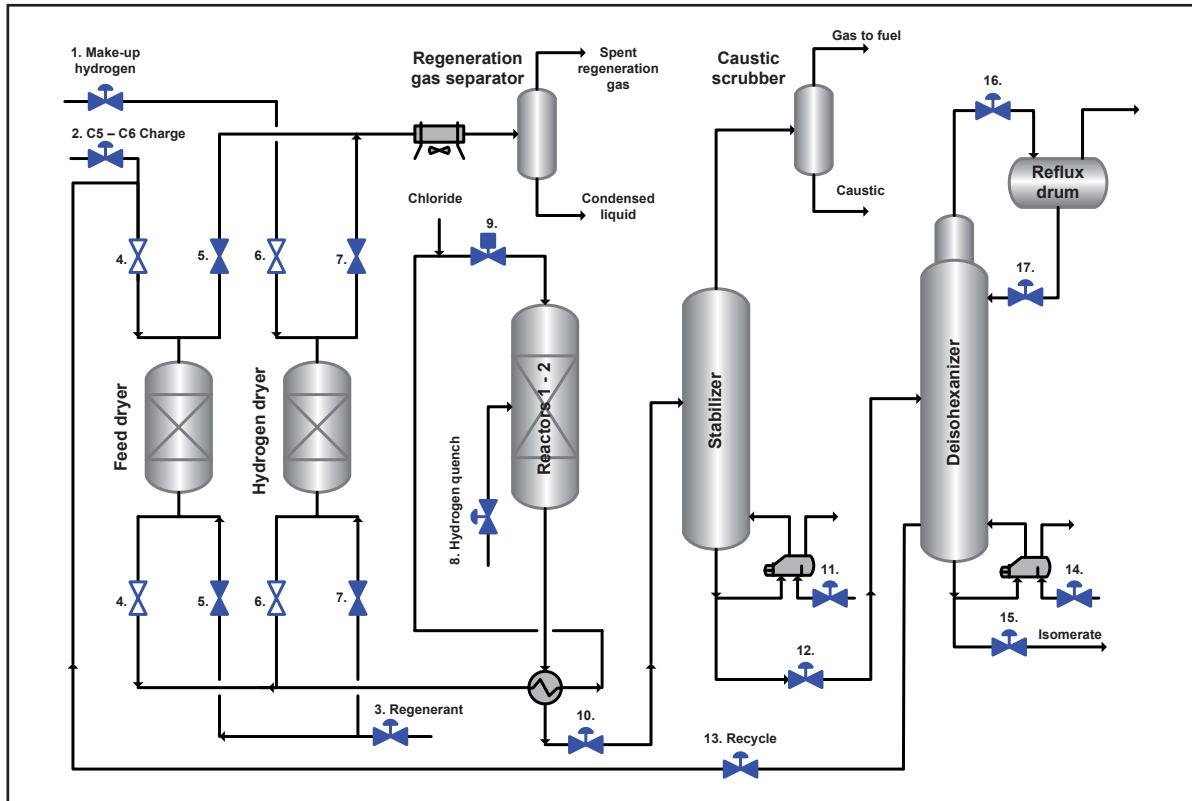


Isomerization – product separation



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 dryers 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.



Product separation applications

Stabilizer bottoms to deisohexanizer (12)
Deisohexanizer sidedraw to feed driers (13)
Reboiler heater passes (11/14)
Isomerase to storage (15)
Deisohexanizer reflux (17)

Challenge – The reactor effluent is cooled before entering the product stabilizer. The stabilizer overhead vapors are caustic scrubbed for removal of the HCl formed from organic chloride added to the reactor feed to maintain catalyst activity. After scrubbing the overhead gas then flows to fuel. The stabilizer bottoms are separated into normal and isoparaffin components by fractionation in a deisohexanizer column that concentrates the low-octane methylpentanes into the sidecut stream that is recycled back to the reactor feed. This way the isomerase product octane number can be further increased. Reboiler controls the amount of heat input to the stabilizer/deisohexanizer and therefore the efficiency of gas stripping from the gasoline. Steam or hydrocarbons are typically used as heating media. Accurate control performance is required for efficient product separation. Reflux is used to control the gasoline separation from the gases. The operation of the reflux control is a balance between the gasoline separation from the gases and reboiler energy consumption. The higher the reflux rate the more heat is required. The lower the reflux rate the more gasoline is lost with the gases, but less heat is required in reboiler.

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 maximize the product separation and optimize the low-octane recycle stream back to the reactor feed. Process reliability can be improved with ND9000 intel-



Finetrol

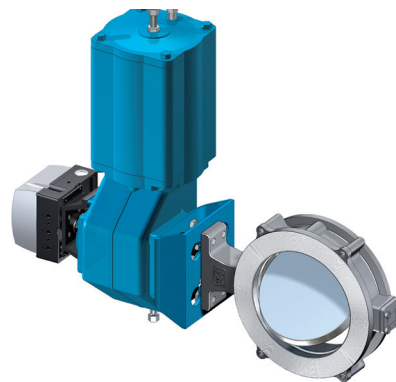
ligent valve controller that provides full transparency to valve performance. Savings are realized in reduced energy consumption in the reboilers and maximum high-octane gasoline product recovery.

Overhead vapour (16)

Challenge – Product separation column pressures are typically kept in minimum in order to minimize the energy consumption at the column reboiler. Stability is required in order to keep the column in stable conditions. Fugitive emission control is important for gas service.

Metso solution – Neles high performance triple eccentric disc valve.

Benefits – With close to equal percentage characteristics and superior tightness Neles triple eccentric disc valve is an economical and reliable choice for large size control applications. As a result of the unique geometry of Neldisc, the contact between disc and seat is mechanically induced and does not rely on assistance from differential pressure. Free movement of the disc provides sensitive operation which makes the column operation easy and stable. Rotary design low emission with reliable stem packing provides simple and cost effective way to reduce overall fugitive emission.



Triple eccentric disc 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.



Neles 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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