BOC
A Member of The Linde Group

Pure air – a clear choice.
CIRRUS® Vapour Emission Control.

Cryogenic condensation and recovery of volatile organic compounds (VOCs).

The ultimate aim of vapour emission control is to prevent the unwanted release of volatile organic compounds (VOCs) into the atmosphere. Firstly, because these VOCs represent a health risk as well as an environmental hazard and – secondly – because their emission is strictly regulated by law.

Pure air – a clear choice

CIRRUS® Vapour Emission Control (VEC) systems constitute a complete and comprehensive approach to minimising or reducing the release of VOCs, using liquid nitrogen to condense the VOC vapour from gas streams. CIRRUS® VEC systems have been marketed and sold across Europe and throughout the Americas. These many satisfied customers serve as our reference base. As a result, Linde now not only has the benefit of wide and extensive know-how, but has also accumulated expertise and extensive field experience regarding VEC systems. This considerable knowledge can be easily transferred to your production facilities to provide you with an optimal VEC solution.

CIRRUS® M50 module reference: Dichloromethane is released, for instance, from reactor vessels during the production of steroids at the pharmaceutical company Richter Gedeon in Hungary. The dichloromethane contained in the off-gas is condensed at -85 °C using a CIRRUS® M50 module. This significantly reduces the unwanted hazardous emissions to the atmosphere enabling Richter Gedeon to comply with environmental demands.

Safe and environmentally sound

A number of factors minimise the impact of cryogenic condensation on the surrounding environment. The inert nitrogen does not come into direct contact with the VOCs. The condensed VOCs and evaporated nitrogen can therefore be recycled and reused for other purposes in your process. The cryogenic process is CFC-free and generates no wastewater. Furthermore, there is no secondary pollution in the form of NOx, acids, gases and dioxins. Cryogenic condensation with CIRRUS® VEC units is a very safe technology. There are no sources of ignition and the equipment is designed and built to operate in potentially explosive atmospheres.

Cost-effective

Nitrogen recycling and chemical recovery are extremely cost-effective, thus significantly reducing your operating costs. In addition, capital investment cost is less than, for example, in case of thermal oxidation or absorption processes. Linde not only supplies all the necessary hardware, software and documentation, it also takes care of the basic installation, safety controls and start-up routines as well as education and training. The systems are easy to install and to operate, which ensures that the cost associated with operating personnel remains very low.

Reliable and uncomplicated technology

A CIRRUS® VEC system is simple to start up and shut down. The fully automatic control system is operated using an easy-to-use panel. It can handle variations in the gas flow, pressure, temperature and the level of solvents in the process gas. As a drop in system pressure is normally between 10 and 70 mbar, blowers or vacuum pumps are usually not required. Together with the absence of moving parts, this means that there is little need for maintenance, which further reduces your operating costs.

An ideal solution

CIRRUS® VEC systems are best suited to processes in which the vapour content in the gas to be cleaned is higher than approximately 40 g/Nm3, and during which the process gas flow is lower than approximately 1000 Nm3/hour. The freezing point of the substances to be condensed should preferably be below minus 30 °C. The compact CIRRUS® VEC systems treat process gases without diluting the carrier gas stream. For the volatile components present in the process steam, conversion to liquid is normally greater than 99 percent. This technology is used for recovering VOCs such as acetone, methanol, toluene, dichloromethane and other hydrocarbons – either as pure compounds or as mixtures. CIRRUS® VEC systems are therefore an ideal solution for VOC control in the pharmaceutical, chemical and petrochemical industries as well as for tank farms or during the loading and unloading of chemicals.

More than 15 years of experience with customer reference installations

The modular CIRRUS® VEC product family provides all our customers with an optimum solution for varying requirements. The modules can be installed separately or combined in systems to adapt to your needs. Site trials of the system are welcome. They will give you the opportunity to see that the CIRRUS® VEC system is the right solution for you.

CIRRUS® M50 system reference:
Two CIRRUS® M50 units for the condensation of various VOCs, such as methanol, acetone, water, ethylbenzene and cumene, at a tank farm. The VOCs are emitted from the storage tanks, owned by the international petrochemical group Borealis, through tank breathing. The two CIRRUS® condensation modules are connected in parallel to ensure automatic, continuous operation. One module is in operation while the other is on stand-by for when the first module needs to be defrosted.

Flexible and efficient emission control.

The CIRRUS® VEC modular system has been developed to provide flexible, compact and efficient solutions for air treatment problems. Each CIRRUS® VEC module, along with its control system, is delivered preassembled and fully tested – enabling you to get your system up and running quickly.

Adapt the system to your needs

CIRRUS® VEC modules can be used for either batch or continuous processing and are suited to intermittent operation with varying flow rates. In addition, their wide operating range allows for greater flexibility when quickly adapting to changing plant conditions.

Any CIRRUS® VEC module can also be easily expanded by simply connecting a new module to the existing one. The control system is an integral component of the CIRRUS® VEC family. To simplify operations, the system can be run automatically by specifying particular programs that are controlled either locally or remotely.

A calendar enables you to specify when a program should be used based on specific times and dates. In the event of ice forming in a CIRRUS® VEC module, the electrical defrosting function can be used to eliminate it quickly. A built-in switching system ensures continuous operation when two or three CIRRUS® VEC modules are connected. Each module can be further tailored to your requirements using a wide range of optional accessories, such as valves and sensors for a number of functions.

CIRRUS® M150 module reference:
Hydrocarbon emissions are reduced when loading trucks at ST1 Varastot Oy, a petrol transportation company in Finland. Displacement gas, containing petrol fumes, is naturally pressed out from the tank when petrol is pumped into a tank truck. Emission into the atmosphere is prevented by condensing the hydrocarbons using a CIRRUS® M150 condensation module. If, in the future, the loading volume of petrol increases, the installation is easily complemented by another unit, thus increasing capacity.

