

**United States  
Environmental Protection Agency  
Office of Transportation and Air Quality  
National Vehicle and Fuel Emissions Laboratory  
2565 Plymouth Road  
Ann Arbor, MI 48105**

**Determination of Oxygenates in Gasoline by Gas  
Chromatography and Oxygen Selective Flame  
Ionization Detector Method**

This method is written for the Environmental Protection Agency, National Vehicle and Fuel Emissions Laboratory (NVFEL) internal use. The use of specific brand names by NVFEL in this method are for reference only and are not an endorsement of those products. This document may be used for guidance by other laboratories.

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**Implementation Approval**

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**Revision Description**

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**1. Scope**

This test method is intended to utilize a gas chromatograph equipped with an oxygen-selective detector to determine the weight concentration of each oxygenate in gasoline. The method is applicable to gasoline samples that contain oxygen weight percent in the range of 0.01 to 5.00.

Samples containing more than this amount can be diluted to fall within the range.

**2. Summary of Method**

- 2.1 An internal standard 1,2-dimethoxyethane (ethylene glycol dimethyl ether 110-71-4) is added in quantitative proportion to the sample (5 to 25 mL). A representative aliquot of the sample and internal standard is injected into a gas chromatograph equipped with a capillary column operated to ensure separation of the oxygenates and an oxygen-selective flame ionization detector (OFID).
- 2.2 Calibration standard mixtures are used for the determination of retention times and the relative response factors of the oxygenates of interest. Suggested calibration materials are listed in Attachment A.
- 2.3 The peak area of each oxygenate in the gasoline sample relative to the peak area of the internal standard is measured. The relative weight response factor is applied and the concentration of each oxygenate is calculated.

**3. Significance**

- 3.1 Oxygenates such as alcohols and ethers are added to gasoline to increase the octane number and reduce tailpipe emissions of carbon monoxide and hydrocarbons. Monitoring the proper amount of oxygenates added to gasoline is necessary for regulatory purposes (Mandated by Clean Air Act Amendments of 1990).
- 3.2 This test method provides sufficient oxygen-to-hydrocarbon selectivity and sensitivity to allow determination of oxygenates in gasoline samples without interference from the bulk hydrocarbon matrix.

**4. Applicable Documents**

- 4.1 Code of Federal Regulations, Title 40, Part 80, Section 80.46
- 4.2 ASTM Standard Method D 5599 - 95, Standard Test Method for Determination of Oxygenates in Gasoline by Gas Chromatography and Oxygen Selective Flame Ionization Detection
- 4.3 Quality Assurance Management Staff. "Calculation of Precision, Bias, and Method Detection Limit for Chemical and Physical Measurements," U.S. EPA, March 30, 1984
- 4.4 Hewlett-Packard 5890A Instrument Manual and Hewlett-Packard Chemstation Software Wasson - ECE Instrumentation Manual

**5. Definitions**

Oxygenate is an oxygen-containing organic compound which may be used as a fuel or fuel supplement. Typical examples of oxygenates are various alcohols and ethers.

**6. Interferences and Limitations**

This test method provides sufficient selectivity and sensitivity to allow determination of oxygenates in gasoline samples without interference from the bulk hydrocarbon matrix. The test method is limited to gasolines having a final boiling point not greater than 220°C and oxygenates having a boiling point limit of 130°C.

**7. Safety**

- 7.1 Gasolines and oxygenates are extremely flammable and may be toxic when exposure is over a prolonged period. Avoid prolonged breathing of vapors and minimize skin contact.
- 7.2 Persons performing this test procedure must be familiar with the chemicals and hazards involved.

- 7.3 Sample handling must be performed in well ventilated areas, preferably in a fume hood, away from open flames.
- 7.4 Analyst must wear safety glasses and Lab coat during sample handling and sample preparation.
- 7.5 The analyst should be familiar with specific procedures for handling fires or spills. These are available from the Manager and/or Safety Officer.
- 7.6 Gas cylinders must be properly secured and handled with extreme caution because of the high volumes and the high pressures at which they are contained.

## **8. Apparatus**

- 8.1 Gas chromatograph (GC) equipped with an oxygen specific flame ionization detector (OFID) and data collection capability.

