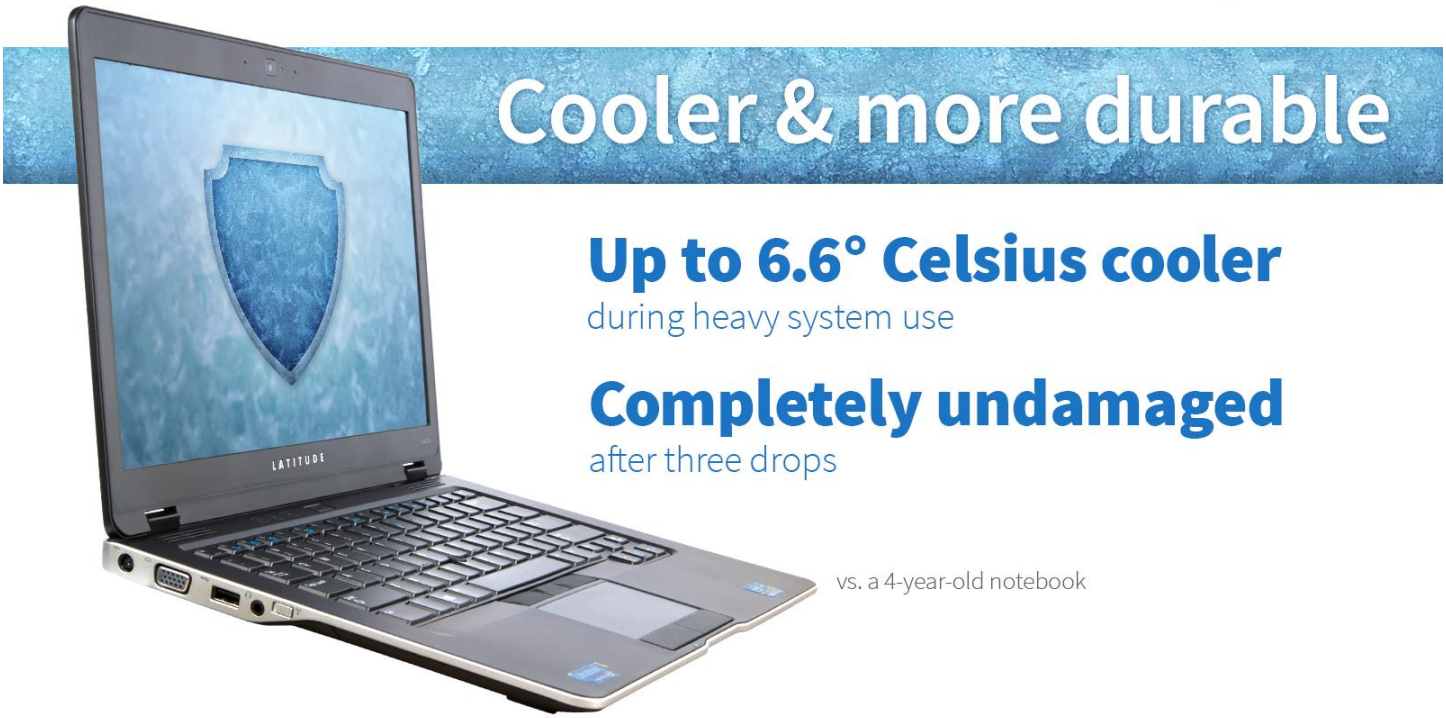
# PORTABLE SYSTEM DURABILITY: DELL LATITUDE 6430U ULTRABOOK VS. OLDER DELL LATITUDE NOTEBOOK




Replacing your four-year-old notebook with a new Dell Latitude 6430u Ultrabook™ can bring a number of advantages. In addition to extreme portability thanks to its sleek profile and light weight, you can enjoy cooler operating temperatures and better protection of data during an accidental fall.

Principled Technologies (PT) tested two Dell Latitude notebooks – the recently released Dell Latitude 6430u Ultrabook and an older notebook, the Dell Latitude E6400. First, we measured the surface temperature at several external locations and found that the Ultrabook ran cooler. Next, we repeatedly dropped both systems from a desk-high height of 29 inches and found that the Ultrabook survived the falls better, experiencing no physical damage to the case and no damage to data on its solid-state drive. These findings, along with the new Ultrabook's sleek and light profile, show that the Dell Latitude 6430u is an attractive choice for users seeking a durable system that provides a comfortable user experience.

