



Hirschvogel  
Group

Traditionally innovative.

# INNOVATION IS IN THE DETAILS

Classic Application Areas

and Innovative Products



## E-DRIVE

Electrification of the powertrain is one of the megatrends in automotive engineering. No matter whether it is for purely electric vehicles (BEV) or for hybridized powertrains (HEV or PHEV), the broad production engineering possibilities at Hirschvogel enable us to develop and produce optimum parts – with maximum load-bearing capacity, high reliability, minimum weight, as well as cost-effectiveness in large-series production.

Examples of serial parts include several rotor shafts with different geometries, rotor carriers and input shafts for flywheel hybrid systems, as well as shafts and gears for reduction gearboxes.



### SINGLE-PART HOLLOW ROTOR SHAFT WITH EXTERNAL PROFILE

- Wide range of materials
- Inner contour produced entirely by forging
- Broad spectrum of processes (extrusion, swaging, hardening, grinding in IT3 quality)
- Internal spline forged into a blind hole, thereby rendering a sealing cover unnecessary



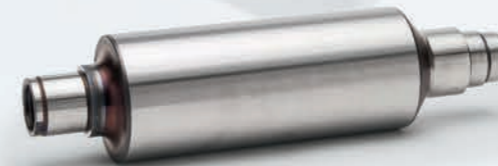
### ROTOR CARRIER

- Rotor carrier for a P2 hybrid powertrain
- Complex component produced by means of hot and cold forging, machining and heat treatment
- Ready-for-assembly lamellae splines and crown geometry produced cost-effectively using cold forging
- Gas-nitrided case-hardening steel



### INPUT SHAFT HYBRID MODULE

- Clutch carrier in a P2 hybrid powertrain
- Warm forged in near-net-shape quality
- Numerous filigree and complex boreholes
- Plasma-nitrided and machined ready for assembly



### JOINED HOLLOW ROTOR SHAFT

- Rotor shaft for electric motor
- Induction hardening steel
- Hollow component made up of two joined parts
- Forged, machined, laser-welded, induction hardened, hard machined and ground
- Minimum wall thicknesses, maximum lightweighting



## CHASSIS

The chassis has a major impact on driving performance and comfort. Here, lightweighting plays a very important role. To reduce the unsprung masses, high-strength and weight-optimized components are required.

For this purpose, we offer steering knuckles, wheel carriers, damper forks and struts made of aluminum, as well as weight-reduced wheel hubs made of steel.



### STEERING KNUCKLE

- Weight- and production-optimized geometry
- Wrought aluminum alloy with high strength and high ductility
- Maximum strength with very good toughness
- Machined ready for assembly
- Automated large-series production
- Test benches for fatigue
- Fully-automated forging production with corresponding material pre-distribution



### WHEEL HUB

- Weight-optimized geometry
- Dispersion-hardening steel with high strength
- Also available as a warm forged part with a finer grain structure
- Fully-automated production
- Machined ready for assembly
- Special production method for the splines in order to achieve defined press-in forces
- Part undergoes a rotary bending fatigue test
- Completed with an aluminum central screw



### WHEEL CARRIER

- Weight- and production-optimized geometry
- Wrought aluminum alloy with high strength values and high ductility



### DAMPER FORK

- Filigree aluminum forging with high load-bearing capacity
- Reduction of the unsprung mass
- Joint development between the OEM and Hirschvogel
- Forging and machining from a single source
- Machined ready for assembly

## TRANSMISSION

Manual and automatic transmissions require hot, warm or cold forged parts that can withstand high loads. We thus produce all types of transmission shafts in a weight range of between 2 and 30 kg, as well as parking lock gears and double-clutch transmission shafts (hollow).



### TRANSMISSION SHAFT

- Low machining allowance thanks to near-net-shape cold forging
- Forging of functional surfaces or forged centers possible
- Axially symmetric, longitudinal fiber flow
- Weight optimization: Hollow design possible
- Long shafts up to 1,000 mm available
- Parts with forged undercut possible

### OUTPUT SHAFT

- Process combination of hot forging/cold calibration
- Complex geometries can be produced
- Ready-for-assembly, high-precision functional surfaces
- Large family of parts
- Calibrated contact surfaces for the planetary gears

### SHAFT: E-TRANSMISSION

- Shaft for reduction gearboxes – BEV
- Cold forged
- Center forged on both sides; cutting to length and centering are rendered unnecessary
- Case-hardening steel
- Resource- and energy-efficient due to low machining allowances/minimized machining operations

### HOLLOW SHAFT

- Forged hollow contours using a backward extrusion process
- Optimized use of input stock
- Large-series component

## OFF-HIGHWAY

We actively embrace the trends and requirements in application areas beyond the automotive industry and consistently align our products and services to these. The Hirschvogel Group thus develops and produces parts for off-highway applications, including components for gas and diesel injection and the powertrain, as well as for the engine, transmission and chassis.

