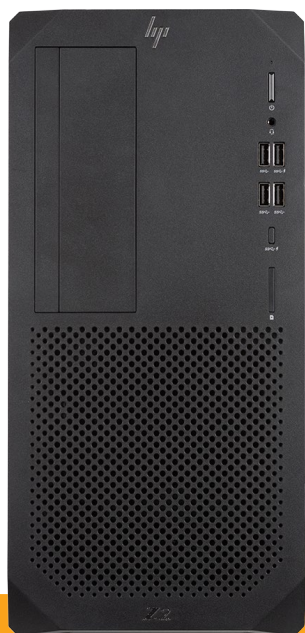# Get in and stay in the productivity zone with the HP Z2 G9 Tower Workstation

We compared CPU performance and noise output of an HP Z2 G9 Tower Workstation in High Performance Mode to Dell Precision 3660 and 5860 tower workstations in optimized performance modes

For many creative and technical professionals, performance is the number one consideration when shopping for tower workstations. The HP Z2 G9 Tower Workstation comes with three performance mode settings: High Performance Mode, Performance Mode, and Quiet Mode. But what kinds of CPU performance gains can you expect from an HP Z2 G9 Tower Workstation set to High Performance Mode? And does using High Performance Mode mean you sacrifice a quiet workplace when running multi-threaded applications? To find out, we compared CPU performance and noise output of an HP Z2 G9 Tower Workstation powered by an Intel® Core™ i9-13900 processor to those of a Dell Precision 3660 Tower Workstation with the identical CPU and GPU. To see if this HP Z2 G9 Tower Workstation in High Performance Mode had enough juice to beat a competitor with a higher-class CPU set to its highest performance mode, we also compared its CPU performance and noise output to a Dell Precision 5860 Tower Workstation with an Intel Xeon® w5-2455X processor in Ultra Performance Mode and a comparable GPU.

Jumpstart 2D and 3D design projects
based on higher Cinebench 2024, Geekbench 6, and PugetBench for After Effects multi-core benchmark scores

Render and manipulate scenes at greater speeds
based on higher SPECapc® Solidworks® 2022 and SPECapc for Maya 2024 composite CPU benchmark scores

Render more samples per minute
based on higher Blender using CPU rendering benchmark results

Get better workstation performance
based on higher SPECworkstation 3.1 benchmark scores

Hear less noise under intense use
based on lower acoustic readings while running Cinebench 2024 and SPECapc for Solidworks 2022 workloads

vs. Dell Precision 3660 and 5860 tower workstations in optimized performance modes

About the HP Z2 G9 Tower Workstation

HP engineered the entry-level Z2 G9 Tower with next-gen Intel Core processors and NVIDIA RTX professional graphics to "seamlessly run applications for quick rendering, fast simulations, and real-time raytracing."[1] In addition, the Z2 G9 Tower is certified by numerous independent software vendors (ISVs) to ensure that their applications perform well on the sytem: https://www.hp.com/us-en/workstations/isv-certifications/mcad-isv-certification.html.

As we show in this report, HP Z2 G9 Tower users can also tailor performance mode settings in the BIOS to meet their specific needs. Their choices are High Performance Mode, Performance Mode, and Quiet Mode. To learn more about HP performance control modes for Z Desktop Workstations, read the whitepaper: https://h20195.www2.hp.com/v2/getpdf.aspx/4AA8-2411ENW.pdf.

What we tested

We conducted two evaluations to see how CPU performance and acoustic output compare when we set each tower workstation to the highest BIOS-based performance mode for that model, if available.

The first evaluation

We compared the HP Z2 G9 to a Dell Precision 3660 with identical specs:

HP Z2 G9 Tower Workstation powered by an Intel Core i9-13900 processor (2.0-5.6 GHz) in BIOS-based High Performance Mode, NVIDIA RTX A5000 graphics, 64 GB of DDR5-4800 memory, and 1 TB of NVMe storage.

