Performance You Can Trust:

HOW CRUCIAL® SSDS ARE QUALITY TESTED

Ever wondered how we test Crucial SSDs for the endurance, performance, and compatibility specifications that we advertise? Here's a behind-the-scenes look at the rigorous process we undertake to ensure that you get a quality-assured SSD.

PART 1: SSD QUALIFICATION TESTING

Before Crucial SSDs enter production, they go through what we call a qualification phase. In this phase, "quals" (sample SSDs representing a given form factor and capacity), are put through several test processes to make sure that they perform at or above the specifications we advertise. Of the qualification tests that we conduct, five have been specifically chosen to represent the rigorous level of quality in our Micron-designed drives. These five tests are:

1. **Design verification**
2. **Environmental verification**
3. **Mechanical testing**
4. **Reliability testing**
5. **Endurance validation**

Each of the five tests above work in tandem to provide a complete picture of the SSD's performance and functionality. Here's what our engineers are looking for when they put one of our SSDs through each of the following tests.

DESIGN VERIFICATION. Our engineers test the entire feature set of the SSD. They're asking, "Does the SSD perform as expected, and does it recognize all of the computer commands that it will be given?" Once a "yes" answer has been verified through extensive command queues, the performance of the drive is confirmed. The SSD must meet or exceed the specifications that we publish. In this test phase, the drive is also put through an additional series of tests to ensure that it's compatible with all of the different chipsets, processors, operating systems, and motherboards that it will likely encounter.

ENVIRONMENTAL TESTING. Our engineers place the SSD in extreme environments and subject it to temperatures and voltages that meet our published specifications. The drive is also tested to ensure that it passes national and international regulatory standards.

MECHANICAL TESTING. Our engineers push the SSD to its mechanical limits where the drive undergoes HAST (highly accelerated stress testing), temperature cycling (accelerated testing), and extreme shock and vibration testing.

RELIABILITY TESTING. Our engineers ensure that the SSD functions reliably under typical operating conditions and extended test durations (where it's tested in an accelerated stress environment for more than 1,000 hours of continuous operation to predict reliability over the life of the drive).

ENDURANCE VALIDATION. Endurance tests ensure that the SSD meets or exceeds our advertised specifications for total bytes written (TBW) and data retention on the NAND.

Once the drive has passed these five qualification tests and the design of the SSD has been pushed beyond our advertised specifications, the qual is deemed fit for production and moves into the manufacturing process where our drives undergo further quality testing.

PART 2: SSD PRODUCTION TESTING

In the production phase, every SSD that we manufacture in-house undergoes three additional test sequences:

1. **Initial testing**
2. **Burn-in testing**
3. **Final testing**

INITIAL TESTING. Our custom firmware is loaded onto the drive to deliver optimal performance. The firmware then performs assembly tests to verify functionality with the drive. Once functionality has been confirmed, the drive goes through a more advanced form of testing called BIST (built-in self test) that compels the SSD to conduct a self-analysis to verify that it's operating according to its original design.

BURN-IN TESTING. The drive is auto-cycled to weed out infant mortality failures (the few SSDs in every batch that aren't able to perform up to our specifications). In this phase, bad data blocks are also identified and mapped on the drive so that the SSD can work around them. (Note: bad data blocks are present in nearly every NAND component. Because of this, we locate these bad data blocks in advance so that our drives can operate in the best possible manner.)

FINAL TESTING. The production firmware is confirmed and the SSD undergoes final functionality testing. Once this has been confirmed, the SSD is ready to be packaged.

In the eyes of almost any other company, the testing process might be over, but with Micron and Crucial SSDs we decided to take it a step further with Ongoing Reliability Testing. In every batch of drives that we manufacture, we select a sample and retest them one more time, just to be sure that they meet our advertised performance, reliability, and compatibility specifications. The result of our thousand-hour qual-to-SSD test process speaks for itself: our drives have become mainstays in the industry and have won numerous international awards.

While our SSD test process is notable in and of itself, it's only one part of our overall quality investment. With our multi-billion dollar commitment to NAND development, our record of patent and process innovation, and our award-winning customer support team, we're dedicated to quality. For you, this means two things: your SSD has been designed with cutting-edge technology and it's been rigorously tested and approved. Don't settle for anything less.

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