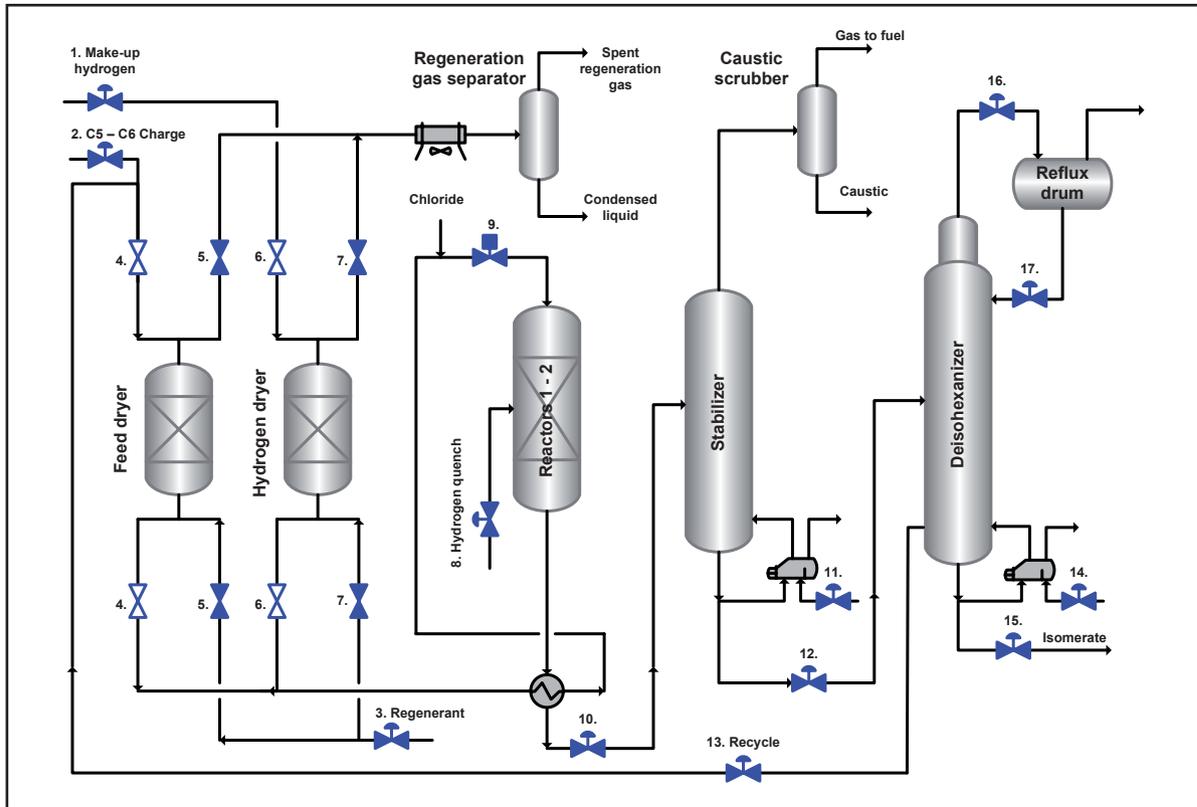


Isomerization – driers



Process overview

The octane numbers of the light straight run naphta can be improved by the use of an isomerization process to convert normal paraffins to their isomers. In once-through isomerization the naphta octane number can be increased from 70 to about 82. If the normal components are recycled, such as in the picture above, the resulting octane numbers will be about 87 to 93. Reaction temperatures of about 95 to 205 °C are preferred to higher temperatures to enhance the conversion to isomers. A very active catalyst is required to provide reasonable reaction rate. Some types of catalysts require the continuous addition of very small amounts of organic chlorides to maintain high catalyst

activities. This is converted to hydrogen chloride (HCl) in the reactor, and therefore the feed must be free of water and other oxygen sources to avoid catalyst deactivation and potential corrosion problems. Feed driers filled with molecular sieves are used to remove water and protect the catalyst. Catalyst life is usually 3 years or more with all of these catalysts. An atmosphere of hydrogen is used to minimize carbon deposits on the catalyst and control reactor bed temperature. The stabilizer bottoms can be separated into normal and isoparaffin components by fractionation (deisohexanizer) or molecular-sieve separation to recycle the normal paraffins.