MARCH 2013
A PRINCIPLED TECHNOLOGIES TEST REPORT
Commissioned by Dell Inc.

# COOL + STURDY = DURABLE

When investing in a portable computer, it's important to select one that will hold up over time. We tested the older Dell Latitude E6400 notebook and the new Dell Latitude 6430u Ultrabook with durability in mind. We measured the systems' operating temperature when under a heavy load and their ability to continue working—and protect data—after we dropped them from a height of 29 inches.

How warm the surface of a portable computer gets while in use is not only an important factor in user comfort—no one wants to hold a hot system on his or her lap—but contributes to its durability as well. It is well established within IT that high operating temperatures decrease hardware reliability. Excess heat can create problems for hard drives, CPUs, memory, and other components. For example, overheating can expand hard drive platters, causing the drive to fail. At the very least, excess heat will likely reduce the drive's effective operating life. According to a recent Fujitsu whitepaper, hard disk manufacturers now suggest cooler operating temperatures for drive enclosures.[1]

Many users fail to back up their data as often as they should, and a drive failure can mean not only costly replacement but the inconvenience of data loss as well. Inadequate ventilation and cooling isn't the only cause of damage to drives. Despite our best efforts to be careful, accidents do happen and portable systems occasionally take a tumble. Systems vary considerably in how well they can survive such an event.

To learn how the new Dell Latitude 6430u Ultrabook compares to an older Dell Latitude E6400 notebook in the area of durability, we conducted two sets of tests. In the first, we measured surface temperature while the systems were running an intensive workload. In the second, we dropped the systems multiple times under controlled circumstances. After each drop, we observed the system and used tools that assess hard drive damage to measure how well the system had protected its data. (For detailed configuration information on the two systems, see Appendix A. For a detailed description of the tests we conducted, see Appendix B.)

We found that the new Dell Latitude 6430u Ultrabook ran considerably cooler and protected its data better during the falls than the older notebook.

[1] http://www.fujitsu.com/downloads/COMP/fcpa/hdd/sata-mobile-ext-duty_wp.pdf

# WHAT WE FOUND

## Temperature

We measured the temperature of the systems at key spots, and found that the Dell Latitude 6430u Ultrabook ran considerably cooler. Figure 1 shows the difference in temperature between locations on the systems with which you commonly come into contact and ambient, or room, temperature during testing. (Because the ambient temperature varied throughout our testing, the temperature difference between the ambient temperature and the surface temperature we recorded for each system makes for the fairest comparison.)

| Surface temperature difference while under load (degrees above room temperature) | Dell Latitude E6400 notebook | Dell Latitude 6430u Ultrabook | Degrees cooler for Ultrabook |
|---|---|---|---|
| Left palm rest | 7.5°C (13.5°F) | 1.2°C (2.1°F) | 6.3°C (11.4°F) |
| Right palm rest | 7.0°C (12.5°F) | 0.4°C (0.6°F) | 6.6°C (11.9°F) |
| Underside HDD | 13.7°C (24.7°F) | 12.4°C (22.3°F) | 1.3°C (2.4°F) |
| Exhaust vent | 22.3°C (40.1°F) | 18.4°C (33.1°F) | 3.9°C (7.0°F) |

**Figure 1: Degrees above ambient temperature of key locations for the systems while under load.**

## Sturdiness

Our drop test measured the damage that a drop of 29 inches (73.7 cm) inflicts upon an open system running a workload. We dropped each system a maximum of three times onto a surface of low pile carpeting like that typically found in an office environment. After each drop, we ran HD Tune Pro 5.00 and HDDScan 3.3, tests that assesses hard drive damage, to measure how well the system had protected its data. Once a system failed to boot, we conducted no further testing on that system.

### Drop 1

After the first drop, both systems continued to run the workload. When our technician attempted to restart them, both successfully restarted. The two scans we conducted showed zero damage on the two systems' storage drives.

