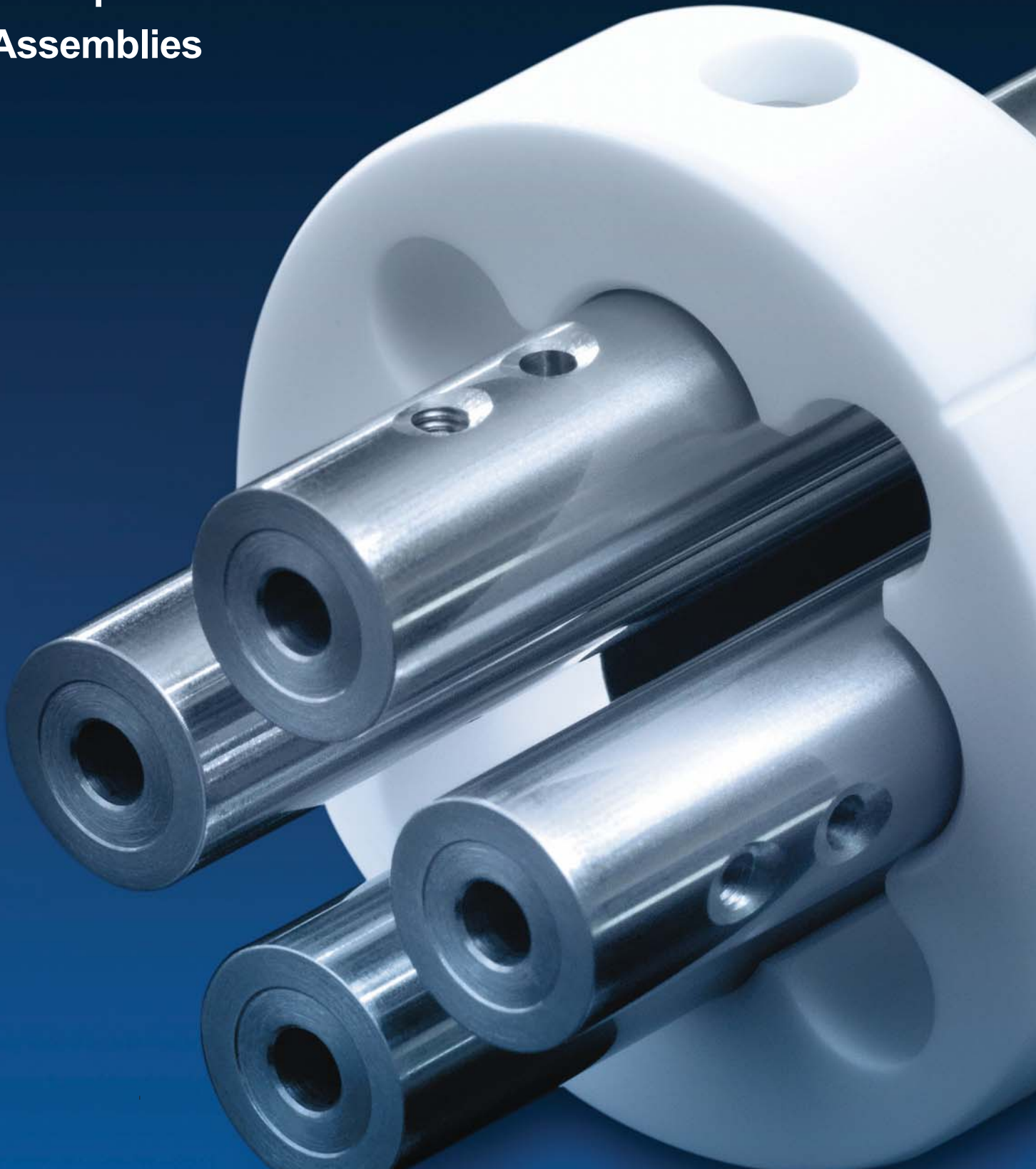
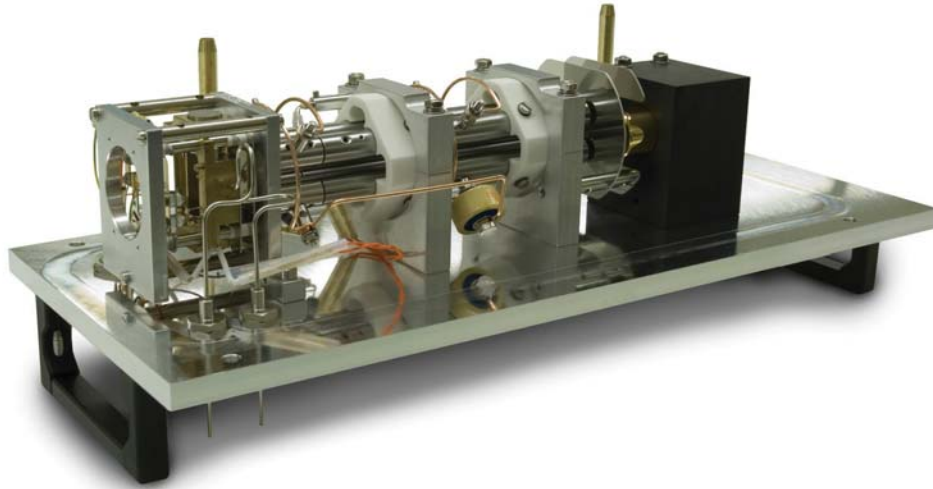