Isomerization challenges

The optimal performance of an isomerization unit is achieved when reactor temperatures are adjusted for favourable reaction rates and equilibrium, while meeting product specifications and minimizing recycles to allow for maximum throughput. The gas and liquid driers perform the important task of safeguarding the catalyst from water vapour and other impurities in the make-up hydrogen and hydrocarbon feed.

Health, Safety, Environment – Valve leaking poses both an environmental and safety issue due to risk of fire and toxicity of volatile gases. Emergency shutdown and on/off valves must be able to perform their action in a process or equipment failure.

Top-class products at maximum yield – The market calls for clean products and high quality. It is important that the process is stable, flexible and under control. Poor control valve performance reduces the accuracy of throughput control and adversely affects to the plant performance and also the downstream processes. The switching valves performance is critical for optimum dryer operation and therefore the whole process success.

Maintenance costs – Poorly performing valves in the process must be serviced because they will have a direct impact on the efficiency of the process. High sequencing valves in the driers are particularly critical. The cost of unscheduled maintenance will be quite high, up to 70% of the cost of a new valve in some applications. Add this to the cost of removing the valve from the line and disruption of the process and the total cost will be much higher.

Plant run-time – Refineries are looking for longer plant run-times since downtime means production losses and is a remarkable cost including maintenance costs. This requires reliable equipment and process control.

Metso solutions

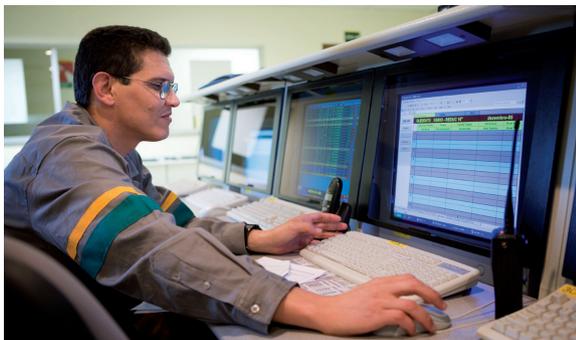
We are all tuned up to answer these challenges through our refining application experience and product offering for control, safety and automated on/off duty that ensure high valve performance in isomerization plants.

Safety – Metso is the only single source emergency shutdown valve supplier who has the experience and knowledge to combine intelligence with most reliable valves and actuators. Technology selections like rotary stem operation and inherently fire safe design ensure that latest emission and fire safety standards can be applied. Reliable valves with first intelligent, SIL3 approved safety valve controller and partial stroke testing system Neles ValvGuard will ensure that plant emergency shutdown valves will always perform properly when needed.

Efficiency – Throughput losses due to sticking and poor control performance will be avoided with high performance rotary valves. Flow through the process unit may be changed as the need arises with rangeability of 150:1 and further with full bore ball valves. Our advanced ND9000 intelligent valve controller ensures higher positioning accuracy and faster response to reduce process variability. Correct valve selection and sizing with our Nelprof-program we can assure the best valve performance and process control.

Availability – Simple rotary designs, same face-to-face dimensions, and global service network and inventory management will help you to optimize your maintenance activities. Rotary valves have been in service for several years without requiring maintenance and show no sign of leakage. The proven performance of Metso valves with long lasting metal seat tightness and shut-off capabilities makes them an ideal solution for control, on-off and switching applications.

Reliability – Valve performance trend data collected by our smart valve controllers and analysed by Neles FieldCare, open FDT/DTM technology based configuration and condition monitoring software, makes it possible to predict and respond to maintenance requirements and reduce unscheduled downtime. This gives full transparency to the valve performance in process control.



