CORPORATION, LLC

41041 Black Bayou Rd, Gonzales, Louisiana, USA 70737
Phone (225) 644-5255 FAX (225) 644-3975
www.geniefilters.com sales@geniefilters.com

Genie® Membrane Testing

Daniel Industries Test

Introduction

A series of tests were conducted at Daniel Industries in Houston, TX (1996) to determine if the composition of sample gas was altered by its passage through Genie® Membrane Separators™ equipped with the Standard (Type 1) and BTU (Type 6) membrane. A baseline condition was established using the entire sample system without sample gas flowing through the membrane, before any further testing was performed.

Test Apparatus

- **Test Gas**: High BTU content natural gas stored at a maximum of 150 PSIG
- **Analyzer**: Danalyzer Gas Chromatograph configured for high BTU natural gas
- **Sample System**: Regulated pressure and flow rate
- **Genie Membrane Separators**: Model 101-000-SS (Stainless Steel Model 101 with Viton O-ring and "Red" Standard Type 1 membrane) and Model 101-006-SSS (Stainless Steel Model 101 with Viton O-ring and BTU Type 6 membrane)

Test Procedure

Three groups of tests were conducted, and each test consisted of multiple analyses taken at four minute intervals. Daniel Industries personnel operated the Daniel GC.

1. The first test was conducted to establish a baseline condition without sample gas flow through either membrane. Sample was extracted from the natural gas source (150 PSI), regulated to 13.5 PSI, and then sent to the GC for analysis without flowing through the membrane.
2. The second test was conducted to determine if the composition of the sample gas was altered by its passage through the Standard (Type 1) membrane. Sample was extracted from the natural gas source (150 PSI), regulated to 13.5 PSI, passed through utilized a Genie® Membrane Separator™ Model 101 equipped with Standard (Type 1) membrane, and then went to the GC for analysis.
3. The third test was conducted to determine if the composition of the sample gas was altered by its passage through the BTU (Type 6) membrane. Sample was extracted from the natural gas source (150 PSI), regulated to 13.5 PSI, passed through utilized a Genie® Membrane Separator™ Model 101 equipped with BTU (Type 6) membrane, and then went to the GC for analysis.

Test Results

1. **Test Group1-Baseline Condition-Sample gas does not flow through the membrane**

Components	Mole % (Mean of 8 Runs)
C6+	0.4145
Propane	2.5807
Isobutane	.9709
N-butane	.6712
Neopentane	.0098
Isopentane	.3019
N-pentane	.1896
Nitrogen	.1381
Methane	87.1957
Carbon Dioxide	1.4533
Ethane	6.0767
Dry BTU value corrected for "z factor" (Mean of 8 runs)	1154.42

2. **Test Group 2-Sample gas flows through the Standard (Type 1) membrane**

Components	Mole % (Mean of 3 Runs)
C6+	0.4167
Propane	2.5818
Isobutane	.9704
N-butane	.6706
Neopentane	.0099
Isopentane	.3011
N-pentane	.1888
Nitrogen	.1376
Methane	87.1932
Carbon Dioxide	1.4540
Ethane	6.0763
Dry BTU value corrected for "z factor" (Mean of 3 runs)	1154.47

3. **Test Group 3- Sample gas flows through BTU (Type 6) membrane**

Components	Mole % (Mean of 3 Runs)
C6+	0.4194
Propane	2.5826
Isobutane	.9711
N-butane	.6719
Neopentane	.0100
Isopentane	.3024
N-pentane	.1892
Nitrogen	.1361
Methane	87.1847
Carbon Dioxide	1.4547
Ethane	6.0782
Dry BTU value corrected for "z factor" (Mean of 3 runs)	1154.72

Conclusion

A+ Corporation Genie® Membrane Separators™ with Standard (Type 1) Membrane and BTU (Type 6) Membrane did not alter the sample gas as confirmed by gas chromatographic analysis.

Southwest Research Institute Test

Summary

The performance of the BTU (Type 6) membrane was tested by Southwest Research Institute as part of the API 14.1 Sampling Project. Dry, rich gas (1250 BTU/scf, 100 PSIA, 115°F, and 1, 500 BTU/scf, 80 PSIA, 115°F) was used to see if it would distort the gas under controlled dry conditions. No distortion in gas density or heating value was seen, within ± 0.25% of control values that were not exposed to the membrane.
For more information concerning this test, please refer to the following document:

Behring, K.A., "*Metering Research Facility Program: Interim Research Results for Collecting and Handling Natural Gas Samples",* GRI Technical Memorandum, GRI Report No. GRI-98/0034, April 1998.