While the Ultrabook showed no physical damage at all, we observed moderate physical damage to the Dell Latitude E6400. The two sides of the lid separated, but our technician was able to put them back together. The screen of this notebook system remained intact.

### Drop 2

After the second drop, the new Dell Latitude 6430u Ultrabook continued to run the workload. The older Dell Latitude E6400 notebook, however, crashed, displayed a black warning screen and then rebooted back into Windows with a "shutdown unexpectedly" warning.

When our technician attempted to restart them, both successfully restarted. The two scans we conducted showed zero damage on the two systems' drives.

As was the case after the first drop, the Ultrabook showed no physical damage at all. In addition to the same moderate physical damage to the lid of the Dell Latitude E6400 that resulted from the first drop, we observed that this system's optical drive also popped open on impact.

### Drop 3

After the third drop, both systems continued to run the workload. When our technician attempted to restart them, both successfully restarted.

The two scans we conducted showed zero damage on the Dell Latitude 6430u Ultrabook's solid-state drive. However, the scans revealed slight damage on Dell Latitude E6400 notebook's hard disk drive. The HDTune scan on the reported 0.1 percent damaged blocks and one bad block appeared on the HDD Scan report.

As was the case after the first and second drops, the Ultrabook showed no physical damage at all. The Dell Latitude E6400 notebook experienced the same physical damage as on the first two drops, with the two sides of the lid separating and optical drive opening on impact.

Figure 2 shows the results of our hard drive scans. As it shows, both systems survived the first two drops with zero damage to the data on their drives. However, after the third drop, one block on the older notebook's hard drive had gone bad.

| Drop testing – physical data protection | Dell Latitude E6400 notebook | Dell Latitude 6430u Ultrabook |
|---|---|---|
| **Drop 1** | | |
| HD Tune Pro 5.00 damaged blocks percentage | 0% | 0% |
| HDDScan 3.3 bad blocks | 0 | 0 |
| **Drop 2** | | |
| HD Tune Pro 5.00 damaged blocks percentage | 0% | 0% |
| HDDScan 3.3 bad blocks | 0 | 0 |
| **Drop 3** | | |
| HD Tune Pro 5.00 damaged blocks percentage | 0.1% | 0% |
| HDDScan 3.3 bad blocks | 1 | 0 |

**Figure 2: The results of our physical data protection drop test for the systems.**

## IN CONCLUSION

No one wants to replace a portable system before its time because excessive heat has caused its components to stop working prematurely. Nor should you risk losing valuable data because of a moment of clumsiness. Investing in the Dell Latitude 6430u Ultrabook gives you not only a sleek, light system but also cooler operating temperatures and better durability to help avoid these scenarios.

In our tests, the Dell Latitude 6430u Ultrabook ran cooler and sustained less damage when dropped than the older Dell Latitude E6400 notebook. The proven durability of the Dell Latitude 6430u Ultrabook makes it an excellent choice to replace your older system.

# APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 3 provides detailed configuration information for the test systems.

