THE LINDE GROUP

Thermal conductivity detector.
Gas chromatography with HiQ® specialty gases.

Gas chromatography

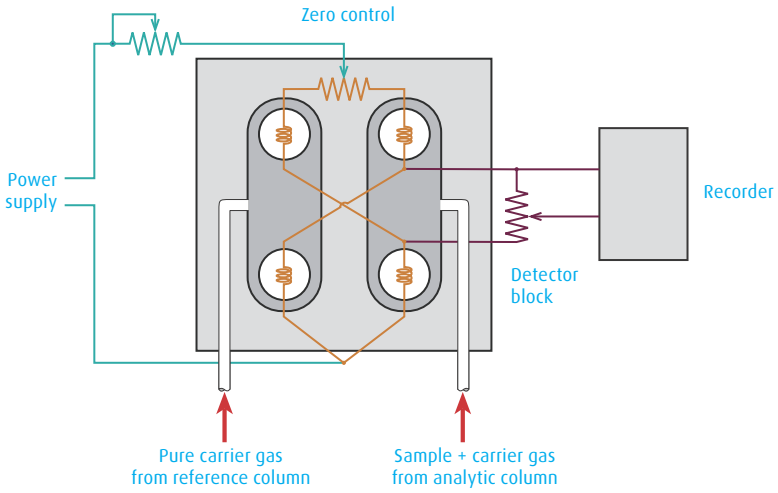
Information about gas chromatography in general can be found in the application sheet "Gas Chromatography" (GC).

Thermal conductivity detector

The Thermal Conductivity Detector (TCD) is truly a universal detector and can detect air, hydrogen, carbon monoxide, nitrogen, sulfur oxide, inorganic gases and many other compounds. The TCD is a non-specific and non-destructive detector. For most organic molecules, the sensitivity of the TCD is lower compared to the Flame Ionization Detector (FID.)

Analyze with the GC-TCD

The TCD is based on the principle of thermal conductivity which depends upon the composition of the gas. The sample components in the carrier gas pass into the measuring channel. A second channel serves as a reference channel where only pure carrier gas flows. Electrically heated resistance wires are located in both channels. The difference in thermal conductivity between the column effluent flow (sample components in carrier gas) and the reference flow of carrier gas alone, produces a voltage signal proportional to this difference. The signal is proportional to the concentration of the sample components.



Chemically active compounds like acids and halogenated compounds should be avoided when using TCD since they can attack the filament (wires) and thereby change the resistance and permanently reduce the detector sensitivity. Oxidizing substances, such as oxygen, can also damage the filament, and a leak free environment should be maintained.

For an optimal and proper response of the TCD, there are a couple of critical factors:

- temperature of the detector block
- flow rate of the carrier gas and the reference gas
- resistance of the filaments

All these factors must be optimal to obtain a representative TCD response.

Gases

In the GC-TCD the carrier gas is both used to transfer the sample through the column and into the TCD-detector, and as a reference gas. With the GC-TCD the reference gas and the detector gas must be the same as the carrier gas. As for any GCs the carrier gas must be inert and may not be adsorbed by the column material. Helium is typically used as the carrier gas for the TCD because of its high thermal conductivity. However, nitrogen, argon or hydrogen are also used as carrier gases with GC-TCD. The choice is dependent on the substances in the sample. A TCD-detector works best when there is a large difference in thermal conductivity between carrier gas and sample.

Like all chromatographic analytical processes, gas chromatography is a relative method, i.e. calibration with a standard mixture is required, both to check linearity and as calibration for the sample.

HiQ® product program

The HiQ® product program offers a wide range of pure gas qualities, calibration mixtures and equipment as well as components that fulfill the demands concerning analytical techniques such as GC-TCD.

Carrier and reference gases

To obtain optimal analytical results, Linde recommends the following gas qualities for the GC-TCD analysis:

Instrument helium 4.6 or	product code 2057
Instrument nitrogen 5.0 or	product code 2093
Instrument argon 5.0 or	product code 2007
Instrument hydrogen 4.5	product code 2056

Specifications

	Instrument He 4.6	Instrument N_2 5.0	Instrument Ar 5.0	Instrument H_2 4.5
O_2	≤ 5 ppm	≤ 3 ppm	≤ 2 ppm	≤ 5 ppm
C_nH_m	≤ 1 ppm	≤ 1 ppm	≤ 0.2 ppm	
H_2O	≤ 5 ppm	≤ 3 ppm	≤ 3 ppm	≤ 5 ppm
N_2			≤ 5 ppm	
Product code	2057	2093	2007	2065

Higher purities are also available for analysis where a higher specification is needed due to the nature of the sample and analysis. You will find it in the HiQ® product program.

Recommended central gas supply

REDLINE® central gas supply systems for inert and non-reactive gases.
Group green for single gas supply panels designed for pure gases and mixtures.

Group blue for single stage supply panels with internal purging designed for high purity gases and mixtures including flammable gases.

Recommended cylinder regulator

Many GCs have inlet valves with built-in regulators for the carrier gas and the reference gas. A single stage REDLINE® regulator C200/1 is then recommended. When high sensitivity is required and for calibration gases we recommend REDLINE® two stage regulator, C200/2 to ensure a stable secondary outlet pressure of the gas. C200 regulators can be plain or equipped with a shut-off valve (type A) or a needle valve (type B).

For GC-TCD we recommend a C200 regulator in brass with a shut-off valve.

REDLINE®		Outlet pressure bar	Outlet pressure psi	Product code
Single stage	C200/1 A, brass	0.2–3	3–45	3100
Single stage	C200/1 A, brass	0.5–6	8–85	5467
Two stage	C200/2 A, brass	0.2–3	3–45	5482

More information

Please look into our HiQ® catalog 'Biotech, chemical, petrochemical & pharmaceutical', visit our website http://hiq.linde-gas.com or contact your local Linde sales representative.

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