



The science behind the report:

Get in and stay in the productivity zone with the HP Z2 G9 Tower Workstation

This document describes what we tested, how we tested, and what we found. To learn how these facts translate into real-world benefits, read the report [Get in and stay in the productivity zone with the HP Z2 G9 Tower Workstation](#).

We concluded our hands-on testing on January 29, 2024. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on January 4, 2024 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

Our results

To learn more about how we have calculated the wins in this report, go to <http://facts.pt/calculating-and-highlighting-wins>. Unless we state otherwise, we have followed the rules and principles we outline in that document.

Table 1: Results of our benchmark testing. We ran each test three times and report the median result. Higher benchmark scores are better and less time is better.

	Z2 G9 Tower Workstation	Precision 3660 Tower Workstation	Precision 5860 Tower Workstation
Cinebench 2024 Higher is better			
Multi-Core	1,571	1,469	1,261
SPECapc Solidworks Higher is better			
Composite CPU Score	2.64	2.57	1.44
CPU Raytrace	5.11	4.22	3.89
CPU Rebuild	2.22	2.29	1.00
CPU Convert	2.10	2.20	1.34
CPU Simulate	1.97	2.05	1.41
CPU Mass Properties	2.24	2.24	0.56
CPU Boolean	1.94	1.91	0.74

SPECapc Maya 2024 Higher is better			
CPU Composite Score	7.92	6.62	6.35
CPU Arnold Raytrace	7.92	6.62	6.35
Evaluation Cache Composite	3.52	3.03	2.90
Animation Playback on CPU, Evaluation Cache Disabled	3.97	3.25	3.33
Animation Playback on CPU, Evaluation Cache Enabled	3.12	2.82	2.53
SPECworkstation 3.1 Higher is better			
Financial Services Score	5.83	6.49	3.87
Convolution Score	14.22	13.79	14.09
Revit 2024 RFO BenchmarkFull Standard Lower is better			
Model creation benchmark	65.38	62.11	176.92
Render benchmark	22.48	28.56	47.69
GraphicsStandard view	18.91	18.13	41.68
GeekBench 6 pro Higher is better			
Multi-Core	18,091	18,141	13,244
Single-Core	2,917	2,915	2,171
Blender Benchmark using CPU rendering Higher is better			
Overall Score	384.09	357.47	315.69
Sub-score: Monster	186.16	177.35	143.29
Sub-score: Junkshop	115.15	106.09	96.78
Sub-score: Classroom	82.77	74.01	75.60
PugetBench for After Effects Higher is better			
Overall Score	1,243	1,244	804
Multi-Core Score	236.8	197.2	157.5
GPU Score	95.0	102.2	62.8
RAM Preview Score	128.3	129.8	79.9
Render Score	124.2	122.5	90.7
Tracking Score	116.4	117.4	60.8

Table 2: The average sound levels, in decibels, we recorded while running CPU-intensive benchmark workloads. Note that the room noise without any workstation running was 23.3 decibels. Lower is better.

	Z2 G9 Tower Workstation	Precision 3660 Tower Workstation	Precision 5860 Tower Workstation
Cinebench 2024 Acoustic Testing <i>Lower is better</i>			
Room (dBA) - Baseline no systems measurement	23.2	23.2	23.2
System under Load	26.7	27.2	29.9
DdBA from Room - System under Load	3.5	4.0	6.7
SPECapc Solidworks 2022 Acoustic Testing <i>Lower is better</i>			
Room (dBA) - Baseline no systems measurement	23.2	23.2	23.2
System under Load	27.1	29.2	28.1
DdBA from Room - System under Load	3.9	6.0	4.9

System configuration information

Table 3: Detailed information on the systems we tested.