Equipment used: Hewlett-Packard 5890A with a Wasson-ECE detector and a 60m x 0.25mm KC 30 column, Siemens SiCHROMAT 1-4 OFID system with a J&W 123-106S 60m x 0.23mm column

- 8.2 Sample introducing systems (autosampler, microliter syringe and injection port) capable of introducing 0.1 to 1.0  $\mu\text{L}$  into the split inlet device of the gas chromatograph.

- 8.3 Preparation of Apparatus

- 8.3.1 Place instrument and detector into operation in accordance with the manufacturer's instructions. Set the flow rate of He, H<sub>2</sub> and zero air to the manufacturer's specifications and select the oven temperature program that would provide for the optimum separation of all oxygenates of interest.

See Attachment A.

- 8.3.2 Ensure that there are adequate quantities of GC supply gases to maintain the run. At least 200 psi in all supply cylinders is prudent.
- 8.3.3 Ensure that rinse vials are filled with iso-octane and waste vials are empty. Ensure that the syringe is in working condition.

## 9. Materials and Reagents

- 9.1 30-mL glass vials with sealing caps are used for Calibration Standards and Sample preparations. 2-mL GC sample vials and aluminum crimp caps with Teflon lined rubber septa are used as samples containers for autosampler. Disposable transfer pipettes are used to transfer samples in a 30-mL glass vial to a GC sample vial.
- 9.2 Class A glass pipettes and volumetric flasks (various sizes) for preparation of Calibration Standards, Independent Standard, Control Fluid and analytical samples.
- 9.3 Reagent grade alcohols, ethers or any other oxygenated compounds of interest.
- 9.4 Helium or hydrogen; ultra pure grade (used as GC carrier gas).
- 9.5 Hydrogen from hydrogen generator or hydrogen cylinder for use as FID fuel.
- 9.6 Zero air from zero air generator or cylinder for use with FID fuel.
- 9.7 Analytical balance with readability in grams to 4 decimal places.
- 9.8 Control Fluid - California Phase II gasoline containing approximately 2 wt% oxygen from the NVFEL underground storage tanks is used as Control Fluid. Control Fluid serves as QC for each sample sequence and for weekly QC checks.
- 9.9 Calibration Standards - Calibration Standards are made from oxygenated compounds diluted in oxygenate free base gasoline to the desired weight concentration. They are used to calibrate the instrument.
- 9.10 Independent Standard – The Independent Standard is prepared in exactly the same manner as the Calibration Standards, except a different batch of oxygenates is used. The Independent Standard is used to check the calibration after it has been established and to confirm the viability of calibrations used for analysis.
- 9.11 Internal Standard - Reagent grade di-methoxy ethane (DME) is used as the internal standard. It is added to each sample to be analyzed.

- 9.12 Reagent blank - A reagent blank is a sample that only contains oxygenate free base gasoline and Internal Standard. It is used to check the purity of Internal Standard, instrument contamination and sample carryover.
- 9.13 Base Gasoline - This is an oxygenate free gasoline which is confirmed by the OFID.
- 9.14 Retention time check sample – The retention time check sample is prepared by adding all the oxygenates of interest (Attachment A) to the reagent blank. It is used to check the recognition time window of the current calibration before sample analysis. This would ensure that all the oxygenates of interest can be correctly identified.

**10. Sampling**

- 10.1 Logged-in samples are provided by field Inspectors and stored in a secure area in Chem Lab.
- 10.2 Check these logged-in samples out of the storage area following the appropriate procedures.
- 10.3 Due to the volatility of gasolines, it is highly recommended that a minimum of 5 mL of each sample be used to mitigate the volatility-induced inaccuracy during the sample preparation.

## 11. Calibration

### 11.1 Preparation of Calibration Standards

Calibration Standards are prepared by diluting pure oxygenated compounds with oxygen free base gasoline (w/w). Concentration of oxygenates that will encompass those of the samples should be prepared. The preparation of standards must be done with all materials at Lab temperature using Class A glassware.

The following represents one dilution scheme for preparing a set of Calibration Standards. Other dilution scheme may be used, provided they are consistent with the range and concentration coverage presented here.