| System | Dell Latitude E6400 notebook | Dell Latitude 6430u Ultrabook |
|---|---|---|
| **General** | | |
| Number of processor packages | 1 | 1 |
| Number of cores per processor | 2 | 2 |
| Number of hardware threads per core | 1 | 2 |
| Total number of processor threads in system | 2 | 4 |
| System power management policy | Balanced | Dell |
| Processor power-saving option | EIST | EIST |
| System dimensions (length x width x height) | 13.25" x 9.6" x 1.25"<br>33.7 cm x 24.4 cm x 3.2 cm | 13.31” x 9.04” x 0.82”<br>33.8 cm x 22.9 cm x 2.1 cm |
| System weight | 5.2 lbs.<br>2.4 Kg | 3.9 lbs.<br>1.8 Kg |
| **CPU** | | |
| Vendor | Intel® | Intel |
| Name | Core™ 2 Duo | Core i5 |
| Model number | P8600 | 3427U |
| Stepping | R0 | E1 |
| Socket type and number of pins | Socket P (478) | Socket 988B rPGA |
| Core frequency (GHz) | 2.40 | 1.8 (2.8 GHz Turbo Boost Technology) |
| Bus frequency | 1,066 MHz | DMI 5 GT/s |
| L1 cache | 32 KB + 32 KB (per core) | 32 KB + 32 KB (per core) |
| L2 cache | 3 MB (shared) | 512 KB (256 KB per core) |
| L3 cache | N/A | 3 MB (shared) |
| **Platform** | | |
| Vendor | Dell | Dell |
| Motherboard model number | 0U692R | 0WTRMG |
| Motherboard chipset | Intel GM45 | Intel QM77 |
| BIOS name and version | Dell A32 (02/09/2012) | Dell A03 (12/03/2012) |
| **Memory module(s)** | | |
| Vendor and model number | Hyundai Electronics HMP125S6EFR8C-S6 | Hyundai Electronics HMT351S6CFR8C-PB |
| Type | PC2-6400 | PC3-12800 |
| Speed (MHz) | 800 | 1600 |
| Speed running in the system (MHz) | 800 | 1600 |
| Timing/Latency (tCL-tRCD-tRP-tRASmin) | 6-6-6-18 | 11-11-11-28 |
| Size (MB) | 2,048 | 4,096 |
| Number of memory module(s) | 2 | 2 |
| Total amount of system RAM (GB) | 4 | 8 |
| Chip organization (single-sided/double-sided) | Double-sided | Double-sided |

| System | Dell Latitude E6400 notebook | Dell Latitude 6430u Ultrabook |
|---|---|---|
| Channel (single/dual) | Dual | Dual |
| **Storage** | | |
| Vendor and model number | Western Digital WD1600BJKT spindle HDD | LITEON LMT-128M3M solid-state drive |
| Number of disks in system | 1 | 1 |
| Size (GB) | 160 | 128 |
| Buffer size (MB) | 16 | NA |
| RPM | 7,200 | NA |
| Type | SATA 3.0 Gb/s | mSATA SSD |
| Controller | Intel ICH9M-E/M SATA AHCI Controller | Intel Mobile Express Chipset SATA RAID Controller |
| Driver | Intel 11.0.0.1032 (11/29/2011) | Intel 11.5.0.1207 (07/09/2012) |
| **Operating system** | | |
| Name | Microsoft Windows 7 Professional x64 | Microsoft Windows 8 Professional x64 |
| Build number | 7601 | 9200 |
| Service Pack | 1 | N/A |
| File system | NTFS | NTFS |
| Kernel | ACPI x64-based PC | ACPI x64-based PC |
| Language | English | English |
| Microsoft DirectX version | 11 | 11 |
| **Graphics** | | |
| Vendor and model number | Mobile Intel GMA 4500MHD | Intel HD Graphics 4000 |
| Type | Integrated | Integrated |
| Chipset | Mobile Intel 4 Series Express Chipset Family | Intel HD Graphics Family |
| BIOS version | 2107.23 | 0.3 |
| Total available graphics memory (MB) | 1,695 | 1,664 |
| Dedicated video memory (MB) | 64 | 32 |
| System video memory (MB) | 0 | 0 |
| Shared system memory (MB) | 1,631 | 1,632 |
| Resolution | 1,280 x 800 | 1,366 x 768 |
| Driver | Intel 8.15.10.2869 (10/04/2012) | Intel 9.17.10.2932 (12/12/2012) |
| **Sound card/subsystem** | | |
| Vendor and model number | IDT High Definition Audio CODEC | IDT High Definition Audio CODEC |
| Driver | IDT 6.10.0.6274 (03/09/2010) | IDT 6.10.0.6421 (08/09/2012) |
| **Ethernet** | | |
| Vendor and model number | Intel 82567LM Gigabit | Intel 82579LM Gigabit |
| Driver | Intel 10.0.6.0 (06/12/2009) | Intel 12.2.45.5031 (09/24/2012) |
| **Wireless** | | |
| Vendor and model number | Intel WiFi 5100 AGN | Intel Centrino Ultimate-N 6300 AGN |
| Driver | Intel 14.3.2.1 (01/22/2012) | Intel 15.5.6.48 (10/04/2012) |

