Have you put your vehicle to the test?

LEADERS IN WEATHERING TESTING FOR THE AUTOMOTIVE INDUSTRY
To test real world performance, you need to replicate real world conditions.

When predicting how a car will stand up to the elements, it isn’t enough to guess. You need to know. For over 75 years, Atlas has worked with nearly every major automotive manufacturer on the market today to develop comprehensive testing programs that deliver reliable results.

Atlas offers:

- Weathering and corrosion instruments
- Outdoor weathering testing
- Methodology and standards development
- Material performance tests for plastics, coatings, textiles, rubber and glass
- Consultation and client education services

Let Atlas drive your testing program.

HISTORY OF ATLAS

AUTOMOTIVE EVENTS RELATED TO MATERIALS AND DURABILITY

1908
Mass production helps popularize the automobile

1915
Birth of Atlas as a provider of materials test equipment as an outgrowth of their stage lighting business

1950’s
Use of plastics in automobiles increases dramatically for a variety of applications

1930’s
Outdoor testing of automotive materials begins in the benchmark subtropical climate at South Florida Test Service

1954
Heraeus develops the first xenon-arc weathering instrument, the Xenotest 150

Late 1970’s
Growth of Japanese automotive industry, largely fueled by improved quality and reliability
Late 1970’s growth of Japanese automotive industry, largely fueled by improved quality and reliability.

1977 Atlas patents the first xenon-arc instruments with controlled irradiance, the Atlas Ci65 weather-ometer.

1980’s Society of Automotive Engineers (SAE) develops test methods for automotive interior and exterior materials. These became the industry standards for 20+ years.

1980’s Full-car testing is popularized by Atlas using metal halide lamps.

2000’s Global OEM’s complete significant work on materials analyses for better weathering simulation resulting in company-specific test methods.

2000’s Society of Automotive Engineers (SAE) develops test methods for automotive interior and exterior materials. These became the industry standards for 20+ years.

2013 Atlas introduces the Right Light™ filter to further increase testing consistency and accuracy.

2013 Atlas instruments meet the new ASTM D7869 coatings testing standard.
Weathering testing for exterior materials and components

Atlas’ rigorous automotive test method development process is designed to replicate real world conditions. The result is an in-depth understanding of the long-term performance of materials commonly used in the automotive industry.

Automotive Maximum Temperatures*

<table>
<thead>
<tr>
<th>Surface Description</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating System Roof/Hood/Trunk Surfaces</td>
<td>90°C</td>
</tr>
<tr>
<td>Bumper Fascia Horizontal Surfaces</td>
<td>85°C</td>
</tr>
<tr>
<td>Upper Exterior Door Panel</td>
<td>80°C</td>
</tr>
<tr>
<td>Lower Door Panel</td>
<td>75°C</td>
</tr>
</tbody>
</table>

* based upon outside ambient temp. of 52°C
# Exterior Weathering

## Paint
- Gloss loss and color change
- Cracking and peeling
- Corrosion of substrate
- Scratch and mar

## Fascias and Body Panels
- Gloss loss and color change
- Delamination
- Scratch and mar

## Headlamps
- Yellowing
- Micro-cracking
- Delamination

## Wheels and Wheel Covers
- Filiform corrosion
- Cracking
- Delamination

## Glazing
- Loss of laminate adhesion
- Hazing
- Yellowing of laminates

## Weather Seals and Gaskets
- Cracking
- Seal failure
- Embrittlement

## Engine Components
- Corrosion
- Seal failure
- Fastener integrity
Atlas testing will determine how long vehicle interior components will last

As thorough as we are with the car’s exterior, we put just as much care and attention to detail in testing the interior. Ensuring a long lifespan of these materials and components is critical for implementing a cost-efficient design and maintaining high user satisfaction.

