

# Cryo condensation for chemistry

<p><b>The task</b></p>	<p>The main purpose of cryo condensation is to adhere to legal regulations (in Germany TA-Luft) and / or to reclaim valuable resources. Cryo condensation is a flexible cleaning process that also works effectively under conditions of changing waste gas parameters.</p>														
<p><b>The principle of the process</b></p>	<p>Liquid nitrogen is used as the cryogen in cryo condensation. The loaded exhaust air is super-cooled in heat exchangers to such a degree that the pollutants or valuable resources that it contains can condense out or freeze out through the condensation point being fallen below. The necessary condensation temperature is defined according to the composition and the required purity of the waste gas. In individual cases, temperatures below <math>-150\text{ °C}</math> may be necessary. Depending on requirements, the residual cold in the pure gas and the gaseous nitrogen can be used to pre-cool the crude gas flow. The nitrogen used can be further used by feeding it into a nitrogen network.</p>														
<p><b>Benefits of cryo condensation</b></p>	<ul style="list-style-type: none"> <li>• Better economy compared with conventional refrigeration machines at low condensation temperatures</li> <li>• Simple adaptation of the temperature management to changed conditions</li> <li>• Realisation of low residual loads down to the ppm range</li> <li>• Reclaiming valuable resources</li> <li>• No additional resources to be disposed of</li> <li>• Less maintenance work because moving parts are avoided</li> <li>• Gaseous nitrogen can be used further, e.g. for inerting</li> </ul>														
<p><b>Industrial use</b></p>	<ul style="list-style-type: none"> <li>• Purification of waste gas flows of up to <math>1500\text{ m}^3/\text{h}</math></li> <li>• Purification of highly-loaded waste gas flows</li> <li>• Removal of exhaust air components with a low condensation point, e.g. alcohol, ketone</li> <li>• Exhaust air flows with a low water content</li> </ul> <p>Two solutions are available to the customer for cryo condensation:</p> <p>► <b>Customer-orientated cryo condensation plants:</b></p> <p>A cryo condensation plant planned and realised to the customer's specific requirements, e.g. with regard to:</p> <ul style="list-style-type: none"> <li>• Throughput</li> <li>• Pressure range</li> <li>• Process management (2 or 3 heat exchangers, redundant heat exchangers, ...)</li> <li>• Valves conforming to the relevant company standard</li> <li>• Materials adapted to the particular use</li> </ul> <p>► <b>Standardised cryo condensation plants CIRRUS® M50, M150, M500:</b></p> <table border="0"> <tr> <td>Nominal volumetric flow</td> <td>Operating pressure</td> </tr> <tr> <td>M50: 50 <math>\text{Nm}^3/\text{h}</math></td> <td>0 – 6.5 bar (abs), 0 – 11 bar (abs) HP option</td> </tr> <tr> <td>M150: 150 <math>\text{Nm}^3/\text{h}</math></td> <td>0.5 – 1.5 bar (abs)</td> </tr> <tr> <td>M500: 500 <math>\text{Nm}^3/\text{h}</math></td> <td>0.5 – 1.5 bar (abs)</td> </tr> </table> <table border="0"> <tr> <td>Tank module:</td> <td>Volume</td> <td>Operating pressure</td> </tr> <tr> <td>CIRRUS® TM100:</td> <td>100 litres</td> <td>0 – 6 bar (abs)</td> </tr> </table> <p>(also see separate brochures on standard plants)</p>	Nominal volumetric flow	Operating pressure	M50: 50 $\text{Nm}^3/\text{h}$	0 – 6.5 bar (abs), 0 – 11 bar (abs) HP option	M150: 150 $\text{Nm}^3/\text{h}$	0.5 – 1.5 bar (abs)	M500: 500 $\text{Nm}^3/\text{h}$	0.5 – 1.5 bar (abs)	Tank module:	Volume	Operating pressure	CIRRUS® TM100:	100 litres	0 – 6 bar (abs)
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## Nitrogen supply

### Example of a customer-orientated cryo condensation plant



View of a cryo condensation plant

## Scope of performance

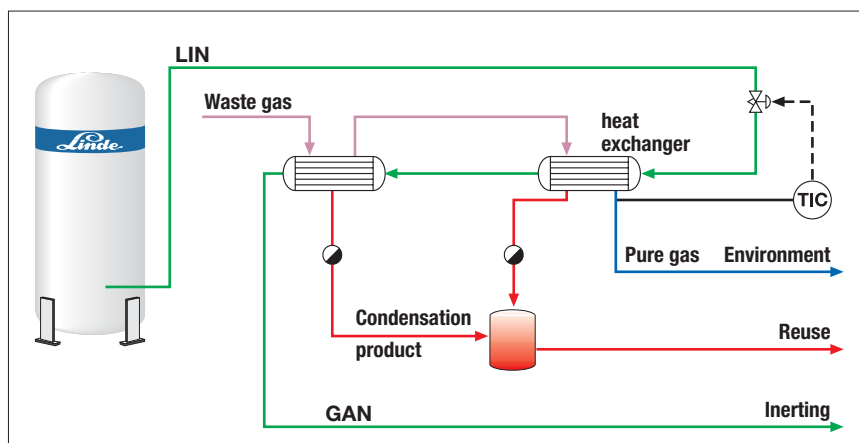


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The suitability of cryo condensation for waste gas purification can be investigated via experiments directly on the customer's premises. The standard plants CIRRUS<sup>®</sup> M50, M150, M500 and a further test plant consisting of 3 heat exchangers are available to the customer for the purpose of conducting experiments.

Tank plants for supplying liquid nitrogen in the sizes from 2000 to 50,000 Nm<sup>3</sup> nitrogen are available as standard.

- Reclaiming methyl chloride and dimethyl ether
- To observe the waste gas limits as defined by TA-Luft
- The use of cryogenic cooler and pre-cooler for utilising the residual coldness of the nitrogen
- Cooling capacity 5 kW
- Further use of the nitrogen used for inerting



Basic diagram of a cryo condensation plant

- Consultation service
- Carrying out feasibility and economy studies
- Process calculations with commercial situation programs
- Physical data from our own material database
- Conducting experiments
- Deriving a tailored plant solution
- Delivery of the cryo condensation plant, including all necessary additional units
- Installation and commissioning
- Delivery of the liquid nitrogen

Other leaflets about our complete range are available in all sales offices.

Our experts are available for consultation.