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Reliable and Durable: What makes HP Point of Sale Systems “Retail Hardened”

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Executive Summary

HP is committed to offering point-of-sale (POS) platforms that are designed, manufactured and tested to meet the demands of the retail market. HP understands the needs of retailers and is focused on providing POS systems that are reliable, durable and can operate under extreme conditions; HP calls this “retail hardening”.

The focus of retail hardening starts with the materials and components selection for the POS platforms. HP selects materials such as the steel chassis and gold-plated connectors that will be able to withstand extended use and extreme temperatures. HP is conscious of the space limitations within a retail environment and therefore selects connectivity components that allow for flexibility, yet provide the power and security features needed in a retail setting. Additionally, HP is mindful of the environment when selecting materials and components for the POS systems, and strives for the platforms to be built with materials and components that are greater than 90% recyclable with less than 1% that must go to landfills. This far exceeds the “Waste of Electrical and Electronic Equipments” (WEEE) requirements.

A focus on retail hardening can also be found in HP’s design and manufacturing of the POS platforms. They are built to be rugged; able to stand up to the everyday wear and tear of a retail environment, yet they are also energy efficient. In many instances, HP POS platforms consume less than a 60W light bulb when sitting idle. HP POS systems are also designed to withstand higher thermal temperatures, which allow the systems to be housed in a small space or operate in outdoor locations without failure. Additionally, HP POS systems are manufactured to ensure power and electrical integrity.

HP performs a multitude of tests to help ensure that the POS systems will continue to operate under extreme conditions. Tests are performed on the exterior materials and components to ensure their ability to endure retail wear without being damaged. The internal systems and components are also put through rigorous tests to make certain that they will continue to operate should there be variations in factors such as AC power and thermal temperatures. HP POS systems are also tested to withstand impacts and vibrations such as a system being placed on a moving cart or jarred in high traffic areas.

In addition, there are other materials, design factors and tests that HP uses to ensure that their POS systems are ready for various retail usage scenarios. These additional factors such as cable construction, diagnostic indications and security features are not limited to the HP POS systems, but they do help to ensure that the POS systems are reliable, durable, and ready to meet the needs of retailers.

HP Point of Sale Systems

Building on the platform strengths of the HP rp5700, the HP rp5800 Retail System is expandable and highly configurable allowing for flexibility and easy implementation within your existing ecosystem. Available with a choice of operating systems, Intel® processors, mass storage, removable media, and memory the HP rp5800 has a flexible design that you can customize to fit your needs.

With extra memory slots, multiple PCI Express (PCIe) slots, 3.5” /5.25” bays, and optional optical drives, the HP rp5800 has a flexible design that you can customize to fit your retail environment. Choose the right removable media for you or add a second hard drive with the internal and external bays.



HP rp5800 Retail System

The sturdy HP rp5800 chassis is designed with reliable, retail-hardened engineering that helps reduce downtime and keep your store running smoothly. We've engineered in oversized cooling that operates in an ambient 40° C environment (optional 50° C kit available, configuration limitations apply) and high-endurance temperature-rated capacitors that help resist heat to last longer. You can rely on your system to have a longer useful life, minimizing disruptions, avoiding long-term equipment planning, and reducing the complexity of rollouts.

Designed with the environment in mind The HP rp5800 includes select components designed for

energy efficiency such as 2nd generation Intel® Core™ i3, i5, and i7 processors(1), and an 90% efficient power supply that draw less power while in operation. Intel® vPro™ (2) processors include hardware-assisted remote shutdown, wake-up, and update which helps to reduce energy and IT costs by controlling your POS systems from a remote location so you don't need an IT person in each store. Also included, HP Power Assistant provides an easy-to-use desktop application so you can control energy usage. ENERGY STAR® models available.

The HP rp5700 Point of Sale System gives retailers the flexibility of a POS platform that can go from the front of the store to the back office. It is built to last with a retail hardened design that offers consistent reliability and a five-year lifecycle to help with long-term planning.

The HP rp3000 Point of Sale System is a value-driven terminal designed to meet retail business challenges with retail-ready components and features. The rp3000 has just the right amount of performance, a durable form factor, retail optimized connection ports, and three-year standard limited warranty.

The HP ap5000 All-in-One Point of Sale System is designed to take the guesswork out of creating a point-of-sale hardware solution and meet the space and performance requirements of retailers of all sizes. Ruggedized for retail, yet stylish enough for even the most high-end settings, the HP ap5000 POS System fits your existing retail ecosystem with ease.

Retail Hardened: Overview

HP points of sale (POS) platforms are designed for retail with reliability and durability in mind. Retailers need a POS system that can withstand the typical wear and tear of the retail environment, from extended operational hours and extreme temperatures, to dirt and dust and accidental impacts. Any failures or downtime can be detrimental to the retailer's revenue and profitability. HP understands the needs of retailers; therefore, HP POS systems are designed and tested to meet high standards, HP calls this "retail hardening". This whitepaper describes some of the steps HP takes to ensure a retail hardened design is achieved, from the meticulous selection of components and materials; to the key design and manufacturing details and the extreme testing methodologies that is instilled in every one of the HP POS platforms. This ensures that HP POS systems are of the highest quality and some of the toughest in the industry. Simply put, HP point of sale platforms are built to last.

