Solutions for:
Refrigerator recycling
Coating lines
Chemical and Pharmaceutical industry

CRYO-CONDAP® process
Clean air, clean technology - outstanding economy

Air Products (NYSE:APD) serves customers in technology, energy, healthcare and industrial markets worldwide with a unique portfolio of products, services and solutions, providing atmospheric gases, process and specialty gases, performance materials and chemical intermediates.

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Focus on emissions

Over the last few decades companies processing VOCs or solvents have been confronted with increasingly restrictive legislation on ODS (Ozone Depleting Substance) and VOC (Volatile Organic Compound) emissions to atmosphere. As a result most companies have begun and continue to take steps to ensure compliance with local regulations by the required deadline. The reliability and efficiency of Air Products CRYO-CONDAP® systems coupled with world-class cryogenic and engineering teams make Air Products the natural business partner to achieve this.

Since 1979, Air Products have installed over one hundred CRYO-CONDAP® cryogenic abatement / recovery systems worldwide. These systems have been supplied to the refrigerator recycling, coating line, chemical, pharmaceutical and other general industries.

The principle for all CRYO-CONDAP® systems is based on simple physical chemistry; at any given gas temperature, a VOC concentration cannot be higher than the value given by the corresponding point on the saturation curve.

Each system is designed to meet specific site and process requirements. A combination of technologies is normally used to achieve the best technical and commercial solution. Technologies considered are:

- mechanical cooling where this is the best cost effective solution
- indirect cooling with nitrogen via horizontal or vertical heat exchangers
- indirect cooling with Air Products’ unique compact low temperature heat exchanger with internal intermediary fluid
- indirect cooling using shell and tube heat exchangers with an intermediary fluid between the liquid nitrogen and the process gas
- direct injection of liquid nitrogen into the process gas stream to freeze out solvents
- molecular sieves or activated carbon for pre-concentration or as a polishing step
- mechanical refrigeration
- heat exchangers with an intermediary fluid
- compact low temperature heat exchanger
- horizontal or vertical heat exchangers
- heat transfer fluid utilised where greater control of temperatures is required.

The application areas where these technologies are most commonly used are:

1. CRYO-CONDAP® technology for coating line

A closed loop system where the coating is applied to the substrate under a nitrogen atmosphere. Solvent-laden gas is extracted from this closed loop and treated within a low temperature condenser to remove the solvent from the gas stream. The cooling medium here often mechanical refrigeration and, dependent on site emission requirements, the exhaust may then be further treated by a cryogenic condenser using liquid nitrogen or a molecular sieve.

2. CRYO-CONDAP® technology for refrigerator recycling

Air Products provides leading technology for safe reclamation of R11, R12 and Cyclopentane propellants that are released during the recycling of refrigerators.

European regulation 2037/2000 came into force on January 1st 2002 making it illegal to dispose of domestic refrigerators and freezers without capturing and safely destroying the ozone-depleting substances (ODS) that are contained within.

The unit uses liquid nitrogen in a patented low temperature heat exchanger to cool down and capture the ODS which are released when the fridges / freezers are crushed. The last traces of R11, R12 and Cyclopentane are then caught using mol sieve adsorption. The exhaust gas can then be discharged into the atmosphere within EC requirements.

3. CRYO-CONDAP® technology for general purpose abatement

These systems use the best available techniques in heat exchanger and separation technology to provide solutions for all industries, especially the chemical and pharmaceutical sector. Typically shell and tube heat exchangers are utilised and the number and configuration depend on the individual process and composition of gas to be treated. The cooling medium can be either mechanical refrigeration or liquid nitrogen and can be either direct (liquid nitrogen on the tube side) or indirect where a heat transfer fluid is utilised where greater control of temperatures is required.

One of the greatest benefits of this type of system is that, providing the site has a high enough gaseous nitrogen demand, most of the nitrogen used for the cooling process can be fed into the customer network for reuse making these systems extremely economical to run.

This type of system can treat the largest range of flows up to 1500 Nm³/hr.

4. CRYO-CONDAP® ExStream® technology

A new patented development from Air Products with systems installed since 2002. This system is designed to simplify the process and has the ability to exceed the most stringent emission standards. The principle behind the process is the freezing of the chemicals to be removed by the direct injection of liquid nitrogen into the process gas. The super-cooled ice particles formed are then filtered out of the process by proven filtration technology specially adapted for cryogenic use. These particles are then recovered for disposal or reuse. This type of system is optimum for flow rates up to 100 Nm³/hr.

Summary

Whatever your requirements are for VOC abatement or recovery, Air Products’ has nearly 30 years experience of evaluating designing and installing individual solutions utilising many technologies across a broad range of industries.

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www.airproducts.com/cryogenics

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