**Automotive Maximum Temperatures**

<table>
<thead>
<tr>
<th>Component</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear Shelf</td>
<td>130°C</td>
</tr>
<tr>
<td>Body Cloth</td>
<td>110°C</td>
</tr>
<tr>
<td>Instrument Panel</td>
<td>122°C</td>
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<tr>
<td>Carpet</td>
<td>75°C</td>
</tr>
<tr>
<td>Interior Ambient</td>
<td>85°C</td>
</tr>
</tbody>
</table>

* based upon outside ambient temp. of 52°C
## Interior Weathering

### Instrument and Door Panels/Airbag Covers
- Color change (fade, shift, chalking)
- Cracking
- Scratch and mar
- Delamination of skin to substrate
- Embrittlement

### Hard Trim
- Color change (fade and shift)
- Embrittlement
- Delamination
- Thermal failure of control knobs

### Seats
- Color change (fade and shift)
- Cracking
- Fiber deterioration

### Carpets and Fabrics
- Color change (fade and shift)
- Fiber deterioration
- Adhesion loss/delamination

### Center Consoles/Overhead Console
- Color change (fade and shift)
- Coating delamination
- Scratch and mar

### Headliners
- Color change (fade and shift)
- Adhesive failure
Your needs determine the direction of your testing program

Atlas offers design and implementation of complete testing and durability solutions to help you meet your quality goals, validate warranty statements, avoid premature failures, save time and money, and strengthen your market position.

Our four-step approach will help you develop the right weathering testing solution for your products:

1. Needs assessment
2. Development of test methods and strategies
3. Failure Mode and Effects Analysis
4. Management of test programs

Our complete offering of services include:

Test Method Development

- Test Method Review and Design
- Test Method Implementation
- Weathering Experiments
- Measurement Analysis and Degradation Modeling

Weathering Technology Consulting

- Process Assessment and Management
- Service Life Solutions
- Test Facility Design

Education and Training

- Seminars
- Workshops
- In-House Programs
- Technical Conferences

Turn Key Outdoor Test Facility Development

- Design of indoor/outdoor testing facility
- Installation of indoor/outdoor testing facility
- Training program for facility operators
Hierarchy of Automotive Weathering Testing

Indoor accelerated testing using xenon arc technology
Higher irradiance, better filters for maximum acceleration and correlation

“Water Cooled” Xenon Arc Lamp
- Best simulation of natural sunlight available
- 340nm up to 1.7 W/m²
- 420nm up to 3.0 W/m²
- 300-400nm up to 170 W/m²
- More than 10 filter combinations available

Sunlight vs. Xenon (Right Light™) vs. Xenon Arc

![Sunlight vs. Xenon (Right Light™) vs. Xenon Arc Graph]
### Automotive Standard Test Methods*

✔ = equipment meets requirements of test method  ❌ = equipment not applicable for test method

#### TESTING FOR INTERIOR MATERIALS

<table>
<thead>
<tr>
<th>OEM</th>
<th>Test Method</th>
<th>Weather-Ometer*</th>
<th>Xenotest*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>C1300+</td>
<td>C14000</td>
</tr>
<tr>
<td>General Motors</td>
<td>GMW 3414</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td></td>
<td>GMW 14162</td>
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<td>SAE J1885</td>
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<td>GM Opel</td>
<td>GME 60292</td>
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<td>Ford</td>
<td>FLTM BO 116-01</td>
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<tr>
<td>Chrysler</td>
<td>PF-11365</td>
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<td>PV1306</td>
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<td>Hyundai</td>
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<td>PSA (Peugeot, Renault)</td>
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<tr>
<td>BMW</td>
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<td>Porsche</td>
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<td>Daimler</td>
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<td>STD 1026, 82439</td>
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<td>STD 1027, 359</td>
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<tr>
<td>International</td>
<td>ISO 105-B06</td>
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<td>ISO 4892-2</td>
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<tr>
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<td>JASO M346</td>
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<td>JIS D0205</td>
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<td>SAE J1895/J2412</td>
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#### TESTING FOR EXTERIOR MATERIALS