Dell Precision 3660 Tower Workstation powered by an Intel Core i9-13900 processor (2.0-5.6 GHz) in out-of-box performance optimization (no BIOS options available), NVIDIA RTX A5000 graphics, 64 GB of DDR5-4800 memory, and 1 TB of NVMe storage.

The second evaluation

We upped the ante and compared the HP Z2 G9 results to those of a Dell Precision 5860 with a server-class CPU:

HP Z2 G9 Tower Workstation powered by an Intel Core i9-13900 processor (2.0-5.6 GHz) in BIOS-based High Performance Mode, NVIDIA RTX A5000 graphics, 64 GB of DDR5-4800 memory, and 1 TB of NVMe storage.

Dell Precision 5860 Tower Workstation powered by an Intel Xeon w5-2455X processor (3.2-4.6 GHz) in BIOS-based Ultra Performance Mode, NVIDIA RTX A5500 graphics, 64 GB of DDR5-4800 memory, and 1 TB of NVMe storage.

To get valuable results for creative and technical professionals tackling resource-intensive tasks such as 3D design, engineering analysis, simulation, rendering, and video editing, we ran industry-standard benchmarks that stressed the tower workstations with many different workloads:

- **Blender benchmark** measured CPU rendering performance.
- **Cinebench 2024** measured CPU multi-core performance.
- **Geekbench 6** measured CPU multi-core performance.
- **PugetBench for After Effects** measured digital visual effects performance.
- **Revit 2024 RFO** benchmark measured high-quality image rendering performance.
- **SPECapc for Maya 2024** benchmark measured 3D modeling and animation performance.
- **SPECapc for Solidworks 2022** benchmark measured 3D modeling and simulation performance.
- **SPECworkstation® 3.1** measured workstation performance.

HP Z2 G9 Tower Workstation vs. Dell Precision 3660 Tower Workstation test results

Whether you're creating 2D models for product design or rely on render engines to bring your 3D art to life, the more power you have at your fingertips, the faster you can present the finished article to its intended audience. Bonus points for a tower workstation that can do that without drowning out all other sound in the room.

In this section, we show our hands-on results from CPU performance and noise output comparisons of an HP Z2 G9 Tower Workstation powered by an Intel Core i9-13900 processor to those same metrics on a Dell Precision 3660 Tower Workstation with identical CPU and GPU specs.

2D and 3D design

Cinebench 2024 uses the Maxon Redshift render engine for photorealistic 3D rendering. Blender using CPU rendering measures how quickly the Cycles production renderer can render path tracing samples. PugetBench for After Effects quantifies motion graphics performance using the popular Adobe® After Effects® tool. In all three cases, the higher the number, the better.

Cinebench 2024
Multi-core score | Higher is better

6.9% better multi-core score

HP Z2 G9 Tower Workstation
1,571

Dell Precision 3660 Tower Workstation
1,469

Figure 1: Cinebench 2024 multi-core benchmark results. Higher is better. Source: Principled Technologies.

Blender using CPU rendering
Overall score | Higher is better

7.4% higher overall score

HP Z2 G9 Tower Workstation
384.09

Dell Precision 3660 Tower Workstation
357.47

Figure 2: Blender using CPU rendering benchmark results. Higher is better. Source: Principled Technologies.

PugetBench for After Effects
Multi-core score | Higher is better

20.0% higher multi-core score

HP Z2 G9 Tower Workstation
236.8

Dell Precision 3660 Tower Workstation
197.2

Figure 3: PugetBench for After Effects benchmark results. Higher is better. Source: Principled Technologies.

Rendering and manipulation

Computer-aided design (CAD) and engineering professionals use Solidworks to manage, track, and convert ideas into products as well as construct virtual test environments that replicate real-world behavior. Creative professionals use Autodesk Maya for 3D animation, modeling, simulation, and rendering.

