



PRECISION MANUFACTURING AND ASSEMBLY SOLUTIONS

Complex mechanical components for engines, transmissions and drivelines for high performance and specialised applications delivered in low volumes.

SPECIALISTS IN PRECISION MANUFACTURING AND COMPLEX ASSEMBLY

Ricardo specialises in the design, precision manufacture and supply of complex mechanical components, gearboxes, and transmissions for high performance and specialised applications.

Operating at low to mid-volumes, our in-house precision manufacturing services cover a broad range of processes and techniques to deliver to the highest quality standards in competitive lead times.

With over 50 years of world-class engineering and manufacturing experience, Ricardo is the manufacturing partner of choice for top-flight motorsport, performance automotive, aerospace, defence, marine, off-highway, and industrial markets.



AEROSPACE



COMMERCIAL
VEHICLE



DEFENCE



PERFORMANCE
AUTOMOTIVE



MARINE



MOTORCYCLE &
POWERSPORT



MOTORSPORT



OFF-HIGHWAY



RAIL



OVER 50 YEARS
OF WORLD-CLASS
MANUFACTURING
EXPERTISE

OUR DESIGN AND MANUFACTURING SOLUTIONS

Ricardo works with customers across the globe operating in industries where reliability, performance, durability, and quality are critical.

We partner directly with OEMs, tiered suppliers, race teams, vehicle design authorities and prime contractors to create solutions to some of the toughest challenges in performance product design, complex manufacture, and niche volume supply.

Ricardo provides expert design and engineering, low volume manufacture and series supply of complex components typically found in engines and drivelines, from complete transmissions down to sub-assemblies and individual parts. Each programme is tailored to the requirements of our clients, but our

solutions can be grouped into three core offerings; bespoke driveline programmes, precision component manufacturing, and contract manufacturing solutions.

Our team of experts have the specialist industry knowledge and access to state-of-the-art manufacturing technologies required to support our customers in bringing their cutting-edge innovations to market.

With our complimentary capability in advanced assembly facility specification, supply chain management, and new product introduction processes, Ricardo can add significant value in a highly complementary manner to our clients' premium product aspirations.

BESPOKE DRIVELINE PROGRAMMES

Bespoke design, manufacture and low-volume supply of driveline solutions for high performance and specialised applications

PRECISION COMPONENT MANUFACTURING

Specialists in the design, manufacture and supply of precision gears, torque path and prismatic components delivered in low to mid volumes

CONTRACT MANUFACTURING SOLUTIONS

Low-volume outsourcing service for precision components and sub-assemblies of existing designs.

OUR CORE PROGRAMME OFFERINGS

BESPOKE DRIVELINE PROGRAMMES

Our bespoke driveline programmes are fully comprehensive solutions tailored to the requirements of our clients. We specialise in creating high quality, cost-effective turnkey gearboxes and transmissions optimised to the requirements of high performance and specialised platforms.



These programmes can include design, low-volume manufacture and assembly, end-of-line test and validation, and supply chain management. We also offer spares supply and warranty packages to support the programme throughout the product lifecycle. All supported by a dedicated programme manager.

Our programmes range from complete driveline design, manufacture, and supply programmes to the development of components and sub-assemblies for existing driveline systems.

END-TO-END SOLUTIONS

Our programmes are completely bespoke to our client's requirements but can include:

- Design and development
- Prototyping
- Design for manufacture and industrialisation
- Production
- End-of-line test and validation
- Series supply
- Supply chain management
- Warranty programmes
- Spares management

They can be tailored to suit the operational requirements of any kind of propulsion system including traditional ICE, electric vehicle, and hydrogen.

With extensive experience delivering solutions for highly regulated markets with complex supply requirements, our clients can expect the delivery of quality products manufactured to exacting specifications with low levels of in-service failure.

PRECISION COMPONENT MANUFACTURING

Ricardo is globally recognised as an independent specialist manufacturer of complex components for high performance and specialised applications. Our in-house manufacturing facility enables us to deliver precision gears, torque path and prismatic components in niche volumes to our clients requiring precision and quality delivered to their exacting standards.

GEARBOX DESIGN, MANUFACTURE AND SUPPLY FOR DS PERFORMANCE

DS Performance needed a new transmission to accommodate new powertrain specifications of the second generation Formula E cars – including a battery with more power and larger capacity with a top speed of 280km/h.

