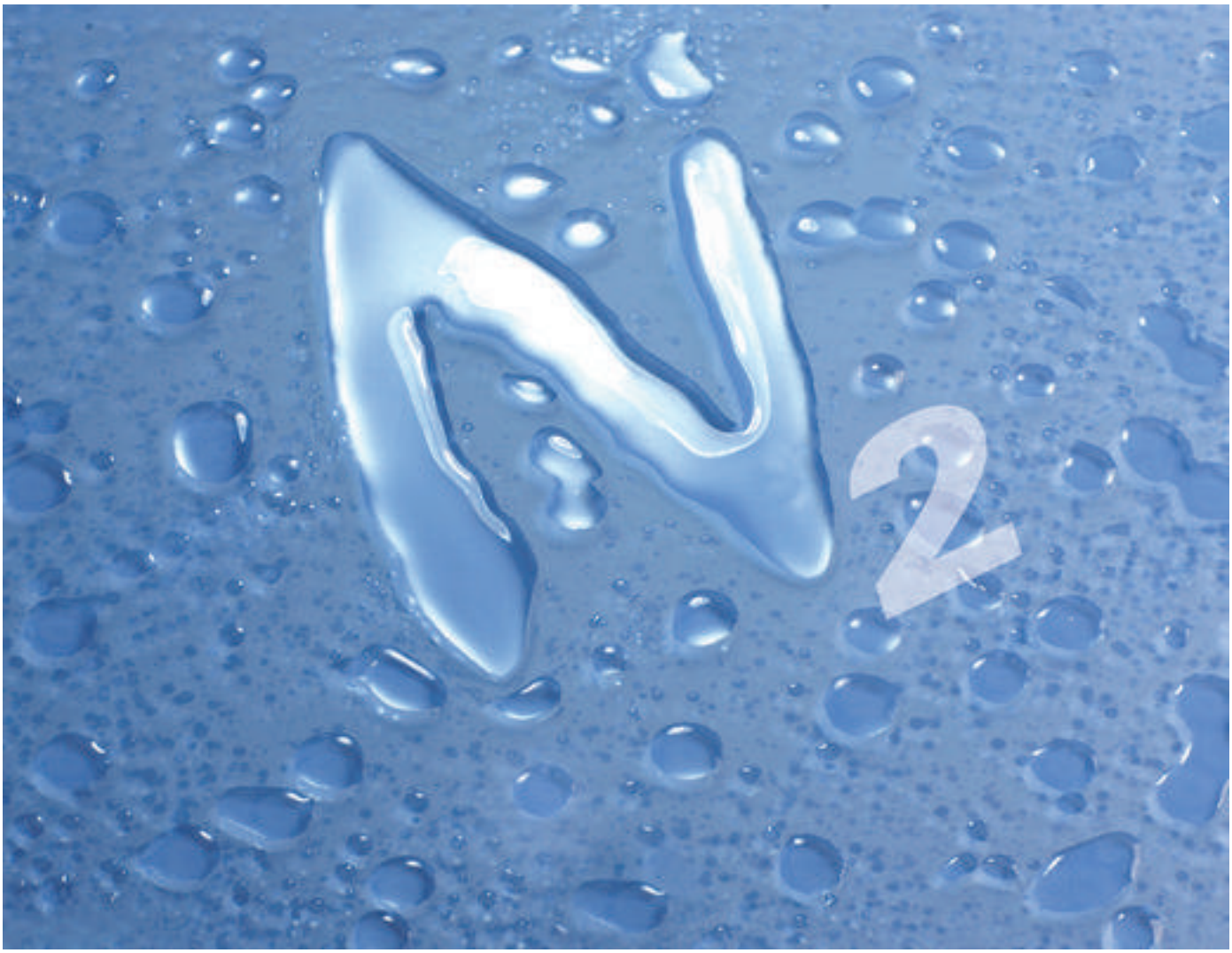
Cold solvent recovery

DuoCondex uses cryocondensation to optimise waste gas purification

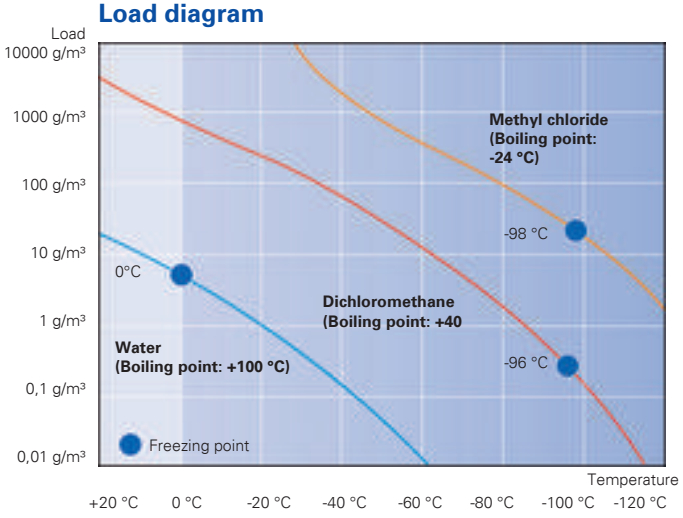


DuoCondex Process: waste gas cleaning and solvent recovery in one

The production of basic chemicals or the recycling of industrial products often leads to the emission of gases and vapours. The purification of waste gas flows by absorption or adsorption processes leads to a transfer of pollutants from the gas flow into the scrubbing liquids or adsorbents being used. Waste gas combustion also frequently causes problems, particularly if halogenated substances are present.

Condensation processes are an environmentally friendly alternative. However, reduction of emissions to the limit values demanded by "TA-Luft" (legal air quality regulation) is only possible here if cryogenically liquefied nitrogen is used to cool the condensers. Only then can practically all the solvents, gasoline vapours or chlorofluorocarbons (CFCs) present in the waste gas be condensed and recovered.

Load diagram



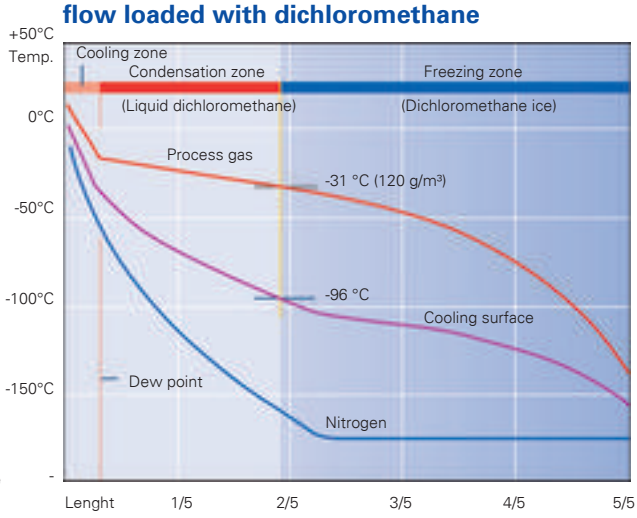