	Oxygenate #1	Oxygenate #2	Oxygenate #3	Oxygenate #4	Oxygenate #5
Level 1	12% MeOH	1% t-BuOH	1% sec-BuOH		
Level 2	12% EtOH	1% IPA	1% n-Propanol	0.5% ETBE	
Level 3	12% t-BuOH	1% MeOH	1% MTBE	1% DIPE	
Level 4	15% MTBE	0.5% MeOH	0.5% iso-BuOH	0.5% n-BuOH	
Level 5	15% ETBE	0.5% EtOH	0.5% MTBE		
Level 6	12% TAME	0.5% IPA	0.5% n-Popanol	1% iso-BuOH	1% t-Amyl alcohol
Level 7	9% MeOH	5% MTBE	0.25% sec-BuOH	0.25% t-Amyl alcohol	0.25% iso-BuOH
Level 8	0.25% MeOH	0.25% MTBE	0.25% TAME	5% DIPE	9% EtOH
Level 9	9% t-BuOH	5% MeOH	0.25% DIPE	0.25% EtOH	0.25% n-BuOH
Level 10	9% MTBE	5% n-BuOH	0.25% t-BuOH		
Level 11	5% EtOH	5% n-Propanol	5% ETBE		
Level 12	5% IPA	5% sec-BuOH	5% t-Amyl alcohol		
Level 13	1% EtOH	5% t-BuOH	5% iso-BuOH	5% TAME	



- 11.2 In the preparation of any single level of standard, first, tare a capped 100-mL volumetric flask. Individual oxygenated components are then added in approximate volumes as listed in the table. After each addition, the weight of the oxygenate is recorded. Finally, dilute the standard to 100 mL with the base gasoline and the weight of gasoline is recorded in the log book. The weight percent concentration for each component at this level is calculated by dividing the weight of an individual oxygenated compound by the total weight of the contents in the flask.

In these preparations it is recommended that compounds typically be added in order of decreasing boiling point and no individual standard content is more than 20% of total weight.

Pipette 5 –25 mL of Calibration Standards or Blank to a tared and capped 30-mL glass vial and record its weight. Add Internal Standard at a proportion of 3 - 6% by weight of the Calibration Standards or the Blank. Record the weight of Internal Standard added. Shake the mixture well and then transfer about 2 mL of the well-mixed solution to a GC sample vial.

- 11.3 Preparation of the instrument for the calibration run:
- 11.3.1 Set the flows of He, H<sub>2</sub> and zero air for GC/OFID system to the manufacturer's specifications. Select the oven temperature program that would provide for the optimum separation of all oxygenates of interest.
  - 11.3.2 The calibration curve should be quadratic forced through the origin fit.
  - 11.3.3 The Reagent Blank needs to be analyzed only once and should have no detectable oxygenated compounds. If a detectable amount is found, this must be resolved, or a different source of Base Fuel or Internal Standard used before proceeding.
  - 11.3.4 Verify that the retention time window has been set properly. The typical value is 5% (this is the Chemstation default).
  - 11.3.5 Retention characteristics for a KC 30 column and physical constants of standards are summarized in Attachment A. The actual retention times may change slightly anytime due to column aging or flow alterations. Retention times may be easily edited in the calibration table to correct for this.
  - 11.3.6 The instrument should be calibrated with a range of standards that will encompass the concentration of the samples.

- 11.4 Initiate the calibration analysis of the Calibration Standards to determine the retention times and peak area of each oxygenate including that of the Internal Standard.
- 11.5 Following the completion of a calibration analysis, the Instrument will calculate the response ratio ( $R_r$ ) and the amount ratio ( $W_r$ ) for each oxygenate standard at various concentration levels. By performing a least-squares fit of the response ratio at various concentrations to their correlated amount ratios, the instrument will generate a calibration curve for each standard as follows:

$$(R_r)_i = b_i + m_{1i} (W_r)_i + m_{2i} (W_r)_i^2$$

where:

$(R_r)_i$  = peak area of oxygenate standard i/peak area of internal standard

$(W_r)_i$  = wt of oxygenate standard i/wt of internal standard

$m_{1i}$  = linear regression coefficient for standard i

$m_{2i}$  = quadratic regression coefficient for standard i

$b_i$  = Y-axis intercept for standard i

For optimum calibration, the absolute value of the Y-intercept for each standard must be at a minimum. In this case, the peak area of oxygenate i should approach zero when its weight percent is less than 0.1. For this test method, as pointed out in 11.3.2, the Y-axis intercept for each oxygenate would be 0 (zero).

