Building selective catalytic reduction systems

Increasing pressure to reduce harmful emissions into the atmosphere has led to a number of design changes for internal combustion engines as well as addition investment by coal fired power stations and waste incinerators. As attention turns to the oxides of nitrogen, which are collectively known as NOx gases, commercial diesel engine manufacturers, amongst others, are looking for packaged solutions that will deliver reliable emissions control.

In recent years exhaust gas recirculation (EGR) and diesel particulate filters (DPF) have given way to selective catalytic reduction (SCR) systems as the preferred method of emissions control. However, as permissible levels continue to be reduced, some manufacturers are looking to combine SCR and EGR in order to remove the DPF, which is a costly maintenance item that can incur significant down-time.

While the automotive and off-highway industries wrestle with integrating this technology into an already packed vehicle, designers and manufacturers in the marine and industrial sectors have considerably more freedom. In many cases bespoke packages are required for certain larger piston engine applications and this requires expertise in fluid control technology as well as experience in systems integration and precision manufacturing.

An SCR system uses a solution of urea, or (NH2)2CO, which is injected into the exhaust stream. In the presence of a catalyst, it turns into ammonia and carbon dioxide, which then reacts with the NOx to create nitrogen and water vapour, or 2N2 + 3H2O. The urea solution is also known as diesel exhaust fluid (DEF) or one of the brand names such as AdBlue.

Bürkert is currently working with a number of clients to develop bespoke, packaged SCR control systems as well as individual components that will provide the necessary accuracy and reliability for the ongoing control of emissions from internal combustion engines. The projects are managed and delivered by the company's Systemhaus facilities.

The definition of a bespoke control system means that the designers have to start from the ground up, working closely with the client to establish what will be delivered by the new system and how best to achieve it. Often existing technology and components will have to be integrated with unique parts and custom designs in order to achieve the best solution.

The most effective way of delivering a bespoke project is to assign a team that contains all the necessary skills and expertise to design, simulate, prototype, construct and test the finished product. Working closely with the client, this team has the ability to ensure the most efficient methods are used to develop an idea into the completed design.

These teams can procure all the necessary components, both from Bürkert's own product lines and from external suppliers in order to achieve the most effective solution for the client. At the same time all the components must be seamlessly integrated and work together to deliver the required control structure and meet the necessary industry standards. The entire process from initial concept, through prototyping, to final commissioning is driven by the same team, ensuring continuity of communication with the client and the most efficient product development process.

The challenge in creating new SCR systems and components is making sure that the reacting agent is delivered precisely. This can be achieved using pulse valves for compact vehicle applications or flow control valves and flow sensors on larger installations.

In some installations there is a need to atomise the urea for a better reaction and this requires additional control for the forced air, which can be incorporated into the design. For airless SCR systems the control valves will come into direct contact with the urea, which means using materials such as EPDM for the seals to ensure the correct level of chemical resistance is maintained.

The actual control structure is based on the load and speed of the engine with active feedback provided on some systems by NOx and ammonia emissions monitoring. At engine start-up urea injection is initiated once the catalyst reaches operating temperature, which is key for effective NOx reduction performance, deposit prevention and to avoid ammonia slip.

In every case, Bürkert is able to draw on a wide range of proven flow control products and many years of experience to develop the exact requirements of each application. This may include the use of mass flow controllers, which can provide excellent control characteristics as well as network compatibility for integration with the wider engine control system.

Designing and installing these systems not only ensures compliance with the latest emissions regulations; there are also opportunities to improve fuel efficiency as well, especially in large marine applications. For ocean-going vessels that move in and out of Emission Control Areas, the engine settings can be adjusted for the local operating restrictions and maximising fuel efficiency.

About BÜRKERT

Bürkert Fluid Control Systems is one of the leading manufacturers of control and measuring systems for fluids and gases. The products have a wide variety of applications and are used by breweries and laboratories as well as in medical engineering and space technology. The company employs over 2,500 people and has a comprehensive network of branches in 36 countries world-wide.

Editor Contact

DMA Europa Ltd. : Roland Renshaw

Tel: +44 (0)1562 751436
Fax: +44 (0)1562 748315
Web: www.dmaeuropa.com
Email: infoallenquiries@dmaeuropa.com

Company Contact

Bürkert Fluid Control Systems : Helen Christopher

Tel: +44 (0)1285 648720
Fax: +44 (0)1285 648721
Web: www.burkert.co.uk
Email: helen.christopher@burkert.com