GLOBAL™ ANALYSER SOLUTIONS G·A·S

Refrigerants analyser

- fast analysis and identification
- different sampling modes available
- for laboratory and industrial utilisation

AN 235WA1019A

GAS offers custom configured GC analysers for many application fields for over 40 years. GAS analysers are designed to meet many standardised methods from GPA, ASTM, UOP, ISO, EN and others. The efficient configurations are based on proven GC technology, resulting in robust instruments with an optimal return on investment.

Refrigerants are substances or mixtures, usually a fluid, used in a heat pump and refrigeration cycle for cooling systems. Often fluoro and/or chloro containing compounds are used but they are being phased out and replaced because of their direct impact on the ozone layer.

Figure 1. Refrigerants analyser using GSV on Thermo Trace GC1300

Rerigerants

Refrigerants are low boiling single components or mixtures containing substances like hydrocarbons and fluoro/chloro-hydrocarbons. Since a wide range of compounds is used, gas chromatography is the first choice for correct analysis.

Channels/Detectors

Often a single column system is not sufficient for complete separation, and two or more analysis channels are needed. This is especially the case when coolants with unknown origin are analysed for possible recycling and therefore many different components can be present. Stationary phases with high retention are required due to the high volatility, therefore thick liquid film or plot columns are applied.

FID and TCD detectors are both suitable, TCD is the only choice when a non condesable like air needs to be detected.

Sampling

The coolant normally is available in liquid state. It can be analysed as a liquid or as a gas after evaporation.

1. Providing the sample as a gas:

The sample is injected as a gas (GSV; Gas Sampling Valve) after off-line sampling of the coolant in (for instance) a Tedlar bag.

2. Providing the sample as a liquid:

- An on board vaporiser evaporates the sample first followed by gas injection, or
- The sample is injected as a liquid using a Liquid Sampling Valve (LSV) without pre-evaporation.

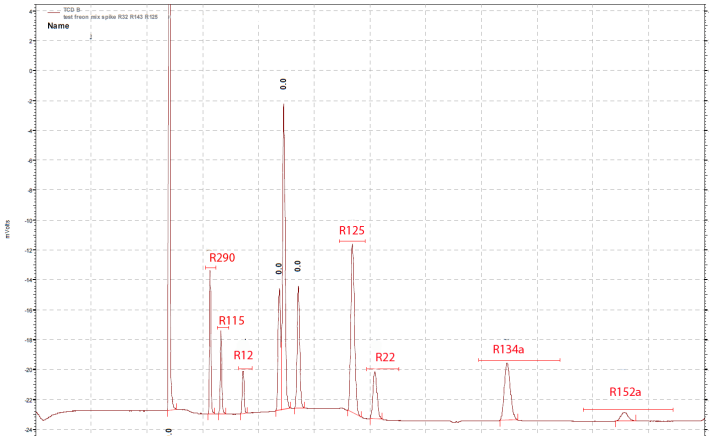

Figure 2. Refrigerants on channel 1 (TCD detection)

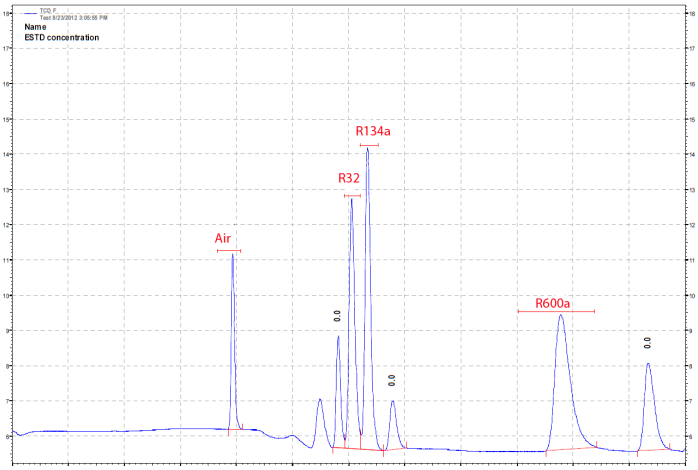

Figure 3. Refrigerants on channel 2 (TCD detection)