Our products make important contributions to reducing consumption and emissions by means of lightweighting, downsizing, transmission and engine optimization, as well as electrification. Additionally, our components can be found in E-Bikes and robotic systems.



### FLEXIBLE TRANSMISSION CORE

- Internal rotor of a harmonic drive transmission
- Heat treatable steel
- Warm forged
- High fatigue limit requirements



### CRANK WEB

- Single part of an assembled crankshaft
- Complex hot forged geometry
- Asymmetrically forged pins
- Thin floor produced by hot forging



### BOTTOM BRACKET SHAFT

- Use in E-Bike drives
- Warm forged part with undercut
- Optimum fiber flow
- Machined ready for assembly
- Increased service life due to plasma nitriding



### CLAMPING BRACKET

- Holder for clamping diesel injectors onto off-highway engine blocks
- Simultaneous Engineering process for optimum design/production coordination
- Produced by a combination of hot/cold forging
- Machined and coated ready for assembly

## ENGINE

To meet increasing demands with respect to performance, minimizing fuel consumption and increasing driving pleasure, a growing number of forged components are finding application in the engine alongside the "classic" ones such as the connecting rod and crankshaft.

For example, our balancer shafts are used for achieving better NVH behavior (noise vibration harshness) in four-cylinder engines, our eccentric shafts and splined shafts for reducing fuel consumption by means of fully variable valve control, and our steel pistons for allowing higher pressures and lower friction in diesel engines.



### EXHAUST CAMSHAFT

- Exhaust camshaft with pressure relief controlled by centrifugal force
- Core: Machined hot forging
- Assembly with sintered components
- Supplied ready for assembly and operation



### READY-FOR-ASSEMBLY BALANCER SHAFT

- Use in mass balancing systems of car engines
- Hot forged component
- Machined ready for assembly
- High surface and roundness requirements on the grinding surfaces
- Mounted anti-friction bearing



### SPLINED SHAFT

- Shaft diameter 25 mm; total length 600 mm
- Raw part with runout deviation max. 0.2 mm
- No straightening necessary in as-forged state
- Machining allowance can be reduced to the grinding allowance
- Significant weight savings on the forged part
- Machined ready for assembly



### STEEL PISTON

- Produced by a combination of hot and cold forging
- Tensile strength 1,000 - 1,200 MPa
- Subsequent machining
- Large forged cooling duct possible
- Monoblock design
- Ignition pressures > 200 bar (power > 90 kW/l)
- Cylinder block height reduced, leading to increased passive vehicle safety (pedestrian protection)

## POWERTRAIN

Hirschvogel defines the powertrain as the system which transmits torque from the transmission output up to the wheel hub.

Here, too, we produce important parts which demand specialist production know-how. The best examples include tripods, Rzeppa stub axles for constant-velocity joints, as well as pinions and disk carriers for transfer gearboxes in four-wheel-drive vehicles.



### CONSTANT-VELOCITY JOINT

- Induction hardening steel
- Warm forged
- Near-net-shape on the inner side due to cold calibration
- Soft machining including thread
- Splines und lubrication grooves produced by cold rolling

### FLANGED SHAFT

- Output from the differential transmission
- Process combination of forging and swaging, followed by machining
- Weight-optimization with hollow design possible
- Forged inner functional surface
- Ready for assembly
- Tested for residual contamination

### TRIPOD

- Part produced by a combination of warm and cold forging
- Precision forged inner contours
- Net-shape (tripod housing), (near-)net-shape (ball joint housing)

### LIGHTWEIGHT PINION

- Warm or cold forged
- Hollow design possible
- Forged centers on both sides possible

## GAS AND DIESEL INJECTION

The diesel engine is one of the most efficient thermodynamic machines and should not yet be written off, especially due to its low CO<sub>2</sub> emissions.

For the highly loaded components of common rail systems, we supply important parts such as injectors, pump shafts, pump heads and rails. Classic injection systems such as distributor pumps and the pump-nozzle system are also served.

In gasoline injection systems, injection pressures are continuously increasing (> 350 bar), particularly in direct injection applications. This not only serves to improve engine efficiency but also to fulfill the legal emissions requirements. To achieve these higher pressures, today's casting and soldering applications are being gradually replaced by pressure-tight forging solutions.



### INJECTOR BODY (DIESEL)

- Customer- and engine-specific, large variety of types
- High-strength steels with adapted integrated heat treatment
- Warm forging process



### CAMSHAFT (DIESEL PUMP)

- Near-net-shape forged part
- Ready for assembly
- Shot peening



### RAIL (DIESEL CR)

- Weight-reduced part design
- Complex mass distribution
- Optimized use of input stock
- Lightweight design achieved in a way that is not possible with a manufactured welded component



### RAIL (GASOLINE DI)

- Stainless steel
- Weight- and stiffness-optimized geometry
- Pressure-tight
- Ready for assembly
- Leakage tested







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