

Testing the business ruggedness and reliability of HP Business PCs



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Commitment to Quality

A product is only as great as its quality. And quality built into the overall product design requires more than just a mix of technologies, best practices, and high standards; it requires a mindset that understands that each design detail is as important as the next, each potentially a spark of quality innovation.

At HP, we make a quality commitment and stand by it. We follow through with our promises. We believe that we can always do it better—and then we do. And that belief pushes our quality standards ever higher.

Quality delivers a higher return on investment to our customers. We want them to be happy with their product throughout its lifecycle.

We care about quality—it's in our DNA

At HP, we believe quality matters. Quality is core to HP's legacy. HP's strong focus on quality design and engineering innovations dates back to its early beginnings with Bill Hewlett and Dave Packard.

Quality is foremost at every stage of HP's product development process. From the earliest design stage through product testing, manufacturing, service and support, and eventual end-of-life, we remain alert for new opportunities to improve our products, services, and customer relationships.

Striking a perfect balance

Our goal is to make our products the highest possible quality with the lowest total cost of ownership. We are focused on enhancing our customers' experience with products that deliver the best price, features set, and value proposition. The HP Business PC portfolio gives customers that perfect balance of cost efficiency, reliability, durability, and innovative design.

Quality is built into every product as a design requirement. HP Business PCs are designed to meet the demands of leading businesses. Built from high-quality materials and backed by legendary HP reliability, these stylish and sturdy devices are powerful yet simple to use.

Performance you can trust

As part of the design process, all HP Elite and Pro Business PCs and select Thin Clients undergo the HP Total Test Process (TTP)¹—an exhaustive series of rigorous tests and validation procedures that demonstrate superior quality and reliability in a wide range of applications and operating environments. To help make our business PCs more robust and a more dependable tool for our customers' evolving business needs, our testing process is constantly reviewed and enhanced.

The HP Total Test Process is an outgrowth of the longstanding HP commitment to quality. That's why we go to extreme measures to build high reliability into every HP Business Desktop and Notebook PC.

Our comprehensive and proven testing program consists of a minimum of 120,000 hours of rigorous multi-tiered testing and validation procedures per computing platform. The program, driven by rigid quality specifications and standards, includes 50,000 test steps, with 240 industry-standard hardware and software products tested for compatibility.

Pre-launch HP Business PCs are exposed to rigorous conditions including harsh drops and vibration, high temperatures, and enduring mechanical and functional tests that simulate rough handling over the life of the product. Strong reliability can mean less downtime and a lower cost of ownership.

Knowledge gained through the HP Total Test Process leads to many innovations that allow HP Business Desktop and Notebook PCs to deliver an enhanced computing experience. Customers can rely on HP Business PCs to help them perform at their very best when their most demanding work is on the line.

World-class design

First impressions are important, as they set the expectations for the rest of the user experience. HP design engineers excel at designing that very important first experience. Clean implementation of innovative PC technologies starts with a holistic design approach to quality. Design engineers work in conjunction with the manufacturing engineers to optimize the design for production in a way that upholds extremely high quality.

Any given HP Business PC design will go through multiple small builds to fine-tune the design for optimal quality and manufacturability before the design is finalized. HP Business PCs are subject to multiple design enhancements prior to our first-production build, resulting in a final design that is as elegantly built as was originally envisioned by the design engineer.

HP's attractive enterprise-class industrial designs, which combine innovation with style, use high-quality materials and flawless finishes. HP's leading-edge chassis construction, component accessibility, electrical and air flow designs elevate the customer experience with product quality and reliability.

Going above and beyond

After careful material selection and precision-engineered construction, HP Business PCs and select Thin Clients are put to the test. Our MIL-STD-810G testing² procedures go above and beyond what a PC may endure on a typical day in business and enterprise environments. This testing helps to demonstrate overall HP product quality and reliability.

HP Business PC models tested

All HP Elite 2-in-1 and 3-in-1 devices, notebooks, tablets, and desktop PCs, plus select Thin Clients, undergo multiple MIL-STD-810G test procedures as a way to help demonstrate product quality and reliability. This standard, though created specifically for the U.S. Department of Defense (DoD), is widely used as a benchmark for quality for commercial products in multiple industries. It outlines a broad range of tests that can be tailored to measure the reliability of specific pieces of equipment and includes multi-tiered climatic and environmental test methods.²

The products identified below have all undergone multiple MIL-STD-810G testing procedures.

