APPLICATION NOTE
LD26-03

Analysis of trace impurities hydrocarbons in oxygen sample gas using the MultiDetek Lite



MultiDetek Lite ▲

Oxygen gas is vital for medical life support, heavy industrial manufacturing, and aerospace operations. It treats respiratory conditions, purifies steel, and acts as a rocket propellant. The oxygen is mainly produced by the air separation using cryogenic and pressure swing adsorption systems. The oxygen producers are all the main gas manufacturers. For producing oxygen, it is required to monitor trace impurities during the process to secure and optimized the oxygen production.

Oxygen is a powerful oxidizer. In high concentrations, it drastically lowers the ignition temperature and increases the combustion rate of organic materials.

- **Accumulation:** Trace hydrocarbons (e.g., acetylene, methane, ethane, butane) present in ambient air are drawn into oxygen compressors.
- **Condensation:** During the cryogenic distillation of liquid oxygen (\(-183^{\circ}C\)), some hydrocarbons—particularly acetylene—have a lower solubility and freezing point than oxygen. This allows them to freeze and collect as highly unstable, shock-sensitive solids.
- **Detonation:** An accumulation of these solid hydrocarbons can react violently with pure oxygen, leading to devastating plant explosions

To control and secure the oxygen production, many types of gas analysers are required including gas chromatography analysers. The GCs can measured multiple impurities within 1 instrument in a short analysis time which is a key factor of using such technology. This application note shows the results obtained using a MultiDetek Lite GC configured with a flame ionisation detector (FID) for measuring trace hydrocarbons.

Measuring trace hydrocarbons in oxygen production—primarily via Air Separation Units (ASUs)—is critical for preventing catastrophic explosions, ensuring product purity, and protecting downstream catalysts. Industry leaders utilize technologies like Flame Ionization Detectors (FIDs) and Plasma Emission Detectors (PEDs) to monitor these impurities.

KEY UTILITY AND APPLICATIONS

INDUSTRIAL & COMMERCIAL

- **Steel & Metal Production:** Injected into molten iron to burn off impurities and increase combustion temperatures, heavily boosting metal production.
- **Welding & Cutting:** Combined with acetylene (oxy-acetylene) to create high-temperature torches for cutting and welding metals.
- **Water Treatment:** Used for chemical oxidation and aerobic aeration to break down waste.

MEDICAL & HEALTHCARE

- **Oxygen Therapy:** Treats hypoxia and conditions like COPD by delivering extra oxygen through nasal cannulas or masks.
- **Resuscitation & Anesthesia:** Powers ventilators and sustains breathing during surgical procedures.

AEROSPACE & SPECIALIZED DIVING

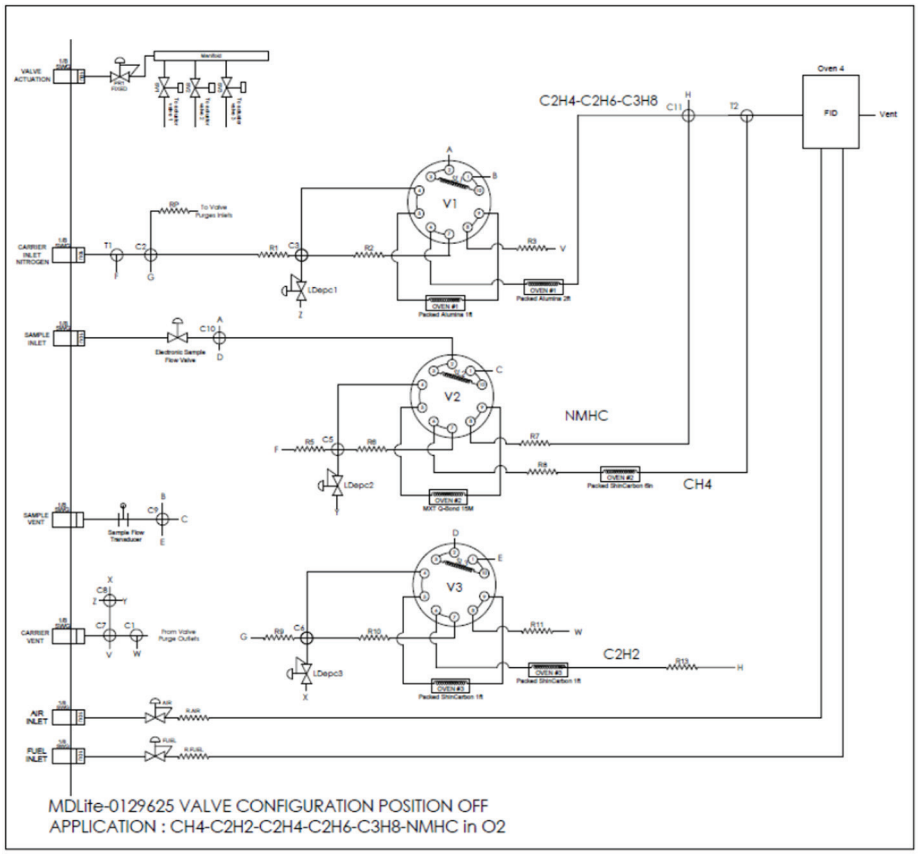
- **Aviation & Space:** Provides life-support and breathing air for pilots at high altitudes and astronauts during space exploration.
- **Deep-Sea Diving:** Mixed with helium and nitrogen to help divers breathe safely at extreme pressures and prevent decompression sickness

LDETEK SOLUTION

Using the small rackmount MultiDetek Lite gas chromatograph instrument configured with a FID module using nitrogen carrier gas and the proper set of columns and valves, the trace analysis hydrocarbons is realized in less than 5 minutes analysis time.