| System | Dell Latitude E6400 notebook | Dell Latitude 6430u Ultrabook |
|---|---|---|
| **Modem** | | |
| Vendor and model number | HDA CX11270 Soft Modem | N/A |
| Driver | Microsoft 7.80.2.52 (11/15/2008) | N/A |
| **Optical drive(s)** | | |
| Vendor and model number | TSSTcorp TS-U633A | External models available |
| Type | DVD-RW | N/A |
| **USB ports** | | |
| Number | 4 | 3 |
| Type | 3 x USB 3.0, 1 x eSATA/USB 2.0 | 2 x USB 3.0, 1 x eSATA/USB 3.0 |
| Other | Media card reader, display port | Media card reader, HDMI, VGA |
| **IEEE 1394 ports** | | |
| Number | 1 (4-pin) | 0 |
| **Monitor** | | |
| LCD type | WXGA | WLED |
| Screen size | 14.1” | 14.0” |
| Refresh rate | 60 Hz | 60 Hz |
| **Battery** | | |
| Type | Dell PT434 lithium-ion | Dell 9KGF8 lithium-ion |
| Size (length x width x height) | 8.25" x 2" x .80"<br>20.9 cm x 5.1 cm x 2.0 cm | 13.19” x 4.38” x 0.5”<br>33.5 cm x 11.1 cm x 1.3 cm |
| Rated capacity | 5050 mAh / 11.1V (56Wh) | 5400 mAh / 11.1V (60Wh) |
| Weight | 11 oz.<br>0.31 Kg | 1 lb.<br>0.45 Kg |

**Figure 3: System configuration information for the test systems.**

# APPENDIX B - HOW WE TESTED

## Measuring surface temperature

### Measuring system temperature while running PassMark's BurnInTest Professional v7.0

#### *Test requirements*

- Fluke 2680A Data Acquisition System
- PassMark BurnInTest Professional

#### *Setting up the system*

1. Set the power plan to the manufacturer's default setting.
2. Set the display brightness to 100 percent:
   a. Click Start.
   b. In the Start menu's quick search field, type `Power Options`.
   c. Move the Screen brightness slider all the way to the right.
3. Set the remaining power plan settings as follows:
   - Dim the display: Never
   - Turn off the display: Never
   - Put the computer to sleep: Never
4. Disable the screen saver.
5. Plug the AC adapter into the system, and completely charge the battery.
6. Place the system in a windowless, climate-controlled room.
7. Attach a Type T thermocouple to the system at the three locations noted in Appendix C.
8. Configure the Fluke® 2680A Data Acquisition System to take measurements from the three surface temperature probes and one ambient temperature probe using the Fluke DAQ software.
   a. Connect the three Type T thermocouples to three channels in the Fluke Fast Analog Input module (FAI).
   b. In the Fluke DAQ software, click each surface temperature channel, select Thermocouple from the list of Functions, and choose T from the list of ranges.
   c. Label each channel with the surface location associated with each thermocouple.
   d. In the Fluke DAQ software, click the ambient temperature channel, select Thermocouple from the list of Functions, and choose F from the list of ranges.
   e. Label this channel Ambient.
9. While running each test, use a Fluke 2680A Data Acquisition System to monitor ambient and surface temperature.

### Measuring system temperature while running PassMark's BurnInTest Professional v7.0

#### *Setting up the test*

1. Download PassMark's BurnInTest Professional 7.0 from http://www.passmark.com/products/bit.htm.
2. Double-click bitpro_x64.exe to run setup.
3. At the Welcome screen, click Next.
4. Accept the license agreement, and click Next.
5. At the Choose Install Location screen, accept the default location of C:\Program Files\BurnInTest, and click Next.
6. At the Select Start Menu Folder screen, click Next.
7. At the Ready to Install screen, click Install.
8. At the Completing the BurnInTest Setup Wizard screen, deselect View Readme.txt, and click Finish to launch BurnInTest.
9. At the Purchasing information screen, copy and paste the Username and key, and click Continue.
10. At the Key accepted screen, click OK.
11. Select Test selection and duty cycles from the Configuration menu item.
12. Select CPU, 2D Graphics, 3D Graphics, and Disk(s), and deselect all other subsystems.
13. Set load to 100, and click OK.

