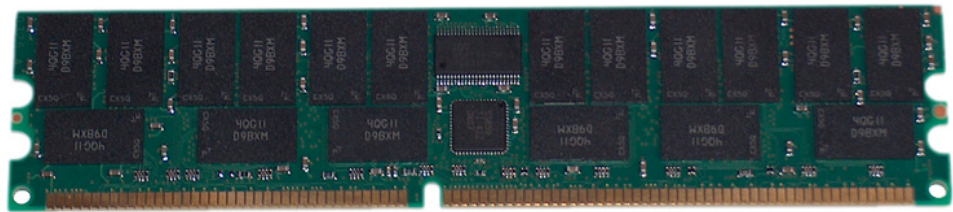


Why buy HP memory for HP workstations?



Overview.....	2
Isn't all memory the same?	2
More factors that affect memory performance.....	2
The HP memory solution	3
Why are HP components different?.....	4
HP memory tests.....	4
HP memory installation	5
HP support for memory issues.....	5
Failure with HP memory on-board	5
Failure with 3 rd party memory on-board	5
Conclusion.....	6
For more information	7

Overview

In the open market, there is a wide variety of available memory, much of it at budget prices. What is the advantage of buying memory and memory upgrades from HP? Why not get it cheaper from any one of the many memory manufacturers?

In this paper, we show you why purchasing HP memory for HP Workstations is a good business decision. These are the key points:

- Not all memory is the same, even when on paper it has identical specs. Non-HP memory may perform less effectively or may even fail when exposed to the demands of a high-end workstation motherboard even though the memory might be perfectly suitable for other consumer or business-type tasks.
- HP analyses and tests a variety of memory modules down to the individual component level. We will specify component part numbers to our memory manufacturers and even purchase memory parts for them to use, if we believe it necessary.
- Third party memory manufacturers can't test their memory on HP workstation as thoroughly as we do, and may not source their memory components with the same rigor regarding specific parts.
- Memory failure costs time and money and can harm workflow. We minimize the impact of this through our highly effective HP workstation warranty, which supports HP memory only, and typically will have your workstation functioning again within a single business day. It is likely your 3rd party memory manufacturer more than one day to replace the part after you have had to locate the fault.

We will look at some of the basic issues that affect memory performance, and then review how HP selects memory for performance and stability. It is the sum of these individual quality initiatives that yield our desired goal – a high quality Total Customer Experience.

The term “component” in this paper will typically refer to an individual memory chips on a DIMM.

Isn't all memory the same?

No! Aside from the obvious differences of latency, clockspeed, and density, memory can differ in a number of other significant ways, even apparently similar memory DIMMs that were packaged by the same manufacturer can behave quite differently depending on where they procure their components.

We can often see this difference in our labs. Memory components that meet JEDEC industry standards that the manufacturer reasonably thought would meet spec for HP workstations may, for example, turn out to draw too much power, which is a particular problem when configuring higher-density memory parts. In some cases, they can exceed the maximum amperage allowed on a memory rail. They may even run unacceptably hot, even to the point where temperature is so high that it could damage the memory itself and drive up the internal temperature of the system. A recent HP workstation qualification of 2 GB parts saw a test failure rate of 2 out of the 5 manufacturers we worked with. This memory might be quite suitable for other business or consumer tasks, but is not suitable for HP workstations. However, we do not know where else the components that made up this memory were deployed, it could be used in another 3rd party memory stick that non-HP vendors might recommend for use with our workstations.

The situation is complicated by the fact that we design our own motherboards to chipset vendor specs, and also to our own requirements. HP workstations are designed to be highly expandable and our motherboards can have complex and strict power requirements, to which each added part such as a CPU or a memory stick must conform.

Part of this is ensuring that the best memory parts are matched to the particular demands of a workstation.

More factors that affect memory performance

Knowing what memory to select becomes even more complex when we consider that a memory manufacturer will often buy the individual Integrated Circuit (IC) components that make up the memory they assemble and

package from different sources. The quality of these components can vary dramatically between manufacturers and even within the same IC wafer. It is impossible to ensure precise uniformity in the manufacturing of IC components.

A good example for this comes from the microprocessor manufacturers. When a wafer of processors is manufactured, there will actually be significant variance in the tolerance of individual processors on the wafer. Some will run faster and some may run slower or may not access all the cache. In the case of the former, these processors will become the high-end high clock speed processors. In the case of the latter they will become slower clocked, lower-end processors, or will have the non-functioning cache disabled and will become smaller-cache parts that are sold for less.

Memory parts are similar – some will be able to run at higher clock speeds and some will create more heat than others. A stick of memory is itself made up from individual components which may be sourced from other manufacturers. The memory manufacturer takes these components and mounts them on an integrated circuit board. Therefore, the characteristics of a stick of memory can be determined by the quality and the variability of its components.

This means that memory which might pass our tests the first time might later fail, if the memory manufacturer changes the source for its memory components. It would be impossible to be sure that later batches would consistently do so, if components are sourced from elsewhere.

