How to Read the Charts

When reviewing the charts, remember that tests are conducted under identical conditions, and if a glove material's combination is rated 'Excellent', it is superior to a combination ranked 'Good'. The charts provide both permeation and degradation data and are useful for determining the overall chemical resistance of a glove to a chemical in a given environment.

Chart Components

- **Overall Degradation Rating**: This is a summary rating that indicates the performance of the glove material in both permeation and degradation tests.

- **Permeation Rate**: This is a measure of how quickly a chemical permeates the glove material. It is expressed as a rating from 'Poor' to 'Excellent'.

- **Degradation Rating**: This is a measure of how well the glove material Resists degradation when exposed to a chemical. It is also rated from 'Poor' to 'Excellent'.

- **Permeation Breakthrough Time**: This is the amount of time it takes for a chemical to breakthrough the glove material. It is reported as a rating from 'Less than 20 minutes' to '240 minutes or greater'.

When a product's overall degradation rating is significantly better than its permeation breakthrough time, it usually means the product is a better choice.

Methodology

- **Permeation Tests**: Permeation tests are conducted in accordance with specific standards. A specimen is cut from the glove material and immersed in a chemical solution. The specimen is then weighed and measured, and the percentage of weight change is calculated. This change is attributed to the permeation rate of the chemical.

- **Degradation Tests**: Degradation tests are conducted in a separate test cell. A specimen is cut from the glove material and immersed in a chemical solution. The specimen is then weighed and measured, and the percentage of weight change is calculated. This change is attributed to the degradation rate of the chemical.

- **Combination of Tests**: When evaluating a glove material, the combination of permeation and degradation tests is used to determine the overall chemical resistance of the material. This information is then used to make recommendations for the use of the material in a specific environment.

Additional Information

- **Chemical Composition**: The chemical composition of the permeated chemical is determined by analytical techniques such as gas chromatography, thin-layer chromatography, and other methods. This information is used to determine the extent of degradation and the overall chemical resistance of the material.

- **Physical Properties**: The physical properties of the glove material, such as thickness, weight, and porosity, are also considered when evaluating the overall chemical resistance of the material.

- **Recommended Usage**: Based on the permeation and degradation data, recommendations are made for the use of the material in specific environments. These recommendations are designed to ensure the safety and performance of the material.

Introduction to the 8th Edition

The 8th Edition of the Permeation/Degradation Resistance Guide for Ansell Chemical Resistant Gloves contains updated and expanded data on chemical resistance to a variety of glove materials. The guide includes new and updated test procedures, as well as additional data and information on chemical resistance.

Permeation/Degradation Resistance Guide for Ansell Chemical Resistant Gloves

Chemical Resistance Guide

Permeation & Degradation Data

Ansell
Permeation/Degradation Resistance Guide for Ansell Chemical Resistant Gloves

Introduction to the 8th Edition

When reviewing the data presented here, remember that test conditions are not standardized and differences exist. A chemical resistant glove is a complex product comprised of a number of factors which are dependent upon the specific glove material and contact with a chemical. The data presented here is gathered from a variety of sources and should be used as only a guide in helping determine which chemical resistant glove will best suit your needs.

How to Read the Charts

We cannot predict how a glove material will respond to a chemical under all possible work conditions. To aid in this determination, the charts included here should be used as a guide in determining which gloves are most suitable for a particular chemical.

When a product chart illustrating two or more “green” ratings contains one with a significant difference in one or more performance factors, then the differing factors should be considered when choosing the best glove material for the job. Two or more “yellow” or “red” ratings should be viewed as potential hazards and the differences in ratings should be considered when choosing the best material for the job.

A glove-chemical combination receives an “excellent” or “good” rate if either set of the following conditions is met:

- The Degradation Rating is excellent or good.
- The Degradation Rating is yellow or red.

All other glove-chemical combinations receive an “average” rate. A glove-chemical combination receives a “poor” rate if the following conditions is met:

- The Degradation Rating is red.

When reviewing the data presented in these charts, keep in mind that the Degradation Ratings are based on a thorough comparison of permeation rates as tested in both the permeation and degradation tests.

Permeation Tests

Permeation tests are conducted between the inside and outside of the sample, with the chemical being the limiting factor. Although permeation tests are generally conducted under the same conditions, the permeation test is not comparative. The results of the permeation test do not indicate which glove material is more or less permeable. It is possible that a glove material may be more permeable to a certain chemical, but not to another. The data presented here is the result of a standard six-hour permeation test using nitrogen as the test gas.