14. Select Test Preferences from the Configuration menu item and set or verify the following by clicking on each tab:
    a. Disk: select C: drive
    b. Logging: select Turn automatic logging on
    c. 2D Graphics: select All available Video Memory
    d. 3D Graphics: use defaults
    e. CPU: use defaults

***Running the test***

1. Boot the system and launch PassMark's BurnInTest by double-clicking the desktop icon.
2. Bring up an elevated command prompt:
    a. Select Windows Start orb.
    b. Type `cmd` and press Control-Shift-Enter.
3. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
   Do not interact with the system until the command completes.
4. After the command completes, wait 5 minutes before running the test.
5. Simultaneously click Start Selected Tests in the BurnInTest V7.0 Pro screen and start the Fluke 2680A data logger using the Fluke DAQ software.
6. At 55 minutes, take the following images of the workstation with a FLIR i7 thermal imaging camera.
    - Front – keyboard and display
    - Underside and back of display
7. Stop the Fluke 2680A data logger using the Fluke DAQ software at 60 minutes.
8. Use the thermal measurement CSV file to find and report the highest temperature measured at each location during the test.
9. Power the system off for 1 hour, and allow it to return to room temperature.
10. Repeat the steps 2 through 9 two more times.

## Testing sturdiness

This test measures the damage a drop of 29 inches (73.7 cm) onto a carpeted surface inflicts upon an open system running MAXON® CINEBENCH 11.5.

### Setting up CINEBENCH R11.5

1. Download CINEBENCH 11.5 from http://www.maxon.net/downloads/cinebench.html.
2. Install CINEBENCH:
    a. Right-click the CINEBENCH ZIP file, and choose Extract All.
    b. In the Select a Destination and Extract Files window, click Browse, click Desktop, and click OK.
    c. Click Extract.

### Running CINEBENCH 11.5

1. Launch CINEBENCH 11.5 by double-clicking the CINEBENCH 11.5.exe file in the CINEBENCH 11.5 folder.
2. Enter the MHz frequency of the processor in the MHz (real freq.) field.
3. Click Start all tests.

### Conducting the drop test

We used a Lansmont PDT56ED Precision Drop Tester, with a landing area covered by commercial carpet. We opened the system so that the screen and keyboard formed a 120-degree angle, and then placed the system flat on the platen. Orienting the system in this way resulted in a flat drop. (Figure 4 shows our test setup.)

To allow us to scan the systems identically, we booted to a Hiren's BootCD and installed the hard disk scanning software to the Microsoft® Windows® 7 virtual machine's RAM disk. Running the scanning software from RAM, we scanned the hard disk with HD Tune Pro 5.00 and HDDScan for Windows 3.3, and recorded the number of bad sectors and blocks before and after the drop test. We also recorded any other physical defects, such as cracks or breaks in the display, as well as separated hinges or displaced screws, which the impact of the drop caused. We took still photographs of the systems before and after each drop. We dropped each system once, using this process:

1. Install MAXON CINEBENCH 11.5 onto the test system, as outlined above.
2. Run EFD Software's HD Tune Pro 5.00 and HDDScan 3.3 to get baseline data on the state of the hard disk. Boot the system using a Hiren's BootCD.
   a. Install HD Tune Pro 5.00:
      i. Insert a USB flash drive containing the HD Tune Pro installation executable, and click once on My Computer.
      ii. Navigate to the USB drive, and double-click the hdtunepro_500_trial.exe installation file to install the application.
      iii. At the welcome screen, click Next.
      iv. Click the I accept the agreement radio button, and click Next.
      v. In the Select Destination Location window, click Browse.
      vi. Click the RAMDisk drive once to select it, and click OK.
      vii. Click Next in the next two windows.
      viii. Leave check box empty for Create a desktop icon, and click Next.
      ix. Click Install.
      x. Leave the check box checked for Launch HD Tune Pro, and click Finish.
   b. Run the HD Tune Pro 5.00 Error Scan:
      i. Select the Error Scan tab.
      ii. Click Start in the right hand pane.

