



RUGGEDNESS

How do you know your mobile computing device will withstand your tough environment?

RUGGEDNESS: HOW DO YOU KNOW YOUR MOBILE COMPUTING DEVICE WILL WITHSTAND YOUR TOUGH ENVIRONMENT?

Equipping mobile workers with computing devices in the field creates numerous opportunities for businesses to improve efficiency and productivity. But it is important for businesses to consider the required ruggedness of their computing devices when deploying into mobile environments. Not only must devices be able to support the application, they must also withstand the physical challenges inherent to potentially tough environments.

Mobile computing devices must endure the shocks, drops, vibrations, dust, water, and extreme temperatures that accompany the harsh conditions faced by the majority of mobile workers. But different applications and environments require devices with different degrees of ruggedness so it is important that business don't simply select the most rugged device for their operations. Why spend extra money for a mobile computer designed for the freezer when your workers will never enter this environment? Conversely, not considering a freezer-focused device for this particular application can result in increased device failures and may prove even more costly in the long term. Therefore, businesses must consider the characteristics of their environments and applications and then choose the most appropriate device for their needs. This document provides insights to help evaluate the ruggedness of a mobile device and determine its fit for a given scenario.



THE MAKEUP OF A RUGGED MOBILE DEVICE

When designing a portfolio of rugged devices, it is imperative that every component works toward supporting the goal of extreme durability. Each element of the device: the body, the keyboard, the display screen, and the internal components must be able to withstand the harsh conditions of its planned environment and application. It also means that all accessory items such as docking stations, pistol grips, and scanner modules should support the rugged mantra.

The Outer Shell: Absorbing Impact and Blocking Contaminants

The design and construction of a device's outer shell is vital to ensuring strength and protection against contaminants. Yet, establishing a strong, impenetrable structure is not as easy as just wrapping the internal components in tough materials. More factors must be considered to ensure the best quality seal and impact protection. Are there cracks in the plastic shell? Are screws tightened with the perfect amount of force to avoid gasket distortion or light (under-spec) tension? These small details, if overlooked, could lead to a device failing to meet the requirements of its intended environment.

There are two primary models for designing handheld bodies: the eggshell and the sandwich. The eggshell design is a one-piece structure and is best for devices that will operate in the most extreme outdoor and indoor conditions such as warehouses, distribution centers, ports, or freezers. An eggshell design results in fewer surface cracks than a sandwich design, reducing the chance of contaminant penetration. Eggshell designs often absorb impacts better than a sandwich design - it is harder to break a structure made up of one piece than one made of numerous pieces. The sandwich design is a multiple-piece structure and can be a solid alternative for less extreme environments. It can be less complex to design, engineer and manufacture, yet when combined with structural supports for strength, still provides a good level of ruggedness.

A rugged device that relies solely on the external structure to protect against impacts will likely fail. Absorbent materials, such as rubber bumpers, can be applied on specific impact points to provide protection. And, if possible, critical parts of any device should be integrated internally - parts such as antennas are more protected against impacts and are less likely to be damaged by impacts.

The Keypad: Maximum Usability for Longer Time Periods

As a primary device interface, keypads must provide maximum reliability - able to handle the constant grinding, pounding, and scraping that happen in a mobile workplace. A common problem faced by mobile workers in harsh environments is that, over time, their handheld keyboards become hard to read and hard to operate as fonts and key colors fade. This is more of a problem if paint is used to create the fonts and graphics for keypads. Paint, especially in tough environments such as warehouses or freezers, wear and make keypads hard to read.

Coactive molding, a method whereby graphics are molded on the underside of the keys, is one way to increase wear resistance of the keypad and maintain usability over time. Another technique is the utilization of colored plastics instead of painted markings. If paint is used, it can at least be given a protective coating. Protective coatings help prolong the time before paint begins to chip off the device, but using colored plastics is the best way to maintain the look and, more importantly, the usability of a handheld for the long term.

The Display: Understanding the Demands of the Mobile Work Environment

A mobile computer's display screen must also endure tough environments while remaining clear and easy-to-read. Improving the durability of the display can be a challenge because doing so often reduces the optical quality of the displayed image. A plastic or glass layer over the display can serve as protection, but special attention must be paid to the spacing between it and the display screen. Any miscalculation could affect the quality of seal, impact protection, and/or image quality. If the protective cover is too close to the display, it may flex inward and crack the display upon impact. Conversely, if the protective cover is positioned too far from the display, the quality of seal could be diminished and the displayed image will become more distorted. Either way, display protection will often reduce the brightness of the display, but it can be well worth the trade-off depending on the environment.

If the mobile computer has a touch-screen, then there are special considerations that must be made in relation to the environment in which it will be used. Two types of rugged touch-screens exist: 4-wire and 5-wire. Both have their advantages depending on the intended application and environment of the handheld. The major difference between them with regards to ruggedness lies in the materials used.

A 4-wire touch-screen uses polycarbonate plastic and a 5-wire utilizes glass. The 4-wire touch-screen can be a better fit for environments where the device is exposed to severe drops, impacts to the touch-screen, or the application does not permit glass in the product (i.e. some food & pharmaceuticals). A 5-wire touch-screen is more durable and will last longer for applications that are graphically based and have heavy reliance on the touch screen. For example, applications which require frequent use of buttons located on the screen, such as "OK" or "CANCEL".