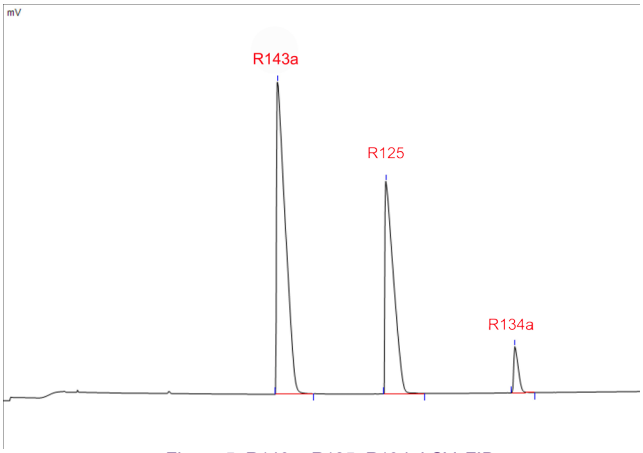

Figure 5. R143a, R125, R134. LSV, FID

Amount		
FrontDetector		
R143a	**R125**	**R134a**
52,0000	44,0000	4,0000
52,0625	44,0533	4,0079
51,9677	43,7173	4,0031
52,0062	43,1697	4,0127
51,9183	43,9137	4,0122
51,7737	43,8090	3,9998
51,6192	43,4165	3,9714
51,6592	43,7131	3,9877
51,6250	43,1212	3,9904
51,6170	*43,6668*	*3,9986*
52,0625	44,0533	4,0127
51,8249	**43,6580**	**3,9984**
51,6170	43,1212	3,9714
0,1840	0,3254	0,0126
0,36%	**0,75%**	**0,31%**

Figure 6. Repeatability (chromatogram figure 5)

Figure 4. CompactGC4.0 with 2 analysis channels

Results

Figure 2 and 3 show chromatograms of a refrigerants analyser based on CompactGC4.0 (figure 4) with 2 separation columns for analysing a wide range of components (the instrument can accomodate 1-4 channels). Both channels use TCD detection. The used columns are Rt-Alumina/CFC and Rt-QBond (Restek USA). The coolant samples were offered as a liquid to the analyser with integrated vaporiser option, and injected as a gas. The instrument and peripheral equipment like vaporiser, filter, oil separator and datasystem were installed in a closed trolley, see figure 8 for examples.

Figure 7. Refrigerants analyser using LSV and Sample Securitiser

Figure 6 shows a refrigerant sample containing R143a, R125 and R134a. The sample was injected as a liquid using LSV and Sample Securitiser (figure 7, separate application note available). Figure 6 shows good repeatability. FID was used for detection, and Restek Al_2O_3/CFC for separation.

Specification

Application:	Custom configured analyser for the analysis of refrigerants
Configuration:	1-4 channel instrument based on Thermo Trace GC1300 or CompactGC$^{4.0}$
	Detector: FID and/or TCD
	Injection:
	- Gas: GSV (Gas Sampling Valve)
	- Liquid: GSV with vaporiser, LSV (Liquid Sampling Valve) with optional Sample Securitiser
	Columns: capillary
Optional:	- Backflush option
	- Vaporiser
	- Particle filter
	- Oil separator
Sample tubing:	Sulfinert® tubing for inert sample path
Range:	100 ppm to high%
Repeatability:	1% RSD or better, depending on concentration level and separation
Sample requirements:	See our pre-installation guide for additional requirements

Figure 8. CompactGC$^{4.0}$ installed in closed trolley and 19" cabinet

GLOBAL™ ANALYSER SOLUTIONS G·A·S MADE IN HOLLAND

GAS is an Interscience company