



FAQs

Atlas 25+ Program

1. I am doing IEC61215/IEC61646; why do I need Atlas 25+?
2. What does the test predict about my modules?
3. What do you base this conclusion on?
4. Why do you believe that the test is predictive?
5. How can I obtain the detailed test plan?
6. How do other experts in the field assess long term durability?
7. What fundamental assumptions is this test scheme based upon?
8. Do you have models for this system?
9. What supporting documentation will you provide?
10. What warranty/guarantee does the program provide?
11. Exactly what do I get from the completion of a full 25+ program?
12. Which version of the test should I use for a module to be sold globally?
13. What customers have used the method so far and what results did they obtain?
14. Why does Atlas 25+ require one year?
15. Can the program be terminated early?
16. What happens if a module breaks during the test or transportation?
17. How statistically significant are the results?
18. What does it cost to add additional modules to the test?
19. What is the purpose of the initial UV pre-conditioning and why is the lab module exposed to such a long period of UV?
20. Is the corrosion test constant or cyclic?
21. Why is the module kept under electrical load conditions?
22. What about the optional modifiers (marine, alpine, urban/agricultural dirt, etc.) mentioned in your brochure?
23. Why do you call it Atlas 25+ when it's only good for 10 years of assurance?
24. How much customer input is required?
25. What product evaluations/measurements are made after the exposures?
26. What is included in the interim and final reports?

FAQs for Atlas 25+ Program

1. I am doing IEC61215/IEC61646; why do I need Atlas 25+?

- The IEC tests provide some short tests that identify infant mortality issues for several specific failure modes identified over the past 30 years.
- You need the IEC tests (61215 or 61646, etc.) for module certification.
- Atlas 25^{PLUS} provides information about potential long term rather than short term failure as the IEC tests do. Atlas 25+ does not duplicate the IEC tests.

2. What does the test predict about my modules?

- It provides reasonable best assurance that your modules will resist weather-related failures for a minimum of > 10 years.
- Additional Atlas 25+ laboratory testing will provide an assurance of > 20 years
- See bullet 23.

3. What do you base this conclusion on?

- Evaluation of the program in terms of real world environmental stresses has led to these combinations.
- Internal work plus work of people such as Wohlgemuth (BP Solar), who used comparative field data, has shown that the use of 1500 thermal cycles provided at least 10 years of equivalent outdoor deterioration.
- Running the core Atlas 25+ chamber test for an additional 100 days provides a total of over 3000 cycles, each the equivalent of 2-3 days of normal stresses.

4. Why do you believe that the test is predictive?

- Atlas' many years of experience in a variety of industries provides a sound base for these conclusions.
- Long term relationships with such organizations as the National Renewable Energy Laboratory (NREL) and OEM's of PV modules have led and assisted us to make many of these conclusions.
- Our semi-empirical approach provides the same weathering stresses as those imposed by nature and in similar format, unlike other more simplistic tests.
- Tests of client modules have resulted in outright failure, power loss, and initiation of defects of probable concern.

5. How can I obtain the detailed test plan?

- It is necessary for the applicant to sign a NDA document, after which we will provide a full description of the Atlas 25+ program.
- Details are covered under the Atlas 25+ proprietary information policy

6. How do other experts in the field assess long term durability?

- Most authoritative laboratories have been limited to extending IEC tests because of the lack of equipment and capabilities to run such a comprehensive set of tests as Atlas 25+.

FAQs for Atlas 25+ Program

- Many experts in the field have been consulted during development of Atlas 25+, and, to date, have universally applauded the approach.
- To date, all work to determine long term durability of PV's has taken incremental steps, which will ultimately support the final concept, but will take many years for completion.

7. What fundamental assumptions is this test scheme based upon?

- That nature applies the same weather stresses regardless of the item under test,
- That we can replicate and accelerate the outdoors in a laboratory environment,
- That combinations of real stresses are the way to obtain real outcomes, not One Factor At a Time (OFAT) experimentation,
- That application of variable stresses is a more realistic and proven methodology than using steady state and extreme stresses, and
- That our previous experience with many other composite systems is applicable to PV modules.