System configuration information	HP Z2 Tower G9 Workstation	Dell Precision 3660 Tower Workstation	Dell Precision 5860 Tower Workstation
Processor			
Vendor	Intel®	Intel	Intel
Model number	Core™ i9-13900	Core i9-13900	Xeon® w5-2455X
Core frequency (GHz)	2.0 – 5.6	2.0 – 5.6	3.2 – 4.6
Number of cores	24	24	12
Logical processors	32	32	24
Memory			
Amount (GB)	64 (4 x 16)	64 (4 x 16)	64 (2 x 32)
Type	DDR5-4800	DDR5-4800	DDR5-4800
Clock speed (MHz)	4000	4000	4800
Integrated Graphics #1			
Vendor	Intel	Intel	NA
Model number	Intel UHD Graphics 770	Intel UHD Graphics 770	NA
Discrete Graphics #2			
Vendor	NVIDIA®	NVIDIA	NVIDIA
Model number	RTX™ A5000	RTX A5000	RTX A5500
Driver	NVIDIA v31.0.15.3799	NVIDIA v31.0.15.3799	NVIDIA v31.0.15.3799
Storage			
Vendor/Model	Micron® MTFDKBA1T0TFH-1BC1AABHA	Kioxia KXG80ZNV1T02	Western Digital SN810
Amount (TB)	1	1	1
Type	NVMe SSD	NVMe SSD	NVMe SSD
Connectivity/expansion			
Ethernet	Intel I219-LM	Intel I219-LM	Intel I219-LM Intel I225-T1 Qualcomm WCN685x Wi-Fi 6E
External I/O Ports (Front)	4 x SuperSpeed USB Type-A 10Gbps signaling rate (1 charging) 1 x universal audio jack	1 x Audio-mic combo (3.5mm) jack 2 x USB 3.2 Type-A Gen 1 (5Gbps) 1 x USB 3.2 Type-C Gen2 (10Gbps) data only 1 x USB 3.2 Type-C Gen 2x2 (20Gbps) data only 1 x SD Card Reader 4.0	1 x Universal Audio Jack 2 x USB 3.2 Gen1 (5Gb/s) Type-A 2 x USB 3.2 Gen 2 (10Gb/s) Type-C 1 x SD card reader

System configuration information	HP Z2 Tower G9 Workstation	Dell Precision 3660 Tower Workstation	Dell Precision 5860 Tower Workstation
External I/O Ports (Rear)	1 x audio-in 1 x audio-out 1 x RJ-45 2 x DisplayPort 1.4 2 x SuperSpeed USB Type-A 10Gbps signaling rate 1 x SuperSpeed USB Type-A 5Gbps signaling rate 3 x USB Type-A 480Mbps signaling rate	1 x Audio out (3.5mm jack) 2 x DisplayPort 1.4 2 x USB 3.2 Type-C Gen2 (10Gbps) with power delivery 2 x USB 3.2 Type-A Gen2 (10Gbps) 2 x USB 2.0 Type-A 1 x RJ45	1 x Line out 1 x RJ45 (1Gb) 1 x RJ45 (10Gb) 3 x USB 3.2 Gen 1 (5Gb/s) Type-A 3 x USB3.2 Gen 2 (10Gb/s) Type-C
Operating system			
Vendor	Microsoft	Microsoft	Microsoft
Name	Windows 11 Pro	Windows 11 Pro	Windows 11 Pro for Workstations
Version	23H2 Build 22631.2861	23H2 Build 22631.2861	23H2 Build 22631.2861
BIOS			
BIOS name and version	HP U50 v02.04.02 (11/6/2023)	Dell v2.10.1 (11/24/2023)	Dell v1.1.14 (12/1/2023)

How we tested

Setting up and updating the OEM image

1. Boot the system.
2. To complete installation, follow the on-screen instructions, using the default selections when appropriate.
3. Set Screen and Sleep options to Never:
 - a. Right-click desktop, and select Display settings.
 - b. From the left column, select System.
 - c. Click Power & Battery.
 - d. For all power options listed under Screen and Sleep, select Never.
4. Disable User Account Control notifications:
 - a. Select Windows Start, type UAC, and press Enter.
 - b. Move the slider control to Never notify, and click OK.
5. Run Windows Update, and install all updates available.
6. Run the OEM specific update utility.
 - For HP, run the HP Support Assistant, and install all HP updates available.
 - For Dell, run the Dell Command Utility, and install all Dell updates available.
7. Download and install the latest graphics driver from www.nvidia.com.
8. Verify the date and time are correct, and synchronize the system clock with the time server.
9. Pause Automatic Windows Updates:
 - a. Click the Windows Start button.
 - b. Type Windows Update settings and press Enter.
 - c. From the Pause updates drop-down menu, select Pause for 5 weeks.