Memory manufacturers can further affect quality by their choice of packaging; some will use gold-coated contacts, others will use aluminum or tin contacts. Some may save money with thinner electroplating of contact layers, but this might lead to seating or connection issues, especially if the plating is so thin that it can be degraded by friction contact caused by the vibrations that are typical during shipping. Thinner plating has also been shown to lead to corrosion failures over time.

The way memory chip components are attached to their printed circuit boards vary from manufacturer to manufacturer. Some use memory chip supports in the corners, others do not. We do not use memory without these supports.

Therefore, just as our customers demand product consistency from HP, we also demand material consistency from our suppliers.

Finally, the tolerances of parts change with time. ICs age due to dielectric breakdown, quantum effects on transistor gates (and the effects of these first two are exacerbated by higher voltages), low-humidity static discharge damage, corrosion, and so on. If they began life operating close to the edge of their tolerances then as their physical state changes, the chance of failure with age increases faster than if they were selected to have a more comfortable tolerance range. Even if 3rd party memory works right away, how sure are you that it will continue to work 2-3 years after installation? HP memory is designed to accommodate this drift.

The HP memory solution

To minimize the affects of component variance, HP will test a variety of memory modules from different component manufacturers down to a component level and then specify the individual component part numbers that a manufacturer must use when they are manufacturing memory for HP workstations. We are so committed to quality that in some cases, HP will purchase high quality memory components direct from the manufacturers and provide them to memory manufacturers for assembly.

The end result is that we avoid situations where memory that apparently meets spec on paper turns out to be unsuitable for HP workstation use, even though it may well be suitable for other workstations or for other purposes in the consumer or business space. We buy high quality memory components in bulk to ensure consistency, and when we buy from new sources, we retest the components to ensure they continue to meet our requirements.

As we have seen on a number of occasions, memory that a manufacturer thought would meet our requirements has been shown in our tests to draw an unacceptable amount of power or to run unusually hot.

Because we control the components of our memory, we can generally be sure that our memory will perform consistently. However, it is tough for memory manufacturers to make the same claims because they are unlikely

to have tested their memory components thoroughly on HP workstations and in some cases may not have access to the same memory components that HP has, even if the components have similar specs. Furthermore, they do not know the specific requirements of the HP motherboard; HP workstations often have unique requirements. One recent example is our memory duct hood on the HP xw9300, which we discovered through our exacting testing process is required to vent excess heat when running higher density large memory configurations. We ship this hood as standard with the HP xw9300. However, most 3rd party memory manufacturers would not be aware of this specific requirement and would sell you high density parts in good faith without awareness of any risk to system stability from high internal temperatures. As memory density increases and parts become higher and higher capacity, potential issues like this are likely to become more common.

We will provide feedback to our memory manufacturers on the performance of their memory during tests, and they may modify their own testing processes accordingly. We are also responsive to feedback from them – in one case we were informed of a manufacturing fault in a batch of memory that had not been previously detected by us or our memory manufacturer. Despite the fact that there had been no customer complaints, we still went ahead replaced the memory in the workstations that shipped with it at no cost to our customers.

Why are HP components different?

Every component inside an HP workstation has been certified as suitable following a battery of tests, including the memory. If a memory stick is failing it can create a variety of troublesome symptoms that can be hard to troubleshoot, as this thread on a hardware web site conclusively shows¹. Not only can information be irretrievably lost, also backups can become corrupted, and whoever provides IT support must then spend time trying to identify and troubleshoot the problem, unless they work directly with workstation support. Nevertheless, all of this costs time and money until the problem is identified and the component is replaced. Memory failures are critical failures, so it is very important that the chance of memory failure is minimized.

HP memory tests

HP qualifies its memory with a rigorous series of tests within our Materials Lab at our Fort Collins Workstation Division headquarters.

Our test criteria is to run with stability and within temperature tolerances and to meet the specific demands of an HP motherboard, which can be different from standard Intel or AMD spec boards. We also test the parts to ensure they continue to function outside our standard tolerances.

To pass HP qualification, a part must pass a suite of 14 memory tests, each repeated 168 times at different system temperatures, memory frequencies and voltage parameters. In each test point, some parameters are specifically assigned to ensure that we test within both normal and extreme tolerances. Others are randomly assigned. We know of no other supplier who tests memory as thoroughly in your HP workstation as HP does. This ensures that:

- Memory can operate within the power budget for a workstation:
 - Power consumed by memory ranges widely between manufacturers – our testing ensures that it stays within the workstation requirements
- Memory can operate within temperature limits for the specific machine:
 - Increased temperature means increased electrical and acoustical levels (cooling fans tend to run at higher RPMs in an attempt to disperse heat) and may even shorten component life.
 - Memory has been disqualified from workstation products because it ran so hot there was a danger that the DIMMs could actually be physically damaged.