<table>
<thead>
<tr>
<th>OEM</th>
<th>Test Method</th>
<th>Weather-Ometer</th>
<th>Xenotest</th>
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<tbody>
<tr>
<td></td>
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<td>C1300+</td>
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<td>Ford</td>
<td>ASTM D7869</td>
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<td>SAE J1960-Daylight Filters</td>
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<td>Volkswagen</td>
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<td>PV3930</td>
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<td>Hyundai</td>
<td>MS-300-31</td>
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<td>PSA (Peugeot, Renault)</td>
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<td>Porsche</td>
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<td>Daimler</td>
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<td>Volvo</td>
<td>STD 1027, 337</td>
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<td>JIS D0205</td>
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<tr>
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<td>SAE J1960/J2527</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

*standards and instrument approvals subject to change
Ci Series Xenon Arc Weather-Ometer®

The #1 selling xenon weathering instrument for the automotive industry

A family of Weather-Ometers delivering the most uniform irradiance and precise temperature and humidity control. They offer the best price/sample capacity ratio in the industry.

Rotating Sample Rack
- Maximum uniformity for irradiance, temperature, relative humidity and spray

High Irradiance Xenon Arc Technology
- Up to 3 sun irradiance levels for acceleration
- More than 10 filter combinations to meet a variety of interior and exterior conditions

Multiple Wavelength and Light Monitoring System
- 340nm, 420nm, 300-400nm
- Full Spectrum Light Monitor (FSM) option allows user to verify compliance to standards and ensure consistent light output

ASTM Black Panel or ISO Black Standard Temperature
- BPT and BST can be installed simultaneously
- Independent control of BPT/BST and chamber temperature

Sample Temperature Measurement
- Specific Specimen Surface Temperature (S³T) takes real-time temperature data of actual exposed samples

Easy-to-Use Touch Screen Controller
- Multiple language capabilities – Chinese, Japanese, Korean, Spanish, English and others
- 14 pre-programmed test methods and space for 10 custom test methods
- DAQ through USB, Ethernet or RS-232

Xenotest® Series Air Cooled Xenon Weathering

The Xenotest Series incorporates a variety of optional features to meet many global weathering test standards.

- Xenotest Alpha+, Beta+, 220+, and 440+
- Rotating rack maximizes exposure uniformity
- Up to 3 sun irradiance levels for acceleration
- Easy programming and monitoring using online features
Corrosion and Solar Testing Instruments

Salt Fog and Cyclic Corrosion Chambers

- Most sophisticated and versatile lab corrosion testing cabinet available
- Replicate up to 15 environmental conditions such as:
  - Salt Fog
    (or complex electrolytes)
  - Immersion
  - Ambient
  - -30°C to 90°C temperatures
  - Solution Spray
  - Controlled RH
  - Other customized solutions

Solar Simulation Chambers

- Test individual components’ ability to withstand solar radiation
- Metal Halide sunlight simulation
- Evaluation of both heat load and long-term aging
- Ensure long-term component durability
Full Vehicle Testing

Applications

- Solar simulation systems for material exposure testing
- High speed lighting systems for crash test photography
- Fit and finish, occupant comfort, heating/AC analysis

Features

- Excellent full-spectrum match to sunlight, especially in IR region
- Efficient light source for large-scale testing
- Custom-designed for specific applications

Filtered Metal Halide vs. Daylight
Phoenix, Arizona

- Recognized benchmark desert weathering site with high levels of UV radiation and temperature.
- EMMAQUA®/UA-EMMAQUA®/LT-EMMAQUA®, IP/DP Box®, car carousel and static testing.

Miami, Florida

- Recognized benchmark subtropical weathering site with high levels of UV radiation, temperature and humidity.
- Testing of full size automobiles, exterior coatings and interior components.

Source: Köppen-Geiger Climate Classification Map, koeppen-geiger.vu-wien.ac.at
Sanary sur Mer, France
- Benchmark Mediterranean site for European made products.
- Warm temperate climate providing the most severe weathering conditions on the European continent.

Hainan, China
- Popular Chinese test site for automotive testing with high levels of UV radiation, temperature and humidity.
- Testing of full size automobiles, IP/DP and exterior coatings.

Chennai, India
- Becoming a recognized benchmark subtropical weathering site in India with high levels of UV radiation, temperature and humidity.
- Testing of full size automobiles, exterior components and coatings.