Estimated acceleration of weathering using Lab Cycles:

	If 1 cycle produces as much damage as	in the corresponding end-use environment, then 1300 cycles will produce as much damage as
	0.5 day	2 years
	1 day	3.5 years
Most likely	2 days	7 years
	3 days	11 years
	5 days	18 years

Note: These equivalences do not take into account the effect of other parts of the program such as prior UV preconditioning and corrosion parts + 10 weeks peak summer outdoor exposure

8. Do you have models for this system?

- We have used several classical model systems to arrive at our acceleration factors. No comprehensive model for full modules exists.
- One of these is an Arrhenius model in which an effective temperature for the global extremes is calculated and coupled with an assumed activation energy to arrive at an acceleration factor. (see reference 1)
- A second important model is the Coffin-Manson(Norris-Landzberg) used to calculate the relative effects of cycling conditions (see reference 2)

9. What supporting documentation will you provide?

- As it is a proprietary program, we will only divulge its full content under the legal restrictions of a non-disclosure agreement.
- There is relevant literature that can be provided upon request.
- Our collected data from earlier PV work does not belong to us and cannot be divulged specifically.

FAQs for Atlas 25+ Program

- In final analysis, Atlas' many years of experience is the ultimate determinant of the validity of this approach to long term durability testing.

10. What warranty/guarantee does the program provide?

- As any accelerated test, including weathering, no absolute warranty or guarantee is either expressed or implied.
- The one year Atlas 25+ program provides assurance that the module is highly likely to survive a minimum of more than ten years in anticipated real applications.

11. Exactly what do I get from the completion of a full 25^{PLUS} program?

- The core Atlas 25+ accelerated laboratory exposure sequence is designed to simulate the key climate stresses in such a way that each cycle provides the equivalent of 2-5 days outdoors. Additional acceleration is provided by the UV, condensing humidity, corrosion and solar tracking exposures such that the entire program delivers in excess of 10 years of real time equivalents.
- Extending the duration of the core aspects (chamber cycles) is optionally available to increase that confidence level to an expectation of 20 years or more.
- Atlas 25+ is the only program designed to answer the basic question of whether a module will last outdoors. The answer to this question is crucial to new product development, establishment of warranty and performance claims, and to provide assurance to financial stake holders.

12. Which version of the test should I use for a module to be sold globally?

- The global cycle represents a composite end-use environment which provides a set of conditions representing most of the common climates within which PV's are expected to function.
- It combines the extremes of the more specific desert and sub-tropical cycles.
- It also represents a temperate climate with extreme conditions.
- If a highly specific climate is anticipated for the module being evaluated, this is accommodated by the more specialized versions of the test.

13. What customers have used the method so far and what results did they obtain?

- Atlas Weathering Testing Services follows a strict secrecy and confidentiality policy regarding customer data
- No customer data is shared outside Atlas, except at the request of the customer
- No customer is identified as a customer of Atlas without written permission.
- LG Electronics has chosen to publicize the fact that their modules have undergone the Atlas 25+ program satisfactorily.

14. Why does Atlas 25+ require one year?

- It is a balance between time needed to produce all the required elements of weathering and the maximum time that our customers have indicated they can tolerate.
- At least one year is required to provide at least ten years of real world stresses.

FAQs for Atlas 25+ Program

- Because Atlas 25+ applies to a far greater time frame than does the IEC testing protocol in order to understand long term durability, it also takes substantially longer than the typical 4 months for the IEC tests to run.

15. Can the program be terminated early?

- It can be, based upon the schedule of inspection intervals and payments.
- Failure is defined by the customer.
- Additional measurements to determine failure can be used at the discretion and expense of the customer.

16. What happens if a module breaks during the test or transportation?

- An accidental breakage will be handled in the same way as with samples for any other test, and is covered by Atlas' normal policies.
- If the breakage comes about as a result of the conditions of the tests, for examples glass breakage due to thermal expansion or breakdown of some other component, this would be grounds for stopping the test due to failure. No further charges would then be due.

17. How statistically significant are the results?

- There is not application for statistics in this test due to the limited number of test specimens.
- This is an observational and semi-empirical test based upon Atlas' long experience and ability to evaluate.
- Atlas 25+ is a semi-empirically based test that is applied to a group of degradation variables that are not stochastic, but are co-dependent and cumulative
- Testing the durability of a limited sample gives a strong indication of the likelihood of failure if such should occur, or demonstrates likelihood, although not proof, of successful functioning of the product for the long term.