The purification of a waste gas loaded with dichloromethane in accordance with the limit values specified by the "TA-Luft" regulation requires the gas to be cooled to -120 °C. The condensation of methyl chloride requires a temperature of approximately -160 °C.

DuoCondex Process: clean and efficient

These disadvantages are avoided by the DuoCondex Process, developed and filed for patent by Messer. In this case, the heat exchanger required for cooling the process gas is not cooled with liquid, but with cold gaseous nitrogen. As a result, the temperature difference between the process gas and the cooling medium inside the heat exchanger is much smaller than that from cooling with liquid nitrogen.

This has the effect that the substances to be condensed are mainly liquefied and there is very little freezing out. The formation of aerosols is also effectively prevented in this way and the waste gases can be purified to the limits demanded by "TA-Luft" (legal air quality regulation) without further treatment.

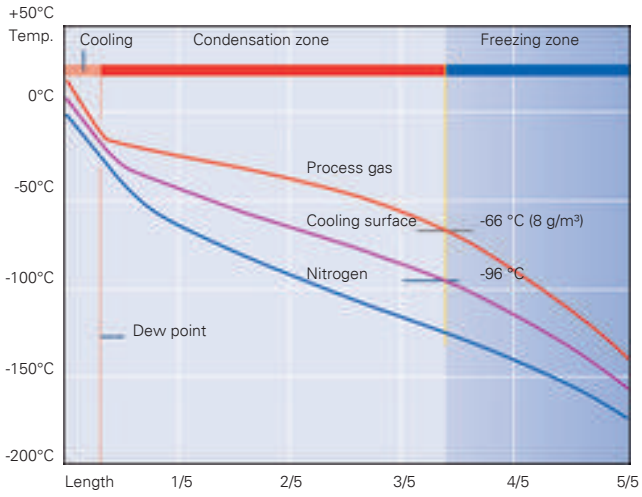
Temperature profile for the cooling of a gas flow loaded with dichloromethane