**Quadrupole Mass Filters, Opto-Mechanical
and Specialist Clean
Assemblies**



Products and Applications



Reliance Precision is a specialist supplier of tested sub-systems to major equipment manufacturers in the scientific instrument, semi-conductor and photonics industries. A longstanding and successful track record in these industries ensures we have effective, established processes in place and the necessary technical expertise to provide consistently high standards of performance and delivery.

We supply custom-built sub-systems to specification, as well as offering our own design platforms, which can be customised to individual requirements. In-house developed software systems give us the flexibility to respond to the needs of our customers' own operational processes and bills of materials, whilst adhering to our manufacturing disciplines and maintaining essential build standard control.

The types of sub-system supplied are critical to the performance of the parent machine. We therefore take a very thorough approach to understanding the application for each customer's product in order to develop the most appropriate manufacturing methods. We also have specialist design engineering facilities, which complement and support our manufacturing capabilities. Typical products and applications include:

Scientific Instrumentation

Vacuum sub-systems such as quadrupole mass filters, optic rails, ion optics, ion sources and detector assemblies, sample cones and extraction cones for:

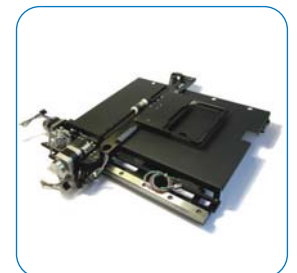
- GC & LC mass spectrometers
- MALDI & QToF mass spectrometers
- ICP mass spectrometers
- Residual gas analysers



Semi-Conductor

Clean, high precision components and assemblies, including specialist materials and coatings, for:

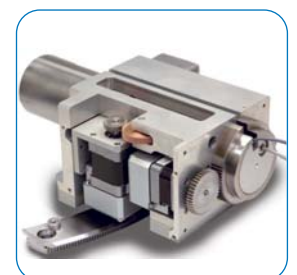
- Wafer handling
- Wafer production tooling
- Wafer inspection equipment
- Heat sinks for ion implantation



Photonics

Rotary and linear positioning systems, drive mechanisms and the integration of electro-mechanical and optical assemblies for:

- Focusing mechanisms
- Laser beam manipulation
- Optic positioning
- Optic mounting



Skills and Capabilities



Critical components are manufactured in-house using unique capabilities for machining ceramics and other complex materials. Supply chain management secures specialist components such as electronics, optics and vacuum pumps, together with components from overseas manufacturing partners. All components have complete material traceability.

We understand that equipment supplied to the scientific instrument, semi-conductor and photonics industries requires extremely high levels of cleanliness in order to avoid contamination, which can result in ineffective performance of the parent equipment or latent failures in service. Our sub-systems are assembled in a suite of laminar flow cleanrooms capable of handling the most sensitive high vacuum and optical work, with appropriate combinations of cleaning processes selected from a range of adaptable state-of-the-art facilities.

Testing is core to our operational activity with all assemblies tested diligently and recorded in line with customers' specifications. In addition, having our own development team means that in-depth design analysis and verification can be undertaken, helping resolve performance issues and validating performance against key functional criteria. We tailor the functional test methods to each customer's requirements so they replicate how the equipment will work in service.