Ricardo developed a fully optimised single-speed gearbox with a two-stage reduction arrangement to match the high motor input speeds to the required vehicle speed.

The transmission was tailored for maximum performance and efficiency. To reduce the weight of the transmission, the casing was optimised and the gears were made from

aerospace steels. The tooth microgeometry was also refined for maximum efficiency.

With DS Performance and Ricardo's transmission technology on board, the DS Techeetah team went on to secure back-to-back Constructor's Championship in season five and six. They also saw resounding success in the Driver's Championship. Jean-Eric Vergne took the title in 2017-2018 and 2018-19, becoming the first series' first repeat champion. António Félix da Costa then went on to win the 2019-2020 season, claiming the title with two races still to run.

We typically support our clients with the delivery of programmes either by designing their components for them or by manufacturing to their design on a make to print basis. We supply components with complex geometries, tight tolerances, specialised quality management processes, and high precision finishing,

We typically supply our clients in series batch quantities of individual components, or as full- or sub-assemblies.

Our manufacturing team are world-class specialists in their field. Using their expert knowledge and our range of advanced machining tools, techniques and processes, they produce gears, shafts, and prismatic components of exceptional quality and precision.

*standard capability - speak to us about other dimensions

WE CAN SUPPLY:

- Spur gears (10-400mm \varnothing)*
- Helical gears (10-400mm \varnothing)*
- Spiral bevel gears (25-300mm \varnothing)*
- Hypoid bevel gears(25-300mm \varnothing)*
- Shafts
- Crown wheel and pinions
- Selector forks
- Selector rails
- Selector barrels
- Cases and housing for gearboxes, axles, and transmissions
- Complex cosmetic components
- Engagement hubs
- Clutch rings
- Dog rings

CONTRACT MANUFACTURING SOLUTIONS

Our low-volume contract manufacturing solutions are designed to support clients with the supply of critical complex mechanical and prismatic components and sub-assemblies for their production programmes.

Our customers outsource to us on a make-to-print basis, enabling them to free up capacity in their own production facilities, reduce cost of production, and get expert support with complex technical production and supply requirements.

We support all manner of programmes which require the low volume component supply including prototyping, specialist production and supply requirements, production phase

out, product variance, and in-service spares supply. We are a specialised sub-contractor to industries characterised by variable supply forecasts, critical lead times, and strict industry and regulatory controls. This makes us the partner of choice for the outsourcing of precision components and sub-assemblies to some of the biggest names in top-flight motorsport, performance automotive, defence and aerospace.

A SPECIALISED SUB-CONTRACTOR TO INDUSTRIES CHARACTERISED BY VARIABLE SUPPLY FORECASTS, CRITICAL LEAD TIMES, AND STRICT INDUSTRY AND REGULATORY CONTROLS

CUSTOMER CASE STUDY

HIGH-LIFT COMPONENTS FOR BOEING AIRCRAFT

Our client approached Ricardo to supply made to specification high-lift components for Boeing aircraft supplied on a contract manufacturing basis on a long-term basis with variable forecast.

As an AS9100D-certified supplier of made to specification components to our partners in the aerospace industry, Ricardo was the ideal choice of supply partner for our client for this application.

The programme required the implementation of a sound new product introduction process to ensure the successful onboarding of the client's

design into Ricardo's process flow.

New specialised tooling was required to machine the components from aerospace grade materials. The components required highly specialised manufacturing knowledge due to the complexity and quality standards required to ensure that manufacture met the exacting standards of our client and Boeing.

Our client has benefited from Ricardo's expert manufacturing capability and quality management processes. The result was stable series supply for the outsourcing of a highly complex component which relies on quality and reliability of supply.



OUR DESIGN AND MANUFACTURING CAPABILITY

DESIGN AND ENGINEERING

Ricardo's highly skilled design engineers specialise in developing innovative solutions to even the most challenging technical briefs. Building on over a century of globally renowned engineering pedigree, we support our clients in the design of drivelines with complex performance specifications, from complete transmissions down to sub-assemblies and individual components.

Working closely with our clients, our team of experts work from a clean sheet to design bespoke transmission solutions to meet highly specialised technical and packaging requirements. We support a wide range of applications from motorsport to performance

OUR INDUSTRIALISATION EXPERTISE ENABLES US TO DESIGN WITH COST-EFFECTIVE MANUFACTURE IN MIND

road vehicle, from defence and off-highway to industrial machinery.