HP requires that memory operates properly in HP test systems beyond product temperature, voltage and frequency specifications. We expect our memory to be able to sustain operations at:

¹ <http://macintouch.com/badram01.html>

- +5 % or -10% clock frequency – we have found this is a good balance to capture most potential problems.
- +/- 6% of supply voltage range
- Beyond product temperature specifications

If a problem occurs that we didn't find through our testing, we will still replace your memory if necessary. In 2005, we had to replace some customers' memory because of an issue our manufacturer identified. We did this proactively without any of these customers actually reporting any problem with their memory, and we did it transparently at no cost to them. Will your non-HP memory vendor do the same?

HP memory installation

HP installs its memory at the factory, and this is done in an electrostatically pristine environment. Once installed, the entire system is burned in for between 2 and 4 hours. The combined result of these two steps is reduction of Dead-On-Arrival systems and increased overall system reliability. The memory is likely to be installed on the motherboard before the motherboard is screwed into the case, lowering the chance of damaging the motherboard's integrated circuits (which is possible when seating memory when the motherboard is mounted on risers) and ensuring proper seating in the DIMM slots.

When you buy memory from a 3rd party, you or your IT staff are likely to be responsible for installing the memory, which increases the chance of IC and possibly electrostatic damage (unless the installer is wearing an anti-static wrist strap).

We have seen cases where memory chip components have been physically scraped off the DIMM stick due to improper insertion of DIMMs into the system. We have also seen cases where memory chip components have become partially detached from DIMMs.

HP support for memory issues

If a workstation fails due to a problem with memory, here's what happens when an HP service technician arrives on-site, and a failed memory part is suspected.

Failure with HP memory on-board

If all memory in the system is HP memory, the technician will use diagnostic programs to identify the failed part and will replace it. The total cost to the end user is nothing other than that incurred through downtime. The total downtime could be as little as 1 business day on the standard warranty.

If any other components were damaged by the failure and the system is within warranty, the HP technician will replace them without further cost to the customer. We will follow up with our memory vendor to ascertain the cause of the error and to ensure it is atypical.

Failure with 3rd party memory on-board

Although the system warranty is not voided, the field service procedures are different. The technician will just remove all the 3rd party memory and then run diagnostics using HP memory. If it appears that 3rd party memory is responsible for the failure, then the technician will return the 3rd party DIMMs to the customer and will send out a time and services bill. Assuming a one hour service call plus 30-minutes each way travel to the site, HP Field Service will charge \$352 for such an incident.

There is also likely to be additional down time to get the system back into production if the customer continues to use 3rd party memory. Following HP's determination that the 3rd party memory has failed, the customer has to call the 3rd party memory vendor, order the appropriate DIMM, wait at least one day for arrival, and then install and test the replacement part. This adds at least one day, perhaps two, to every outage.

Although 3rd party vendors do typically tend to offer a "lifetime warranty", it is worth finding out exactly what this means, and how valuable such a warranty really is. After all, you or your IT department may have to do the

system diagnostics to isolate which stick has failed and then return the stick to the manufacturer. This adds time and cost to troubleshooting.

Also, you should consider how long your workstation will be a front line system? In many cases, 3 years is a typical lifecycle for a business-critical workstation system before it is retired to a less demanding role.

Conclusion

Memory is a critical component in workstations but there is a lot of variability across different pieces of memory and in its sub-components. We test stringently to ensure memory compatibility, and if we introduce new memory options or if a manufacturer changes their memory, we will retest to ensure continued compatibility.

Below is a chart which summarizes various factors and costs a customer should consider when selecting memory. HP cares about product quality and end user productivity, and our memory strategy reflects our values. We believe that this strategy is what best helps our customers achieve their business goals and gives them reliable workstation systems.

Memory Characteristic	HP	3rd Party
Purchase, Installation and service		
Cost of extra PO to buy memory	Not required	?
Cost of shipping and receiving memory	Not required	?
Installation done by	HP	?
Cost of Installation	Covered by warranty	?
Consequential damage liability	Covered by warranty	?
HP Service charge if memory at fault	Covered by HP	?
Replacement parts stocked in field	yes	?
Cost to re-install uninstalled memory?	Not required	?
Cost of extra day of downtime?	NA	?
Quality, Performance, Reliability		
Percentile on quality curve	top 20%	?
2-4-hour burn in?	yes	?
Certified to work on HP workstation?	yes	no

Given these points, our memory can be more expensive than budget-class memory. However, a key reason for this is the same reason that you may be considering an HP workstation. Our main design consideration isn't just cutting costs at any price, it's ensuring that you have a truly professional tool which has been repeatedly tested to ensure stability, and has been engineered and enhanced to be as easy to use and update as possible. The additional cost of our memory helps ensure that we can continue developing and building world-class workstations.

HP workstations represent the high end of desktop computing. They are designed, tested and built for both high performance and extreme stability when running professional applications. Raw performance must also be accompanied by stability and reliability, or your workstation could become a production liability instead of an asset. Exceptional performance is meaningless if you suffer a system failure when you are working towards a deadline.

Of course, even very reliable systems sometimes fail. If this happens the next best outcome is fast problem identification and resolution, and HP workstations have an excellent reputation for fast and effective support.

For more information

www.hp.com/workstations