Both SPECapc for Solidworks 2022 and SPECapc for Maya 2024 measure how long it took each tower workstation to render and manipulate a variety of scenes. Each test represents a usage model, and the composite CPU scores below are based on a weighted geometric mean of all scenes and rendering modes.[2,3] In both cases, higher scores indicate greater speed.
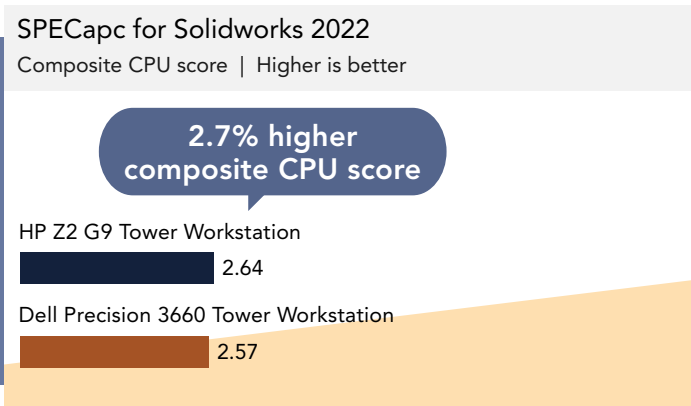
SPECapc for Solidworks 2022
Composite CPU score | Higher is better

2.7% higher composite CPU score

HP Z2 G9 Tower Workstation
2.64

Dell Precision 3660 Tower Workstation
2.57

Figure 4: SPECapc for Solidworks 2022 benchmark composite CPU results. Higher is better. Source: Principled Technologies.

SPECapc for Maya 2024
Composite CPU score | Higher is better

19.6% higher composite CPU score

HP Z2 G9 Tower Workstation
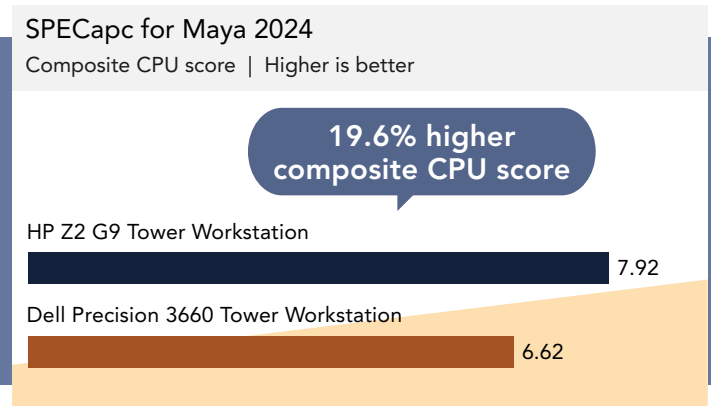7.92

Dell Precision 3660 Tower Workstation
6.62

Figure 5: SPECapc for Maya 2024 benchmark composite CPU results. Higher is better. Source: Principled Technologies.

Ray tracing, a technique for modeling the movement of light, is a game changer for creative and technical professionals who want more realistic images. To see more SPECapc benchmark subtest results, read the science behind the report.
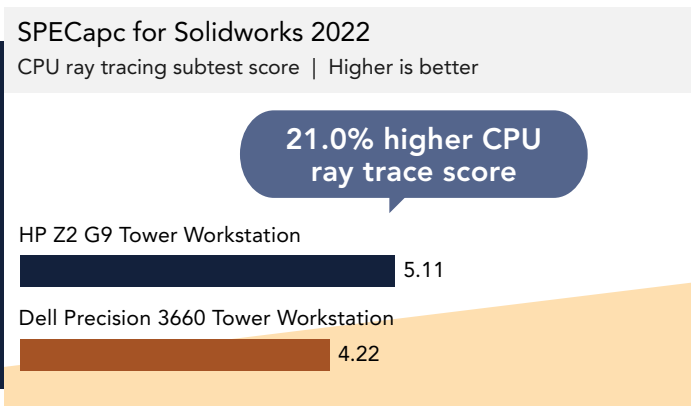
SPECapc for Solidworks 2022
CPU ray tracing subtest score | Higher is better

21.0% higher CPU ray trace score

HP Z2 G9 Tower Workstation
5.11

Dell Precision 3660 Tower Workstation
4.22

Figure 6: SPECapc for Solidworks 2022 benchmark CPU ray trace subtest results. Higher is better. Source: Principled Technologies.