Retail Hardened: Materials and Components

HP POS platforms are constructed with materials and components that are able to withstand the long-term wear and tear of a typical retail environment. HP is focused on how the POS system operates in a retail environment, many times in small, high traffic spaces where dust and dirt is prevalent. The following section will discuss the retail hardened materials and component selection for:



HP ap5000 All-in-One



HP rp3000 POS System

- Chassis construction
- High-quality connectors
- High endurance capacitors
- Robust power supplies
- Powerful and flexible connectivity
- Material recyclability

Chassis construction

HP chooses materials and components that are able to hold up in retail environments. The chassis is constructed by using thick grades of sheet metal and plastics that are UV resistant, pliant, and flammable resistant. The internal plastics are of the highest flammability rating as well. In addition, many of the chassis seams and edges are hemmed to provide additional strength and durability where needed. The POS chassis is designed to withstand a weight load of 75lbs without warping or bending. HP POS chassis, built like small army tanks, are ready to meet the challenges of any retail environment. In addition to the strength of the system itself, stability is also important for POS systems. Especially with All-in-One units like the HP ap5000, when the operator interacts with the touch screen with various speeds and force, the system needs to remain stable. All of these factors go into consideration when designing all of the HP POS systems.

Gold-plated connectors

HP selects high-quality connectors that are gold-plated for most of the internal and external connectors. With many POS systems running continuously for long periods of time in various climates, connectors may be more vulnerable to corrosion which can lead to faulty connection points between the POS platform and the POS peripherals. Gold-plated connectors provide longer insertion life and lower susceptibility to corrosion. In addition, most of the connectors on the HP POS systems feature a latching capability. For example, HP uses screw-locks on serial, parallel, and video connectors. Also, LAN jacks and powered USB ports have a latching mechanism. In a busy retail

environment where systems are bumped or where cables can get caught and pulled out easily, these latching mechanisms allow for the peripherals to stay connected to the POS system.

High endurance capacitors

In many retail environments, the POS system operates in small confined spaces for extended hours where thermal conditions may tend to be higher. Therefore, it is important that components, such as capacitors are able to function in these extreme conditions without failure. HP selects only the highest-quality, high-endurance capacitors for extended life and better thermal susceptibility. Most of the capacitors are rated for 3,000-4,000 hours, meaning they can run at their highest temperature rating for 3,000-4,000 hours continuously (which is unlikely to occur in any retail operation). In a retail environment, this translates into many years of operation without bulging or failure. All capacitors are tested at maximum system thermals to ensure they can sustain the temperatures of the POS system that may be placed in an ambient environment of up to 40°C. This means, HP POS systems are designed to have a longer life and will be able to handle the stressful demands of point-of-sale environments.

Robust power supplies

HP POS systems use strong and robust power supplies that reduce the need for separate peripheral “power bricks” (external power supplies that come with many other peripherals) and can support powered peripherals. Simply put, this means HP power supplies are rated to handle any POS peripheral load and it also means that in a tight-spaced retail environment, less power supply adapters (“power bricks”) laying around will help to free up valuable counter space. HP power supplies are rated well above the power needed for any POS environment (typically doubling the power

needed). HP only selects high-endurance capacitors and ball-bearing fans for the power supply designs. This allows the power supplies to withstand higher thermal conditions and longer run-times as many customers may run their POS systems for extended hours.

Powerful and flexible connectivity

HP POS platforms are the most flexible, offering all of the standard I/O connections while also supporting point-of-sale specific connections for powered POS peripherals. This eliminates the need for traditional “power brick” which cuts down on cable clutter and allows for more counter space. HP POS systems offer optional “Powered USB” ports and configurable “Powered Serial” ports on all point-of-sale platforms. Some key benefits of powered ports:

- 1) **Flexibility:** Allows the use of Powered USB peripherals or standard USB 2.0 peripherals since either type of peripheral will work in a Powered USB port.
- 2) **Power:** Powered USB ports and Powered Serial ports are designed to deliver the power needed to support POS peripherals without the need for an external power supply adapter (power brick) which is commonly seen on POS peripherals.
 - a. **Protection:** Each Powered USB, Standard USB, Serial, VGA, and PS/2 ports have polyfuse protection so that if a peripheral malfunctions due to an over current condition or power to ground short, the polyfuse will open and protect the platform from permanent damage. The polyfuses are self-resetting, which means after a trip condition, the polyfuse will reset, enabling the circuit automatically and the ports will again function normally.

- 3) **Locking:** Each Powered USB port has a self latching feature so that POS peripheral connectors lock into the port. Each serial port has a screw-lock feature so that the serial port peripherals can be screwed into the port. These are both valuable features in a populated environment, like a retail store, where non-latching cables could accidentally be unplugged.

