Hewlett Packard Enterprise

The driving force behind HDD quality, reliability, performance, and satisfaction

HPE hard disk drive quality process

Introduction

As your business attempts to keep pace with a geometric explosion of data, your IT landscape is changing at a breakneck pace. Now more than ever before, you face the ever-growing need to process and store massive amounts of structured data such as databases, as well as unstructured data such as Facebook and Twitter, in a cost-effective way—without sacrificing performance.

To meet your data storage needs, you can turn to Hewlett Packard Enterprise for help. HPE servers configured with HPE hard disk drives (HDDs) deliver proven performance and reliable data integrity at a low cost per gigabyte. Depending on your needs, you can choose from:

- **Enterprise-class HDDs** for mission-critical, high I/O workloads such as email, enterprise resource planning (ERP), and customer relationship management (CRM)—with capacities up to 1.8 TB, and growing

- **Midline HDDs** for high-capacity, high-availability storage—including backup, archive, and reference—with capacities up to 8 TB, and growing

- **Entry-level HDDs** for low I/O workloads—with capacities up to 4 TB, and growing

Before a new HPE HDD is delivered to customers, it must pass through HPE's Hard Disk Drive Qualification (HDDQ) process. As one of the most disciplined and well-structured processes in the industry, this time-proven methodology helps us drive continuous improvement of our current and future products—ensuring that each HPE HDD solution delivers the business outcomes you expect:

- Proven performance for any workload

- Unwavering reliability

- Outstanding cost-efficiency

HPE's HDDQ benefits suppliers

"The HDDQ initiative is one that provides a sustainable advantage for HPE through clearly defined qualification expectations and deliverables. This in turn drives our (the supplier) resource management process to ensure the correct level of human and equipment capital are in place to support HPE's time-to-market product launch."

– Seagate Technology, Inc.

HPE and our HDD suppliers work together for years before each new HDD solution is released. During that time, each new product must successfully pass through the four steps of the HPE HDDQ process:

1. Selection evaluation

2. Development validation

3. Supplier production qualification

4. Continuous improvement/performance monitoring

Before we examine each step of the HPE HDDQ process, let's take a few minutes to explore the process itself.

Process overview

Much more than a cursory review of a candidate HDD, the unique HPE HDDQ process includes approximately 50 procedures and specifications performed across several areas, including electrical, mechanical, and firmware. By defining comprehensive test sequences and criteria, HPE can help achieve enhanced HDD performance and reliability for the HPE applications running in your IT environment (see table 1).

Table 1. Disciplines and validation coverage in the HPE HDDQ process

Discipline	Validation sequence		
Electrical	Signal integrity	Power consumption	Noise injection
Electrical	Power variation	Electromagnetic interference (EMI)	Hot plug
Head/disk	Durability	Longevity	Storage
Mechanical	Operational shock	Non-operational shock	Vibration
Mechanical	Acoustics	Drive mounting analysis	Storage application mounting analysis
Quality and reliability	Large quantity in a defined sequence of events	Statistical analysis of results with projections	Over 2.5M drive hours
Firmware	Conformance to specifications	Configuration establishment	Operational stress conditions
Firmware	Performance	Reliability and robustness	Approximately 100,000 drive hours (typical)

Figure 1 illustrates the HPE HDDQ process architecture and the validation of the major functional disciplines of an HDDQ project, which can take place in parallel or run on their own schedules until the successful completion of the project.

HDDQ project
(Concurrent tasks and sequences iterating until complete with acceptable results)

| Electrical | ▶ | Head/disk | ▶ | Mechanical | ▶ | Quality and reliability | ▶ | Firmware |

Figure 1. Major functional disciplines of an HDDQ project

Selection evaluation focuses on:
- Understanding how an HDD meets the requirements defined by customer input
- Researching and developing product specifications
- Researching and developing potential sources
- Assessing the feasibility of new technologies
- Developing new technology

Development validation focuses on:
- Validating conformance to specifications
- Validating system compatibility
- Measuring initial product quality
- Measuring initial product reliability

Step 1: Selection evaluation

During selection evaluation, HPE receives early HDD prototypes from suppliers. After careful scrutiny of the prototypes—discovering how the new technology integrates with existing systems, how it conforms to specifications and requirements, and how it performs under typical workloads—HPE provides significant feedback to the HDD suppliers. By addressing the concerns raised during selection evaluation, HDD suppliers can deliver new technologies that closely match your needs and product requirements.