SPECapc for Maya 2024
CPU Arnold ray tracing subtest score | Higher is better

19.6% higher CPU Arnold ray trace score

HP Z2 G9 Tower Workstation
7.92

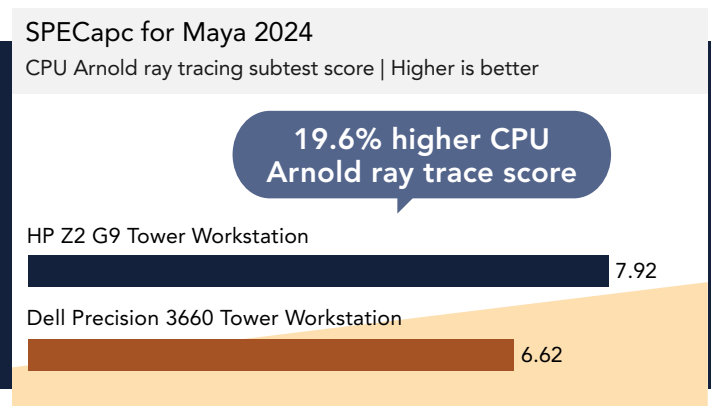Dell Precision 3660 Tower Workstation
6.62

Figure 7: SPECapc for Maya 2024 benchmark CPU Arnold ray trace subtest results. Higher is better. Source: Principled Technologies.

Engineering analysis

Autodesk® Revit® is 3D Building Information Modeling (BIM) software used by professionals in fields including architecture, computational designer, engineering, and construction. It lets users generate floor plans, optimize building performance in early-stage design, and generate photorealistic renderings, among other capabilities.[4]

The SPECworkstation® 3.1 benchmark includes 30-plus workloads that test CPU, graphics, I/O and memory bandwidth.[5] We ran its Convolution workload, which implements a surface-related multiple prediction (SRMP) algorithm to compute a convolution with a random filter of 100 x 100 pixels on an image that is 20,000 x 20,000 pixels.[6]

Revit 2024 RFO
Time (seconds) to render | Lower is better

21.2% less time to render

HP Z2 G9 Tower Workstation
22.48

Dell Precision 3660 Tower Workstation
28.56

Figure 8: Revit 2024 RFO benchmark results. Less time is better. Source: Principled Technologies.

SPECworkstation 3.1
Convolutions score | Higher is better

3.1% higher convolutions score

HP Z2 G9 Tower Workstation
14.22

Dell Precision 3660 Tower Workstation
13.79

Figure 9: SPECworkstation 3.1 convolution workload benchmark results. Higher is better. Source: Principled Technologies.

Noise levels under load

A recent study from the University of Arizona Institute on Place, Wellbeing, and Performance found that "an individual's physiological wellbeing is optimal when sound level in the workplace is at 50 dBA."[7] Furthermore, the researchers found that for every 10dBA decrease in amplitude ranges, they could see a marked decrease in the heart rates (and associated stress levels) of the study participants.[8] For context, normal breathing is 10 dBA, quiet library noises are 40 dBA, and the ambient room noise in our test environment was 23.3 dBA, which is the equivalent of hearing someone whisper from 5 feet away.[9]

Acoustic readings while running a workload
dBA | Lower is better

- HP Z2 G9 Tower Workstation
- Dell Precision 3660 Tower Workstation

Cinebench 2024: 26.7, 27.2
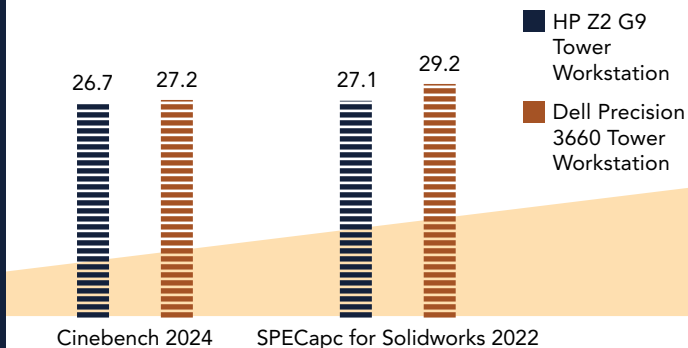SPECapc for Solidworks 2022: 27.1, 29.2

Figure 10: The average sound levels, in decibels, we recorded while running CPU-intensive benchmark workloads. Lower is better. Source: Principled Technologies.