Drier applications

Since there are more than 70 valves typically involved in the operation and regeneration of the driers, valve performance plays a key-role in the operation to minimize operations expense and to protect the catalyst and equipment. Effective operation of driers extends the catalyst life and ensures optimum regeneration requiring less utilities.

Make-up hydrogen control (1)

C5-C6 feed control (2)

Regenerant feed control (3)

Challenge – Light naphta feed and make-up hydrogen are both charged to own drier vessels. Hydrogen-to-hydrocarbon ratios are controlled to the minimum level required to prevent excessive catalyst coking in the reactors after driers. Reactions take place in the presence of hydrogen at operating conditions that promote isomerization and minimize hydrocracking. All the feed benzene is hydrogenated to cyclohexane. Only a slight excess of hydrogen above chemical consumption is used. The make-up hydrogen is typically provided by a catalytic reformer. Driers must be regenerated properly and frequently to remove the adsorbed water and other impurities from the molecular sieve beds by hydrocarbon (isomerate) or steamed hydrocarbon. Seat leakage required for these control valves is typically class IV or class V.

Metso solution – Intelligent Finetrol eccentric plug valve.

Benefits – Valve plays a significant role in control loop, especially when high loop performance is targeted. Wide control range and stable control behaviour provides accurate control performance that keeps process deviations to a minimum. This makes it possible to operate the process at optimum hydrogen-to-hydrocarbon ratio and optimize the hydrocarbon consumption for dryer regeneration. Metal seats provide long lasting performance and tightness. Rotary design and packing structure reduces the fugitive emissions. Process reliability can be improved with ND9000 intelligent valve controller that provides full transparency to valve performance.



Finetrol

Feed driers process switching valves (4)

Feed driers regenerating switching valves (5)

Make-up gas driers switching valves (6)

Make-up gas driers regenerating switching valves (7)

Challenge – Adsorptive dryers include normally three beds, two in drying stage and the third in regeneration with hot gas or in reactivation with cool gas. Switching from bed to bed takes place in 2 – 6 hours, minimum 4 to 6 switching valves are required for each bed. The switching valves play an important role of directing the inlet/outlet gas streams into the adsorption bed columns switching the columns from an adsorption phase to regeneration phase (and cooling phase) in a preset sequence. These valves are also called drier sequencing valves. The valves should resist hot regeneration gas (200 – 350 °C) and temperature swings (25 up to 350 °C). They should maintain the operability in spite of some particulates (molecular dust) with operating pressure up to 50 - 60 bars. Tight shut off is required, typically class V for feed drier valves and class V or VI for hydrogen drier valves.

Metso solution – Trunnion mounted or seat supported X-series ball valves / D-series trunnion mounted ball valves / Top entry ball valves with Neles SwitchGuard intelligent on/off valve controller. Valve series depends on the size and pressure class required.

Benefits - The Neles X-series metal seated ball valves are widely used for molecular sieving drying applications. Trunnion mounted ball valve is an excellent choice for high cycle shut-off service with high pressure differentials. The floating ball design assures good metal seated tightness for demanding high cycling applications with low shut-off pressures. For extremely long service life with impure fluids we can offer D- or T-series ball valves with strong stem integrally cast with the ball and large low-friction bearings. For a complete valve solution for the driers we offer our Neles SwitchGuard, intelligent on/off valve controller that is designed to meet the demands of process-critical switching operations, particularly high cycling applications. With SwitchGuard and Neles FieldCare, configuration and condition monitoring software, you can monitor the condition of all the critical switching valves and utilize the unique on/off valve diagnostics to predict occurring valve failures in advance. In addition, with SwitchGuard, exact stroking profiles and times can be set for the switching valves.



Neles switching valve

Optimize your isomerization process performance, reduce energy and maintenance costs and produce top-class products with our intelligent rotary control, on-off and ESD valves.



Nebes intelligent valve controllers



Visibility to switching applications



Intelligent safety

The information provided in this bulletin is advisory in nature, and is intended as a guideline only. For specific circumstances and more detailed information, please consult with your local automation expert at Metso.

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