      **Note**: The Error Scan is complete when the Start button changes from grey to black.
   c. Save the Error Scan Results.
   d. Click the Copy information to clipboard button on the upper right hand menu bar (it is the first button on the left):
      i. Open a new text file by clicking Start→Run, typing `notepad`, and clicking OK.
      ii. In the Notepad window, click Edit→Paste.
      iii. Click File→Save As, enter an appropriate filename using a `.txt` extension, and choose the location to save the file (we saved ours to a USB flash drive). Click Save.
   e. Close the HD Tune Pro 5.00 Hard Disk Utility.
   f. Scan the system's hard drive with HDDScan for Windows version 3.3:
      i. Open the HDDScan folder, and double-click the HDDScan.exe executable file to run the application.

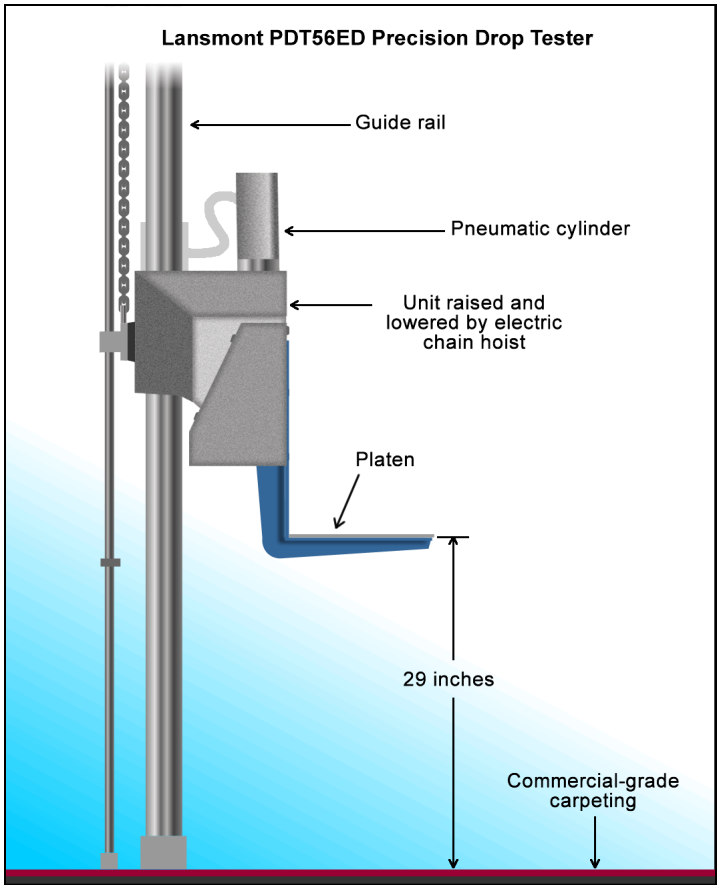



**Figure 4: Our physical data protection test setup.**

ii. Click Tasks→Surface Tests to open the Test Selection window.
iii. Select Verify from the list of tests, and click Add Test.
iv. At the conclusion of the run, double-click the VR-Verify test id in the Test Manager window to open up the results.
v. Select the Report tab, and copy and paste the test results into Notepad.
vi. Save the results as a text file.

3. Set the height of the platen on the Lansmont Precision Drop Tester to 29 inches (73.7 cm) above the surface of the 28-ounce commercial carpeting.
4. Place the fully charged system onto the platen of the drop tester, with the system's base flat on the platen and the screen facing forward, open at a 120-degree angle.
5. Launch CINEBENCH.
6. Unplug the system, and drop the system onto the commercial carpeting.
7. Wait until the system is completely still.
8. If the battery or any other components come off the system, inspect them for damage, and reinstall them if possible.
9. Take digital pictures of the system from all angles after completing the checklist.
10. Stop CINEBENCH.
11. Reconnect the system's AC adapter.
12. Run HD Tune Pro 5.00 and HDD Scan 3.3 using the process in Step 2, and record the results as the system's post-test disk status.

# APPENDIX C – SCHEMATIC OF THE SYSTEMS FOR TEMPERATURE READINGS

Figure 5 presents a schematic of the systems that shows the points where we measured the surface temperature. For underside surface temperature, we record and present the highest temperature found on the underside of each system.

