

CO₂ RECOVERY PLANT

FOR CO₂-RICH RAW GAS STREAMS



Pentair's **CO₂ Recovery plants (RBU)** are designed for a broad range of industrial production sites generating CO₂-rich raw gas streams. These streams typically contain 85–99 % CO₂ and can originate from fermentation, ethanol, ammonia, or ethylene production, and other high-purity industrial processes. The RBU system combines compression, purification, and liquefaction to produce high-quality liquid CO₂.

Each RBU is built around a precise understanding of the customer's feed gas composition, impurity profile, required CO₂ quality, operating conditions, and business objectives. By combining standardized process blocks with application-specific engineering, Pentair can tailor each solution to deliver the required CO₂ specification and quantity while optimizing CAPEX, OPEX, reliability, and overall lifecycle performance.

With a broad portfolio of proven, proprietary, and patented purification technologies, Pentair can address a wide range of impurities, including hydrocarbons, NO_x, sulfur components, alcohols, oxygenates, and aromatic compounds.

KEY BENEFITS

- ◆ **High-quality liquid CO₂ production**
- ◆ **Tailored purification for every feed gas profile**
- ◆ **Competitive lifecycle economics**
- ◆ **Reliable compliance with demanding CO₂ specifications**
- ◆ **Sustainable long-term operation**

Sustainability and Operational Competitiveness

Beyond producing liquid CO₂ from CO₂-rich feed gas streams, the RBU concept can support customers in improving the sustainability and competitiveness of their operations.

For bioethanol producers, recovering fermentation CO₂ can help reduce the carbon footprint of ethanol and organic compound emissions while creating an additional revenue stream.

At the same time, technologies such as CO₂ Scrub, CO₂ refrigeration, and application-specific process flow design can help reduce site utilities, including water consumption, while supporting reliable product quality and efficient plant operation.

Safety-Driven Engineering and Compliance

Every RBU plant undergoes a thorough safety assessment in line with EN standards for HAZOP/LOPA and Functional Safety (SIL). This supports safe and efficient operation and helps ensure a smooth CE marking process.

Lifecycle Services and Support

To support reliable operation long after commissioning, Pentair offers tailored Service Level Agreements that combine preventive maintenance, remote diagnostics, performance monitoring, and dedicated technical support. These services help ensure that the plant continues to deliver the required CO₂ quality, operational reliability, and uptime throughout its lifecycle.

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Proven Purification Technologies for Demanding CO₂ Specifications

CO₂Scrub Technology

For demanding bioethanol fermentation applications, the CO₂Scrub is particularly well suited to removing high-boiling impurities, including aromatic components, alcohols, oxygenates, and selected sulfur compounds, and maintaining product quality even when feed gas composition and impurity levels vary. Unlike conventional water-based purification approaches used in many fermentation applications, CO₂Scrub supports a completely water-free purification process, helping reduce water consumption and environmental impact. In addition, the process requires no chemical additives and produces no liquid or solid waste, supporting more sustainable and resource-efficient CO₂ purification.

NO_x Removal Technology

Certain CO₂-rich feed gas streams may contain nitric oxide (NO) and other nitrogen oxides that must be removed to meet food-grade or industrial CO₂ specifications. Pentair offers dedicated NO_x removal technologies as part of the RBU purification portfolio, selected according to the feed gas composition and required product quality. By integrating NO_x removal into the overall purification process, Pentair helps customers achieve stringent CO₂ purity requirements while maintaining reliable plant operation and minimizing the impact on operating costs.

Catalytic Oxidation

For CO₂-rich feed gas streams containing residual hydrocarbons or volatile organic compounds (VOCs), Pentair's Catalytic Oxidation technology (CATOX) converts these components into CO₂ and water through a controlled catalytic reaction. The process provides an efficient method of removing impurities that cannot otherwise be removed from the CO₂ feed. By reducing hydrocarbon concentrations before downstream purification and liquefaction, CATOX supports compliance with demanding CO₂ product specifications while helping maximize CO₂ recovery and operational reliability. This technology is particularly valuable for industrial CO₂ recovery applications where hydrocarbon contamination may vary over time.

Adsorptive Purification

Pentair's adsorptive purification technologies are used to remove trace contaminants that may affect CO₂ quality, equipment reliability, or downstream processing. Using activated carbon, molecular sieves, and specialty adsorbents, Pentair can target impurities such as sulfur compounds, alcohols, oxygenates, aromatics, VOCs, and residual moisture. The technology can be tailored to the specific impurity profile of each application, helping customers achieve demanding CO₂ specifications while supporting reliable and efficient plant operation.



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