

# Application

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## SP-1700 GC Column Provides Reproducible Hydrocarbon Analyses

*An SP-1700 column provided peak symmetry for isopentane and hexane in a qualitative ASTM mix, indicating that the column is not overloaded by highly concentrated compounds. This column also separated highly disproportionate concentrations of the components in an industrial butane sample. Despite the wide concentration range, all peaks were nearly symmetrical, with separation completed in only 14 minutes. Propane and propylene in liquid propane can be resolved when the concentration ratio is 90:1 or more.*

### Key Words:

- hydrocarbons • petroleum • packed column GC

For petroleum and petrochemical analyses, a good general purpose GC column must separate numerous C1-C5 saturated and unsaturated hydrocarbons. It also must provide rapid analyses, have a large sample capacity, and withstand the stress of pressure surges from sample valve operation. Columns consisting of 23% SP™-1700 on Chromosorb® P AW meet all of these requirements.

Analysts can separate many hydrocarbons using a stock 30' x 1/8" SP-1700 column (Table 1). Figure A shows an isothermal analysis that includes most of the compounds in C1-C6 petroleum streams. At 70°C, the C1-C5 components elute from the column in about 21 minutes. Methylhexane, a C7 compound and the heaviest component, elutes in 36 minutes with a symmetrical peak. Even isopentane and 1,3-butadiene, hydrocarbons which coelute from many columns, separate sharply when an SP-1700 column is used.

A chromatographer analyzing hydrocarbon mixtures must operate most columns at 35°C or lower — difficult temperatures to maintain in a chromatograph oven. Component retention times vary as a result, and components may be misidentified. Furthermore, columns used in these situations typically are operated near their maximum recommended temperature and consequently exhibit high bleed and short life spans. Other columns for hydrocarbon analyses may require temperature programming. When the cool-down and stabilization periods are included, the analyses are often undesirably long.

SP-1700 columns can be used from room temperature to 110°C in isothermal as well as temperature-programmed analyses. Time is saved between samples because the analyst can perform isothermal separations on these columns, and because SP-1700 columns are conditioned and ready to use within an hour after installation.

**Table 1. Hydrocarbon Retention on 23% SP-1700/Chromosorb P AW**

Component	Retention Time (min) at 70°C	Component	Retention Time (min) at 70°C
Air or Composite	3.17	cis-2-Butene	10.49
CH <sub>4</sub> /H <sub>2</sub> S	3.27	Isopentane	11.18
Ethane	3.67	1,3-Butadiene	11.81
Ethylene	3.70	n-Pentane	13.08
CO <sub>2</sub>	3.86	Pentene-1	14.92
Propane	4.73	trans-2-Pentene/	
Propylene	5.04	2-Methyl-1-butene	16.16
Acetylene	5.20	cis-2-Pentene	17.89
Isobutane	6.12	2-Methyl-2-butene	19.18
COS	6.58	2-Methylpentane	20.19
n-Butane	7.4	3-Methylpentane	22.85
Isobutylene/1-Butene	8.34	n-Hexane	25.13
trans-2-Butene	9.50	3-Methylhexane	35.71

Packing: **23% SP-1700 on 80/100 Chromosorb P AW**  
Cat. No.: **11865** (packing)  
Column: 30' x 1/8" OD stainless steel  
Cat. No.: **12809-U** (general configuration stock column)  
Oven: 70°C  
Carrier: helium, 25mL/min<sup>▲</sup>  
Det.: FID, 110°C  
Inj.: 100°C

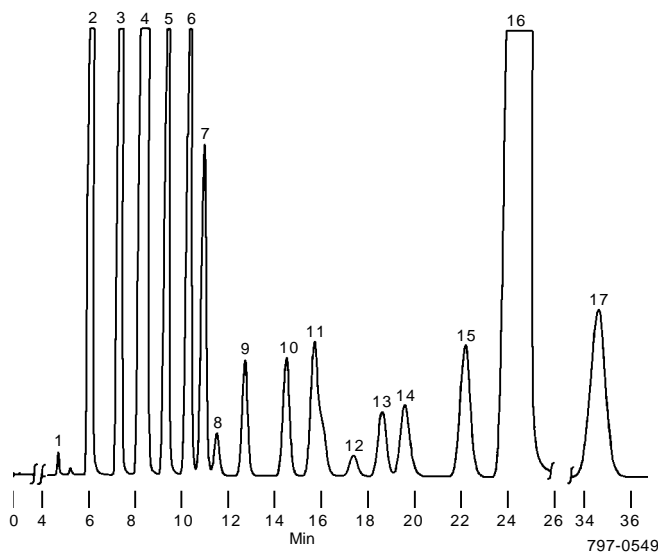
Many columns presently being used to separate petrochemicals have inadequate sample capacity. Such columns may separate trace levels of hydrocarbons well (e.g., levels in environmental or industrial hygiene samples). But if the sample contains large quantities of some components, these columns become saturated and resolve components poorly. In contrast, the high stationary phase content (23%) of SP-1700 columns provides a large sample capacity: 0.5µL-2µL for liquid samples, 0.5-10cc for gas samples. In Figure A the difference between the isopentane and hexane concentrations is extremely large, yet both peaks are symmetrical. The symmetry of the hexane peak (sample solvent) shows the column is not overloaded by highly concentrated compounds.