2-in-1 Detachable Notebook PCs

- HP Pro x2 612 G2
- HP Elite x2 1011 G1
- HP Elite x2 1012 G1
- HP Elite x2 1012 G2
- HP Pro x2 612 G2 Advanced Keyboard
- HP Elite x2 1012 G1 Travel Keyboard
- HP Elite x2 1012 G1 Advanced Keyboard
- HP Elite x2 1012 G2 Collaboration Keyboard

3-in-1 Device

- HP Elite x3 G1

HP ElitePad Tablets

- HP ElitePad 1000 G2

HP EliteBook Notebook PCs

- HP EliteBook 725/745/755 G3
- HP EliteBook 725/745/755 G4
- HP EliteBook 820/840/850 G3
- HP EliteBook 820/840/850 G4
- HP EliteBook Folio G1
- HP EliteBook 1030 G1
- HP EliteBook 1040 G3

HP Convertible Business Notebook PCs

- HP EliteBook x360 1030 G2
- HP EliteBook Revolve 810 G3
- HP ProBook x360 11 G1 EE
- HP Spectre Pro x360 G2
- HP ProBook x360 11 G2

HP ProBook Notebook PCs

- HP ProBook 430/440/450/455/470 G3
- HP ProBook 430/440/450/455/470 G4
- HP ProBook 640/650 G2
- HP ProBook 640/650/645/655 G3
- HP ProBook 11 G2 EE

HP Chromebooks

- HP Chromebook 11 G4 EE
- HP Chromebook 11 G5 EE
- HP Chromebook 13 G1
- HP Chromebook 14 G4
- HP Chromebook x360 11 G1 EE

HP Mobile Workstations

- HP ZBook 14 G2
- HP ZBook 15u G2, G3, G4
- HP ZBook 15 G2, G3, G4
- HP ZBook 17 G2, G3, G4
- HP ZBook Studio G3, G4

HP recommends Windows 10 Pro.

HP EliteDesk Business PCs

HP EliteDesk 800 G3 TWR
HP EliteDesk 800 G3 SFF
HP EliteDesk 800 G3 DM
HP EliteDesk 705 G3 MT
HP EliteDesk 705 G3 SFF
HP EliteDesk 705 G3 DM

HP EliteOne All-in-One Business PCs

HP EliteOne 800 G3 AiO

HP Elite Slice

HP Elite Slice G1

HP Thin Clients

HP mt43 Mobile Thin Client
HP mt20 Mobile Thin Client

Test results

The following tables summarize independent third-party test of HP Business PC models based on MIL-STD-810G test methods.²

The conditions or specifications outlined in each of the MIL-STD-810G test methods are not covered under the HP Limited Warranty.

2-in-1 Detachable Notebook PCs

Test	HP Pro x2 612 G2	HP Elite x2 1011 G1	HP Elite x2 1012 G1	HP Elite x2 1012 G2	HP Pro x2 612 G2 Adv KB	HP Elite x2 1012 G1 Travel KB	HP Elite x2 1012 G1 Adv KB	HP Elite x2 1012 G2 Collab Keyboard
Drop	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Functional Shock	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Vibration (Category 4)	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Vibration (Category 24)	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Dust	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Humidity	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Altitude	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
High Temperature	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Low Temperature	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Temperature Shock	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Sand	PASSED	NO	PASSED	PASSED		PASSED	PASSED	PASSED
Explosive Atmosphere	PASSED		PASSED	PASSED		PASSED	PASSED	PASSED
Freeze/Thaw	PASSED	NO	PASSED	PASSED		PASSED	PASSED	PASSED

3-in-1 Device

Test	HP Elite x3
Drop	PASSED
Functional Shock	PASSED
Vibration (Category 4)	PASSED
Vibration (Category 24)	PASSED
Dust	PASSED
Humidity	PASSED
Altitude	PASSED
High Temperature	PASSED
Low Temperature	PASSED
Temperature Shock	PASSED
Sand	PASSED
Explosive Atmosphere	PASSED
Freeze/Thaw	PASSED

HP ElitePad Tablets

Test	HP ElitePad 1000 G2
Drop	PASSED
Functional Shock	PASSED
Vibration (Category 4)	PASSED
Vibration (Category 24)	PASSED
Dust	PASSED
Humidity	PASSED
Altitude	PASSED
High Temperature	PASSED
Low Temperature	PASSED
Temperature Shock	PASSED

