

FA 07 Refineries are quite sophisticated

Valve makers are increasingly targeting refineries outside of Europe. Energy efficiency is decisive for the competitiveness of refinery operators and their valve suppliers.

Refineries always are in operation, and simply cannot be replaced. Traffic can only flow with their products, namely petrol and diesel. Electric cars, however, are nipping at their heels, even if ever so slightly. In order to prepare for the future, European refinery operators are introducing efficiency programs to curb growing energy costs. They have also teamed up with valve manufacturers to target growth markets in Asia.

Refineries secure economies

The role of the refinery sector for the European economies is without question, emphasises Elisabetta Gardini, member of the European Parliament. Nonetheless, the industry is changing. Already today, European refineries have to come to terms with a 25 percent loss in competitiveness between 2000 and 2015 to international competitors, due to strict environmental regulations in Europe. Competition is stiff, especially in Asia and the Middle East, as the findings of the EU Commission's refinery fitness check show.

Protection from Carbon Leakage

"Next to the EU Industrial Emissions Directive (IED), competitive disadvantages are mainly caused by the costs for CO2 emissions trading," explains the Association of the German Petroleum Association MWV e.V. In regions outside of Europe, a comparable burden can so far not yet be found. As long as this is the case, it is essential Europe needs to be kept safe from what is called "Carbon Leakage", the exodus of energy intensive plants or entire industries out of Europe. Valve manufacturers are naturally following these developments very closely.

Europe's largest refinery site is Germany. Thirteen refineries sum up to 103.4 million tons of crude oil processing capacity. "With refinery production of 101 million tons Germany is the largest refinery site and mineral oil market within the EU," states Germany's Federal Ministry for Economic Affairs and Energy. Rising consumption of mineral oil products



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and increasing competition from outside of Europe are also leading to refineries being sold, or going out of operation.

A complex process

In 2014, Germany imported around 89 million tons of crude and produced 2.44 million tons in the country itself. The refineries process crude oil mainly into diesel, petrol, heating oil, wide cut fuel and naphtha for the petrochemical industry, as well as bitumen for road construction, extruded charcoal for industry, calcite for the aluminium industry, and sulphur for the chemical industry.

A complex process requiring numerous of plant components. Amongst others, this for instance includes crude oil tanks, furnaces, dephlegmators, precipitators, tanks, coolers, turbines, reboilers, desulphurisers, flares, piping and reactors. Valves are, of course, found nearly everywhere. The tremendous amount of valves used in a refinery, and thus also what a manufacturer can sell, can, for example, be seen in the German mineral oil refinery Oberrhein (MiRO). During a major inspection 1,200 safety valves and 1,800 valves were checked, that are required in nearly all steps of the process: in the desalination of crude oil, in the boiler, in the distillation at up to 400°C, in catalytic cracking, the hydrofiner, enrichment and for desulphurisation. In addition, valves are required for the piping between the plant segments. The entire process poses a great challenge for valves: "In refineries hazardous substances are dealt with, such as hydrocarbon, hydrofluoric acid, acid water, various liquid gases, toluene, anilines and ethylene oxide," explains manufacturer Schroeder Valves. Fluids are furthermore transported in high-pressure circuits with high vapour pressures.

Entire valve spectrum required

Nearly the entire spectrum of valves is therefore needed, for instance for steam, condensate, gas and process, tank, gas scrubbing and crude oil separation applications. Manufacturer ARI-Armaturen manufactures triple eccentric metal butterfly valves, safety valves, steam traps, control valves with pneumatic or electric actuators and manual shut-off valves with safety stuffing box or bellows.

Refineries require valves tailor-made for the oil production process. Leusch manufactures valves for large nominal diameters, up to a pipe diameter of DN 2500. Requirements include a fast and secure shut-off of gaseous media and fuels. “The self-media operated quick-closing valve is equipped with a piston actuator fully suitable to be applied with the gaseous operating media,” explains valve manufacturer Kühme. Automatic quick-closing is performed by the installed spring force in less than 1 second. The valve cone with soft sealing element guarantees absolute tightness. This is a must for refineries.