Our design engineers work closely with our production, manufacturing, and supply chain experts to ensure solutions are designed with cost-effective and efficient manufacture in mind. All without compromising consistent quality, precision, reliability, and performance.

PRODUCTION

Whether we are supporting a series supply component programme or the development and production of full transmission solutions, our clients can be assured that each component is manufactured and finished to an unrivalled standard.

Our manufacturing facilities boast an impressive array of machinery and technical capability to enable us to deliver high quality torque path and prismatic components made to exacting specifications.

Our clients can expect exceptional attention to detail and a premium product which match and exceed expectations, whether the product has been designed in-house by Ricardo's experts or we are manufacturing to an existing design,

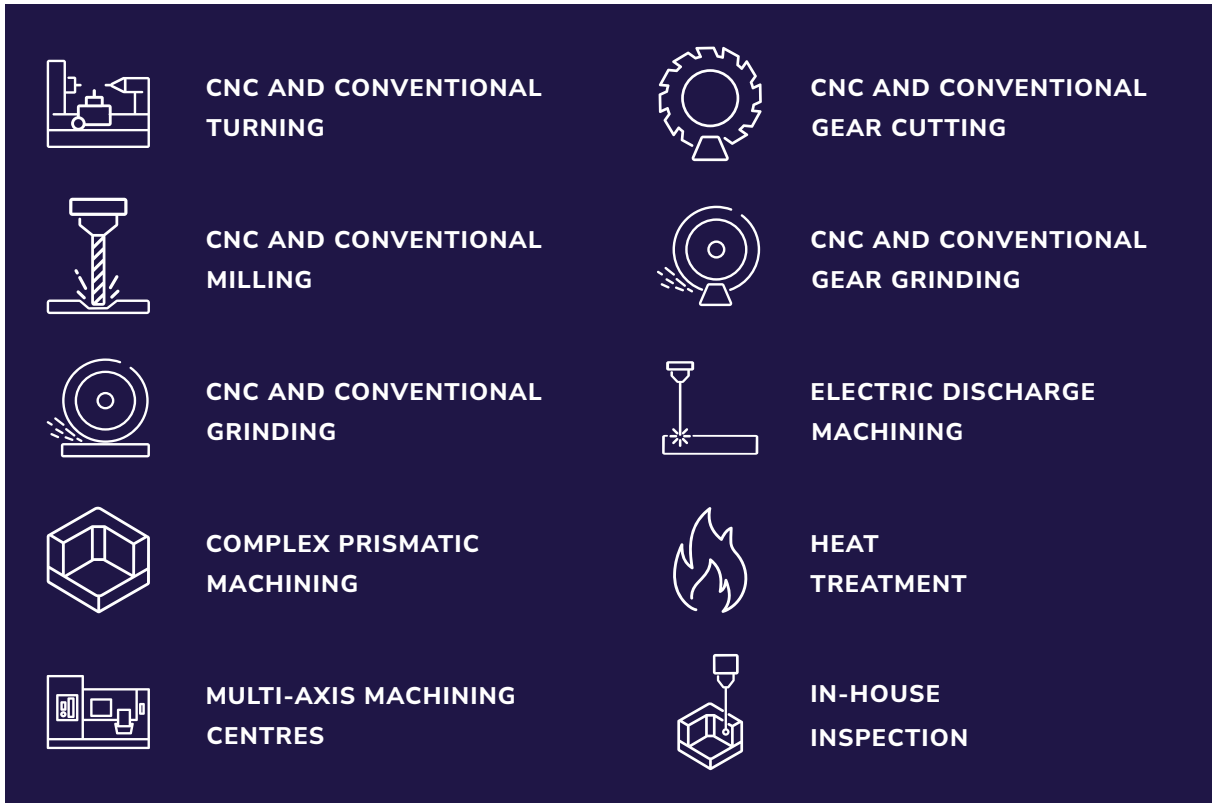
Operating out of our manufacturing hub in Leamington Spa, our expert manufacturing

specialists work with the latest multi-axis CNC machinery, conventional tools and machinery, and precision techniques to create components to exacting tolerances for the most demanding applications.