As part of the selection assessment, a core team of HPE technical and business managers assesses each HDD supplier's technology, product design, program plans, past track records, and manufacturing capabilities. Based on the assessment findings, the team chooses the best-fit supplier and product, and the product advances to step 2 of the HPE HDDQ process.

Step 2: Development validation

During this phase of the process, HPE's HDD development team and the HDD supplier work together to perform extensive tests on the HDD candidate, and complete exhaustive system integration sequences with the appropriate HPE applications. For example, candidate HDDs are tested with HPE host units, servers, and controllers to certify compatibility. In addition, approximately 1000 HDD units are run for at least two million test hours to prove reliability and performance.[1]

To promote the continuous improvement of existing HDD products as well as speed the development of new offerings, suppliers maintain dedicated HPE HDDQ labs equipped with approximately 300 HPE servers and storage units. This way, suppliers have the resources they need to successfully meet process requirements and boost HDD product quality.

HPE and suppliers often collaboratively design, implement, and subsequently prove HDD features or functions to provide the peak HDD end-products for use with HPE's applications, host products, and customer environments. Sample features and functions include:

- Performance enhancements for HPE storage arrays

- Storage management features

- Pre-failure warranty

- Cross-platform and legacy compatibility assurances

- Universal drive proofing

- Consistency and predictability across HPE HDD products in error recovery and exception case handling, which might be open to interpretation in industry standards

By working collaboratively, HPE and its suppliers can deliver targeted HDDs to market—enabling your business to capitalize on the latest HDD technology and remain one step ahead of your competition.

[1] Number of drives and hours apply to SCSI and SAS drives. Numbers for SATA drives vary.

Once an HDD candidate passes step 2, the product advances to the product validation phase and the supplier production qualification phase simultaneously. Supplier production qualification focuses on:

- Validating supplier process capability

- Validating supplier process controls

- Measuring product quality

Step 3: Supplier production qualification

To verify that an HDD product candidate can satisfy HPE's stringent quality requirements, each HDD supplier's production processes are carefully analyzed. This phase of the HPE HDDQ process—supplier production qualification—includes extensive review of the supplier's process controls, closed-loop corrective action processes, and overall system quality. The final stage of this phase includes a comprehensive analysis of the product's quality performance during an HPE configuration pilot.[2]

The qualification phase begins with a process design review, which pays particular attention to the lessons learned from previous-generation products. These lessons are then reviewed and verified so that corrective actions can be incorporated into the new product's processes.

Assessing the HDD supplier's process capabilities involves a weekly evaluation of HDD factory yields, post-process test data, corrective action, improvement plans, and much more. HPE also ensures that the HDD supplier follows comprehensive process control plans that enable real-time quality monitoring, corrective actions, and improvement at every process step.

Going one step further, HPE validates the HDD supplier's process capabilities and control plans through factory audits. These audits include an on-site resident international procurement organization (IPO) resource who assists with audits, problem identification, and issue resolution at the supplier's factory.

A critical component of supplier production qualification is the HPE configuration pilot, which involves building and testing SCSI and SAS HDDs into HPE configured option kits. The objective of the configuration pilot is to demonstrate that the HDD supplier's production volume can meet HPE's quality requirements. The configuration pilot requires 3000 to 4000 HDDs to fully demonstrate that HPE's quality requirements can be achieved. If a product fails to meet the configuration pilot criteria, it is modified as necessary, and then another configuration pilot is performed. This way, HPE can verify the effectiveness of corrective actions before the HDD is released to market.