Valves under pressure

High-performance valves are also required for high-pressure steam applications in refineries. Here, Crane produces valves with bolted bonnets and pressure seals. They are made from rugged cast carbon and alloy steels in multi-turn and several check valve configurations. For delayed coker isolation wedgeplug valves are used, that can handle high temperatures.

Arca uses GS-C25/ A216WCB as a standard material for its valves for use in catalytic cracking and Claus plants. Special designs made from Hastelloy and Monel are also in demand. Arca states temperatures can range from -190 Grad Celsius up to +570 Grad Celsius.

Shut-off valves required

Burners are used in refineries for water tube boilers and CO₂ combustions – the fuel burning operation needs to be secured. Burner stations therefore need to be fitted with all valves required for secure boiler operation. “In the oil lines, a combination of two shut-off valves is usually employed, with one having a control function for fuel supply,” explains Kühme. Parallel to the oil line a steam line conveys the atomising steam to the burner. “The burner station is equipped with safety shut-off valves for the fuels and in case of oil burners, additionally for atomising – and purging steam”. The steam lines are also equipped with safety valves. Kühme: “By standard the upstream side in front of each safety shut-off valve furthermore has to be equipped with a manual shut-off device as well as a strainer”. Manometers can be installed on the pressure end. All pneumatic valves are supplied through a central compressed air distributor.

Focus on energy efficiency

Refineries base all decisions for what they want to be supplied with solely on energy efficiency. In order to remain competitive with the growing number of competitors outside of Europe, energy costs need to be reduced. Take the PCK Refinery in Schwedt, Germany, as an example. It supplies the Berlin-Brandenburg region with 90 percent of its petrol with petrol, diesel, kerosene, heating oil and other mineral oil products – its total share of fuel production in Germany is around ten percent. An energy efficiency programme (PEP) was introduced by the PCK Refinery. Overhauling and retrofitting of the plant is to go hand in hand with yield and energy efficiency, bringing the level of crude oil used as energy to below ten percent in the future. The aim is to increase the efficiency of the furnace, reduce the amount of fuel gas, lower the temperature of the emitted waste gas and the total amount of CO2 emissions.

A long process chain

Furthermore, the PCK Raffinerie implementing an environmentally-friendly logistics concept: 60 percent of products are distributed by rail, 27 percent using pipelines and just 13 percent over roads. Operating as a residue-free refinery, non-exploitable crude oil is turned into power in a heat and power generation plant. Valve manufacturers have to come to grips with these developments in order to participate for their own benefit.

In the end, refineries are only part of a long process chain. The chain begins with on- and offshore crude oil production, pipelines and pipeline construction to processing capacities in refineries, or the petrochemical and chemical industries. “At the same time, there is a growing need for high-quality equipment such as valves,” explains ARI Armaturen. And one needs to take note of further steps in the process, such as the numerous storage facilities and, finally, the distribution of diesel, petrol, heating oil to companies and households. As a matter of course, valves are required everywhere up and down the chain.

585 billion tons of crude oil

All stakeholders have no need to fear the future. Valve makers will still participate in the output of refineries in the long term. Thanks to global economic growth and growing energy consumption processing of crude oil remains highly important. Even though oil is a finite resource, the global

amount of oil reserves has been rising, emphasises Dr. Steffen Dagger, director of the German Petroleum Association MWV e.V. Germany's Federal Institute for Geosciences and Natural Resources, the BGR, sees total oil reserves of around 585 billion tons. Annual consumption, states Dagger, is around for billion tons.

Growth markets China and India

The sector can trust a positive outlook, also because of growing demand in emerging markets such as China and India. The oil processing industry is massively ramping up production in these countries. A development bound to fill the order books of valve manufacturers.

Innovations on valves will be presented at Valve World Expo Düsseldorf from November, 29 until December, 1, 2016 at Düsseldorf Fairgrounds.

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