Materials recyclability

All HP POS platforms are designed with the environment in mind. HP targets the POS platforms to be built with material/components that are greater than 90% recyclable and less than 1% that must go to landfills. This far exceeds the “Waste of Electrical and Electronic Equipments” (WEEE) requirements which states that a system must be at least 65% recyclable with less than 25% that can go into landfills. Simply put, HP products are designed to be mostly recycled which helps reduce the negative impact on the environment and the amount of waste into landfills.

Retail Hardened: Design and Manufacturing

HP POS systems are designed for retail with the environment in mind. They are built to be rugged, yet energy efficient. HP is focused on designing POS platforms that are able to withstand the wear and tear of retail environments and continue to operate without failure. The following section will discuss design and manufacturing around:

- Chassis Stability
- Energy efficiency
- RoHS regulations
- Thermal tolerance
- Electrical signal integrity
- Power cycling
- Dust and Spill resistance

Chassis Stability

In addition to the strength of the chassis itself, stability is also important for POS systems. Especially with All-in-One units like HP ap5000, when the operator interacts with the touch screen, the screen and system needs to remain stable for fast, accurate and comfortable input. The system weight along with base body construction is designed to ensure chassis stability and provide excellent user experience.

Energy efficiency

The HP POS platforms are designed to be energy efficient, which helps ensure that they do not waste valuable electrical energy when sitting idle or powered off. In many instances, HP POS platforms consume less than a 60W light bulb when sitting idle. All of the POS platforms are also designed to conform to the latest European Union (EU) mandate that requires computer equipment to draw less than 1W when off (plugged into an AC outlet). Although this mandate is only required for products that ship into the EU, all of the HP world-wide POS platforms meet this requirement.

RoHS regulation

HP also designs all of the POS platforms to be compliant with the "Restriction of Hazardous Substances" (RoHS) regulations. RoHS mandates that harmful substances such as lead, mercury, hexavalent chromium, polybrominated biphenyls (PBBs), polybrominated diphenyl ethers (PBBDE), cadmium, and more are greatly reduced below defined limits set by the RoHS regulators. HP goes one step further and strives to completely eliminate many of these harmful substances. All of HP POS platforms conform to RoHS regulations.

BFR/PVC Free

The rp5800 is the first HP retail platform that does not contain any brominated flame retardants (BFR's) or polyvinyl chloride (PVC) which are both found typically in plastic parts and wires. This BFR/PVC free platform

is eco-friendly which is important upon disposal later on when the product is retired and replaced.

*** Meeting the industry definition of 'BFR/PVC-free' per the iNEMI Position Statement on "Low Halogen" Electronics. Plastic parts incorporated into the chassis generally contain < 1000 ppm (0.1%) of bromine or chlorine. Printed circuit board and substrate laminates generally contain < 1500 ppm (0.15%) of total bromine and chlorine. Service parts after purchase may not be BFR/PVC-free. External accessories, including power supplies, power cords, and peripherals are not BFR/PVC-free.**

Thermal tolerance

Many POS systems are exposed to a wide range of temperatures when placed in areas such as a drawer, closed cabinet/closet, cubby holes, or outdoors. Because of this, all of HP's POS systems are designed to operate in a 40° C/104° F ambient temperature and 30° C/104° F, 85% relative humidity environment. HP also conducts many tests and component/material evaluations to validate the designs and ensure this claim is met.

50°C Configuration

The rp5800 is the first HP retail platform to offer a configuration that can survive in temperatures ranging up to 50C (122F). A 50C configuration is essential for retail environments that experience extreme heat conditions such as an outdoor/enclosed kiosk, garden center, outdoor industrial applications, etc. The components inside the rp5800 were designed and tested to withstand such thermal conditions in addition to intelligent thermal sensing for optimized fan ramp, attention to component placement, cable routing, and good thermal dynamics (cold air in, hot air out). The 50C configuration utilizes a special thermal chamber architecture that keeps pre-heated processor air from mixing with cool hard drive air.

Board Flex/Dye stain testing and cross section

In busy retail environments where the POS system many get frequently moved or bumped, it is important to ensure that the circuit boards continue to function normally in the event of an impact. Therefore, the motherboards are flexed and a dye-stain test is performed to ensure sensitive Ball Grid Array (BGA) connections are soldered robustly. After the board flex test, the boards are dipped in a special dye. Once the dye cures, all BGAs are removed and balls/pads are inspected. If any cracks are noted that are more than 50% of the ball/pad surface, the design is rejected and a re-design of the board and/or chassis takes place until acceptable results are achieved. The motherboards are also cross-sectioned and all through-hole barrels are inspected to ensure proper plating and soldering has thoroughly flowed. All surface mount components are visually inspected under a high-powered microscope to ensure solders are solid and that pads have not lifted during the manufacturing process. This not only ensures that board flex will not cause failures; it also provides assurances that the manufacturing processes are of the highest quality.