18. What does it cost to add additional modules to the test?

- This can only be negotiated on a case by case basis, as there are so many variables included in planning these tests. Running several mini-modules in place of a standard module adding up to the same area is a reasonable option.
- Addition of enough core cycles to represent a full 20 year exposure is available at a somewhat reduced cost, but requires additional time.

19. What is the purpose of the initial UV conditioning and why is the lab module exposed to such a long period of UV?

- Some formats of PV's are deactivated by dark storage and need to be reawakened.
- Some others (eg. CIGS) respond negatively to exposure to UV
- Thin film amorphous silicon PV's are subject to the Stabler-Wronski effect, and the shorter time exposure of the IEC tests is generally considered to be too short to demonstrate this effect.
- Many components of PV systems are polymeric, most of which have a response (usually negative) to longer UV exposure.

FAQs for Atlas 25+ Program

- The UVA/UVB exposure “kick starts” any photochemical degradation processes.

20. Is the corrosion test constant or cyclic?

- The corrosion test is a typical steady-state version.
- The size of the modules precludes use of a cyclic lab test for corrosion at this time.
- The corrosion cabinet is a walk-in unit without cyclic capability.

21. Why is the module kept under electrical load conditions?

- Placing a resistive load on the module during all phases of the Atlas 25+ program where there is radiant energy shining on the surface renders a stress condition similar to what occurs in the real world.
- The load provides for electrical flow similar to what the module will experience in service.

22. What about the optional modifiers (marine, alpine, urban/agricultural dirt, etc.) mentioned in your brochure?

- A Coastal/Marine modifier is available.
- An agricultural/NH₃ modifier is available.
- A high altitude with snow load modifier is available.
- Others, such as dust/dirt loading can be established upon agreement.

23. Why do you call it Atlas 25+ when it's only good for 10 years of assurance?

- The concept of this test protocol arose out of Atlas' 25 years of significant involvement with the PV technology, and an effort to differentiate it from short term tests such as IEC.
- Starting with the work for NASA in testing the PV modules for SKYLAB, Atlas has been an active participant in evaluating PV materials and, to some extent modules, ever since.

24. How much customer input is required?

- Pass/fail criteria are agreed to between Atlas and the customer
- Preconditioning before each evaluation cycle will also be adjusted based upon customer input
- Any special or unique characteristics of the product may result in adjustments being made to the program, such as additional measurement points or types.

25. What product evaluations/measurements are made after the exposures?

- Digital photographs are taken
- Inspection of modules is done to identify visual defects
- IV curves are run to provide power evaluations
- Infrared photos are made to identify hot spots
- Electroluminescence photos are made to identify cell cracking
- Wet leakage current is measured as a safety identifier

FAQs for Atlas 25+ Program

26. What is included in the interim and final reports?

- Currently, seven reports are planned: 1.) an initial conditions report, 2.) after UVA/UVB exposure, 3.) after Salt Mist and Condensing Humidity exposure, 4.) after the heat and humidity chamber cycles, 5.) after elevated temperature exposure, 6.) after ten weeks of high summer Arizona exposure, and 7.) the final report.
- Each report includes the above data (See Question 25). The final report also includes Atlas' final evaluation, interpretation of observations and conclusions regarding the outcome of the program.

References:

1. O.Haillant and D.Dumbleton, Theoretical Estimation of Acceleration Factors for Temperature Dependent Processes When Testing PV Models. Inter PV, January, 2011, pp.76-80. <http://www.edn.com/article/518187>
2. Relative to the Coffin-Manson/Norris-Landzberg Model
 - a. O. Haillant, Realistic test approaches provide accurate LED-lifetime numbers, Electronics Design, Strategy, News. May 18, 2011.
 - b. R. Weglinski, Highly accelerated stress screening for air-cooled switching power supplies part 1: Understanding stress test methodology, White paper: TW0058, February 1, 2007, TDIPower, http://www.tdipower.com/PDF/white_paper/hass.pdf.