Monitoring combustible gas mixtures in an effluent gas stream

Application Note

Environmental

Introduction

Methane has a lower explosive limit (LEL) of 5% v/v in air (20.8% oxygen). While carbon monoxide has a higher LEL (12.5% v/v), it also poses environmental considerations with a threshold limit value (TLV) in air of only 50 ppm v/v.

A VALCO series “W” 6-port Gas Sample Valve was employed for sample introduction. The valve was plumbed upstream of a split injector (Figure 2).

Oxygen and nitrogen (the bulk component) were measured by Thermal Conductivity Detection with the TCD plumbed in series with a nickel catalyst and Flame Ionization Detector for quantitation of methane and catalyzed carbon monoxide (Figure 1).
Conditions

Column: MolSieve SA PLOT, 0.53 mm x 50 m
   Part no. CP7539

Oven: 80 °C Isothermal

Detector: TCD block 120 °C
   Filament 180 °C
   Range: 0.05
   Ref flow: 5 mL min⁻¹
   FID: ionization oven 300 °C
   Range: 12
   25 mL min⁻¹

FID Make-up: 25 mL min⁻¹

Catalyst: 380 °C

Hydrogen: 20 mL min⁻¹

Injector: Valve Loop Size 250 μL
   1077 split 40:1
   Temperature 120 °C
   Column flow 5 mL min⁻¹ Helium

Figure 1
As the oxygen and nitrogen were expected to be present at % levels, a split of 40:1 was employed to prevent column overload. This splitting of the sample in turn created minimum measurable quantities of the methane and converted carbon monoxide of the order of 3 ppm v/v. (MMQ = 10 x MDQ, where MDQ = 2 x noise).

Unattended operation of the method was possible through “Sequence” operation. In addition, the column was automatically “reactivated” at night to remove water vapor introduced from the effluent gas samples by means of column standby temperature at 250 °C.