HP EliteBook Notebook PCs

Test	HP EliteBook 725/745/755 G3	HP EliteBook 725/745/755 G4	HP EliteBook 820/840/850 G3	HP EliteBook 820/840/850 G4
Drop	PASSED	PASSED	PASSED	PASSED
Functional Shock	PASSED	PASSED	PASSED	PASSED
Vibration (Category 4)	PASSED	PASSED	PASSED	PASSED
Vibration (Category 24)	PASSED	PASSED	PASSED	PASSED
Dust	PASSED	PASSED	PASSED	PASSED
Humidity	PASSED	PASSED	PASSED	PASSED
Altitude	PASSED	PASSED	PASSED	PASSED
High Temperature	PASSED	PASSED	PASSED	PASSED
Low Temperature	PASSED	PASSED	PASSED	PASSED
Temperature Shock	PASSED	PASSED	PASSED	PASSED
Sand	PASSED	PASSED	PASSED	PASSED
Explosive Atmosphere	PASSED	PASSED	PASSED	PASSED
Freeze/Thaw	PASSED	PASSED	PASSED	PASSED

HP EliteBook Notebook PCs

HP Convertible Business NoteBook PCs

Test	HP EliteBook Folio G1	HP EliteBook 1030 G1	HP EliteBook 1040 G3	HP EliteBook x360 1030 G2	HP EliteBook Revolve 810 G3	HP ProBook x360 11 G1 EE	HP Spectre Pro x360 G2	HP ProBook x360 11 G2
Drop	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Functional Shock	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Vibration (Category 4)	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Vibration (Category 24)	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Dust	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Humidity	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Altitude	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
High Temperature	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Low Temperature	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Temperature Shock	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Sand	PASSED	PASSED	PASSED	PASSED	NO			
Explosive Atmosphere		PASSED	PASSED	PASSED				
Freeze/Thaw	PASSED	PASSED	PASSED	PASSED	NO	PASSED		
Bench Handling								PASSED

HP ProBook Notebook PCs

Test	HP ProBook 430/440/450/455/470 G3	HP ProBook 430/440/450/455/470 G4	HP ProBook 640/650 G2	HP ProBook 640/645/650/ 655 G3	HP ProBook 11 G2 EE
Drop	PASSED	PASSED	PASSED	PASSED	PASSED
Functional Shock	PASSED	PASSED	PASSED	PASSED	PASSED
Vibration (Category 4)	PASSED	PASSED	PASSED	PASSED	PASSED
Vibration (Category 24)	PASSED	PASSED	PASSED	PASSED	PASSED
Dust	PASSED	PASSED	PASSED	PASSED	PASSED
Humidity	PASSED	PASSED	PASSED	PASSED	PASSED
Altitude	PASSED	PASSED	PASSED	PASSED	PASSED
High Temperature	PASSED	PASSED	PASSED	PASSED	PASSED
Low Temperature	PASSED	PASSED	PASSED	PASSED	PASSED
Temperature Shock	PASSED	PASSED	PASSED	PASSED	PASSED

HP Chromebooks

Test	HP Chromebook 11 G4 EE	HP Chromebook 13 G1	HP Chromebook x360 11 G1 EE	HP Chromebook 14 G4	HP Chromebook 11 G5 EE
Drop	PASSED	PASSED	PASSED	PASSED	PASSED
Functional Shock	PASSED	PASSED	PASSED	PASSED	PASSED
Vibration (Category 4)	PASSED	PASSED	PASSED	PASSED	PASSED
Vibration (Category 24)	PASSED	PASSED	PASSED	PASSED	PASSED
Dust	PASSED	PASSED	PASSED	PASSED	PASSED
Humidity	PASSED	PASSED	PASSED	PASSED	PASSED
Altitude	PASSED	PASSED	PASSED	PASSED	PASSED
High Temperature	PASSED	PASSED	PASSED	PASSED	PASSED
Low Temperature	PASSED	PASSED	PASSED	PASSED	PASSED
Temperature Shock	PASSED	PASSED	PASSED	PASSED	PASSED
Freeze/Thaw		PASSED			
Bench Handling			PASSED		