TDR/PCB impedance

Retailers rely on their POS systems to run their business; therefore, system stability is extremely important. The Time Domain Reflectometry (TDR) is used to verify that the impedance of all printed circuit board (PCB) traces on the motherboard, riser cards, and daughter cards are within specification as outlined by their corresponding interface guidelines. If any impedance measurement is out of specification, the board must be redesigned to bring the impedance back into specification. This ensures good electrical and electromagnetic signal integrity which translates into system stability especially when intensive software applications are running in an environment with unstable AC power and thermal conditions.

Power cycling

In order to ensure that all voltage regulators, control signals, and clock signals within the POS system sequence on and off correctly, HP performs a power cycling test to ensure the system's stability. Power cycling is performed during all design and prototype phases and during manufacturing up until production by cold power cycling, removing AC power ("AC" alternating current, power that comes from the electrical outlet) and warm power cycling, only remove DC power, ("DC" direct current, the power that goes through a transformer circuit), but the POS system is still plugged into the wall (receiving AC power).

Dust and Spill Resistance

The HP POS Keyboard key area is rated IP54 (International Protection Rating otherwise known as Ingress Protection Rating) which is dust & minor spill resistant. It will keep the dust intrusion to a minimum helping to prevent operational interference by dust. It also withstands operation by "wet hands" commonly occurring in restaurant, cafeteria, and other hospitality retail environments.

While the HP ap5000 AiO Point-of-Sales system is not entirely water-resistant due to its side ventilations, the main operators touch screen display is designed to resist minor amounts of water. The touch screen is mounted with a special internal gasket surrounding the panel seam to protect the internal system from occasional water drips & streaks. This allows for casual "wet hands" operation that occurs in many retail space.

Retail Hardened: Testing Methodologies

HP is committed to offering reliable and durable retail point-of-sale platforms. Therefore, meticulous testing is performed on the POS systems to ensure that they are able to operate under extreme conditions without failure. The following section will discuss the various tests that are performed on:

- Exterior materials and components
- Internal systems
- Power and thermal variations
- Impacts and vibrations

Cosmetic finish testing

In most retail environments, the POS system is visible to the public and possibly one of the focal points in the store. For this reason, it is important that the system is able to maintain a clean and presentable exterior finish that can take the abuse of situations such as bumps, scratches, accidentally dropping inventory or supplies, inks, tapes, etc. All POS chassis are designed with a durable coating/finish for retail wear-and-tear as well as to ensure that chassis and electrical components inside will not corrode. All tests are performed under cold and hot/humid conditions.

The tests consists of a “coat thickness test” to ensure that painted surfaces have a consistent paint thickness over the entire surface of sheet metal; an “adhesion test” to ensure tapes, items with rubber feet, sticky notes, etc. will not damage the finish; an “abrasion test” which is performed for 300 cycles to ensure paint will not peel or rub off; a “stain and fade test” which uses ink, coffee, wax, lipstick, soap, washing powder, and pencil/pen marks to ensure surfaces will not stain or degrade; and an “ultraviolet light test” where the system is placed under a special UV light for 100 hours at 70° C to ensure color will not fade. All external surfaces are inspected after each test. If any blemishes are found, the design is rejected and the design and/or the manufacturing process is improved until acceptable results are achieved.

Corrosion inspection

Retailers have unique business needs which may expose the POS system to elements that contain moisture and/or pollutants. To ensure the POS systems continue to run in these types of settings, they are placed in a 70° C/85% Relative Humidity (RH) environment

for several weeks and then all internal system components are inspected to ensure corrosion has not started to occur. This ensures that the POS system will not be susceptible in environments where salt-air/water, chemicals, and air-pollution may heavily occur.

Connector contamination testing

All connectors, both internal and external, are evaluated for contamination after the manufacturing process to ensure that contaminants are not found or lodged into a connector/port. This test is performed under a microscope at 125X magnification on each connector and port on the board. If a connector is found contaminated, the source of contamination is found and the problem is corrected or the system design is modified to safe guard against manufacturing contaminants.

Power supply industrial testing

As previously mentioned, HP POS systems are often required to operate in extreme environments and power supplies can sometimes be a point of failure. To mitigate this, various aspects of the power supplies are checked to ensure a robust design and solid construction. The industrial tests check solder joints, glue adhesion/positioning, mounting structures of internal heatsinks, locations of all through-hole components, and internal cable/wire management. Shock, vibration, drop, and board flex tests are performed to ensure solid solder joints and to ensure that the power supply will continue to operate should the system be dropped, bumped, jarred, or subjected to continuous vibration.

Battery life test

The battery life test ensures that key system information that is stored in CMOS, such as hard drive configuration, memory configuration, processor information, date, time, etc., will not be lost should the POS system be without power for an extended period of time. The purpose of the battery life test is to ensure the coin cell CR2032 battery, which keeps this critical circuitry powered on

when the POS system is unplugged from an AC power outlet, will not prematurely fail if the system is unplugged from an AC outlet for an extended period of time. If a battery dies before its life rating, then the electrical circuit design is checked to ensure unnecessary loads on the battery do not exist when the system is unplugged from AC power. If unnecessary loads are found, the circuit is redesigned as necessary to ensure battery life is optimized and will not prematurely die before its life rating.