Cleanroom Facilities

Over 350m² of laminar flow clean rooms:

- ISO 14644-1 Class 7 (Fed Std 209E Class 10,000)
- ISO 14644-1 Class 4 (Fed Std 209E Class 10)
- Opto-mechanical assembly cleanroom
- Dedicated development cleanroom



Cleaning Facilities

Flexible state-of-the-art facilities:

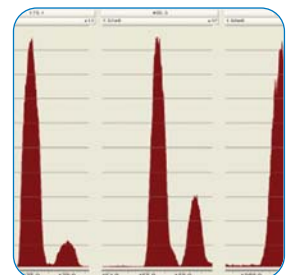
- Plasma cleaning
- Vacuum baking
- Solvent cleaning
- Acid cleaning
- Aqueous cleaning



Test Facilities

Giving customers confidence the equipment will work first time:

- Vacuum leak testing
- Pressure testing
- Ion beam testing
- Electrical conditioning testing
- Opto-mechanical testing



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Quadrupole Assemblies

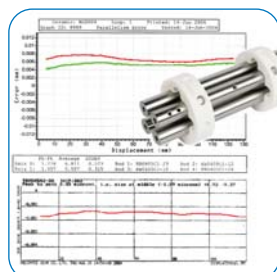


Specialists in Quadrupole Manufacturing

One of our core areas of expertise is the ability to manufacture, assemble and undertake mechanical and functional testing of quadrupole mass filters for use in LC, QToF, GC, ICP, SIFT mass spectrometers and residual gas analysers. Reliance has over 20 years' experience in the manufacture of quadrupoles. Through continued investment and development our capability has evolved into a state-of-the-art quadrupole manufacturing facility incorporating: close tolerance rod and ceramic grinding, assembly in cleanroom conditions, a diverse range of fully automated component and assembly cleaning methods, as well as mechanical and functional testing.

Quadrupole Development

In addition, our experienced design engineers have developed a standard quadrupole product and ion flight model, which enable us to provide a range of standard and customised products. We can supply our standard quadrupole or use this as the basis to customise a design to suit individual customer applications. The ion flight modelling capability provides customers with a high degree of flexibility in the quadrupole design to meet their specific technical and commercial needs.



Product Application

The Reliance standard quadrupole has proven to be a very cost effective solution for use in the proofing and prototyping stages of our customers' designs and for use in lower volume instrument production.

Product Specification

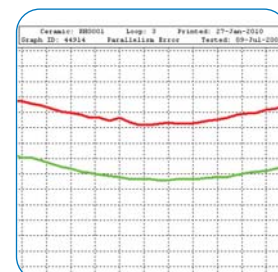
Our manufacturing processes are primarily based around electrode rods of 12mm diameter, up to 200mm in length, dimensions and features of which can be produced to precisions of 20 parts per million. We also have the capability to manufacture electrode rods in diameters from 6mm to 12mm. To complement this, the mechanical dimensions of the parts and assemblies can be determined down to hundredths of a micron, using Reliance's unique test equipment.

Choice of Materials

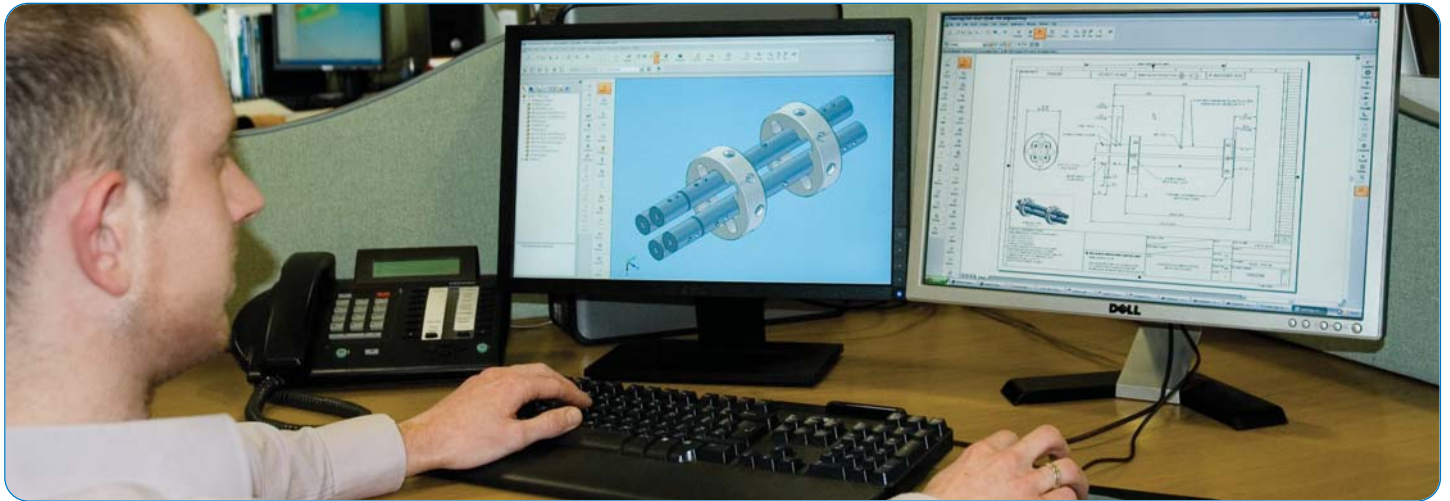
We have the capability to manufacture electrode rods from a variety of different materials including molybdenum and stainless steel. Our standard range of collars are manufactured in high purity grade ceramic, but alternative materials, such as high performance engineered plastics, can be applied.