Degradation Tests

Degradation tests are conducted between the interior and exterior of the sample, with the glove material being the limiting factor. The results of the degradation test may be compared to one another, but not with the results of the permeation test. Since the same chemical is being tested in both the permeation and degradation tests, the overall chemical resistance of a glove material may be compared to the overall chemical resistance of another.

Performance Data

Performance data is determined by testing each glove material hardness and tear resistance. The hardness and tear resistance test is conducted on a standard latex glove and a standard neoprene glove. The results of the hardness and tear resistance test are compared to one another, and to the hardness and tear resistance of the same glove material when tested in the permeation and degradation tests.

Key to Degradation Ratings

The 0 hour test rate is observed, but not measured, since the test is run for only one hour. The 1 hour test rate is observed, but not measured, since the test is run for only one hour.

The 2 hour test rate is observed, but not measured, since the test is run for only two hours. The 4 hour test rate is observed, but not measured, since the test is run for only four hours.

The 6 hour test rate is observed, but not measured, since the test is run for only six hours. The 8 hour test rate is observed, but not measured, since the test is run for only eight hours.

The 12 hour test rate is observed, but not measured, since the test is run for only twelve hours. The 24 hour test rate is observed, but not measured, since the test is run for only twenty-four hours.

The overall chemical resistance of a glove material is determined by the permeation resistance, degradation resistance, and hardness and tear resistance. The overall chemical resistance of a glove material is determined by the permeation resistance, degradation resistance, and hardness and tear resistance.

Permeation/Degradation Data

Permeation and degradation data is used to determine which chemical resistant glove is most suitable for a particular chemical. The data presented here is the result of a standard six-hour permeation test using nitrogen as the test gas.

Performance Data

Performance data is determined by testing each glove material hardness and tear resistance. The hardness and tear resistance test is conducted on a standard latex glove and a standard neoprene glove. The results of the hardness and tear resistance test are compared to one another, and to the hardness and tear resistance of the same glove material when tested in the permeation and degradation tests.

Key to Degradation Ratings

The 0 hour test rate is observed, but not measured, since the test is run for only one hour. The 1 hour test rate is observed, but not measured, since the test is run for only one hour.

The 2 hour test rate is observed, but not measured, since the test is run for only two hours. The 4 hour test rate is observed, but not measured, since the test is run for only four hours.

The 6 hour test rate is observed, but not measured, since the test is run for only six hours. The 8 hour test rate is observed, but not measured, since the test is run for only eight hours.

The 12 hour test rate is observed, but not measured, since the test is run for only twelve hours. The 24 hour test rate is observed, but not measured, since the test is run for only twenty-four hours.

The overall chemical resistance of a glove material is determined by the permeation resistance, degradation resistance, and hardness and tear resistance. The overall chemical resistance of a glove material is determined by the permeation resistance, degradation resistance, and hardness and tear resistance.

Permeation/Degradation Data

Permeation and degradation data is used to determine which chemical resistant glove is most suitable for a particular chemical. The data presented here is the result of a standard six-hour permeation test using nitrogen as the test gas.

Performance Data

Performance data is determined by testing each glove material hardness and tear resistance. The hardness and tear resistance test is conducted on a standard latex glove and a standard neoprene glove. The results of the hardness and tear resistance test are compared to one another, and to the hardness and tear resistance of the same glove material when tested in the permeation and degradation tests.

Key to Degradation Ratings

The 0 hour test rate is observed, but not measured, since the test is run for only one hour. The 1 hour test rate is observed, but not measured, since the test is run for only one hour.

The 2 hour test rate is observed, but not measured, since the test is run for only two hours. The 4 hour test rate is observed, but not measured, since the test is run for only four hours.

The 6 hour test rate is observed, but not measured, since the test is run for only six hours. The 8 hour test rate is observed, but not measured, since the test is run for only eight hours.

The 12 hour test rate is observed, but not measured, since the test is run for only twelve hours. The 24 hour test rate is observed, but not measured, since the test is run for only twenty-four hours.

The overall chemical resistance of a glove material is determined by the permeation resistance, degradation resistance, and hardness and tear resistance. The overall chemical resistance of a glove material is determined by the permeation resistance, degradation resistance, and hardness and tear resistance.

Permeation/Degradation Data

Permeation and degradation data is used to determine which chemical resistant glove is most suitable for a particular chemical. The data presented here is the result of a standard six-hour permeation test using nitrogen as the test gas.

