What is Rugged?

How rugged mobile devices are tested and rated, and why it matters

Consumer and commercial grade products are built to be used under the most benign of conditions. Some computers are defined as semi-rugged or built to withstand coffee spills and some drops. But how can one determine if a computer is "fully rugged," that is, able to operate under the harsh conditions they will encounter if utilized for extreme jobs and outdoor areas?

By definition, a tablet that is rugged is designed and built specifically for hazardous situations and must conform to rigorous military and industry standards. Compliance with these standards must be determined by third parties. The two most important methods of determining "ruggedness" are the Ingress Protection (IP) rating system and the U.S. Department of Defense "Test Method Standard for Environmental Engineering Considerations and Laboratory Tests," commonly referred to as MIL-STD 810. These ratings and standards provide independent and objective criteria with which to grade specific characteristics of a rugged computer.

When determining which rugged tablet or computer to purchase for your industry, these ratings and specs can often seem arbitrary or confusing. To help demystify the rugged computing world, Xplore Technologies offers this guide to rugged rating and testing systems for mobile devices. This guide explains IP ratings, MIL-STD-810G tests, and offers a few pointers on rugged factors to consider when making your purchasing decision.

IP Ratings

Ingress Protection (IP) ratings are developed by the European Committee for Electro Technical Standardization (CENELEC) and they specify the environmental protection provided by an enclosure. With regard to rugged computers, the rating denotes the effectiveness of a computer's rugged casing at preventing solids and liquids from reaching it's easily damaged internal parts.

IP Ratings are represented as IP##, with the first number following the IP corresponding to solid ingress, and the second number corresponding to liquid ingress.

For example, a tablet rated at IP67, such as Xplore's iX104C5 tablets, is sealed tight against the smallest particulate matter (dust), and can be fully immersed in liquids up to a meter for a limited time. To be considered "fully rugged," a computer must be rated a minimum of IP54, according to VDC Research Group. However, most industrial environments involve conditions that are more hostile that this rating will protect against. Therefore, a rating of IP65 or higher is recommended to ensure the longest life and best ROI for your rugged tablet or computer. This level of ruggedness provides, at a minimum, sufficient protection against dust to maintain satisfactory performance in all atmospheres, and protects against water from any direction, so any accidental spills will not damage your computer.

Protection against solids

The first number represents protection against solid objects. The degrees of protection are ranked from 0 to 6:

- **0** — **No Protection**
- **1** — *Protected Against Solid Objects Up to 50 MM (e.g accidental touch by hands)*
- **2** — *Protected Against Solid Objects Up to 12 MM (e.g person's fingers)*
- **3** — *Protected Against Solid Objects Over 2.5MM (e.g tools and wires)*
- **4** — *Protected Against Solid Objects Over 2.5MM (e.g tools, wires and small wires)*
- **5** — *Protected Against Dust Limited Ingress (No Harmful Deposit)*
- **6** — **Totally Protected Against Dust**

Protection against liquids

The second number represents protection against liquids. The degrees of protection are ranked from 0 to 8:

- **0** — **No Protection**
- **1** — *Protection Against Vertically Falling Drops of Water (e.g. Condensation)*
- **2** — *Protection Against Direct Sprays of Water Up to 15° From the Vertical*
- **3** — *Protection Against Direct Sprays of Water Up to 60° From the Vertical*
- **4** — *Protection Against Water Sprayed from All Directions- Limited Ingress Permitted*
- **5** — *Protection Against Low Pressure Jets of Water from All Directions- Limited Ingress Permitted*
- **6** — *Protection Against Temporary Flooding of Water (e.g. for use on ship decks)- Limited Ingress*
- **7** — *Protected Against the Effects of Immersion between 15cm to 1m*
- **8** — *Protects Against Long Periods of Immersion Under Pressure*

MIL-STD-810G Testing & certification

Just as IP ratings are important to the definition of rugged, equally important is the U.S. Department of Defense's MIL-STD-810G rating. This rating allows users to predict the performance and service life of a device based on the environmental conditions it will encounter during normal operations. The standard includes an extensive set of test methods to assess effects of drops, extreme temperatures, rain, humidity, sand, dust, shock, vibration and numerous other conditions. VDC Research only considers systems that conform to the MIL-STD-810 standard to be fully rugged.

