Gas Permeability Testing – Flexelene™ 135C Material

Testing provided by:

Akron Rubber Development Laboratory
2887 Gilchrist Rd.
Akron, OH 44305

ISO 9001:2008 registered
Accredited Laboratory
Member ACIL

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GAS PERMEABILITY-ASTM D1434-82 (2003), PROCEDURE V
Apparatus: Custom Scientific Model CS-135
Gas Used: **CARBON DIOXIDE**
Test Temperature: 23.0°C
Test Gas Pressure: 30.0 psi
Permeation area of the sample: 66.4 cm_2
Capillary Diameter: 0.0932 em
Gas permeability testing was performed following the test conditions listed above. Please see the attached page explaining the calculations for the permeability constant.

SAMPLE THICKNESS (CM) P (CM2/SEC-ATM) P [(CM3)(CM)/(CM2)(SEC)(PA)]

SAMPLE	THICKNESS (CM)	P (CM2/SEC-ATM)	P [(CM3)(CM)/(CM2)(SEC)(PA)]
135C	0.1906	1.51877E-07	1.49891E-12

GAS PERMEABILITY-ASTM D1434-82 (2003), PROCEDURE V
Apparatus: Custom Scientific Model CS-135
Gas Used: **METHANE**
Test Temperature: 23.ooc
Test Gas Pressure: 30.0 psi
Permeation area of the sample: 66.4 cm_2
Capillary Diameter: 0.0932 em
Gas permeability testing was performed following the test conditions listed above. Please see the attached page explaining the calculations for the permeability constant.

SAMPLE THICKNESS (CM) P (CM2/SEC-ATM) P [(CM3)(CM)/(CM2)(SEC)(PA)]

SAMPLE	THICKNESS (CM)	P (CM2/SEC-ATM)	P [(CM3)(CM)/(CM2)(SEC)(PA)]
135C	0.1906	1.18661 E-07	1.17109E-12

GAS PERMEABILJTY-ASTM D1434-82 {2003), PROCEDURE *V*
Apparatus: Custom Scientific Model CS-135
Gas Used: **NITROGEN**
Test Temperature: 23.0°C
Test Gas Pressure: 30.0 psi
Permeation area of the sample: 66.4 cm_2
Capillary Diameter: 0.0932 em
Gas permeability testing was performed following the test conditions listed above. Please see the attached page explaining the calculations for the permeability constant.

SAMPLE THICKNESS (CM) P (CM2/SEC-ATM) P [(_CM3)(CM)/(CM2)(SEC)(PA)]

SAMPLE	THICKNESS (CM)	P (CM2/SEC-ATM)	P [(CM3)(CM)/(CM2)(SEC)(PA)]
135C	0.1906	6.21960E-08	6.13827E-13

GAS PERMEABJLITY-ASTM 01434-82 (2003), PROCEDURE V
Apparatus: Custom Scientific Model CS-135
Gas Used: **OXYGEN**
Test Temperature: 23.0°C
Test Gas Pressure: 30.0 psi
Permeation area of the sample: 66.4 cm_2
Capillary Diameter: 0.0932 em
Gas permeability testing was performed following the test conditions listed above. Please see the attached page explaining the calculations for the permeability constant.

SAMPLE THICKNESS (CM) P (CM2/SEC-ATM) P [(CM3)(CM)/(CM2)(SEC)(PA)]

SAMPLE	THICKNESS (CM)	P (CM2/SEC-ATM)	P [(CM3)(CM)/(CM2)(SEC)(PA)]
135C	0.1906	1.23786E-07	1.22167E-12

GAS PERMEABILITY-ASTM 01434-82 (2003), PROCEDURE V

This is an example showing how the permeability constant has been calculated using a hypothetical slope. The permeability constant is calculated at steady state by the following steps.

1) The slope of the line from a graph plot of em Hg versus time is acquired. The volume-flow rate, q, is obtained by multiplying the slope by the cross-sectional area of the capillary tube. For example:

q = 1.39 x 1 o-5 em/sec. x (0.05 cm)2 x 3.14 = 1.09 x 1 o-7 cm3/sec.

2) To convert to STP conditions, a barometric pressure of one atmosphere is used. For example, at 26 C:

q (STP) = 1.09 x 1 o-7 cm3fsec. x (760/760) x (273/299) = 9.95 x 1 o-8 cm3/sec

3) The permeability constant, p, is calculated using the following equation;

$$p = q\,(STP) \times L) \,/\, (A \times DP)$$

where:

L =test specimen thickness, em,
A= cross-sectional area of test specimen, cm2, and
DP = pressure differential across test specimen, atm.
For example:

$$p = \frac{(9.95 \times 1 \text{ o-8 cm3/sec})\ (0.20 \text{ em})}{(66.4 \text{ cm2})\ (3.40 \text{ atm})}$$

$$= 8.81 \times 10\text{-}11 \text{ cm2fsec-atm}$$

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AKRON RUBBER DEVELOPMENT LABORATORY, INC.

Akron, OH

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Presented this 26th day of May 2010.

President & CEO
For the Accreditation Council
Certificate Number 0255.02
Valid to January 31, 2012

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Chemical Scope of Accreditation.