Fan reliability

Retail environments vary and many retailers are operating for extended hours therefore, it is important that fans do not fail inside the POS system. Such failure may cause the POS system to overheat and shut off. To safeguard against internal fan failure, only the highest quality, ball bearing fans are used in the HP POS systems. To ensure the highest quality fans, HP tests a sample of 55 fans from different fan suppliers for 4,000 hours running at full speed in a 70° C/85% RH humidity environment, non-stop. This is a very intensive test for fans. A sub-standard fan will undoubtedly fail such test; however, HP insists that the fans run the full 4,000 hour duration without failure. Once the test is complete, 5 sample fans are torn apart and evaluated for wear and corrosion. If a fan fails or if any unusual wear/corrosion is found, HP will work with the fan suppliers to improve their fan design or chose another fan model/supplier. A retailer should never have to worry about their POS system overheating due to internal fan failure.

Hardware System Compatibility and Integration Testing (HSCIT)

Retailers need flexibility with their POS systems in order to meet their unique business needs therefore, a comprehensive Hardware System Compatibility and Integration Test (HSCIT) is performed on all POS systems HP designs. This test consists of mixing and matching internal and external accessories and components to ensure the POS system will operate normally. This helps ensure that many combinations of internal

and external modules will operate and perform as expected.

Interface stress testing

POS systems, as with all electronic devices, have critical internal electrical interfaces and circuitry. Each electrical interface is put through its paces by utilizing stressful test suites in our evaluation lab. The stress tests are designed to maximize and stress all electrical interfaces using tests written by the HP Evaluation Test Design (ETD) team and by using industry benchmark applications and high-power applications. All major interfaces are margin tested for voltage and timing to ensure that fluctuations in power and timing (clock generators) will not result in system hangs, blue screens, or reboots. These tests ensure that the POS system is highly reliable and robustly designed.

Power measurements

HP POS systems are robust enough to handle any internal or external accessory (components or peripherals) as well as a possible faulty accessory (components or peripherals) that may get unknowingly installed. Power consumption of all key critical components is checked as well as many 3rd party (non-HP) peripherals to ensure that they will not exceed the power in which the power supply can deliver. Fault conditions are also checked such as shorting devices to ensure the power supply and on-board regulators shut down as designed to ensure that overheating and fire will not occur. This helps ensure that the POS system is protected from system overload or permanent damage.

Lightning strike test

Lightning can strike at anytime and cause system failure. HP POS systems are tested for power surges and all POS systems are designed to withstand a surge of up to 2,000 volts.

Electrostatic Discharge (ESD)

Electrostatic Discharge (ESD) can occur without warning and can be very detrimental to a retailer's business if the POS system gets

damaged as a result of ESD. An ESD event can permanently damage a system if the system is not designed properly to handle such event. HP POS systems are designed to survive an electrostatic discharge (ESD) of up to 4,000 volts (direct contact) and 8,000 volts (air contact). In many cases, the POS systems can withstand an ESD of up to 15,000 volts air contact discharge. This is extremely important in a retail environment where ESD events occur all the time. Designing our systems to help withstand these types of events allows the retailer to continue operating without failure.

Power on after loss in BIOS

In the event that a retailer's location loses power, the HP point of sale systems feature a "power-on after loss" in F-10 setup. The retailer can enable this setting so that if a power outage is experienced, the system will power back on automatically and boot back into the operating system after a power loss. This feature is extremely important if the POS system is in a remote location where staffing is at a minimum and the POS system needs to be on at all times, such as a self check-out, kiosk, or as a server application in the back office.

Radio Frequency (RF) Interference

In this day and age with the multitude of devices that use radio frequency (RF) signals, it's important that these signals not interfere with one another. HP tests all POS systems for a wide range of radio frequency (RF) signals to ensure that RF interference will not cause the systems to lock up, blue screen, or shut down. The systems are also tested to verify that they do not exceed the acceptable RF emittance into the environment as specified by regulatory agencies. Designing the HP POS systems with this in mind allows the retailer to continue operating without failure to their POS system or having to worry that their POS system will cause failure to nearby electronics.

Storage thermals

HP POS systems are exposed to severe temperatures when the system is powered off

to simulate storage/warehousing conditions for all climate types. The temperature range tested is -40° C to 60° C. After this test, all internal system components are inspected to ensure corrosion has not started to occur or that degradation in thermal paste for internal heatsinks has not occurred. This ensures that the system will not be susceptible in warehouses that are located in hot/humid environments.

Extended burn-in

In the event that a retailer experiences AC power failure and unusual thermal temperatures, it is important to ensure that their POS system will continue to function. In this type of situation, system failure could cause the retailer to lose revenue, for that reason power and temperature cycle tests are performed on all POS systems simultaneously to ensure system stability and robustness especially if AC power is removed (system is unplugged from the wall outlet) at high or low ambient thermal temperatures. This process is called the "burn-in" process. The test is performed in a thermal chamber for a pre-defined thermal environment which is designed to thermally stress the system while cycling AC power 10 times per hour, or 480 times over a 48 hour period in parallel. During the test, the temperature chamber is walked up to an elevated temperature in 5° C increments, held for 2 hours, and then walked back down in 5° C increments. The entire process takes 48 hours.