HP Z2 G9 Tower Workstation vs. Dell Precision 5860 Tower Workstation test results

Top-quality performance benefits financial professionals, designers, video and photo producers, and engineers. Because once you get in the productive zone, you want to stay there as long as possible.

In this section, we compared CPU performance and noise output under load on the Intel Core i9 processor-powered HP Z2 G9 Tower Workstation and an Intel Xeon w5-2445X processor-powered Dell Precision 5860. To keep the focus on CPU performance, we tested models with comparable GPUs. And, because both tower workstations come with performance-first modes for users who are willing to tolerate noise in exchange for higher performance, we set them both to their highest performance mode before we ran our tests (High Performance on the Z2 and Ultra Performance on the Precision 5860).

2D and 3D design

As we noted earlier, Cinebench 2024 uses the Maxon Redshift render engine for photorealistic 3D rendering. Geekbench 6 uses data compression, image processing, machine learning, and compiling code workloads to measure CPU performance. Blender measures how quickly Cycles can render path tracing samples per minute on the CPU. PugetBench for After Effects quantifies motion graphics performance using the popular Adobe tool. In all four cases, higher numbers are better.

Cinebench 2024
Multi-core score | Higher is better

24.5% better multi-core score

HP Z2 G9 Tower Workstation
1,571

Dell Precision 5860 Tower Workstation
1,261

Figure 11: Cinebench 2024 multi-core benchmark results. Higher is better. Source: Principled Technologies.

Geekbench 6 Pro
Multi-core score | Higher is better

36.6% better multi-core score

HP Z2 G9 Tower Workstation
18,091

Dell Precision 5860 Tower Workstation
13,244

Figure 12: Geekbench 6 multi-core CPU benchmark results. Higher is better. Source: Principled Technologies.

Blender using CPU rendering
Overall score | Higher is better

21.6% higher overall score

HP Z2 G9 Tower Workstation
384.09

Dell Precision 5860 Tower Workstation
315.69

Figure 13: Blender using CPU rendering benchmark results. Higher is better. Source: Principled Technologies.

PugetBench for After Effects
Multi-core score | Higher is better

50.3% higher multi-core score

HP Z2 G9 Tower Workstation
236.8

Dell Precision 5860 Tower Workstation
157.5

Figure 14: PugetBench for After Effects benchmark results. Higher is better. Source: Principled Technologies.

Rendering and manipulation

People running 3D CAD design and engineering workloads use Solidworks to manage and transform ideas into products and build virtual test environments that simulate real-world behavior. 3D animation, modeling, simulation, and rendering professionals use Autodesk Maya.

Both SPECapc for Solidworks 2022 and SPECapc for Maya 2024 measured how long it took each tower workstation to render and manipulate a variety of scenes. Each test represents a usage model, and each composite CPU score below is based on a weighted geometric mean of all scenes and rendering modes.[10,11] In both cases, higher scores indicate greater speed.
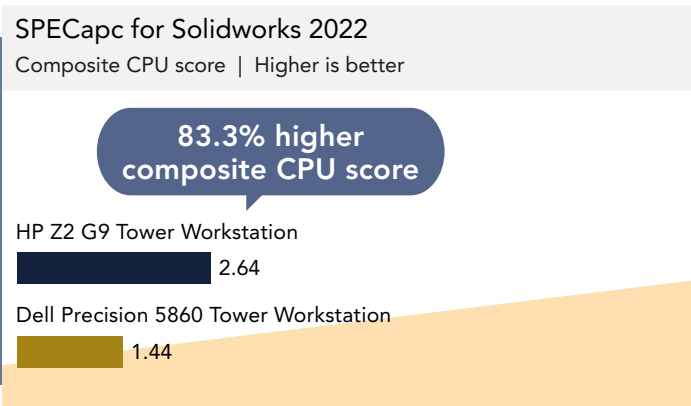
SPECapc for Solidworks 2022
Composite CPU score | Higher is better