HP Mobile Workstations

Test	HP ZBook 14 G2	HP ZBook 15u G2	HP ZBook 15 G2	HP ZBook 17 G2
Drop	PASSED	PASSED	PASSED	PASSED
Functional Shock	PASSED	PASSED	PASSED	PASSED
Vibration (Category 4)	PASSED	PASSED	PASSED	PASSED
Vibration (Category 24)	PASSED	PASSED	PASSED	PASSED
Dust	PASSED	PASSED	PASSED	PASSED
Humidity	PASSED	PASSED	PASSED	PASSED
Altitude	PASSED	PASSED	PASSED	PASSED
High Temperature	PASSED	PASSED	PASSED	PASSED
Low Temperature	PASSED	PASSED	PASSED	PASSED
Temperature Shock	PASSED	PASSED	PASSED	PASSED

HP Mobile Workstations

Test	HP ZBook 15u G3	HP ZBook 15 G3	HP ZBook 17 G3	HP ZBook Studio G3	HP ZBook 15 G4	HP ZBook 15u G4	HP ZBook 15 G4	HP ZBook Studio G4
Drop	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Functional Shock	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Vibration (Category 4)	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Vibration (Category 24)	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Dust	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Humidity	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Altitude	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
High Temperature	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Low Temperature	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Temperature Shock	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Sand	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Explosive Atmosphere	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Freeze/Thaw	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Crash Hazard Shock	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Bench Handling	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED

HP EliteDesk Business PCs

Test	HP EliteDesk 800 G3 TWR	HP EliteDesk 800 G3 SFF	HP EliteDesk 800 G3 DM	HP EliteDesk 705 G3 MT	HP EliteDesk 705 G3 SFF	HP EliteDesk 705 G3 DM
Drop	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Functional Shock	PASSED	PASSED	PASSED	NO	NO	PASSED
Vibration (Category 4)	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Vibration (Category 24)	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Blowing Dust	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Humidity	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Altitude	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
High Temperature	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED
Low Temperature	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED

HP EliteOne All-in-One Business PCs

Test	HP Elite One 800 G3
Vibration (Category 4)	PASSED
Vibration (Category 24)	PASSED
Blowing Dust	PASSED
Humidity	PASSED
Altitude	PASSED
High Temperature	PASSED
Low Temperature	PASSED

HP Elite Slice

Test	HP Elite Slice G1
Drop	PASSED
Shock	PASSED
Vibration (Category 4)	PASSED
Vibration (Category 24)	PASSED
Blowing Dust	PASSED
Humidity	PASSED
Altitude	PASSED
High Temperature	PASSED
Low Temperature	PASSED
Temperature Shock	PASSED

HP Thin Clients

Test	HP mt43 Mobile Thin Client	HP mt20 Mobile Thin Client
Drop	PASSED	PASSED
Functional Shock	PASSED	PASSED
Vibration (Category 4)	PASSED	PASSED
Vibration (Category 24)	PASSED	PASSED
Dust	PASSED	PASSED
Humidity	PASSED	PASSED
Altitude	PASSED	PASSED
High Temperature	PASSED	PASSED
Low Temperature	PASSED	PASSED
Temperature Shock	PASSED	PASSED
Sand	PASSED	PASSED
Explosive Atmosphere	PASSED	PASSED
Freeze/Thaw	PASSED	PASSED

MIL-STD-810G test background

Created by the U.S. government, the MIL-STD-810G test method standard is intended to help organizations prepare environmental tests to evaluate how well a particular piece of equipment can perform in the field. The standard outlines dozens of test methods, each associated with a source of environment stress, such as vibration, moisture, dust, extreme temperatures, or humidity; for example, Method 500.5 describes Low Pressure (Altitude) testing, while Method 501.5 describes High Temperature testing. While there is not a recommended or required list of tests for device categories, most major PC vendors generally perform between 5 and 8 test methods.

Each test method outlines multiple test procedures; for example, Method 501.5 describes Procedure I (Storage) and Procedure II (Operation). Thus, Procedure I can be used to evaluate the effects of high-temperature storage on the subsequent performance of a business PC; Procedure II evaluates the effects of high temperature while the PC is running.

Test scenarios

A third-party facility tested the durability of the HP Business PC models using procedures tailored from MIL-STD-810G. HP used the MIL-STD-810G test menu to select tests that most closely reflect the challenges faced by today's professionals.

Note

MIL-STD-810G testing is conducted on select HP products. Testing is not intended to demonstrate fitness for U.S. Department of Defense (DoD) contract requirements or for military use. Test results are not a guarantee of future performance under these test conditions. Accidental damage or damage under these test conditions requires an optional HP Accidental Damage Protection Care Pack.

The following sections describe the grueling test scenarios to which these business-rugged PCs were subjected. All testing was performed by a third-party testing facility.