- 10° C: hold for 2 hours
- Ramp to 40° C in 5° C increments (hold each increment for 30 minutes)
- 40° C: hold for 2 hours
- Ramp back down to 10° C in 5° C increments (hold each increment for 30 minutes)

Impact test

In retail settings, the POS system is often prone to wear and tear. This test is designed to ensure the enclosure/chassis has the proper reinforcement to sustain damage in the event of an impact specifically in areas such as the fan guard which is more

susceptible to structural failure. The test consists of a smooth steel ball, approximately 50mm in diameter and 400g of mass to freely fall from rest through a vertical distance of 1.3m onto the subject surface (vertical impact) and a similar ball that is suspended by a cord and swung as a pendulum to apply horizontal impact. This test ensures that if a sales clerk accidentally drops merchandise on the system or accidentally hits the system with merchandise or an accessory such as the barcode scanner, etc., the POS system will continue to function without damage or failure.

Drop test

HP POS systems are tested to sustain drops from 24" and 30" when packed in their shipping boxes. The drop test simulates what might happen during shipping/handling, such as a forklift that may drop a pallet load or a boxed system that may fall off a shelf. The test consists of 30 drops from 24" to 30" while the system is packed. If the system can pass this test, i.e. no components are damaged or fall off, and the system can boot and successfully run a 24 hour system stress test without any failures, blue-screens, lock-ups, or reboots, then HP is confident that it can survive the typical shipping/handling events:

- 9 flat drops at 30"
- 9 flat drops at 24"
- 4 corner drops at 30"
- 8 edge drops at 24"

Packaging testing

The packaging test is also designed to simulate shipping/handling events that may possibly damage the system such as a truck rollover or a fork lift dropping a pallet load. The packaging test is focused on the card board box and cushions to ensure they are designed to withstand an extreme, highly-unrealistic environment. If the system can pass this test, i.e., no components are damaged or fall off, and the system can boot and successfully run a 24 hour system stress test without any failures, blue-screens, lock-ups, or reboots, then HP is confident that the

packaging is well designed to protect the POS system during shipping/handling.

Operational vibration

Operation vibration testing is performed on all POS systems to ensure that they can survive any retail environment such as a system that may be placed on a rolling cart. Operational vibration tests are performed on all three axes (side/side, front/back, top/bottom). The system must successfully remain powered on during these tests without any failures, blue-screens, lock-ups, or reboots.

Random vibration, trapezoidal shock, half-sine shock

The purpose of this test is to ensure the system can survive harsh vibrations and shock. This test is similar to the operational vibration test except the vibration and shock events are random. The test is designed to simulate an extreme, highly-unrealistic, environment. The system must also pass a 45G square wave shock. If the system can pass this test, i.e. no components are damaged or fall off, and the system can boot and successfully run a 24 hour system stress test without any failures, blue-screens, lock-ups, or reboots, then HP feels confident that it can survive the typical daily shocks and vibration events in a retail environment.

HALT (Highly Accelerated Life Test)

HP POS systems are tested under an accelerated vibration and thermal scenario to find out where the first point of failure may occur. The test runs in steps and if the POS system continues to pass, the vibration and thermals are increased at each step until a failure is noted. This helps determine how much vibration and thermal margin are in the POS systems which therefore allows HP to build confidence in the designs knowing that the POS systems can withstand a lot of abuse before failing. HP's goal is to have good margin so that the end-user will never experience a failure. Many of the units do not see failures until 12-17 grm of vibration or at 70° C thermals. All failures are evaluated and then a decision is made if the failure

was acceptable or if the design needs further improving.

Strife Testing (Stressful Life Testing)

The strife test is designed to shock the system thermally under various power loads and various time durations. This test ensures that the POS system will operate correctly under any extreme thermal or power load environment. The test is performed in a chamber that can instantly change power loads and thermal loads in a matrix of conditions, checking all 4 corners and combinations therein. The four corners are equal to = high temp/low power, high temp/high power, low temp/low power, low temp/high power. The purpose of this test is to ensure reliability and robustness of the POS system.

Beyond Retail Hardened

There are additional tests, checks, and features that HP uses to ensure that not only are HP POS systems, but all HP products are designed, manufactured and tested to be highly reliable and durable. The next section details how these relate to the retail environment.

SATA cable test identification (TID)

In a retail environment, protecting your data is paramount and therefore HP attempts to mitigate data failure by ensuring robust connectivity between the POS system's internal hard drive and motherboard. Since SATA cables can be a point of failure HP only selects SATA cable suppliers that have a Test Identification (TID) on file with the serial ATA organization.

The Serial ATA organization has a standardized test suite that checks the construction and durability of SATA cables. When the tests are completed with passing results, a SATA Test ID (TID) is assigned to the SATA cable supplier. The tests verify connector housing quality, connector mating, surface insertion, angle insertions, front and back inclined forces, cable crimping, and separation. A SATA cable must pass this test

to receive a TID. HP only selects SATA cables that have a TID.