- 11.6 Any of the composite points that visually deviate from the calibration plot should be investigated. Evaluate the curve fit of the data statistically by checking the correlation coefficient,  $r^2$ . The  $r^2$  should be at least 0.99 or better.
- 11.7 If the calibration curve appears satisfactory, run an Independent Standard or Calibration Standards (with oxygenates at low, mid and high level) as samples and check the recovery of oxygenates.

The recovery of oxygenates from this analysis should be within +/-5 % of the target concentration. The cause of any discrepancy must be found and corrected. Make new standards and recalibrate if the discrepancy can not be corrected.

- 11.8 If the concentration for the Independent Standard or the Calibration Standards appears satisfactory, run the Control Fluid in triplicate. The results of oxygenate content from this analysis should be within +/-5% of the statistical analysis established value of the weekly QC measurement results.
- 11.9 If the data from this analysis appears satisfactory, the calibration must be saved within the data acquisition system.
- 11.9.1 The naming convention for saving a calibration is a prefix CAL plus a date, written as month, day and year. For example, if a calibration were completed on the twenty-ninth day of last December, it would be saved as "CAL12-29-01."
- 11.9.2 After saving the calibration, a plot of the calibration should be printed, along with a list of the calibration parameters, and this printout must be saved in a notebook specific to the Instrument. This notebook is stored in a secure place, normally in close proximity to the Instrument.
- 11.10 Recalibration of the instrument may be required if:
- Current calibrations are lost or damaged.
  - It is after reconfiguration or repair of an existing Instrument.
  - A sample concentration is out of the range of current calibrations.
  - Current independent standard or Control Fluid results fall outside the acceptance criteria.
- 11.11 If recalibration is required, complete all the steps in Section 9.1 through 9.9.

## 12. Analytical Procedure

- 12.1 Create a sequence as described below for the data station per the Instrument Manufacturer's instructions. Enter the sample ID (FTAG number) in the sequence table and on the GC sample vials.

Control fluid  
Independent standard  
Blank  
Control fluid  
Samples (10)  
Duplicate sample  
Control Fluid  
Samples (10)  
Duplicate sample  
Control Fluid  
Etc.

A minimum of one Independent Standard as well as one Blank is used for each sequence. Independent Standard is used to check the established calibration, and Blank is used to check the purity of Internal Standard and for any sample carryover. The analytical session is always begun and ended with the Control Fluid sample.

- 12.2 Pipette 5 to 25 mL of Control Fluid, Independent Standard, Blank or sample into a tared and capped 30-mL glass vial and record its weight in the sequence table.
- 12.3 Add Internal Standard to this glass vial at a proportion of 3 – 6% by weight of the Control fluid, Independent Standard, Blank or sample. Record the weight of Internal Standard added in the sequence table.
- 12.4 Shake the mixture well and then transfer about 2 mL of the well mixed solution to a GC sample vial. Make sure that the sample ID on the GC sample vial matches that in the sequence table. Also make sure that each sample vial is sealed and that the seal is intact. Upon the completion of sample preparations, transfer the vials sequentially into the autosampler.
- 12.5 Before sample analysis run an in house prepared retention time check sample to ensure that all oxygenates of interest are within the recognition time window of the current calibration.

- 12.6 Initiate sample analysis after the retention times for each analyte have been confirmed and so that all oxygenates can be identified with the current calibrations.
- 12.7 At the completion of each analysis, the HP Chemstation will produce an output report showing the chromatogram and calculated weight percent concentrations. Review individual report to verify that all retention times are within the retention time window by verifying that each peak of interest is identified.
- 12.8 Ensure that the content of oxygenates in the Control Fluid is within +/-5% of the statistical established value from the weekly QC measurement results. Investigate any out-of-compliance results and take immediate corrective action. Record the action and implication.