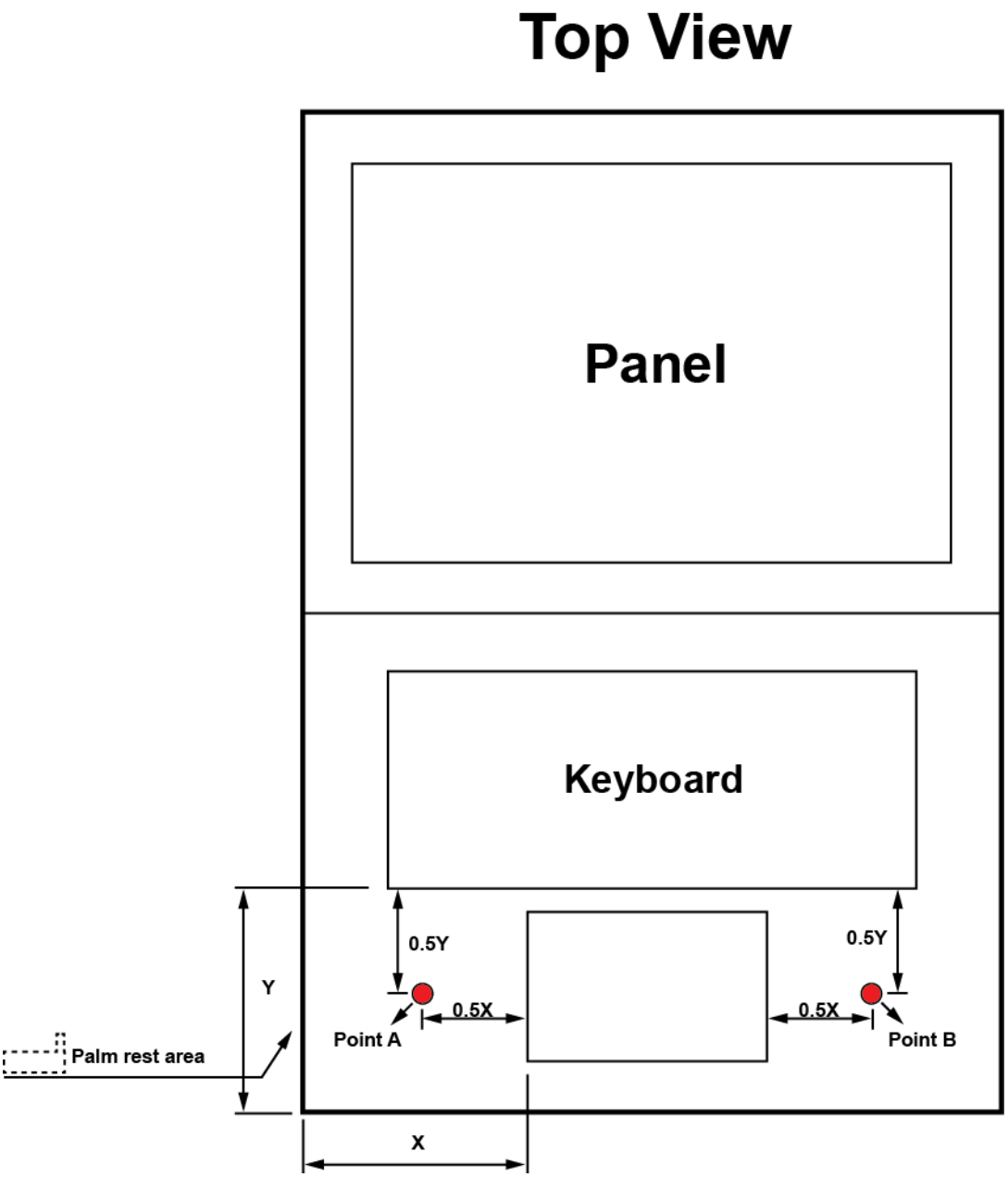



**Figure 5: Points where we measured the surface temperature on the systems. We also measured the temperature of the hottest spot on the underside of each system.**

# ABOUT PRINCIPLED TECHNOLOGIES

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We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

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Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.