Capturing an image

1. Connect an external HDD to the system.
2. Click the Windows Menu button
3. In the search bar, type Control Panel.
4. Click Control Panel→System and Security→Backup and Restore (Windows 7)→Create a system image.
5. Verify that the external HDD is selected as the save drive, and click Next.
6. Verify that all drives are selected to back up, and click Next.
7. Click Start backup.
8. At Do you want to create a system repair disc, select No, and close the dialogs.

Restoring an image

1. Connect an external HDD to the system.
2. While restarting the system, press and hold Shift.
3. Select Troubleshoot.
4. Select Advanced options.
5. Select See more recovery options.
6. Select System image recovery.
7. Select the User account.
8. Enter the system password, and click Continue.
9. At the Restore system files and settings screen, select Next.
10. Verify that the external HDD is selected, and click Next.
11. Once the recovery has completed, click Finish.

Benchmark testing

Once every 24-hour period before any testing begins for that day, to prevent possible interference during benchmark testing, perform the following tasks:

1. Run a full virus scan.
 - Select Windows Start.
 - Type `Windows Security` and press Enter.
 - Select Virus & threat protection.
 - Click Scan options.
 - Select Full scan, and click Scan now.
 - Wait for the virus scan to fully finish before moving to the next step below.
2. Run the `ProcessIdleTasks` command.
 - Select Windows Start.
 - Type `cmd` and press Ctrl+Shift+Enter.
 - Type `cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
 - After the command completes, wait 5 minutes before running the test.

Cinebench 2024

Setting up the test

1. Download and install Cinebench 2024 from <https://www.maxon.net/en/downloads/cinebench-2024-downloads>
2. Launch Cinebench 2024.
3. Select File→Advanced benchmark.
4. From the Minimum Test Duration drop-down menu, select Off.

Running the test

1. Launch Cinebench 2024.
2. Click CPU (multi-core) Start.
3. Record the result.
4. Wait 5 minutes before re-running.
5. Repeat steps 1 through 4 two more times.

Geekbench 6 Pro

Setting up the test

1. Purchase a Pro license, and download and install Geekbench 6 Pro from <https://www.geekbench.com/download/>.

Running the test

1. Launch Geekbench.
2. Click Run CPU Benchmark.
3. Record the result.
4. Wait 5 minutes before re-running.
5. Repeat steps 1 through 4 two more times.

PugetBench for After Effects

We used the following application:

- Adobe After Effects

Setting up the test

1. Launch Adobe After Effects.
2. Click through the Tutorial pop-up tips.
3. Close Adobe After Effects.
4. Purchase and download the PugetBench for After Effects license from <https://www.pugetsystems.com/labs/articles/PugetBench-for-Adobe-Creative-Cloud-1642/>.
5. Click Get on Adobe Marketplace, and log into your Adobe account.
6. To install, click the PugetBench After Effects Plug-in.
7. Open Adobe After Effects.
8. Click Edit→Preferences→Scripting & Expressions.
9. Select Allow Scripts to Write Files and Access Network, and click OK.
10. Click Edit→Preferences→Memory & Performance.
11. The benchmark requires After Effects to have 12 GB of RAM space. Adjust the RAM reserved for other applications to get to 12 GB of RAM reserved for After Effects, and click OK.
12. Click Composition→New Composition.
13. Accept the default Composition Settings, and click OK.
14. Click Composition→Preview, and uncheck Cache Frames When Idle.
15. Click Window→Extensions→PugetBench for After Effects.
16. Next to License Key, click Change, enter your license key, and click Save.