[2] HPE configuration pilot requirements vary across hard drive interfaces.
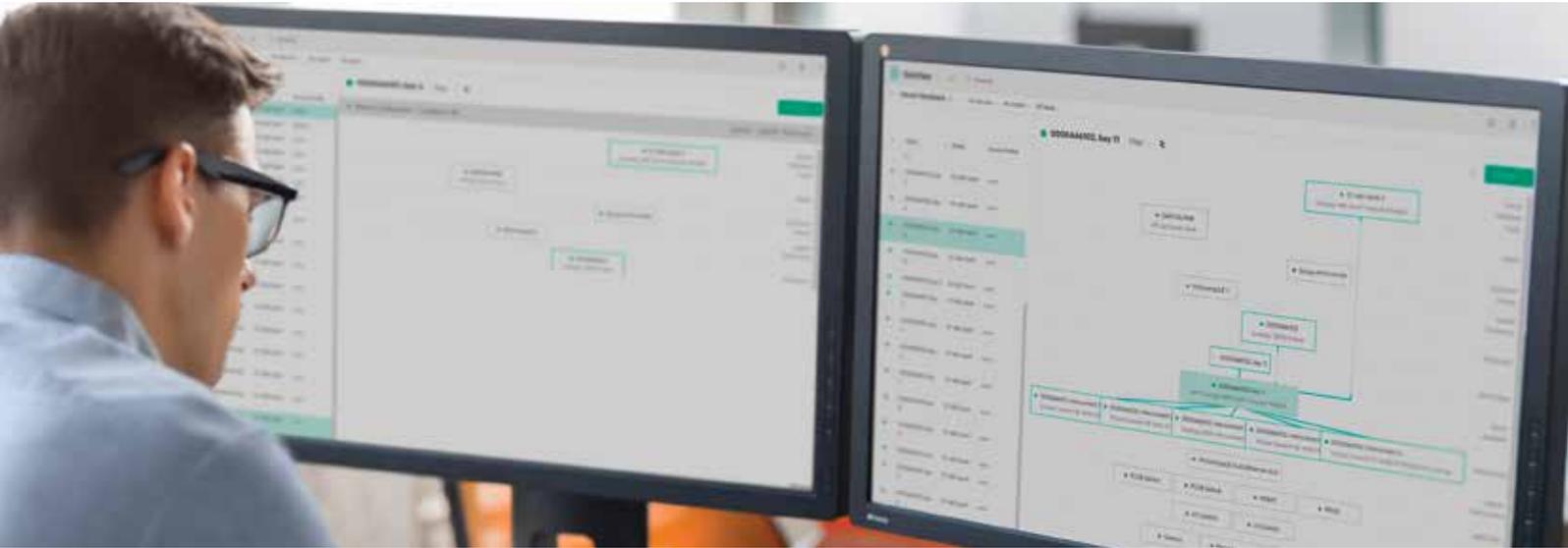
HDD products that pass the extensive HPE qualification process proceed to the continuous improvement/ performance monitoring phase, which occurs during volume production. This phase focuses on:

- Validating that volume production is in process control

- Measuring, analyzing, and reacting to product quality data

- Delivering continuous product improvements

Step 4: Continuous improvement/performance monitoring

During the continuous improvement phase, HPE and the HDD supplier execute the steps in the HPE HDD closed-loop quality process. To ensure that volume products meet HPE quality and reliability standards, we document each product's requirements and the procedures we follow in the HPE supplier management process (SMP) system.

Working together as a team, HPE and HDD suppliers monitor the performance of each product by following quality control methods at the supplier's factory and at the HPE option kitting configuration sites. Daily, weekly, and monthly, the team reviews product quality data, including:

- Supplier factory yields

- Paretos

- Critical process parameters

- Drive out-of-box audit of defective parts per million (DPPM)

- Ongoing reliability test results

- Field reliability performance

- Option kit out-of-box audit of DPPM[3]

- Option kit 36-hour extended quality audit test of DPPM[4]

The product's performance is measured against HPE established goals for quality metrics. Quality and reliability improvement plans are continuously worked between HPE and the HDD supplier to ensure quality metric goals are not only achieved, but exceeded.

Once an HDD enters the volume production phase, it is subject to ongoing change management. Each change request is reviewed by the HPE and supplier team, and then is validated through the HPE HDDQ process. The change management process helps ensure that a product change has no negative impact on product quality, reliability, system compatibility, or conformance to the specification.

[3, 4] This information applies only to SCSI and SAS hard drives.

Closed-loop quality system

What is a closed-loop system?
In a closed-loop control system, the behavior of a system is sensed, fed back to the controller, and mixed with the desired state of the system. This way, the actual behavior can be used to adjust the system to its desired state.