Additional Options

The standard quadrupole can be adapted to include additional options such as pre and post filters, mounting saddles, electrical connections and interfaces.



Ion Flight Modelling



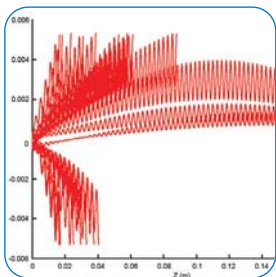
Customising the Quadrupole Design

Quadrupole mass filters require a very high degree of mechanical accuracy. In an effort to help reduce our customers' time-to-market on new instrument designs, or indeed help to identify potential performance issues with existing instrument designs, Reliance has developed a computer model which simulates ion trajectories for quadrupole analysis.

The modelling software is a key enabling tool, not only to aid customisation of the quadrupole design, but also to assess the manufacturing and assembly issues involved in making the quadrupole. It allows us to determine the ideal manufacturing strategies and test methods to meet the performance requirements, both of which are fundamental to reducing time-to-market for new products.

Optimising Performance

Reliance's modelling capability allows our customers a high degree of flexibility in the design of their quadrupoles and assists with optimising the design in terms of cost and performance.



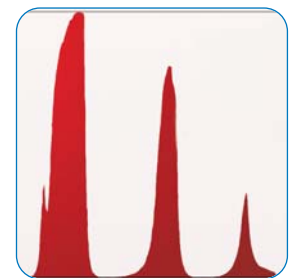
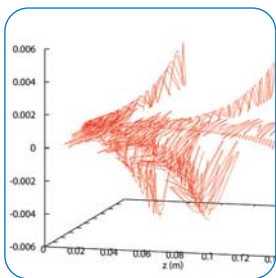
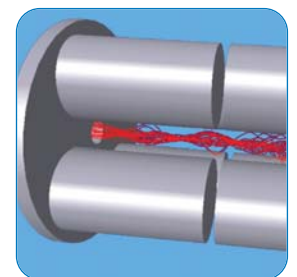
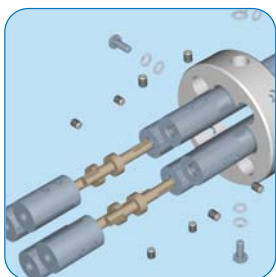
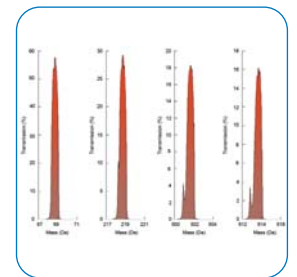
Overview of the Ion Flight Model

The computer model is used to evaluate the design of a quadrupole against its required performance criteria. Tolerance details for size, straightness, orthogonality, symmetry, positional accuracy, curvature, taper, and parallelism can be studied, and tolerances specified in relation to the customer's application.

The model can produce details of ion entrance conditions, trajectories, and exit conditions as well as representative mass peak shape calculations. Transmission versus resolution can be rapidly assessed for any design, enabling the optimum ion injection conditions to be specified.

Using the customer's parameters for their quadrupole application, ions are injected in a round beam into the model, parallel to the Z-axis. Their trajectories through the quadrupole are then calculated by numerically solving a set of ordinary differential equations derived from the Mathieu equation. Only ion trajectories that pass through the circular aperture of the exit filter are regarded as having been detected.

Several million ion flights are calculated in a simulation to determine the aggregate mass peak shape. The effects of imperfect quadrupole geometry can be simulated in order to identify potential resolution limitations and peak shape degradation.



Flexible Solutions



Extending Design Skills and Capacity

In addition to the supply of standard quadrupole mass filters and custom built sub-systems, Reliance offers a flexible design support service. Customers are able to complement their own design and manufacturing resources by working with Reliance's technical teams on a variety of projects including new product development and the ongoing development of established product ranges. This provides our customers with access to additional capacity in order to free up valuable in-house resource or, alternatively, to utilise facilities and technical expertise which they may not have within their teams.