If out-of-compliance occurrences cannot be reconciled, make new standards and recalibrate and repeat the samples analyzed since the last successful control fluid analysis.

- 12.9 Ensure that the reported quantities for the Independent Standard are within +/-5% limits of the target concentration. If they are not within specification, discard the vial and replace it with a fresh one

If a fresh vial is out of specification, investigate the cause; it may be necessary to make new standards and recalibrate.

- 12.10 Verify that the analyte for the duplicate samples is within +/-5% of each other. If the duplicate range is out of this limit, halt the analysis and take immediate corrective action to resolve the abnormal analysis variability. Record the action and its implications.

If the investigation indicates that an out-of-compliance occurrence may have affected the previous analysis samples, repeat the samples analyzed since the last acceptable duplicate analysis. Discard the original results from the samples.

- 12.11 If the analyte in an unknown exceeds the calibrated range, it must be diluted with oxygenate free Base gasoline to make sure it falls within the calibrated range.

The concentration of analyte in the undiluted sample is as follows:

$$C_o = C_d \times [(V_s + V_d)/V_s]$$

where:

$C_o$  = concentration of analyte in the original sample

$C_d$  = concentration of analyte in the diluted sample

$V_s$  = volume of the original sample

$V_d$  = volume of the diluent volume

The dilution factor,  $[(V_s + V_d)/V_s]$ , must be recorded in the sequence table.

### 13. Calculations and Reporting

After identifying the various oxygenates by retention times, the data system of the instrument will calculate the response ratio ( $R_i$  = peak area of oxygenate/peak area of internal standard) for each identified oxygenate. From the least-squares fit calibrations and the value of response ratio, the weight of each oxygenate present in the sample can be obtained. The data system of the instrument also will calculate the weight percent ( $w_i$ ) of each identified oxygenate as follows:

$$w_i = (W_i/W_g) \times 100\%$$

where:

$W_i$  = weight of oxygenate i in the test sample

$W_g$  = weight of sample

Total weight percent of all oxygenates present in the test sample is calculated as follows:

$$\text{Total weight percent} = \text{sum}(w_i)$$

- 13.2 Upon the completion of each discrete analysis, a summary report containing sample ID, sample weight, weight of internal standard, analysis chromatogram, retention times, the weight percent of oxygenates detected and the total weight percent of all oxygenates present in the sample will be generated from the HP Chemstation (Attachment B). The operator must verify that the identity and label on the report match the sample identification number from the vial.
- 13.3 The analyst reviews an individual report to verify peak recognition, baseline stability, and the shape of peak. For this analysis, peaks should be reasonably symmetrical with no obvious splitting, flat tops, or baseline aberrations. Excessive trailing is an indication of column decay or other instrument problems.
- 13.4 The analyst reviews the results of the analysis of Control Fluid, Independent Standard, samples and duplicate samples for conformance to acceptance criteria.
- 13.5 Results for diluted samples are corrected on the report, per the formula above, to reflect their undiluted concentration.
- 13.6 Calculate volumetric concentration of oxygenates present in the sample.

If the volume percent concentration of each oxygenate is desired, the weight% from Chemstation report can be converted to the volumetric concentration as follows:

$$v_i = w_i \times (d_s/d_i)$$

where:

$v_i$  = volume percent of oxygenate i

$w_i$  = weight percent of oxygenate i

$d_i$  = relative density of oxygenate i at 60°F

$d_s$  = relative density of the fuel under study at 60°F

Total volume percent of all oxygenates detected can obtained follows:

$$\text{Total volume percent} = \text{sum } [v_i]$$

- 13.7 Calculate weight percent of oxygen in the test fuel.