Using the proper sampling loop volume, each impurity can be optimized for the critical analysis range required and for its proper limit of detection.

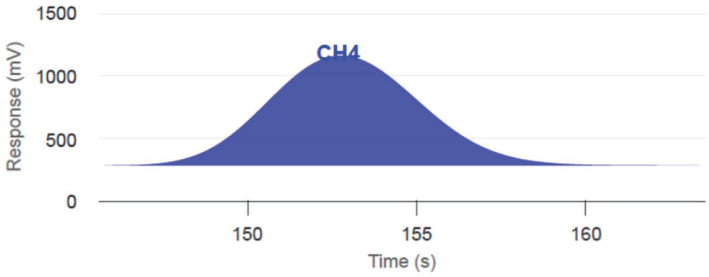
Other configurations and ranges/Idls are possible. The parameters mostly depend on the site production requirements and process.



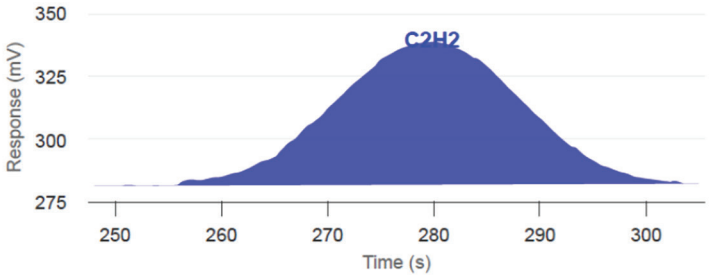
RESULTS

A series of chromatograms (Span calibration) of trace impurities CH4-C2H2-C2H6-C3H8-C4H10-NMHC in balance gas Oxygen.

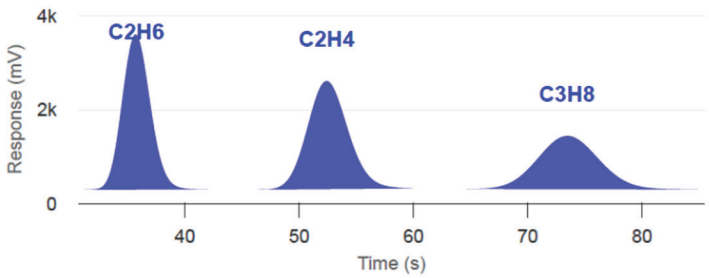
Component	Unit	Calibration Value	_Area Counts
CH4	ppm	110.00	9982



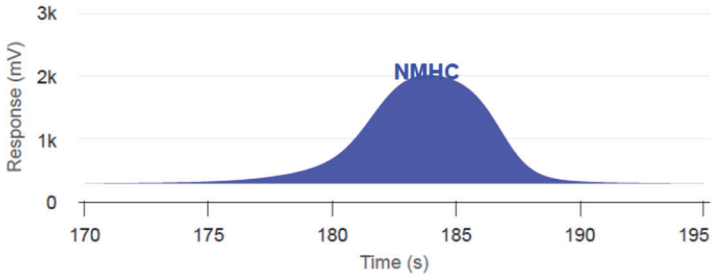
Component	Unit	Calibration Value	_Area Counts
C2H2	ppm	2.10	10051



Component	Unit	Calibration Value	_Area Counts
C3H8	ppm	50.00	10010
C2H6	ppm	99.20	10000
C2H4	ppm	101.00	10006



Component	Unit	Calibration Value	_Area Counts
NMHC	ppm	99.00	10011



Limit of detection (based on 3 times the noise level from a blank)

Components	Concentration (ppm)	Peak height	Noise	LDL (3x Noise)
CH4	110.00	981mV	0.75mV	250ppb
C2H2	2.10	58mV	0.75mV	81ppb
C2H6	99.20	3620mV	0.57mV	62ppb
C2H4	101.00	2173mV	0.75mV	105ppb
C3H8	50.00	570mV	0.75mV	197ppb
NMHC	99.00	1699mV	0.75mV	131ppb

Note: other LDL could be obtained with different injection volume and chromatographic condition

Repeatability: Based on the GC standards. Using 6 of 10 consecutive runs, being lower than 5% of 3*CV%

Linearity: Based on the GC standards. A linear curve having its R2 at a value between 0.998 and 1.00.

Accuracy: Based on the GC standards. <= 1% of error or ldl whichever is higher

CONCLUSION

The MultiDetek Lite configured with a FID module offers a good analytical solution for trace ppb/ppm hydrocarbons impurities to produce oxygen. The gas chromatograph is configured with standard industrial communication protocols and a remote-control interface. Due to its high sensitivity FID, measuring trace impurities hydrocarbons with the compact MultiDetek Lite gas chromatograph down to ppb is perfectly suitable for the oxygen production requirements. The small gas chromatograph is a rackmount very robust gas analyzer configured for industrial market to run 24/7. Combined with the other LDetek accessory modules, it fits the complete application requirements of the industry.