

Equilibar back pressure regulator provides superior control for refinery catalyst testing

DISCOVERING IMPROVED CATALYST FOR REMOVING IMPURITIES TO MEET IMO 2020 AND TIER 3 FUEL ENVIRONMENTAL REQUIREMENTS

Background

In the oil and gas industry, removing impurities from petroleum fuels leads to cleaner emissions and improved downstream processing. Hydrodesulfurization (HDS) and hydrodenitrogenation (HDN) are chemical processes that use catalysts to remove sulfur and nitrogen impurities. New legislation such as [IMO 2020](#) for marine fuels and [Tier 3](#) for automotive fuels requires substantial reductions of sulfur and nitrogen to reduce their environmental impact.

[ILS-Integrated Lab Solutions, GmbH](#), is a world leader in providing medium and high-throughput refinery testing units. They have extensive experience with deep HDS and HDN applications where exceptionally low flow rates and high pressures are needed to provide true trickle- and plug-flow to reactors to reach high sulfur conversion levels. ILS researchers have had repeated success using Equilibar products to improve these complex systems.

Benefits of dome-loaded technology for catalysis

ILS is using Equilibar backpressure controllers in multiple refinery catalyst testing units. Equilibar's technology is uniquely well suited for applications involving two-phase flow because it uses a direct sealing diaphragm over multiple orifices to control the pressure drop ([see how it works](#)).

The valve action is not provided by the movement of a tapered stem, but by the close proximity of the diaphragm and the orifice plate. The supply diaphragm can vary its proximity to the orifice nearly instantaneously to adjust to the varying valve coefficient requirements of the various phases. A further benefit is provided by the unique multiple orifice design. Even if one orifice is totally flooded by the denser liquid, volumetric flow control can still be maintained so long as some of the orifices are still predominantly in the gas phase.



Figure 1: Refinery catalyst test unit by ILS - Integrated Lab Solutions, GmbH

In the ILS system, the ability to manage two-phase back-pressure control means that high pressure gas-liquid separators are no longer necessary. This is particularly helpful in units handling heavy feedstocks such as Vacuum Gas Oil (VGO) or Bitumen where the process has to be heated to temperatures above 150°C. ILS engineers find the Equilibar controller to be insensitive to blockage by particles and useful in preventing the formation of aerosols, which are hard to crash out.

Additional benefits are the compact size and gas dome-loading of Equilibar pressure controllers. These qualities allow them to be easily placed into ovens and then operated remotely through pilot lines run to the dome reference port. This setup is an improvement over that which is required for traditional style valves where the control valve is closely tied to the needle actuator. When using traditional valves, ILS engineers must often install separate trace heating to avoid significant heat-loss because those valves cannot be placed into ovens.

Finally, the superior turndown of the Equilibar BPC provides researchers with a much broader pressure-flow testing envelope over which they can test catalysts.

“The design of Equilibar controllers is unique,” said Dr. Anton Nagy, founder of ILS. “They have a definite advantage for two-phase flow and catalysis.”

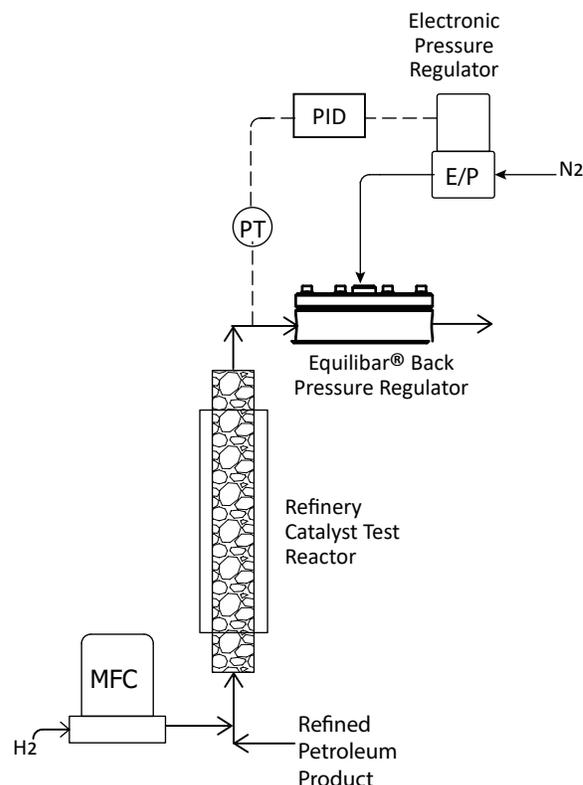


Figure 2: Schematic of refinery catalyst test reactor with Equilibar back pressure regulator

Contact Equilibar

Equilibar is a provider of unique and innovative pressure control solutions based near Asheville, North Carolina. The patented back pressure technology is used in a wide array of processes including catalyst, petrochemical, supercritical and other industrial applications. For more information contact an Equilibar application specialist at inquiry@equilibar.com or 828.650.6590.

Anton Nagy, founder and CEO of ILS-Integrated Lab Solutions, has worked previously as a research chemist at Avantium, Shell and Bayer. Dr. Nagy can be reached at +49-302639669100 or anton.nagy@integratedlabsolutions.com. ILS-Integrated Lab Solutions GmbH, Barbara-McClintock-Strasse 11, 12489 Berlin, Germany.

Jeff Jennings, P.E., is founder and president of Equilibar, LLC, a provider of high precision pressure control solutions. Prior to Equilibar, he worked as a process development engineer for 23 years. He is a licensed professional engineer in North Carolina and holds several patents. Jennings can be reached at jeffjennings@equilibar.com or 828-650-6590.