83.3% higher composite CPU score

HP Z2 G9 Tower Workstation
2.64

Dell Precision 5860 Tower Workstation
1.44

Figure 15: SPECapc for Solidworks 2022 benchmark composite CPU results. Higher is better. Source: Principled Technologies.

SPECapc for Maya 2024
Composite CPU score | Higher is better

24.7% higher composite CPU score

HP Z2 G9 Tower Workstation
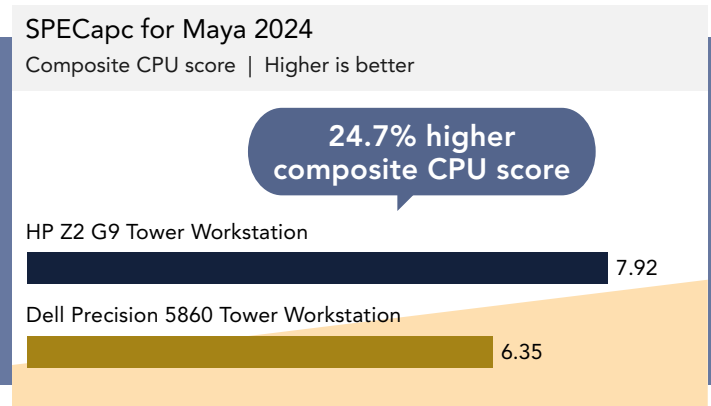7.92

Dell Precision 5860 Tower Workstation
6.35

Figure 16: SPECapc for Maya 2024 benchmark composite CPU results. Higher is better. Source: Principled Technologies.

In both SPECapc benchmark comparisons, the CPU ray trace subset scores for the HP Z2 G9 were significantly higher than those of the Dell Precision 5860. To see more SPECapc benchmark subtest results, read the science behind the report.
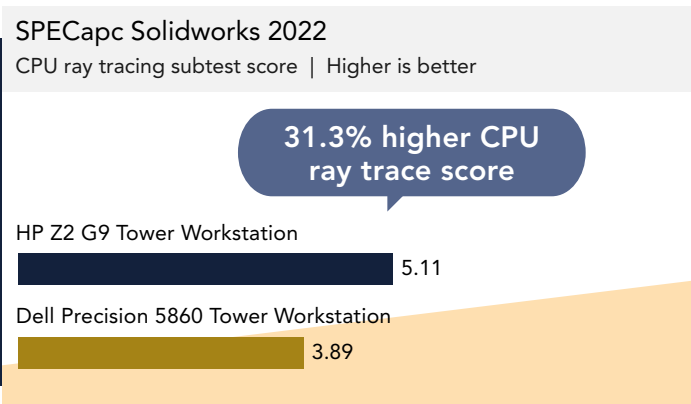
SPECapc Solidworks 2022
CPU ray tracing subtest score | Higher is better

31.3% higher CPU ray trace score

HP Z2 G9 Tower Workstation
5.11

Dell Precision 5860 Tower Workstation
3.89

Figure 17: SPECapc for Solidworks 2022 benchmark CPU ray trace subtest results. Higher is better. Source: Principled Technologies.

