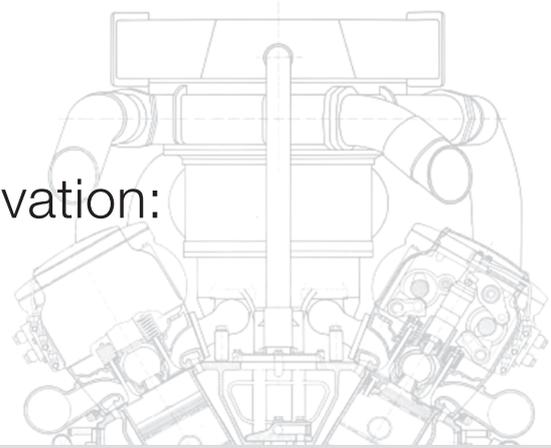


A source of permanent innovation:
Development at L'Orange.



Achieving peak performance and maximum emissions reduction: Development at L'Orange puts the customer in the foreground

Development

One of the main challenges facing engine manufacturers is meeting increasingly stringent emissions legislation. Injection systems need to fulfil three key requirements: reduced exhaust and noise emissions, reduced fuel consumption and a longer service life. And these are all actively pursued with innovations from L'Orange. Our customers' specifications represent the platform upon which L'Orange initiates and develops solutions.

Being the innovation leader in this area has been a long-standing tradition at L'Orange. As world market leader, the organisation is well known for its consistent orientation and focus. Each and every injection system developed by our engineers serves these three objectives. And their success is due in part to a clear focus on high injection pressures of over 2,500 bar and highly accurate multiple injection with an optimised focus on engine combustion. Precisely defined and implemented development processes lead us to the best results in all three areas. This is how we guarantee quick, cost-effective and high-quality implementation of our projects.

In order to develop increasingly powerful injection systems and to finetune them through to series production, new developments run through clear process steps, and throughout we involve our specialists with their broad range of varied skills. The close interaction of all functional areas, together with global and local closeness to the customer, guarantee efficient work of the highest quality.

At L'Orange, technological development spans the entire process from the first idea to pre-development, design and analytics all the way through to testing. We use state-of-the-art design and simulation tools to assess a design's desired characteristics early on, before initiating extensive and costly testing. Most load and stress situations can be simulated with the computer quite realistically.

The close collaboration between design and testing with analytics and simulation guarantees ideal product design – making use of finite element analysis, hydraulic and flow simulation as well as programmes to optimise engine dynamics. A further example of our specialised development expertise is the L'Orange spray diagnostic capability. During testing without combustion, spray patterns of the nozzles can be visualised. These injection images provide accurate information on the quality and fineness of fuel atomisation – a requisite for the optimal combustion achieved with L'Orange injection systems.

And finally, through the very close collaboration between suppliers and the various production areas at L'Orange, we can proceed quickly from prototypes to series production.



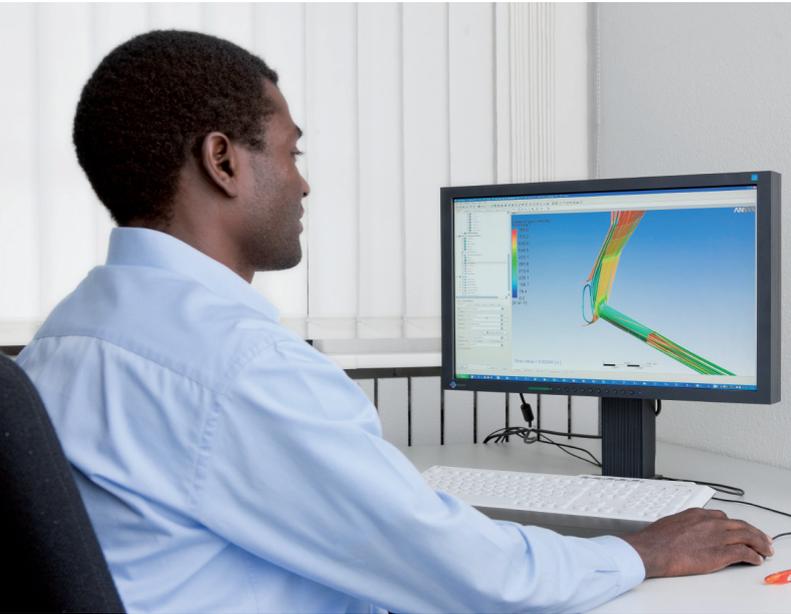
Common-rail system



Pump-line-nozzle system



HFO common-rail system



System solutions

A leading force in injection technology. Yesterday, today, tomorrow. As a pioneer in state-of-the-art injection technology, L'Orange works closely with successful manufacturers of large diesel engines in the off-highway segment worldwide. As a preferred partner, we are continuously setting new standards with regard to quality, durability, fuel consumption and emissions – helping our customers meet the requirements of future emissions legislation. Our service spectrum encompasses the entire range of products in injection technology for all off-highway applications in ship propulsion, special-purpose vehicles and power plants. Our systems supply high and medium-speed engines with a wide variety of fuels and additives. One of our key strengths lies in bringing to life system solutions developed to address our customers' specific requirements.

From consistently run development processes through to programmed market success.

Development teams

All development teams at L'Orange are in constant contact with each other, to ensure system conformity with predefined performance specifications. On over 20 functional and endurance test benches developed in-house, a new system's functions are put to the test, while endurance runs provide additional certainty against breakdown or wear. The next step is system validation at the customer's location on test engines and field-trial engines.

Over and above our development teams and tools, standard process-supporting methods such as FMEA and risk analysis are deployed as well. The development results are safeguarded through seven Quality Gates, which need to be passed before a system can enter series production.

Our customers and their users know they can always count on optimally developed and finely tuned products of the highest quality. And we consistently honour the high expectations placed on L'Orange, as proven market leader, with our exceptional standard of development.

Development advantages

Development advantages you'll benefit from

- State-of-the-art 3D design and simulation tools
- Many years of expertise using our in-house test stands and the most advanced measuring technology available (15 functional and 4 endurance test stands)
- Spray diagnostic capability in the "cold chamber"

L'Orange GmbH

Porschestraße 30, D-70435 Stuttgart
Tel. +49 711 82609-0, Fax +49 711 82609-61
www.lorange.com