To determine the oxygen content of the test fuel, convert and sum the oxygen content of all components present according to the following equations:

$$\text{Oxygen weight\% of oxygenate } i = (w_i/m_i) \times 16.0 \times n_i$$

where

$m_i$  = molecular weight of the oxygenate  $i$

16.0 = atomic weight of oxygen

$n_i$  = number of oxygen atoms in the oxygenate  $i$

$$\text{Total oxygen weight\%} = \text{sum} [(w_i/m_i) \times 16.0 \times n_i]$$

- 13.8 If all acceptance criteria are met, the analyst exports the test results directly to the OFID subform in the Access Table. The OFID subform contains all the equations needed to calculate the volume% and oxygen weight% of each oxygenate detected; and the total weight%, total oxygen weight% and total volume% of all oxygenates present in the sample. The OFID subform thus will have the weight%, volume% and oxygen weight% of each oxygenate; and the total weight%, total oxygen weight% and total volume% of all oxygenates present in the test sample. Export information in the OFID subform to the Access Result Table.
- 13.9 Complete all information requested on the EPA NVFEL Form and sign and file the HP analysis reports.
- 13.10 If a new calibration curve is generated, a plot of the calibration and a calibration parameter printout, and the calibration curve evaluation report are filed within a notebook specific to the Instrument.
- 13.11 Backup the test results on the Instrument monthly and the OFID subform weekly to a Compact Disk/



**14. Performance Criteria**

- 14.1 The retention times for each analyte in the retention time check sample must be within the recognition time window of the current calibration, as evidenced by instrument peak identification.
- 14.2 Concentrations of the Control Fluid must be within the limits of  $\pm 5\%$  of the statistical analysis established value.
- 14.3 Concentration of oxygenates in the Independent Standard must be within  $\pm 5\%$  of their target values.
- 14.4 The difference between the reported values of the duplicate samples must be within  $\pm 5\%$  limit.
- 14.5 The baseline of any analysis run must not contain any noise greater than the threshold level for the lowest calibrated point and have no discernible drift. Individual peaks should not display any aberrant morphology.
- 14.6 The GC reports must be signed by the analyst to signify they have been checked for compliance with the acceptance criteria, and filed in the Chem Lab.
- 14.7 If a new calibration curve is generated, then the difference between the results of the Independent Standard and Control Fluid analyzed immediately following the calibration must also conform to the  $\pm 5\%$  quality control limit. In addition, the Base gasoline analyzed as part of the calibration must have no detectable amount of oxygen.
- 14.8 Refer to ASTM Standard Method D5599 for details on the statistical qualification of this test method.

**Attachment A**

**Attachment A**

**PERTINENT PHYSICAL CONSTANTS AND RETENTION  
CHARACTERISTICS FOR OXYGENATES**

Component	Mwt	Retention Time (min)	Relative Density @ 60F	Boiling Point (C)
Methanol	32.04	4.10	0.7963	64.70
Ethanol	46.07	5.41	0.7939	78.00
iso-Propanol	60.10	6.68	0.7899	82.40
tert-Butanol	74.10	7.64	0.7922	83.00
n-Propanol	60.10	8.75	0.8080	97.00
MTBE	88.20	9.65	0.7460	55.56
sec-Butanol	74.10	10.50	0.8114	99.00
DIPE	102.20	11.20	0.7300	102.18
iso-Butanol	74.10	11.80	0.8058	108.00
ETBE	102.20	12.20	0.7452	72.50
tert-Pentanol	88.10	12.70	0.8170	102.00
DME	90.12	13.10	0.8720	85.00
n-Butanol	74.10	13.50	0.8137	117.70
TAME	102.20	14.60	0.7758	85.50

Retention time of oxygen: 2.56 min

Retention time of water: 3.38 min

DIPE - Di-isopropylether (Isopropyl ether)

TAME - tert-amylmethylether

ETBE - Ethyl-tert-butylether

MTBE - Methyl-tert-butylether

DME - 1,2-Dimethoxyethane (Ethleneglycol dimethylether)