Socketed components

Many of the HP POS systems are the ultimate in flexibility and serviceability which allow the retailer to focus on growing their business because it offers them the ability to easily enhance their POS systems as needed. The HP rp5700 POS System for example, uses socketed processors, memory and card slots for maximum flexibility for upgrading as well as for servicing since socketed parts allow for quick and easy repair in the unlikely event of a failure due to that part.

Active Power Factor Correction (PFC)

There are a lot of inefficiencies in a power distribution network as the power circuits perform "work" to deliver power (voltage x current) to a load. Inefficiencies can occur due to energy stored in a load and returned to the source (power supply) or due to non-linear loads that distort the wave shape of the current drawn from the power supply. Power Factor Correction is the ability to correct these inefficiencies. There are two types of power factor correction: Active PFC and Passive PFC. Passive PFC is the most common and less costly solution because it uses a passive network of capacitive filters on the AC input to correct power inefficiencies. Passive PFC is not as robust as Active PFC because it requires the AC input voltage be set manually and does not use the full energy potential of the AC input. Active power factor correction (PFC) allows power distribution to be as efficient as possible by using an active circuit to correct power inefficiencies. The circuit is "active" meaning it can respond to harmonics and is capable of a full range of AC input voltages, versus a limited manually set range for Passive PVC. Simply put, Active PFC translates into a more efficient power distribution network which equates into less energy waste and higher energy cost savings. All of the HP POS platforms use power supplies that are designed with Active PFC.

Power dip testing

Many retailers are subjected to unstable power conditions at some point in time, especially in emerging countries. HP power supplies can withstand a 20% dip in power without the need for secondary UPS. They are designed to operate between 90Vac - 132Vac. So a 20% drop to nominal 115Vac voltage equals 92Vac which is above the minimum rating for all countries except Japan. In Japan, the nominal voltage is 90Vac. For this region, HP power supplies can withstand a 10% dip in power. Therefore, HP POS systems will operate seamlessly even under unstable power conditions.

Power line testing

Power line conditions can change unexpectedly especially in emerging countries. Therefore, HP performs power line testing; this test ensures the POS system will be stable even when unstable AC power scenarios might exist. The test is performed at various temperatures under the following AC voltages: 90V/63Hz, 180V/53Hz, 90V/57Hz, 180V/47Hz, 132V/63Hz, 264V/53Hz, 132V/57Hz, and 264V/47Hz. For each AC voltage, a system stress test is performed and the system must pass each voltage for 8 hours of continuous operation without failures, blue- screens, lock-ups, or reboots. This helps ensure that HP POS systems will operate seamlessly even under unstable power conditions.

Altitude testing

Altitude testing is performed to ensure that the HP POS systems will operate normally at extreme altitudes. This test is performed in a chamber that can simulate an altitude of 3,100m (10,170 feet). The test is performed at 100% max power load for 96 hours at this elevation. No blue-screens, lock-ups, or reboots are allowed.

Acoustic testing

Some retailers have quiet, serene environments. In such an environment, the last thing they need is a POS system with a

loud fan. Therefore, acoustic testing is performed on the HP POS systems to optimize the acoustic levels of the internal fans, hard drives, and optical drives. A sophisticated algorithm is implemented in the HP BIOS that optimizes acoustic levels while maintaining good thermal margin of key components within the POS system.

Electrical signal integrity

POS systems, as with all electronic devices, have critical internal electrical interfaces and circuitry. Electrical signal integrity testing is performed on all signals and interfaces on the motherboard, power supply board, riser boards, etc. Signal integrity includes noise measurements, cross-talk evaluation, setup/hold time evaluation, signal overshoot/undershoot, ring back, duty cycle, jitter, etc. The full electrical parameters of each signal is tested and the results are compared against the interface specifications from PCI, PCI-express, SATA, USB, Powered USB, DDR, LPC, PS/2, UART, FSB. HP also checks and verifies the operation of power sequencing signaling, thermal signaling, and control signaling. Power rail noise, power rail margining, and clock and differential pair margining are also measured. All signals must be within spec or the design is rejected and re-designed as necessary to bring the signals within specification.

Memory compatibility testing

Tests are performed on all possible system memory configurations which includes mixing and matching various sizes, speeds, cache latency, models, and vendors to ensure all memory is compatible under any configuration in the system without failures, blue-screens, lock-ups, or reboots. If a failure is noted, the root cause is located and the design is corrected and/or HP will work with the memory supplier to correct their memory module design. This helps ensure that the HP POS systems will run with any memory mix.

Network Interface Connection (NIC) IEEE testing

Network connectivity is an important necessity for many retailers, allowing them to

take orders or process transactions. The purpose of the NIC IEEE test is to ensure good network connectivity and end-to-end signal integrity over a cable length of 160 meters (525 feet). All signal integrity measurements must be within specification with no bit errors. This ensures that the HP POS platform can be placed anywhere within the store and will have solid network connectivity even on long network cable runs.