Our robust quality management systems and processes ensure that each component leaves the shop floor with the reliability, durability, and quality that our clients demand for their premium products.

Our capability extends beyond traditional manufacturing, encompassing advanced CNC 5-axis machining. Whether you require complex geometries, tight tolerances, or intricate designs, our state-of-the-art machining facilities and skilled team enable us to produce precision parts that meet the most demanding specifications.





OUR MACHINE SHOP CAPABILITY

INSPECTION AND QUALITY

Ricardo embeds quality at every stage of the production process. We take a proactive approach to continuous improvement and identifying and addressing potential issues or deviations early on to minimise risk of defects and failures.

Our 'right first time' mentality can be found throughout the production process, helping us to reduce waste, improve efficiency and ensure that our clients receive quality products. To achieve this, we use Production Part Approval Process (PPAP) techniques throughout production to ensure that every product meets the required specifications and quality standards for the production programme.

From design, through supply chain accreditation to assembly and end of line testing, we ensure

that every product is supplied to our clients' exacting standards.

Our in-house quality and inspection facilities include a metallurgical laboratory and a range of metrology tools and techniques including Coordinate Measuring Machine (CMM) tools and software, which allow us to ensure the fidelity of our finished products.



FINAL DRIVE REFURBISHMENT FOR UK MINISTRY OF DEFENCE

The UK Ministry of Defence (MOD) needed to refurbish or replace the final drive units on the CVR(t) platform. Successful execution of the programme required the supplier to accept units in for assessment, re-establish the supply chain, refurbish or replace the final drive and return to the MOD in accordance with their logistical requirements.

Ricardo assessed the original design and, where necessary, reverse engineer and redesign components to meet contemporary MOD standards. We took a proactive approach to identify and resolve programme issues to protect the schedule and quality expectations, used precision manufacturing and quality

management processes to ensure that replacement components met or exceeded the expectations of the programme, and reactivated the supply chain and used their logistics capability to execute the contract to MoD requirements. All in very short lead-time requirements to first hardware.

Ricardo's familiarity with the automotive standard of traceability and quality supported high value delivery and as such the programme was delivered on budget and time to the MOD to maintain the serviceability of these vehicles and their important status as part of their ground fleet.

MATERIALS

Premium quality products start with premium quality materials. Ricardo manufactures using the highest quality materials matched to the bespoke requirements of the client's programme. We primarily work in nitriding, through-hardening, or carburising steels and aluminium. However, we have the expertise and resources to work with other materials upon request, including titanium, magnesium, and copper.

Our supply chain experts work with closely with our clients and our manufacturing team to source materials that match the precise performance, regulatory, weighting, and cost requirements of our clients. They tap into Ricardo's network of trusted supplier partners to help maintain stable supply of materials which meet programme objects as well as any industry-specific regulatory requirement



COMPLEX ASSEMBLY

Ricardo specialise in low-volume assembly of complex automotive components, from sub-assemblies through to full builds of engines and driveline.

Our services range from single prototype builds through to flexible semi-automated production lines, delivering thousands of quality-assured units per year. We set-up and manage supply chains and ensure that all products align to or exceed expected quality standards and industry specifications.

Our complex assembly programmes are offered as stand-alone services - building existing designs to specification, or as part of our bespoke transmission solutions.

END-OF-LINE TEST

Ricardo conducts end-of-line testing at our in-house testing facilities before products are delivered to our clients. This involves subjecting each product to rigorous testing procedures to ensure that it functions as intended and meets all of the necessary performance and safety requirements.

Ricardo's end-of-line testing capability covers the complete powertrain and driveline down to the component level across a wide variety of vehicle platforms. Our testing capability includes traditional ICE, electrified, hydrogen and alternative fuel propulsion technology

ACCREDITATIONS

Ricardo's manufacturing processes and systems are backed up by our certifications for a range of criteria including Quality Management Systems, Environmental Management, Energy Management, and Information Security.

- ISO 9001:2015 – Quality Management Systems
- AS9100D – QMS for Aviation, Space and Defence
- ISO 14001:2015 – Environmental Management System
- ISO 50001:2018 – Energy Management
- ISO/IEC 27001:2013 – Information Security Management System
- IATF 16949 - Quality Management Systems (Automotive)
- JOSCAR
- TISAX level 3



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