Performance Data

Performance data is determined by testing each glove material hardness and tear resistance. The hardness and tear resistance test is conducted on a standard latex glove and a standard neoprene glove. The results of the hardness and tear resistance test are compared to one another, and to the hardness and tear resistance of the same glove material when tested in the permeation and degradation tests.
Permeation Testing

Ansell conducts permeation testing in accordance with ASTM Method F 739 standards. A specimen is cut from the glove and clamped into a test cell as a barrier membrane (see illustration). The “interior” side of the glove is exposed to a hazardous chemical. At timed intervals, the unexposed “exterior” side of the test cell is checked for the presence of the permeated chemical and the extent to which it may have permeated the glove material.

This standard allows a variety of options in analytical technique and collection media. At Ansell, dry nitrogen is the most common medium and gas chromatography with FID detection is the most common analytical technique. Our Research Department also uses liquids such as distilled water and hexane as collecting media, and techniques such as conductivity, colorimetry, and liquid chromatography for analysis of the collecting liquid.

Degradation Testing

Patches of the test material are cut from the product. These patches are weighed and measured, and then completely immersed in the test chemical for 30 minutes. The percentage of change in size is determined, and the patches are then dried to calculate the percentage of weight change. Observed physical changes are also reported. Ratings are based on the combined data.
Experimental carcinogens at extremely high dosages, Properties of Industrial Materials. Highlighted in blue are experimental carcinogens:

159. Turpentine
155. Triallylamine
153. Toluene (Toluol)
150. Sulfuric Acid, 120% (Oleum)
148. Sulfuric Acid, 47% (Battery Acid)
136. n-Propyl Alcohol
131. Phenol, 90%
128. n-Pentane
125. Pad Etch® 1 (Ashland Chemical)
122. n-Octyl Alcohol
121. 2-Nitropropane
119. Nitromethane
118. Nitrobenzene
111. Mineral Spirits, Rule 66
109. Methyl Methacrylate (MMA)
107. Methyl Iodide (Iodomethane)
96. Mercury
95. Maleic Acid, saturated solution
94. Hydrogen Chloride Gas
93. Hydrogen Chloride, liquid
92. Hydrogen Chloride, 40% solution
91. Hydrogen Chloride, 70% solution
84. Hydrogen Fluoride Gas
83. Hydrofluoric Acid, 95%
82. Hydrofluoric Acid, 50%
81. Hydrochloric Acid, 37% (Concentrated)
79. Hydrobromic Acid, 48%
78. Hydrazine, 65%
73. n-Heptane
71. Glutaraldehyde, 25%
63. Ethylene Oxide Gas
61. Ethyl Alcohol, Denatured, 92% Ethanol
59. Ethidium Bromide, 10%
58. Epichlorohydrin
57. Electroless Nickel Plating Solution
50. Dimethyl Sulfoxide (DMSO)
48. Diethylamine
39. "Chromic Acid" Cleaning Solution
38. 4-Chlorotoluene
34. 2-Chlorobenzyl Chloride
25. Butyl Cellosolve
22. n-Butyl Acetate
21. 2-Bromopropionic Acid
9. Ammonium Fluoride, 40%
7. Allyl Alcohol
3. Acetone
1. Acetaldehyde

The data in this guide are subject to revision as additional knowledge and experience are gained. Test data herein... and not necessarily the complete unit. Anyone intending to use these recommendations should first verify that the glove with that chemical.

Green: The glove is very well suited for application.
SPECIAL NOTE: The chemicals in this guide

RED: Avoid use of the glove with this chemical.

YELLOW: The glove is suitable for that application

Permeation/Degradation Resistance Guide for Ansell Gloves

These recommendations are based on laboratory tests, and reflect the best judgement of Ansell in the light of data available at the time of publication. They are intended to guide and inform qualified professionals engaged in the selection of appropriate protective glove materials.

NOTE: Gloves are not fail-safe. A glove that is suitable for a specific application or chemical is not necessarily suitable for a different application or chemical. Gloves, equipment and personal protective equipment (PPE) should not be used where there is a risk of PPE failure. The user is responsible for selecting the correct PPE for the intended task.

For each glove type is color coded for:

- **PERMEATION**
- **DAMAGE**
- **GLOVE FAILURE**
- **PUNCTURE**
- **PUNCTURE & PERMEATION OF GLOVE**
- **PERMEATION & DEGRADATION OF GLOVE**
- **PERMEATION & DEGRADATION OF GLOVE & GLOVE FAILURE**

Permeation: The chemical is likely to penetrate the material of the glove. Damage: The chemical may cause damage to the material of the glove. Glove failure: The chemical is likely to cause failure of the glove. Puncture: The chemical is likely to cause puncture of the glove. Puncture & permeation: The chemical is likely to cause puncture and permeation of the glove. Permeation & degradation: The chemical is likely to cause permeation and degradation of the glove. Permeation & degradation & glove failure: The chemical is likely to cause permeation, degradation and failure of the glove.