SPECapc for Maya 2024
CPU Arnold ray tracing subtest score | Higher is better

24.7% higher CPU Arnold ray trace score

HP Z2 G9 Tower Workstation
7.92

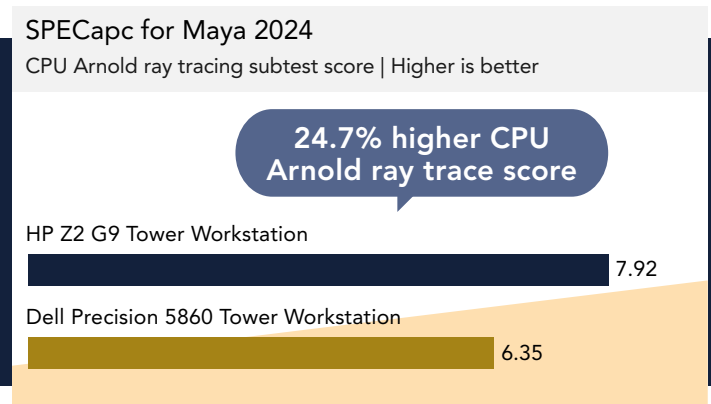Dell Precision 5860 Tower Workstation
6.35

Figure 18: SPECapc for Maya 2024 benchmark CPU Arnold ray trace subtest results. Higher is better. Source: Principled Technologies.

Financial services

The SPECworkstation 3.1 Financial Services workload uses a Monte Carlo simulation, a Black-Scholes pricing model, and a Binomial option pricing model—"three popular algorithms from the financial services industry."[12]

SPECworkstation 3.1
Financial Services score | Higher is better

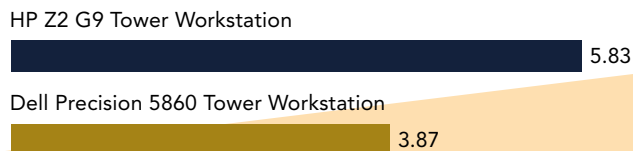**50.6% higher financial services score**

HP Z2 G9 Tower Workstation
5.83

Dell Precision 5860 Tower Workstation
3.87

Figure 19: SPECworkstation 3.1 financial services benchmark results. Higher is better. Source: Principled Technologies.

Engineering analysis

Autodesk® Revit® is 3D Building Information Modeling (BIM) software popular with architects, engineers, computational designers, construction professionals, fabricators, and more.

Revit 2024 RFO
Time (seconds) to render | Lower is better

52.8% less time to render

HP Z2 G9 Tower Workstation
22.48

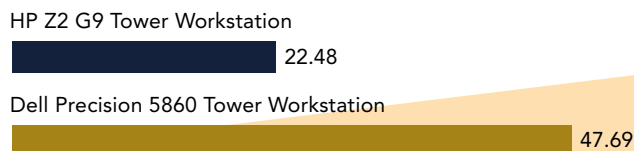Dell Precision 5860 Tower Workstation
47.69

Figure 20: Revit 2024 RFO benchmark results. Less time is better. Source: Principled Technologies.

Noise levels under load

As we noted earlier, researchers at the University of Arizona Institute on Place, Wellbeing, and Performance found that a workplace sound level of 50 dBA is optimal for an individual's physiological wellbeing."[13] The study also states "sound is the most-reported environmental factor causing stress and discomfort.[14] For our hands-on tests, the ambient room noise in our test environment was 23.3 dBA. For context, normal breathing is 10 dBA and quiet library noises are 40 dBA.[15]

Acoustic readings while running a workload
dBA | Lower is better

■ HP Z2 G9 Tower Workstation
■ Dell Precision 3660 Tower Workstation

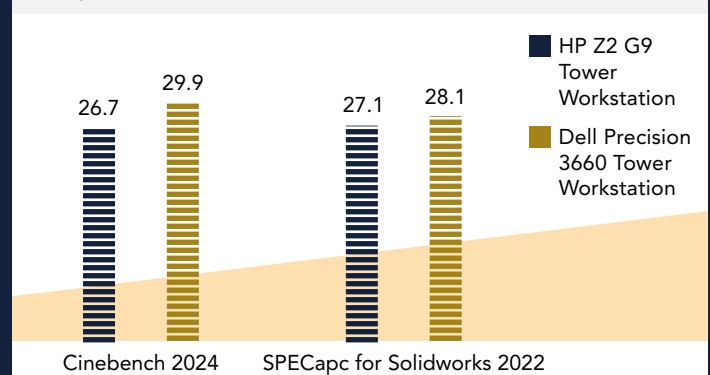Cinebench 2024: 26.7 / 29.9
SPECapc for Solidworks 2022: 27.1 / 28.1

Figure 21: The average sound levels, in decibels, we recorded while running CPU-intensive benchmark workloads. Lower is better. Source: Principled Technologies.

