

Disk drive manufacturers move ahead with RFID-enabled media process line

The world's disk drive manufacturers are positioned at the heart of today's information-centric world. Throughout their history, disk drive manufacturers have successfully relied on a strategy of ownership and vertical integration of key underlying technologies. In the last several years, leading HDD manufacturers have used RFID systems to gain competitive advantage in their HGA and media manufacturing processes.

In order to respond quickly and intelligently to the rapid changes in the industry and to deliver new storage products rapidly to a price-sensitive consumer market, disk drive manufacturers are always looking to optimize their manufacturing operations and gain visibility into the internal supply chain often to achieve Six Sigma proficiency within manufacturing. This visibility additionally affords an improvement in current accountability of process tools, highlight process improvement opportunities, minimize manufacturing rework and automate line processes.

Increased profitability and supply chain efficiency

- Driving to improved production yields in a high-volume, mixed product manufacturing shop floor
- Sharing of real-time demand and production data to synchronize multiple production facilities

Improved quality: 6 Sigma quality control capability with measurable metrics.

Several HDD companies have implemented RFID WIP tracking solutions to track materials, processes, and equipment used in their HGA and media manufacturing processes. This provides detailed information about:

- Material consumption (raw in, WIP, finished out)
- Material containment (defects by process)
- Key process indicators (labor, run rates, WIP tracking)
- Movement of material (raw to WIP to finished good inventory) with verification

Maintaining a leading position in the highly competitive hi-tech manufacturing market demands continuous improvement within its manufacturing operations. Increasing production yield while reducing scrap has a direct impact on customer satisfaction by accelerating demand fulfillment capability and supporting competitive market pricing.

Problem Statement: Improve traceability and manufacturing yield

HDD manufacturing processes are complex and encompasses numerous steps that convert aluminum blanks into high density data storage media that are used in hard drives for instance. The manufacturing operations are performed in a Class 100 clean room environment with material flowing through harsh conditions than contain metal, liquid, magnetic materials.

Since manual handling of blank discs can cause production problems and reduce production yields, disk drive manufacturers use a custom designed carrier throughout manufacturing to reduce contamination and achieve process precision.

In order to achieve end-to-end manufacturing traceability, manufacturers require the disc carrier to flow through a controlled environment and capture the Work-In-Progress (WIP) information like lot number, cycle time between processes, carrier routing and resources used for every carrier under operation.

Drive manufacturers migrated from using paper travelers for WIP tracking to manual input terminals located throughout the process line. By using manual input traceability accuracy was often lost due to operator (human) input errors. Engineers later experimented with barcode technology but found the labels could not reliably survive the processing steps and barcodes being a read-only recording media fell short of meeting the read/write requirements. It was impacting production throughput and since the WIP data was not accessible in real-time; it led to delayed decision making.

Drive Manufacturers' Requirements

Media and other disk drive processes basic disk processes consist of many interrelated steps grouped into five major categories.

Disk drive manufacturers require that every carrier that goes through each station be validated against different manufacturing criteria to ensure that the right operation is being performed on the right lot, by the right tool and has the right pre-processing conditions. It needed these validations to be performed in real time at every station and record the results of the process conducted at the station in their factory information system prior to routing the carrier to the next operation.

An RFID-enabled WIP solution includes:

- RFID readers that communicate and control the tool operations
- RFID read/write tags that are embedded into the carrier and can handle harsh processing environments. These tags retain processing information that can be read easily among different plant locations and vendors.
- WIP application software that enables current processes with RFID and manage the WIP data between their enterprise systems and the factory floor operations

Common 'Pain Points'

Several 'pain points' exist in all complex manufacturing systems. The RFID enabled media and HGA carriers implemented by HDD manufacturers provide the real-time data or complete process traceability that lets managers resolve these 'pain points'.

1. Process bottlenecks. Real-time data from RFID enabled processes allow plant managers to know precisely where each bottleneck is and what the real capacity is at that point. This information is critical for efficient planning for capacity upgrades and daily manufacturing operations.
2. Quarantines. Minimizing the financial loss caused by process upsets, flawed raw incoming materials and even post sale recalls such as Dell Computer's recent 'exploding battery' recall. Having critical details of how every part is processed tucked safely away in a database can save huge amounts of money when these manufacturing crises occur.
3. Process optimization for yield. Often the final test yield/sort is the final arbiter of process yield. With detailed information on high yield parts processing history, processes can be 'tweaked', high/low yield process tools isolated and the continuous improvement programs moved forward. The process data stored in RFID enabled carriers provide the common thread tying final test yield back to each process step.
4. Mis-processing. Real-time automated decision making based on the data stored in each RFID enabled carrier prevents mis-processing at each decision point preventing lost product due to

mis-processing.