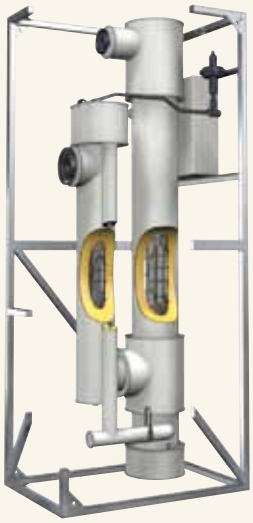
CIRRUS® M500 system reference:
A CIRRUS® M500 unit is used to recover acetone vapours emitted during the loading of ships. The high capacity, short start-up time and the ability to handle very high VOC concentrations make it ideal for this type of operation. After a quality check, the acetone can be reused. The nitrogen is supplied into the site´s inert gas network after it has been used to cool the off-gas from the ships.

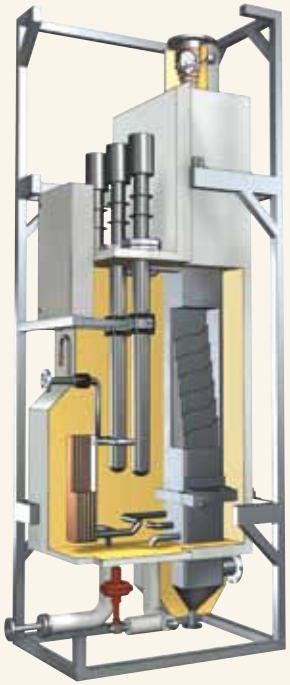
Complete range of CIRRUS® VEC solutions to meet your demands.

Linde offers a modular product family that will fulfil all your needs in the field of vapour emission control. The modules can be easily connected to form a complete system designed to meet your specific requirements.

Condensation modules

The three different unit sizes provide you with the opportunity to select the model that is best suited to your needs. The two main parameters determining the size are the required cooling capacity and the flow rate of the process gas. The CIRRUS® M50, M150 and M500 modules have a nominal flow capacity of 50, 150 and 500 Nm3/h, respectively. This means that any of these modules can be combined to create a system to treat emissions with flow ranges between approximately 10 Nm3/h and 1000 Nm3/h. The units are very compact with a small footprint. Furthermore, they can be easily fitted into your production facilities, indoors or outdoors. As the weight of the heat exchangers is lower than is the case with comparable equipment of similar capacity, the losses and the nitrogen consumption when cooling down a CIRRUS® VEC unit are significantly lower.





CIRRUS® M50, M150 and M500 condensation modules

CIRRUS® TM100 tank module (top) and CIRRUS® ZE300 adsorption module (bottom)

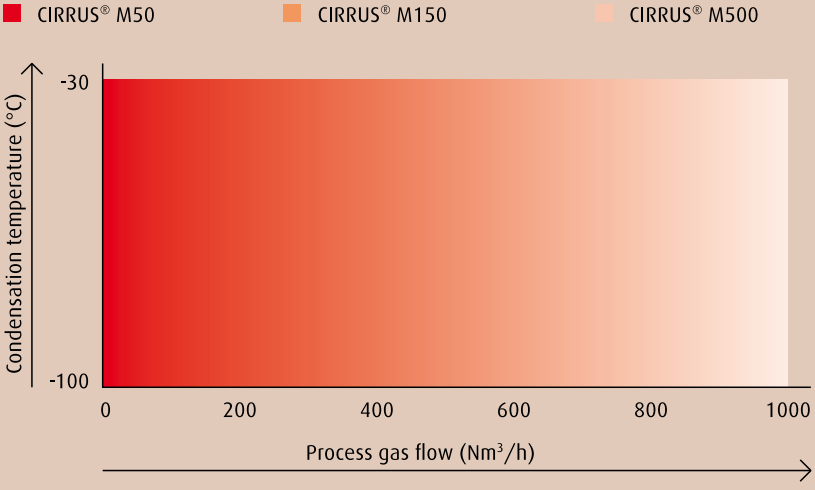
Condensate tank module

The CIRRUS® TM100 tank module has been developed for the safe and flexible collection of condensed VOCs. This module can be easily connected to one or two additional condensation modules for the convenient collection of condensate.

Adsorption module

The CIRRUS® ZE300 module enables you to attain extremely low emission levels. You can connect it downstream of a CIRRUS® VEC condensation system as a polishing step. The last few g/Nm3 emitted from the condensation step are thus reduced to mg/Nm3 levels through the adsorption of VOCs by zeolite pellets. This will enable you to fulfil the stringent demands, for example, of the German TA-Luft guidelines and the EC Solvent Emission Directive.

Suitable operating ranges for the various CIRRUS® VEC systems



Getting ahead through innovation.

With its innovative concepts, Linde Gas is playing a pioneering role in the global market. As a technology leader, it is our task to constantly raise the bar. Traditionally driven by entrepreneurship, we are working steadily on new high-quality products and innovative processes.

Linde Gas offers more. We create added value, clearly discernible competitive advantages, and greater profitability. Each concept is tailored specifically to meet our customers' requirements – offering standardised as well as customised solutions. This applies to all industries and all companies regardless of their size.

If you want to keep pace with tomorrow's competition, you need a partner by your side for whom top quality, process optimisation, and enhanced productivity are part of daily business. However, we define partnership not merely as being there for you but being with you. After all, joint activities form the core of commercial success.

Linde Gas – ideas become solutions.

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