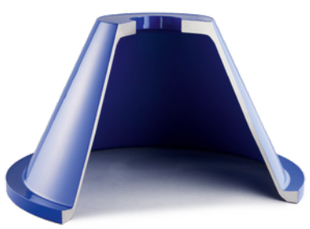
Rotationally symmetrical hollow components made of high-strength alloys can generally be manufactured in three ways: through machining from solid material, through forging with subsequent machining, or through chipless metal forming. In contrast to machining from solid material or forging, chipless metal forming achieves significantly higher material utilization and lower post-processing effort with comparable or superior structural integrity.

Both conventional processes reach strict economic limits when applied to alloys such as maraging steel or Inconel. Machining generates high material loss and significant tool wear, while forging with subsequent machining and variant changeovers is more cost intensive. Chipless metal forming closes this gap: It is more precise, more material-efficient, and better suited for series production while additionally utilizing the effect of strain hardening, which no other process provides.

Process Comparison of Manufacturing Methods

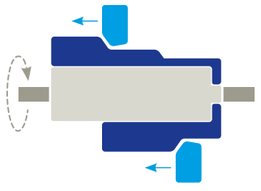
	Machining	**Forging**	**Chipless metal forming**
Material utilization	low	medium	high
Investment	low	very high	medium
Variant flexibility	high	low	high
Structural integrity	medium	medium	very high utilizing strain hardening
Post-processing effort	very high	high	low





projection cone

FLOW FORMING

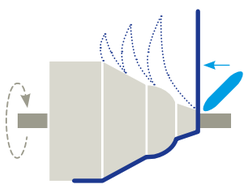


Motor cases and artillery shell cases start as thick-walled tubes or forged hollow components. During flow forming, the preform is clamped onto a mandrel and rotated while forming rollers reduce the wall thickness from the outside and force the material axially into length. The result is a thin-walled, high-precision end product with an exact internal contour requiring only minimal finishing operations at the ends.

Benefits

- Significantly lower tooling investment than forged components
- Wall thickness can be adjusted precisely according to structural requirements, reinforcement ribs possible
- Seamless component without weld joints, high structural integrity, reduced inspection effort, and minimal post-processing
- Tubes with optimized wall thickness profiles that cannot be manufactured with comparable precision using another process
- Significantly lower material costs through near-net-shape manufacturing, particularly substantial savings potential for expensive raw materials
- Higher component strength without additional heat treatment minimizes machining costs

METAL SPINNING

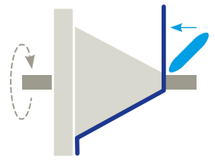


Inlet rings, propeller noses, rocket nozzles, and seeker sections require a precise external geometry while the wall thickness is tailored according to application requirements. During spinning, a blank or preform is formed against the tool contour on a rotating mandrel in multiple passes using a spinning roller. Geometry modifications can be implemented quickly and cost-effectively through program changes without new tooling and with short machine setup times.

Benefits

- Large dimensions achievable
- Precise geometry achievable through localized forming pressure
- Short setup times and high flexibility through variant changes via CNC programming

SHEAR FORMING

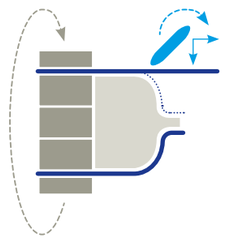


Shear forming as a specialized form of spinning is used for conical components, typically for rocket nozzles, seeker sections, or shaped charge liners. The decisive difference compared to spinning: The wall thickness depends on the cone angle. This enables the manufacturing of complex conical geometries in a single forming operation.

Benefits

- Low unit costs through forming in a single operation
- Maximum material efficiency through controlled reduction of wall thickness
- Economical manufacturing due to near-net-shape forming and short through-put times

NECKING-IN



Shells and bomb shells feature an aerodynamic external geometry commonly designed as an ogive shape. Conventional machining for these lengths and geometries is extremely complex and expensive. The geometry and required wall thickness profile are produced reliably in a single operation.

Benefits

- Precise internal contour without extensive and expensive post-processing
- Low material loss through near-net-shape forming

Note:
The selection of the appropriate forming technology is project-specific and based on geometry, material, and wall thickness requirements. Multiple processes can be combined within a coordinate process chain.

Manufacturing Architecture and Service

WF Maschinenbau supports customers as a system partner from the initial development project and the prototype phase to full series production.

01

Analysis and Process Development
Joint design of preform, forming strategy, and heat treatment

02

Prototyping and Validation
Prototype testing, if required on in-house testing systems in the R&D Center

03

Machine and System Engineering
Development of a custom machine tailored to the workpiece and production volume

04

Series Production and Scaling
Delivery of production-ready systems including training, commissioning, and ongoing support

Scope of Services:

- Process consulting and feasibility analysis
- Development and manufacturing of customized machines
- Integration of automation solutions (robotic cells, induction systems, etc.)
- Commissioning, training, and after-sales support
- Spare parts supply
- Maintenance agreements

European Manufacturing Competence

WF Maschinenbau stands for reliable, high-quality manufacturing technology from Germany.

Development and Manufacturing in Germany

Complete value creation at the German site, from engineering to delivery, exclusively with European suppliers

High In-House Manufacturing Depth

Control over critical manufacturing steps ensures quality and delivery reliability

In-House R&D Center

Testing systems for process development and prototype validation directly in-house

Long-Term Experience

Decades of expertise in chipless metal forming for highly demanding applications and the defense industry

International References

Proven projects with leading customers in the aerospace and defense industry

Export Control Compliance

Experience in the export of dual-use goods

FORMING EXCELLENCE

We are represented around the world in

Brazil – Canada – China – Denmark – France – Germany – India – Italy – Japan
Korea – Mexico – Poland – Portugal – Spain – Taiwan – Turkey – Ukraine – UK – USA

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