To ensure each HDD product meets HPE quality and reliability requirements, the HPE and supplier team follows a proven closed-loop process that includes multiple quality controls and monitoring systems. The controls alert the team to any "out-of-control" conditions or quality issues, enabling the team to contain nonconforming products and implement corrective actions immediately.

HPE's closed-loop quality process adheres to the HPE Eight-Discipline (8D) approach to problem solving. HPE follows the 8D process to resolve quality issues and customer-escalated problems, or whenever a corrective action is required. The HPE 8D approach is a proven way to understand the root cause of an issue so that we can prevent a recurrence in the future.

The HPE closed-loop quality process consists of the following three stages and their respective quality monitors (see figure 2):

- **Disk drive manufacturing**—Quality monitors include in-process critical process parameters, ongoing reliability testing, and post-process out-of-box audit testing.

- **HPE option kit configuration center**—Quality monitors include functional testing, post-process out-of-box audit testing, and post-process extended quality audit test (36-hour) functional testing (on some products).[5]

- **Customer field return analysis**—Quality monitors include root cause analysis of field returns.

HPE HDD Procurement Engineering
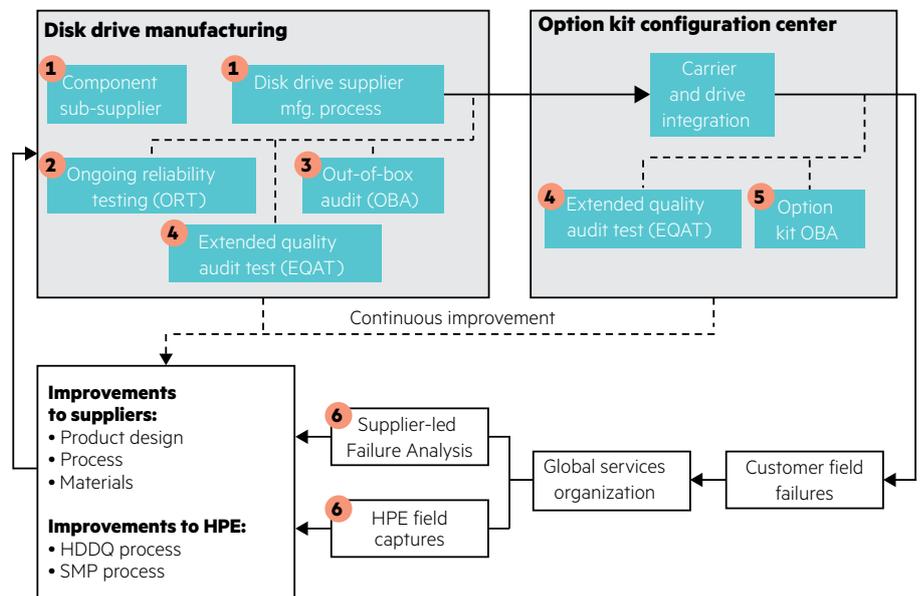Hard drive closed-loop quality system

Figure 2. HPE closed-loop quality process

Feedback mechanisms exist in each stage, enabling continuous improvement in the current and future products and processes—and that means better products for your business.

[5] This information applies only to SCSI and SAS hard drives.

Summary

To bring new HPE HDDs to market, each product candidate must meet the stringent requirements of the HPE HDD quality process. This process ensures that every new HDD product is reliable, meets your performance and efficiency requirements, and enters the market in a timely fashion. This four-step process enables you to receive products that have passed through one of the most disciplined and well-structured processes within the technology industry.

Steps in the HPE process include:

1. **Selection evaluation**—A new HDD prototype/candidate is thoroughly assessed

2. **Development validation**—Extensive tests are performed on the HDD candidate and exhaustive system integration sequences are completed with the appropriate HPE applications

3. **Supplier production qualification**—The HDD supplier's processes and procedures are scrutinized

4. **Continuous improvement/performance monitoring**—Feedback on actual HDD product behavior is used to improve current and future releases of the product

By working closely with HDD suppliers far in advance of product availability—as well as qualifying HDD technology during the above four-step process—HPE can provide technology feasibility and successful integration with your IT systems. This way, you receive the peace of mind you deserve, knowing that over 500 years of combined technical expertise works together to select, qualify, and support every HPE HDD product you purchase.

Learn more at
hpe.com/products/harddiskdrives

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