Running the test

1. Open Adobe After Effects.
2. Click Window→Extensions→PugetBench for After Effects.
3. Click Run Benchmark.
4. When the benchmark finishes, record the overall score.
5. Close Adobe Photoshop, and restart the system under test.
6. Wait 30 minutes before performing the next run.
7. Repeat steps 1 through 6 two more times.

Blender benchmark

Setting up the test

1. Download the Blender Benchmark from <https://opendata.blender.org/>.

Running the test

1. Launch the Blender Benchmark.
2. At the Welcome screen, click Next.
3. Select Blender version 4.0, and click Next.
4. At the Benchmark Scenes screen, click Next.
5. At the Benchmark Device screen, select the CPU option, and click Start Benchmark.
6. When the benchmark finishes, record the samples per minute results for the Monster, Junkshop, and Classroom renders.
7. Click Submit results, and record the Overall score.
8. Wait 15 minutes before performing the next run.
9. Repeat steps 1 through 8 two more times.

Revit 2024 RFO benchmark

Setting up the test

1. Download and install Revit 2024 from <https://www.autodesk.com/products/revit/free-trial>.
2. Launch Revit 2024, and sign in with the account information.
3. At the Tutorial screen, click Don't show this again.
4. Close Revit 2024.
5. Download the Revit 2024 RFO Benchmark Tool from <https://www.revitforum.org/forum/revit-all-flavors/hardware-and-infrastructure/36875-rfo-benchmark-v3>.
6. Extract the Revit 2024 RFO Benchmark Tool.

Running the test

1. Open the Extracted Revit 2024 RFO Benchmark Tool directory.
2. To launch the benchmark, click _RFO Benchmark – Full_Standard shortcut.
3. When the benchmark finishes, record the results.
4. Wait 15 minutes before performing the next run.
5. Repeat steps 1 through 4 two more times.

SPECworkstation 3.1 (Financial Services workload)

Setting up the test

1. Go to <https://www.spec.org/gwpg/wpc.static/workstation3-info.html>, purchase the benchmark, and download the vendor license.
2. Unzip the SPECworkstation_3.1.zip file to C:\.
3. To install the benchmark, navigate to the extracted SPECworkstation_3.1 directory, and click SPECworkstation_3.1.exe.
4. Set the DPI scaling to 100%.
 - a. Right-click the desktop, and select Display settings.
 - b. From the Scale drop-down menu, select 100%.
5. Shut down the system.

Running the test

1. Launch SPECworkstation.
2. Next to Financial Services, check the box.
3. Click Run Benchmark.
4. When the test is complete, record the results.
5. Repeat steps 1 through 4 two more times.

SPECworkstation 3.1 (Convolution workload)

Setting up the test

1. Go to <https://www.spec.org/gwpg/wpc.static/workstation3-info.html>, purchase the benchmark, and download the vendor license.
2. Unzip the SPECworkstation_3.1.zip file to C:\.
3. To install the benchmark, navigate to the extracted SPECworkstation_3.1 directory, and click SPECworkstation_3.1.exe.
4. Set the DPI scaling to 100%.
 - a. Right-click the desktop, and select Display settings.
 - b. From the Scale drop-down menu, select 100%.
5. Shut down the system.

Running the test

1. Launch SPECworkstation.
2. Next to Convolution, check the box.
3. Click Run Benchmark.
4. When the test is complete, record the results.
5. Repeat steps 1 through 4 two more times.

SPECapc for Maya 2024

Setting up the test

1. From <https://www.autodesk.com/products/maya/overview>, purchase and install a full license of Autodesk Maya 2024.
2. Go to <https://gwpq.spec.org/benchmarks/benchmark/specapc-maya-2024/>, purchase the benchmark, and download the vendor license.
3. Unzip the SPECapc Maya.zip file to C:\.
4. To extract installation files, navigate to the extracted SPECapc for Maya 2024 directory, and click SPECapcMaya2024-1.01.exe.
5. To install the benchmark, click SPECapc_Maya2024_combined.exe.
6. Set the DPI scaling to 100%:
 - a. Right-click the desktop, and select Display settings.
 - b. From the Scale drop-down menu, select 100%.
7. Shut down the system.