Drop test²

The Drop test was performed in accordance with MIL-STD-810G, Method 516.6 Procedure IV. The objective of this test was to determine whether the unit could be safely operated after being dropped from desk height. For this test, 26 drops were performed from 30 in. onto every side, angle and edge onto 2 in. of plywood over steel over concrete. Unit is powered down and checked for operation.

Functional Shock test²

The Shock test was performed in accordance with MIL-STD-810G, Method 516.6 Procedure I. The objective of this test was to determine whether the unit could be safely operated after being exposed to sudden physical shock events while operational. For this test, 3 shocks were performed across each axis and direction for a total of 18 shocks.

Vibration test²

The Vibration Resistance test was performed in accordance with MIL-STD-810G Test Method 514.6, Procedure I (Non- operational) and Procedure II (Operational). Test parameters were set to simulate the following:

- Operate the unit during a 1000-mile simulation of vibrations created by a truck driving on a U.S. highway.
- Operate the unit after it has been subjected to higher levels of vibration while in storage.

Terrain, road and surface discontinuities, vehicle speed, loading, structural characteristics, and suspension system are all reflected in this simulation.

Dust test²

The Dust Resistance test was performed in accordance with MIL-STD-810G, Method 510.5, Procedure I (Dust). Test parameters were set so that the unit was dusted with Arizona Road Dust for six hours while being operated.

Humidity test²

The Humidity test was performed in accordance with MIL-STD-810G, Method 507.5, Procedure II with the aggravated temperature-humidity cycle. Each cycle was one day (24 hours); ten cycles with the temperature being cycled between 30°C (86°F) and 60°C (140°F); and relative humidity was a constant 95%.

Altitude test²

The Altitude test was performed in accordance with MIL-STD-810G, Method 500.5, Procedure I (Storage) and II (Operation). The altitude level simulated for both procedures was 15,000 feet (the highest equivalent altitude given within MIL-STD-810G for cargo pressures within military aircraft).

High Temperature test²

The High Temperature test was performed in accordance with MIL-STD-810G, Method 501.5, Procedure I (Storage) and II (Operation). This test evaluated the units' performance while it was being exposed to high temperature conditions: 60°C (140°F) operational and 71°C (160°F) non-operational.

Low Temperature test²

The Low Temperature test was performed in accordance with MIL-STD-810G, Method 502.5, Procedure I (Storage) and II (Operation). This test evaluated the unit's performance while it was being exposed to low temperature conditions: -29°C (-20°F) operational and -51°C (-60°F) non-operational.

Temperature Shock test²

The Thermal Shock test was performed in accordance with MIL-STD-810G, Method 503.5 Procedure I. The objective of this test was to determine whether the unit could be safely operated after being exposed to sudden changes in ambient temperature while non-operational. The high temperature was set to be 96°C (205°F) and the low temperature to be -51°C (-60°F); three high-to-low cycles were performed.

Sand test²

The Sand test was performed in accordance with MIL-STD-810G, Method 510.4 Procedure II. The objective of this test was to determine whether the unit could be safely operated after being exposed to blowing sand of up to 20M/S at a temperature of 60°C (140°F) for 4.5 hours (every 90 minutes, the unit is rotated 90°).

Explosive Atmosphere test²

The Shock test was performed in accordance with MIL-STD-810G, Method 511.5 Procedure I. The objective of this test was to determine whether the notebook could be safely operated in fuel-air explosive atmospheres without causing ignition.

Freeze/Thaw test²

The Freeze/Thaw test was performed in accordance with MIL-STD-810G, Method 524.54 Procedure III. The objective of this test was to determine whether the unit could be safely operated after being exposed to a temperature drop of -10°C (14°F) for two hours. Unit is removed and checked for operation.

Bench Handling test²

The bench handling test was performed in accordance to the MIL-STD-810G, Method 516.6 Procedure VI. This test was designed to test whether the unit can withstand levels of shock resulting from bench handling, bench maintenance, and/or packaging.

Crash Hazard test²

The crash hazard test was performed in accordance to the MIL-STD-810G, Method 516.5 Procedure V. The purpose of this test was to ensure that the ZBook does not eject sub-elements and that its restraining devices will not fail during crash situations.

ESD (Electrostatic Discharge) test²

The ESD test was performed in accordance with IEC 61000-4-2. The objective of this test was to determine whether the unit could be safely operated after being exposed to sudden electrostatic discharge events of up to 8,000 volts. Electrostatic discharge points were performed at horizontal and vertical ground planes, chassis screw, serial port ground, screen, finger pad, power cable, power button, keyboard, speaker button, and trackball for a total of 11 discharge points.