Attachment B

Attachment B

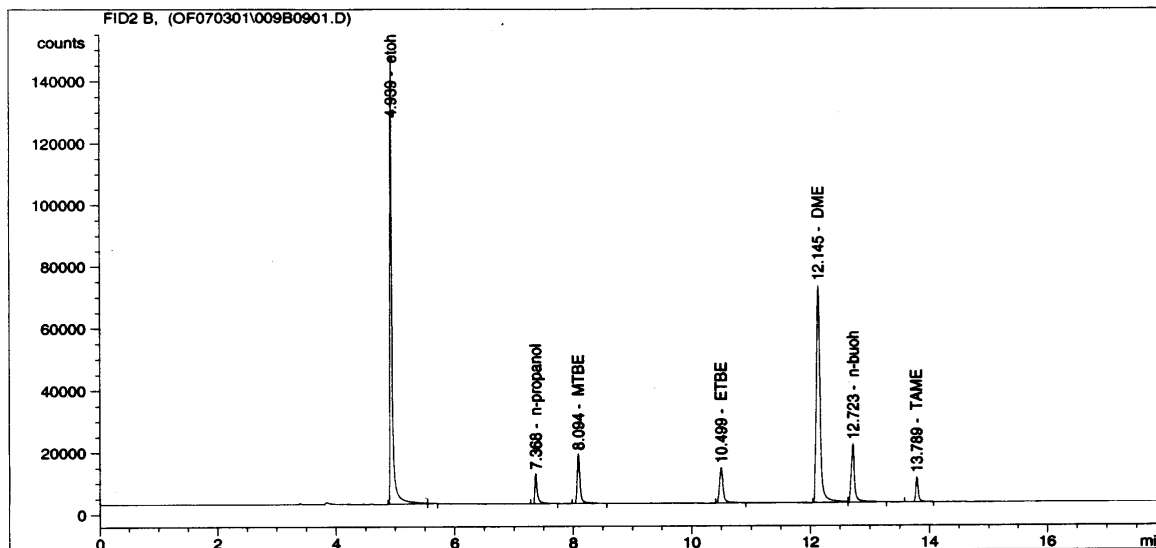
Data File C:\HPCHEM\1\DATA\OF070301\009B0901.D

Sample Name: 10882

```

=====
Injection Date : 7/3/01 1:20:43 PM      Seq. Line : 9
Sample Name    : 10882                  Vial      : 9
Acq. Operator  :                        Inj       : 1
                                           Inj Volume: 1 µl

Sequence File  : C:\HPCHEM\1\SEQUENCE\OF070301.S
Method         : C:\HPCHEM\1\METHODS\SCOT1030.M
Last changed   : 6/28/01 10:09:02 AM
Injection port A and the TCD detector analyze benzene and toluene in
gasoline following ASTM Method 3606. Injection port B and the FID
Detector analyze oxygenated compounds in compounds using an O-FID.
    
```



ISTD Percent Report

```

=====
Sorted By      :      Retention Time
Calib. Data Modified : 6/28/01 10:08:51 AM
Multiplier     :      1.0000
Dilution       :      1.0000
Sample Amount   :      18.81150 [g]
    
```

```

Sample ISTD Information:
ISTD ISTD Amount Name
# [g]
    
```

```

-----
1 8.61000e-1 DME
    
```

Signal 1: FID2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area ratio	Amount %	Grp	Name
4.180	1		-	-	-		meoh
4.939	1	BV	3.53239e5	1.04423	5.308026		etoh
5.725	1		-	-	-		IPA
6.365	1		-	-	-		t-buoh
7.368	1	BB	2.86284e4	1.44158	0.593887		n-propanol
8.094	1	BB	5.52040e4	2.08196	1.653912		MTBE
9.025	1		-	-	-		sec-buoh
9.650	1		-	-	-		DIPE
10.150	1		-	-	-		iso-buoh

Instrument 1 7/3/01 1:38:47 PM

Attachment B Continued

Attachment B (continue)

Data File C:\HPCHEM\1\DATA\OF070301\009B0901.D

Sample Name: 10882

RetTime [min]	Sig	Type	Area counts*s	Amt/Area ratio	Amount %	Grp	Name
10.499	1	BB	4.79165e4	2.27651	1.569728		ETBE
11.650	1		-	-	-		t-amyl alc
12.145	1	BV I	3.18061e5	1.00000	4.576987		DME
12.723	1	VV	7.60192e4	1.57122	1.718819		n-buoh
13.789	1	BB	2.39752e4	2.35176	0.811379		TAME

Totals without ISTD(s) : 11.655752

Results obtained with standard integrator!

2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

Warning : Calibrated compound(s) not found

=====  
\*\*\* End of Report \*\*\*