Conclusion

HP Z2 G9 Tower Workstation users can change the BIOS settings to dial in the performance mode that best suits their needs: High Performance Mode, Performance Mode, or Quiet Mode. In good news for both creative and technical professionals, we found that an Intel Core i9-13900 processor-powered HP Z2 G9 Tower Workstation set to High Performance mode received higher CPU-based benchmark scores than both a similarly configured Dell Precision 3660 and a Dell Precision 5860 equipped with an Intel Xeon w5-2455x processor. Plus, the HP Z2 G9 Tower Workstation was quieter while running CPU-intensive Cinebench 2024 and SPECapc for Solidworks 2022 workloads than both Dell Precision tower workstations. This means HP Z2 G9 Tower Workstation users who prize performance over everything else can do so without sacrificing a quiet workspace.

1. HP, "HP Enhances Hybrid Experiences for Desk-Centric Workers," accessed February 2, 2024, https://press.hp.com/us/en/press-releases/2022/hp-enhances-hybrid-experiences-desk-centric-workers.html.

2. SPECapc, "SPECapc™ for Solidworks 2022 Benchmark Results Summary," accessed February 2, 2024, https://www.spec.org/gwpg/apc.data/Dell/3660-W6800/sw2022/2K-FSAA/results_2022-07-29-15-36-37/apcSolidworksResults.html.

3. SPEC GWPG, "SPECapc™ for Maya 2024 Benchmark Results Summary," accessed February 2, 2024, https://spec.org/gwpg/apc.data/specapc_maya2024_summary.html.

4. Autodesk, "BIM tools for architects," accessed March 18, 2024, https://www.autodesk.com/products/revit/architecture.

5. SPEC GWPG, "SPECworkstation® 3.1, accessed January 29, 2024, https://gwpg.spec.org/benchmarks/benchmark/specworkstation-3_1/.

6. SPEC GWPG, "SPECworkstation® 3.1.".

7. NPJ Digital Medicine, "Discovery of associative patterns between workplace sound level and physiological wellbeing using wearable devices and empirical Bayes modeling," accessed February 2, 2024, https://www.nature.com/articles/s41746-022-00727-1.

8. NPJ Digital Medicine, "Discovery of associative patterns between workplace sound level and physiological wellbeing using wearable devices and empirical Bayes modeling."

9. Audicus, "How loud are everyday sounds — in decibels? Accessed February 5, 2024, https://www.audicus.com/noise-levels-of-everyday-sounds/.

10. SPECapc, "SPECapc™ for Solidworks 2022 Benchmark Results Summary," accessed February 2, 2024, https://www.spec.org/gwpg/apc.data/Dell/3660-W6800/sw2022/2K-FSAA/results_2022-07-29-15-36-37/apcSolidworksResults.html.

11. SPEC GWPG, "SPECapc™ for Maya 2024 Benchmark Results Summary," accessed February 2, 2024, https://spec.org/gwpg/apc.data/specapc_maya2024_summary.html.

12. SPEC GWPG, "SPECworkstation® 3.1," accessed January 29, 2024, https://gwpg.spec.org/benchmarks/benchmark/specworkstation-3_1/

13. NPJ Digital Medicine, "Discovery of associative patterns between workplace sound level and physiological wellbeing using wearable devices and empirical Bayes modeling," accessed February 2, 2024, https://www.nature.com/articles/s41746-022-00727-1.

14. NPJ Digital Medicine, "Discovery of associative patterns between workplace sound level and physiological wellbeing using wearable devices and empirical Bayes modeling."

15. Audicus, "How loud are everyday sounds — in decibels? Accessed February 5, 2024, https://www.audicus.com/noise-levels-of-everyday-sounds/.