For more information, please refer to the Ansell glove testing laboratory, which is accredited by the American Society for Testing and Materials (ASTM) and offers a wide range of testing services to ensure the safety and efficacy of our products.

Ansell is committed to providing the highest quality, most reliable, innovative and technologically advanced protective gloves. We are dedicated to helping our customers meet their safety needs, and we continue to invest in research and development to develop new products and technologies that meet the changing demands of the workplace.

Skydrol is a registered trademark of Solutia Inc. Vertrel is a registered trademark of DuPont.
The data in this guide are subject to revision as additional knowledge and experience are gained. Test data herein are offered for guidance only and should not be used to determine chemical resistance, rates of permeation or degradation, or glove suitability. The data presented in this guide are intended to provide an indication of the relative resistance of gloves to the chemicals listed. Performance data are obtained through permeation and/or degradation testing and provided to facilitate the selection of appropriate gloves. Performance data are based on permeation and/or degradation testing with representative chemicals. It should be noted that the list of chemicals presented in this guide is not exhaustive. The data in this guide may not cover all chemicals that could be encountered in industrial applications. The product description and the chemical resistance of the glove material may require consideration of factors such as temperature, pressure, concentration, and contact time.

Skydrol is a registered trademark of Solutia Inc. Vertrel is a registered trademark of DuPont.

Permeation/Degradation Resistance Guide for Ansell Gloves

**Legend:**
- **Red** - Avoid use of the glove with this chemical.
- **Yellow** - The glove is suitable for that application.
- **Green** - The glove is suitable for that application, according to the glove manufacturer's data.
- **Orange** - The glove is suitable for that application, according to the chemical manufacturer's data.
- **Gray** - No data available.

**Table Notes:**
- A degradation test against this chemical was not run. However, in view of data obtained with similar compounds, the Degradation Rating is expected to be.
- The data in this guide are subject to revision as additional knowledge and experience are gained. Test data herein are offered for guidance only and should not be used to determine chemical resistance, rates of permeation or degradation, or glove suitability. The data presented in this guide are intended to provide an indication of the relative resistance of gloves to the chemicals listed. Performance data are obtained through permeation and/or degradation testing and provided to facilitate the selection of appropriate gloves. Performance data are based on permeation and/or degradation testing with representative chemicals. It should be noted that the list of chemicals presented in this guide is not exhaustive. The product description and the chemical resistance of the glove material may require consideration of factors such as temperature, pressure, concentration, and contact time.
### Permeation/Degradation Resistance Guide for Ansell Gloves

**Chemicals Highlighted in BLUE are Experimental Carcinogens,** and the letter in each colored square is for Degradation alone.

<table>
<thead>
<tr>
<th>CHEMICAL</th>
<th>Degradation Rating</th>
<th>Permeation Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur Dichloride</td>
<td>G &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Propylene Glycol Methyl Ether Acetate (PGMEA)</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Perochloroethylene (PERC)</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Oxalic Acid, saturated solution</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>n-Octyl Alcohol</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>1-Nitropropane</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Nitrobenzene</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Nitric Acid, Red Fuming</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Naphtha, VM&amp;P</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Morpholine</td>
<td>F &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Methylene Chloride (DCM)</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Methylene Bromide (DBM)</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Lactic Acid, 85%</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Hypophosphorus Acid, 50%</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Hydrofluoric Acid, 95%</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Hydrochloric Acid, 10%</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>HFE 7100</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>n-Hexane</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Hexamethyldisilazine</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Glutaraldehyde, 25%</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Freon TF</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Ethyl Acetate</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Electroless Copper Plating Solution</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Dimethylacetamide (DMAC)</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Diisobutyl Ketone (DIBK)</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>1,2-Dichloroethane (Ethylene Dichloride, EDC)</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>1,5-Cyclooctadiene</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Cyclohexanol</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Butyl Carbitol</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>n-Butyl Acetate</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>2-Bromopropionic Acid</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>1-Bromopropane (Propyl Bromide)</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Aqua Regia</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Aniline</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Allyl Alcohol</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
<tr>
<td>Acetic Acid, Glacial, 99.7%</td>
<td>E &gt;360</td>
<td>—</td>
</tr>
</tbody>
</table>

**Rating is expected to be GREEN:** The glove is very well suited for application.

**Rating is expected to be BLUE:** The glove is not suited for application.

**Rating is expected to be RED:** The glove is not suited for application.