Diagnostics

In the unlikely event that the POS system experiences a failure, HP has designed each of the POS platforms with a critical event self diagnostic feature, called "BeepLED". This feature quickly allows the retailer or service technician to identify critical failures with the POS system so that down time is minimized. BeepLED provides visual and audible notification in the event of a failure by blinking the power LED red and sounding the buzzer/speaker synchronously in a series of beeps/blinks. This feature only works at boot/POST and checks for the following:

Beeps/Blinks	Error
2	Processor overheating
3	Processor not installed
4	Power supply failure
5	Video failure
6	Memory failure
7	Motherboard failure
8	Invalid ROM checksum
9	No-boot condition, where system powers on but does not boot
10	Bad option cards

Security

Security is important in a busy retail environment. Store owners should never have to worry about their POS systems getting stolen or being tampered with; therefore, HP designs all of the POS systems with security in mind. For instance, each of the HP POS systems features locking support that accepts a Kensington lock, a Noble lock, or a padlock. The lock kits keep the hood of the POS system from being opened and also keeps the system from being easily

stolen. On the rp3000, HP designed a lockable door which covers the power button and optical disk drive. This helps reduce unwanted tampering with the system. On the rp5700, a rubber cover for the front USB ports acts as a deterrent for unwanted use of these ports. Additionally to reduce unwanted tampering, all USB ports can be disabled in F-10 setup. Also, in F-10 setup, the user can setup a "power-on-password" and an "F-10 setup password". These password capabilities are available to keep personnel or others from changing critical system and CMOS configuration information on the POS system.

Under desk mount / wall mount security sleeve

An under desk mount / wall mount security sleeve was designed for the HP rp5700. This sturdy, all-steel sleeve was designed to mount the rp5700 POS system out of the way to free up valuable counter or floor space. The sleeve also allows a retailer to lock the POS system into the sleeve with any of the three lock kits mentioned previously (Kensington lock, Noble lock, pad lock).

Computrace

Since sensitive data may be stored on the POS system it is important to protect this data from risk of breach or theft. Computrace, which is supported on all HP POS systems, is a possible solution to protect sensitive data. All HP POS systems contain the appropriate BIOS code to support Computrace*; however, a subscription and downloadable software must be obtained from Absolute Software at www.absolute.com. With Computrace you can:

- Delete data remotely on stolen systems and get a record of sensitive data that's been accessed.
- Accurately track remote computers – on or off a corporate network
- Obtain alerts about unauthorized or illegal software

such as file sharing applications that could jeopardize sensitive data

*The Computrace agent is shipped turned off, and must be activated by customers when they purchase a subscription. Subscriptions can be purchased for terms ranging from one to four years. Service is limited, check with Absolute for availability outside the U.S. The Absolute Recovery Guarantee is a limited warranty. Certain conditions apply. For full details visit: www.absolute.com/pdf/eula.pdf. Data Delete is an optional service provided by Absolute Software. If utilized, the Recovery Guarantee is null and void. In order to use the Data Delete service, customers must first sign a Pre-Authorization agreement and then purchase one or more RSA SecurID tokens from Absolute Software.

Removable hard drive option

HP offers an alternative option to protecting sensitive data that may be stored on the POS system's hard drive. That alternative is an optional removable hard drive. The rp5700 was designed to support a removable hard drive that can be installed in lieu of an optical disk drive. The removable hard drive features a steel case that is fire resistant and lockable. At the end of the business day, a store owner or manager can simply power down the POS system and remove the hard drive from the front of the system without opening the hood. The hard drive stays inside the steel case and the entire case is removed which can then be stored in a safe or taken home for safe keeping. The removable hard drive has another benefit in that a retailer could install up to three hard drives into the rp5700 POS system.

Redundant Array of Independent Disks (RAID)

Many retailers need to protect the data stored on their POS system's hard disk drive in the event of a hard drive or POS system failure. Redundant Array of Independent

Disks (RAID) offers this protection as an affordable back-up alternative. RAID is designed to allow several hard disk drives function as one storage area (array) to provide the following benefits:

1. Data redundancy for back up security, or...
2. Faster performance by striping read/write data to/from the hard disk drives

NOTE: HP ships RAID level 1 when configured to order. RAID level 0 is supported but must be enabled by the user. RAID level 5 is supported but requires an optional 3rd hard disk drive via the optional removable storage device in lieu of an optical disk drive.

HP offers RAID on our high-end POS systems and two hard drives must be installed for RAID to work.

IEEE 508 (Electronic and Information Technology Accessibility Standards Checklist Plan)

This test plan contains a checklist for products to make sure that they are compatible with the government regulation implementing Section 508 of the Rehabilitation Act of June 21, 2001. Section 508 applies to "normal operation", which excludes initial setup (such as driver setup, application setup), initial configuration, maintenance (such as Desktop management), diagnostic, repair tasks, and adding or replacing parts. This test also ensures that the hardware and software is compatible with certain human handicap conditions such as deafness, blindness, color-blindness, etc.

Hewlett-Packard Company
3000 Hanover Street
Palo Alto, CA 94304
www.hp.com

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