Pass/fail criterion

The third-party verified that the tested unit was operational after each environmental exposure by booting the Microsoft® Windows® operating environment.

Test descriptions

The following table includes the tests performed with specific MIL-STD-810G method references and key test parameters.

Test	MIL-STD-810G Reference	Key Test Parameters	
Vibration	Method 514.6	Procedure I, Category 24 (Minimum Integrity Test) Procedure I, Category 4 (Ground Vehicle)	Non-operational 0.04 g ² /Hz at 20-1000 Hz, -6 dB/octave at 1000-2000 Hz; One hour/axis duration Operational U.S. highway truck exposure 1000 mile Simulation One hour/axis duration
Dust Resistance	Method 510.5	Procedure I (Blowing dust)	Particles of Arizona Road Dust, 10.6 +/-7 grams per cubic foot Six hours duration
Humidity	Method 507.5	Procedure II	Relative humidity 95%; Temperature cycled between 30°C and 60°C (86°F and 140°F); Test cycle 24 hours; test consisted of ten cycles
Altitude	Method 500.5	Procedure I (Storage/air transport) Procedure II (Operation/air carriage)	Non-operational 15,000 feet at 57 kPa One hour duration Operational 15,000 feet at 57 kPa One hour duration
High Temperature	Method 501.5	Procedure I (Storage) Procedure II (Operation)	Non-operational Temperature cycled between 35°C and 71°C (95°F and 160°F) Test cycle 24 hours; test consisted of seven cycles Operational 60°C (140°F) Four hours duration
Low Temperature	Method 502.5	Procedure I (Storage) Procedure II (Operation)	Non-operational -51°C (-60°F) Four hours duration Operational -29°C (-20°F) Four hours duration
Temperature Shock	Method 503.5	Procedure I (Steady State)	Non-operational High temperature -132°C (-205°F) Low temperature -51°C (-60°F); Three cycles (a cycle consists of a dwell low, low to high, dwell high, high to low) One hour dwell time
Shock	Method 516.6	Procedure V	Operational 3 shocks/axis/direction for a total of 18 shocks; 40 Gs peak, 11 ms
Drop	Method 516.6	Procedure IV	26 drops from 30 in. onto every side, angle and edge onto 2 in. of plywood over steel over concrete. Unit is powered down and checked for operation.
Explosive Atmosphere	Method 511.5	Procedure I	Unit could be safely operated in fuel-air explosive atmospheres without causing ignition

Test	MIL-STD-810G Reference	Key Test Parameters	
Freeze/Thaw	Method 524.54	Procedure III	Non-operational Exposed to a temperature drop of -10°C (14°F) for two hours Unit is removed and checked for operation
Crash Hazard	Method 516.5	Procedure V	Non Operational 2 shocks in each axis/direction for a total of 12 shocks; 75 Gs peak 6 ms
Bench Handling	Method 516.6	Procedure IV	16 drops from 4 inches on a wooden bench top on all sides, edges and corners that could be impacted during normal handling or during maintenance

ESD test descriptions

The following table includes the specific test parameters for the Electrostatic Discharge test.

Test	Reference	Key Test Parameter
ESD (Electrostatic Discharge)	IEC 6100-42	Temperature: 23°C (73°F) Humidity 39% Between 6 to 8,000 Volts applied to: <ul style="list-style-type: none"> • Horizontal Ground Plane • Vertical Ground Plane • Chassis Screw • Serial Port Ground • Screen • Fingerprint • Power Cable • Power Button • Keyboard • Speaker B

The MIL-STD-810G test specification can be accessed at at.ec.army.mil/publications/Mil-Std-810G/Mil-Std-810G.pdf.

Learn more about HP business notebooks, tablets, and desktops at hp.com or contact your local HP sales representative.

¹ HP's Total Test Process is not a guarantee of future performance under these test conditions. Accidental Damage or damage under these test conditions requires an optional HP Accidental Damage Protection Care Pack.

² MIL STD 810G testing is conducted on select HP products. Testing is not intended to demonstrate fitness for U.S. Department of Defense (DoD) contract requirements or for military use. Test results are not a guarantee of future performance under these test conditions. Accidental damage or damage under these test conditions requires an optional HP Accidental Damage Protection Care Pack.

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