Running the test

1. To launch the SPECapc for Maya 2024 benchmark, click the desktop icon.
2. Click Run Benchmark.
3. When the test is complete, record the results.
4. Repeat steps 1 through 3 two more times.

SPECapc for Solidworks 2022

Setting up the test

1. From <https://www.solidworks.com/>, purchase and install a full Premium license of Solidworks 2022 Pro version.
2. Go to <https://gwpq.spec.org/benchmarks/benchmark/specapc-solidworks-2022/>, purchase the benchmark, and download the vendor license.
3. To install the benchmark, click SPECapc_sw2022_1.3.exe.
4. Set the DPI scaling to 100%:
 - a. Right-click the desktop, and select Display settings.
 - b. From the Scale drop-down menu, select 100%.
5. Shut down the system.

Running the test

1. To launch the SPECapc for Solidworks 2022 benchmark, click the desktop icon.
2. Click Run Benchmark.
3. When the test is complete, record the results.
4. Repeat steps 1 through 3 two more times.

Measuring acoustics while running Cinebench 2024

These tests require the following items:

- Extech SDL600 Sound Level Meter/Datalogger with SD card
- Cinebench 2024 benchmark

Setting up the test

1. Place the system under test in a sound-proofed professional sound booth.
2. Set the Extech SDL600 on a tripod so that it is 2 feet in front of, and 1 foot above the system under test.
3. From <https://www.maxon.net/en/downloads/cinebench-2024-downloads>, download and install Cinebench 2024.
4. Launch Cinebench 2024.
5. Select File→Advanced benchmark.
6. Select File→Preferences, change the Custom Minimum Test Duration to 20 minutes, and click OK.
7. Exit Cinebench 2024.

Running the test

1. Launch Cinebench 2024.
2. In the Minimum Test Duration field, select Custom (20 minutes).
3. Simultaneously start the Extech SDL600 Sound Level Meter/Datalogger and click the Cinebench 2024 CPU (multi-core) Start button.
4. At the end of the 20-minute Cinebench 2024 run, stop the Extech SDL600, and record the average sound level (dBA) while running Cinebench 2024.
5. Shut down the system for 40 minutes, and let the system return to room temperature.
6. Repeat steps 1 through 5 two more times.

Measuring acoustics while running SPECapc for Solidworks 2022

These tests require the following items:

- Extech SDL600 Sound Level Meter/Datalogger with SD card
- Dassault Systèmes SOLIDWORKS 2022 Premium
- SPECapc for Solidworks 2022 benchmark

Setting up the test

1. Place the system under test in a sound-proofed professional sound booth.
2. Set the Extech SDL600 on a tripod so that it is 2 feet in front of, and 1 foot above the system under test.
3. From <https://www.solidworks.com/>, purchase and install a full Premium license of SOLIDWORKS 2022 Pro version.
4. Go to <https://gwpq.spec.org/benchmarks/benchmark/specapc-solidworks-2022/>, purchase the benchmark, and download the vendor license.
5. To install the benchmark, click SPECapc_sw2022_1.3.exe.
6. Set the DPI scaling to 100%:
 - a. Right-click the desktop, and select Display settings.
 - b. From the Scale drop-down menu, select 100%.
7. Shut down the system.

Running the test

1. To launch the SPECapc for Solidworks benchmark, click the desktop icon.
2. Simultaneously start the Extech SDL600 Sound Level Meter/Datalogger and click Run Benchmark.
3. When the SPECapc Solidworks 2022 benchmark finishes, stop the Extech SDL600, and record the average sound level (dBA) while running SPECapc for Solidworks 2022.
4. Shut down the system for 40 minutes, and let it return to room temperature.
5. Repeat steps 1 through 4 two more times.

Read the report at <https://facts.pt/PZH1hc2>

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