Condenser, cooled with liquid nitrogen:
- *small condensation zone, large freezing zone*
- *120 g/m³ frozen out*

Good in theory, problematic in practice: cryocondensation

In the simplest case, the waste gas flow is cooled by heat exchangers (cryocondensers), in which the process gas is cooled to temperatures of -100°C to -160°C in a counterflow of liquid nitrogen. The nitrogen which evaporates in this process, however, cools the apparatus to such a degree that the pollutants largely freeze out and quickly block the gas channel. Furthermore, aerosols – extremely fine mist droplets – are produced, very little of which are separated in the cryocondenser, and this prevents effective purification of the process gas.



Condenser, cooled with gaseous nitrogen:
- *large condensation zone, small freezing zone*
- *only 8 g/m³ frozen out*
- *15 times less ice produced than by cooling with liquid nitrogen*

The special design of the DuoCondex Process permits cooling of the heat exchanger (cryocondenser) with gaseous nitrogen, while fully exploiting the vaporization enthalpy and the sensible coldness of the cooling medium.

DuoCondex plants: individual and economical

DuoCondex plants are offered as individual solutions. Particular value is placed on the economy of these installations. Therefore, most plants are supplied with recuperators, in which the cooling energy can be recovered from the purified gas and the nitrogen requirement is minimised.

The DuoCondex process is used for a large number of customers in a variety of sectors. In the chemical industry, it is frequently used for the recovery of volatile solvents. The waste gas is purified in accordance with the specifications of the "TA-Luft" regulation, and the evaporating nitrogen can be fed into the plant network for further use.

Another application is the recovery of CFCs emitted by refrigerator recycling plants. Since the waste gas residual load has to be below 20 mg/m^3 even for the extremely volatile CFCs, DuoCondex units for this application are equipped with two cryocondensers. The main condenser separates R11 from the off gas,

a second downstream condensation stage ensures the recovery of R 12, a pollutant with extremely high vapour pressure which, in ambient conditions, is only present in a gaseous state of aggregation. The evaporating nitrogen in the condensers is used to inert the recycling-machines and thus protect them against dust and pentane explosions.

Options: as varied as your needs

In many cases, the condensed substances can be returned directly to production. In most cases, the liquid nitrogen used for cooling can also be fed into an inert gas network as a gas, and thus be used twice. If, in addition to vapours, gaseous substances such as volatile CFCs, methyl chloride or natural gas have to be condensed, the cryocondenser is followed by a purification stage cooled directly with liquid nitrogen. This is just one of many options we can offer when we design your projects.

Your advantages at a glance

- Waste gas treatment with simultaneous solvent recovery
- Cost savings by recycling of solvents
- Compliance with the TA-Luft limits
- Total utilisation of latent and sensible coldness of liquid nitrogen
- Dual use of the liquid nitrogen: the nitrogen that evaporates in the process is also used as an inerting gas
- Individual plant design with a wide range of options
- Pilot plant available for trials at your factory

Pilot plant: test DuoCondex

A practical trial is still the best way to prove performance. On request, we shall be happy to demonstrate the process on your premises with our mobile pilot plant, designed for a volume flow of 200 m^3/h. The data needed for project design can be obtained most reliably under real operating conditions.

We will be happy to give you our professional advice

If you have any questions about the DuoCondex Process or would like an individual consultation, simply get in touch with the Messer subsidiary in your country or talk directly to our experts in Krefeld (Germany):

Dipl. - Ing. Stefan Terkatz
Tel.: +49 (2151) 7811-240
E-Mail: stefan.terkatz@messergroup.com

Dipl. - Ing. Iván Pérez-Rosino
Tel.: +49 (2151) 7811-237
E-Mail: ivan.perez-rosino@messergroup.com

Dr. - Ing. Friedhelm Herzog
Tel.: +49 (2151) 7811-225
E-Mail: friedhelm.herzog@messergroup.com

MESSER

Messer Group GmbH
Gahlingspfad 31
47803 Krefeld
Tel. +49 2151 7811-0
Fax +49 2151 7811-501
info@messergroup.com
www.messergroup.com

Part of the Messer World