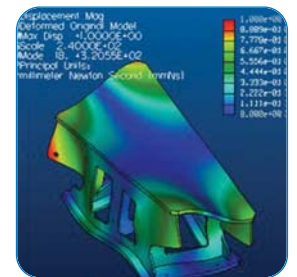
Confidence in Product Performance and Quality

Customers can define how they would like to work with Reliance to best suit their own resources, areas of expertise and company procedures. We are able to provide design support throughout the product life-cycle: from initial design, into manufacture, and through to end-of-life. As well as providing highly specialised design skills we offer the benefit of practical experience in bringing product designs into manufacture using proven disciplines and processes. Our aim is to help our customers enhance the performance and quality of their products, both technically and operationally.



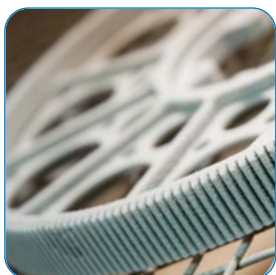
Design Engineering

Design projects can be undertaken independently or jointly with the customer's team. Projects include: concept design, detailed design to specification, prototyping, or alternatively the validation of critical aspects of a customer's own design. Reliance also provides a design analysis service which can be undertaken where product performance issues have been identified. We work together with the customer to investigate alternative design and manufacturing solutions.



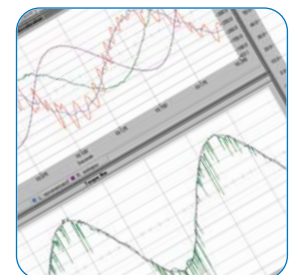
Production Engineering

Reliance's production engineering team can undertake a design for manufacture review before a design's transition into manufacturing. This can help identify and resolve potential problem areas in manufacturing, or identify opportunities for improvements, such as part count reduction or alternative manufacturing methods. This can bring direct benefits to our customers in terms of cost and performance.



Design Validation

Reliance's test development team plays a key role in providing customers with confidence in the quality and performance of their equipment. By integrating test throughout the whole design and manufacturing process we are able to verify that we have made the sub-assemblies accurately to specification and can provide essential data to the customer which validates the functional performance of their design.



Company Overview

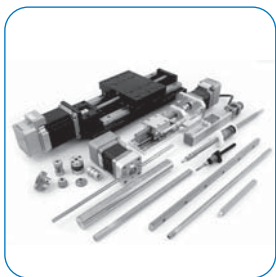


Company History

Reliance Precision is an independent family-owned engineering company offering a complete service for the design, manufacture and test of sub-micron precision components, intricate electro-mechanical and high vacuum assemblies. We are an established supplier to customers from a diverse range of markets including the defence, aerospace, scientific, medical, semi-conductor, photonics and industrial sectors. Founded in 1920, we have maintained a programme of investment to keep at the forefront of modern manufacturing and precision engineering. Working closely with our customers to achieve a thorough understanding of how our equipment is used in their particular fields has been an important factor in our continued innovation in manufacturing processes, and the development of our unique technical capabilities.

Company Organisation

Reliance as a whole comprises three distinct but interrelated companies. The design and manufacturing capabilities provided by Reliance Precision are further strengthened by the specialised facilities provided by Reliance Precision Manufacturing Ireland, whilst our services are complemented by products supplied by Reliance Precision Mechatronics.



Standard Products and Assemblies

Reliance Precision Mechatronics offers an extensive catalogue of standard components and assemblies including: couplings, leadscrews, motors, gears and actuators. Technical support is available to help customers select the optimum product and ensure the best performance of their design. Where necessary, products can be customised to suit individual customer requirements.



Quality Assured

Reliance is committed to providing high standards of quality in product and service delivery. We are approved to BS EN ISO 9001 and, with over forty years' experience in the defence and aerospace sector, are able to demonstrate consistent achievement of the stringent performance criteria required by these industries. We are quality assured to AS 9100 and are actively engaged in the SC21 Supply Chain Programme, having achieved a bronze award. We pursue an active environmental policy with accreditation to ISO 14001.



Training and Development

Our commitment to training and development extends to running an in-house apprenticeship scheme, which ensures we continue to combine new skills with our longevity and experience. We have a dedicated in-house training school - formally accredited - in addition to links with universities and research centres specialising in precision engineering and manufacturing.



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