Mil-std-810g Test List

500.5	Low Pressure (Altitude)
501.5	High Temperature
502.5	Low Temperature
503.5	Temperature Shock
504.1	Contamination by Fluids
505.5	Solar Radiation (Sunshine)
506.5	Rain
507.5	Humidity
508.6	Fungus
509.5	Salt Fog
510.5	Sand and Dust
511.5	Explosive Atmosphere
512.5	Immersion
513.6	Acceleration
514.6	Vibration
515.6	Acoustic Noise
516.6	Shock
517.1	Pyroshock
518.1	Acidic Atmosphere
519.6	Gunfire Shock
520.3	Temperature, Humidity, Vibration, and Altitude
521.3	Icing/Freezing Rain
522.1	Ballistic Shock
523.3	Vibro-Acoustic/Temperature
524	Freeze / Thaw
525	Time Waveform Replication
526	Rail Impact
527	Multi-Exciter
528	Mechanical Vibrations of Shipboard Equipment

Importance of Mil-std testing

A computer that passes MIL-STD-810G tests is essential to ensure optimum performance in tough field conditions. The tests cover a wide variety of common outdoor conditions, including an array of climates and weather possibilities, drop and shock scenarios, and factors like pressure, contamination, and heavy vibrations (from machinery, for example). Some of the ratings differ from computer to computer; for example, operating and storage temperatures can vary, as well as drop rating and humidity ratings. Be aware of these variations as you compare rugged computer manufacturers.

Some leading rugged computer manufacturers continue to make significant investments for inhouse environmental, reliability and emissions testing labs. In some instances, there can be continuous Accelerated Life Testing and Accelerated Stress Screening on its rugged products during the design phases as well as ongoing regression testing from random production line sampling, which is a very important aspect of quality assurance. Many manufacturers may also undertake mechanical lifecycle stress testing on all key connectors, jacks and insertion points to maximize reliable lifetime operation of the computers.

Rugged Testing Implications and Recommendations

Testing and rating ensure that you get what you pay for as a rugged tablet consumer. These tests must be conducted by a third party in order to be considered for rating, and the processes involved are very strict and precise. This way, companies are prevented from cheating on quality and rugged design.

However, if you want to be certain you get the most bang for your buck, there are a few things you should consider when making your purchasing decision. For one, consider the daily conditions the rugged device will face on the job. Also consider common accidents and environments. Will it be around liquids (water, oil, etc)? Will it be in freezing or hot temperatures, or both? The predicted conditions of your work environment should determine the IP rating and MIL-STD-810G standards you require, and once you've determined those rating requirements, you can better narrow down your options for rugged mobile devices.

You also want to ensure the quality and reliability of your device. Some of the key questions to ask the manufacturer include:

- What sort of testing is conducted on a regular basis to make certain that the computers are as rugged as possible?
- Is the warranty based off of your rugged testing standards?

If the manufactuer continues to test their products for quality control, and displays confidence in their products' rugged abilities by basing their warranty off MIL-STD and IP ratings, you can have more peace of mind that the product will last over a long life cycle and survive the typical conditions of an industrial environment.

About Xplore Technologies

Established in 1996, Xplore Technologies Corp. is the number two provider of rugged tablet PCs worldwide. With its recent acquisition of the Motion product line, the company now delivers the broadest range of rugged Windows and Android tablets available in the market. The company's award-winning tablet PCs are among the most powerful and longest lasting in their class – able to withstand nearly any hazardous condition or environmental extreme – and are purpose-built for the unique workflow demands of critical industries including oil & gas, utilities, telecommunications, government, military, public safety, manufacturing, distribution and healthcare. Xplore's products are sold and serviced on a global basis across the Americas, Europe, Middle East, Africa, and Asia Pacific regions. For more information, visit the Xplore Technologies website at www.xploretech.com.