The Internal Organs: Ensuring Full Functionality of the Device

A key contributor to ruggedness is internal component spacing. If internal components continuously rub and bang into one another when a device is dropped or endures vibration, then damage is highly likely. It is important that the design ensures these components are safe and protected. Rugged devices should be designed with space around internal components to provide flexibility and ensure internal parts don't collide when a device is dropped or bumped.

Accessories: Enhancing Usability and Supporting Ruggedness

A rugged mobile device is only as tough as its weakest component. If a handheld can withstand multiple drops, but the pistol grip shatters on the first drop, then users will be subject to a frustrating, potentially productivity impacting, experience. All supporting accessories and components must be designed and manufactured with the same focus on ruggedness as the rest of the mobile device. Buyers should understand the accessory items they will need, and that the supplier has taken the necessary steps to create items that withstand the same harsh conditions as the mobile device.



PSION: MEETING YOUR RUGGED NEEDS

Psion prides itself on considering all the details required to design a portfolio of rugged mobile computers that address the varying needs of its customers. We understand that to build a fit-for-purpose rugged device, all elements must be designed to withstand tough conditions. Nothing has been overlooked, from the tension of screws to the design of docking stations, in the development of the Psion product portfolio.

Psion utilizes both eggshell and sandwich designs for the outer shell of its devices depending on their intended application and the environment in which they will be used. Both designs are assembled using an alloy of ABS and polycarbonate plastic. The ABS alloy is used to eliminate stress cracking and the polycarbonate plastic, the same used in riot shields, has proven strength and durability. Plastics are

carefully polished in areas that attach to a sealing gasket to eliminate imperfections on the plastic that could diminish the quality of the seal. Furthermore, assembly is conducted within strict parameters such as applying the exact force to screws with calibrated torque drivers. Why? Because too little force results in a poor seal as the tension is too light, but too much force can distort a seal or gasket which may also result in a poor seal.

All Psion handhelds can withstand the multiple drops that occur in mobile environments. Devices undergo extensive testing and modeling to get the structure right. Drop, shock, and vibration test machines help pinpoint areas of vulnerability. Handhelds are further strengthened by internal integration of key components such as the antenna and with rubber bumpers that line the exterior of the device to shield critical impact points.

Many keypads are assembled with colored plastic hard-capped keys to avoid the long-term wear challenges that arise when using paint. Furthermore, coactive molding is utilized to make graphics significantly more wear resistant than competing devices that don't follow the same process. And, because keypads must endure the grinding, scraping, and pounding of a typical workday, Psion performs abrasive testing on all keypads to ensure longevity.

Maintaining a quality seal for the keypad and display is a difficult challenge that Psion has overcome with its devices. Using the right combination of rubber gaskets and layers has made keypads and displays virtually impenetrable by contaminants. For example, the Ikon keypad consists of a rubber layer that is compressed into the front housing during assembly for ideal sealing. Similarly, NEO's display module is encased in a thermoplastic elastomer boot with the center section cut out to allow screen visibility, and then it is compressed onto the housing with mounting screws. This process provides both a maximum seal and impact protection. However, there are still tradeoffs between display protection, seal, and quality that are unavoidable. Handhelds such as the 7530 or 7535 that are used in very harsh environments are designed to achieve the optimal distance from the display to provide both high optical quality and extreme ruggedness.

Internal component spacing is vital to device ruggedness and Psion has invested extensive time and money to determine the optimal spacing requirements of internal components. Computer-aided design (CAD) modeling combines with real-world experience to reduce the device size while maintaining ruggedness. The result is devices that possess the necessary flexibility to resist tough impacts.

But, while mobile devices are a big part of the story, accessories are also an important consideration. Many applications couple the mobile device with accessory items, and hence, Psion designs and manufactures accessories with the same rugged focus. For instance, docking stations feature drain holes so that even if a handheld is inserted while wet, water cannot pool at the bottom of the docking station, potentially damaging connectors. Scanner windows are reinforced both front and back. All stylus are constructed with polyacetal plastic that is durable and self-lubricating to slide smoothly across touch-screens without scratching. Further, stylus feature a large radii to reduce potential touch-screen damage and consequently increase screen lifespan.

Psion thoroughly tests its devices and accessories across all ruggedness variables, including shock, vibration, ingress protection (IP), temperature, and durability. Through use of qualified IP testing labs and its own shock and vibrate machines, temperature chambers, and drop testing machines, Psion is able to address complications that arise throughout development. Plus, to ensure the best possible quality, devices are sent to external labs for independent testing and certification before they are offered to customers.

Psion has been creating mobile devices for over four decades and is an expert in designing truly rugged devices that thrive in the toughest conditions. Because no single device can meet the demands of every application and environment, a broad product portfolio delivers a wide range of capabilities and degrees of ruggedness. To learn more about Psion' rugged mobile devices and how the right one can improve your business, please visit www.pSION.com.