An analysis of an industrial butane sample also reveals that an SP-1700 column separated highly disproportionate concentrations of sample components well (Figure B). Although the components ranged in concentration from 97.9% (n-butane) to 0.01% (n-pentane), all peaks were nearly symmetrical. In addition, the analysis was completed in only 14 minutes. Propane and propylene in liquid propane can be resolved (Figure C) when the concentration ratio is 90:1 or more. ASTM Section L Blend No. 5 and Phillips Petroleum Blend No. 40 also separated extremely well on an SP-1700 column. Although several pairs of compounds eluted at the same or similar times (Table 1), the coelution of isobutylene and 1-butene is the only significant column limitation.

**Figure A. Isothermal Separation of ASTM<sup>®</sup> Section L Blend No. 6 Plus C5s**

Packing: 23% SP-1700 on 80/100 Chromosorb P AW  
 Cat. No.: 11865 (packing)  
 Column: 30' x 1/8" OD stainless steel  
 Cat. No.: 12809-U (general configuration stock column)  
 Oven: 70°C  
 Carrier: helium, 25mL/min<sup>▲</sup>  
 Det.: FID, 110°C  
 Inj.: 1µL qualitative mix in hexane, 100°C

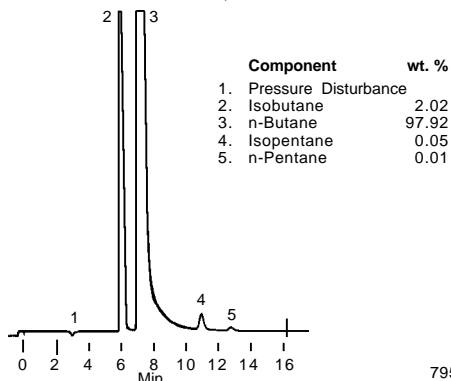
- |                         |   |                       |
|-------------------------|---|-----------------------|
| 1. Propane              | 7. Isopentane                             | 12. cis-2-Pentene     |
| 2. Isobutane            | 8. 1,3-Butadiene                          | 13. 2-Methyl-2-Butene |
| 3. n-Butane             | 9. n-Pentane                              | 14. 2-Methylpentane   |
| 4. 1-Butene/Isobutylene | 10. 1-Pentene                             | 15. 3-Methylpentane   |
| 5. trans-2-Butene       | 11. trans-2-Pentene/<br>2-Methyl-1-Butene | 16. n-Hexane          |
| 6. cis-2-Butene         |   | 17. 3-Methylhexane    |



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**Figure B. Symmetrical Peaks from Major and Trace Components of Industrial Butane III**

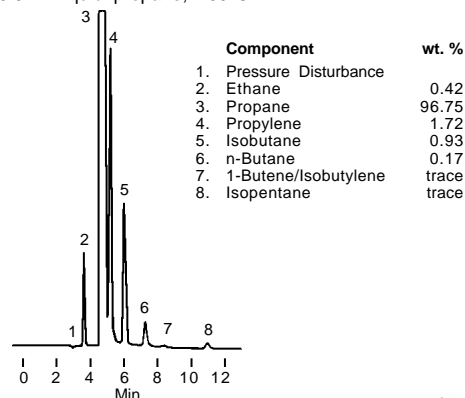
Packing: 23% SP-1700 on 80/100 Chromosorb P AW  
 Cat. No.: 11865 (packing)  
 Cat. No.: 12809-U (general configuration stock column)  
 Oven: 70°C  
 Carrier: helium, 25mL/min<sup>▲</sup>  
 Det.: FID, 110°C  
 Inj.: 0.75mL industrial butane III, 100°C



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**Figure C. Propane and Propylene Peaks Resolved at Highly Disparate Ratios**

Packing: 23% SP-1700 on 80/100 Chromosorb P AW  
 Cat. No.: 11865 (packing)  
 Column: 30' x 1/8" OD stainless steel  
 Cat. No.: 12809-U (general configuration stock column)  
 Oven: 70°C  
 Carrier: helium, 25mL/min<sup>▲</sup>  
 Det.: FID, 150°C  
 Inj.: 0.5mL liquid propane, 100°C



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These examples illustrate results of several general, widely used hydrocarbon analyses performed using stock 30 foot SP-1700 columns. To meet unique requirements, we also offer custom SP-1700 columns and 23% SP-1700/Chromosorb P AW packing. (SP-1700 phase is not available separately.) Thus, analysts can obtain an SP-1700 column that will provide excellent results in almost any situation.

**Ordering Information:**

Description	Cat. No.
23% SP-1700 on 80/100 Chromosorb P AW Packing (21-22g will fill a 30' x 1/8" column.) 25g	11865
Stainless Steel Column, 30' x 1/8" OD General configuration, 6" coil, conditioned.	12809-U
Coiled to any other configuration and conditioned.*	custom

<sup>▲</sup>A head pressure of about 70 lbs. is typically observed when producing the desired 25mL/min flow rate. To avoid flow controller problems, we recommend an instrument supply pressure of 90psi.

<sup>■</sup>American Society for Testing and Materials.

\*Refer to the Supelco catalog for ordering information and for custom length stainless steel columns.

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