

THE GHOST S1

All in One (closed-loop) liquid cooling system for a CPU test



Definitions

AIO – All in One (closed-loop) liquid cooling system for a CPU

Setup

The Ghost S1 was tested with an Intel Core i7-8700K Coffee lake- 12 threads / 3.7GHz (4.7Ghz Turbo) , GIGABYTE Z370N WIFI - ITX / Z370, 16 GB Corsair Vengeance, Samsung 950 PRO M.2 (front mounted), ASUS GTX 1070 STRIX, Corsair SF600 and bottom mounted 120 x 25 mm fan from Noctua, NF-F12 PWM set at a constant 800 RPM

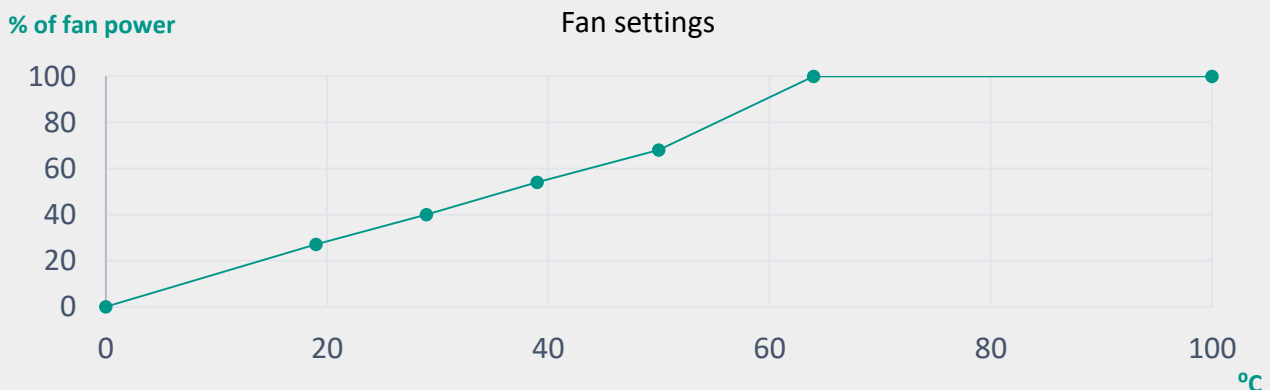
All AIOs were mounted in a L-TopHat in the top position with fans under the radiator pushing air out through the top of the system.

Method

In order to create generate more comparable results, the BIOS CPU fan settings were set to “Normal” for all test runs and heatsinks. Fan settings as follows:

- 0 °C – 0%
- 19 °C – 27%
- 29 °C – 40%
- 39 °C – 54%
- 50 °C – 68%
- 64 °C – 100%

Fan curve for all heatsinks:



This is by no means optimal for any one AIO in terms of balance between noise to heat dissipation but it creates an even playing field for comparison of both temperature build up and noise levels. In theory the temperatures should stay pretty close to each other among the different AIOs as long as they are able to dissipate enough heat.

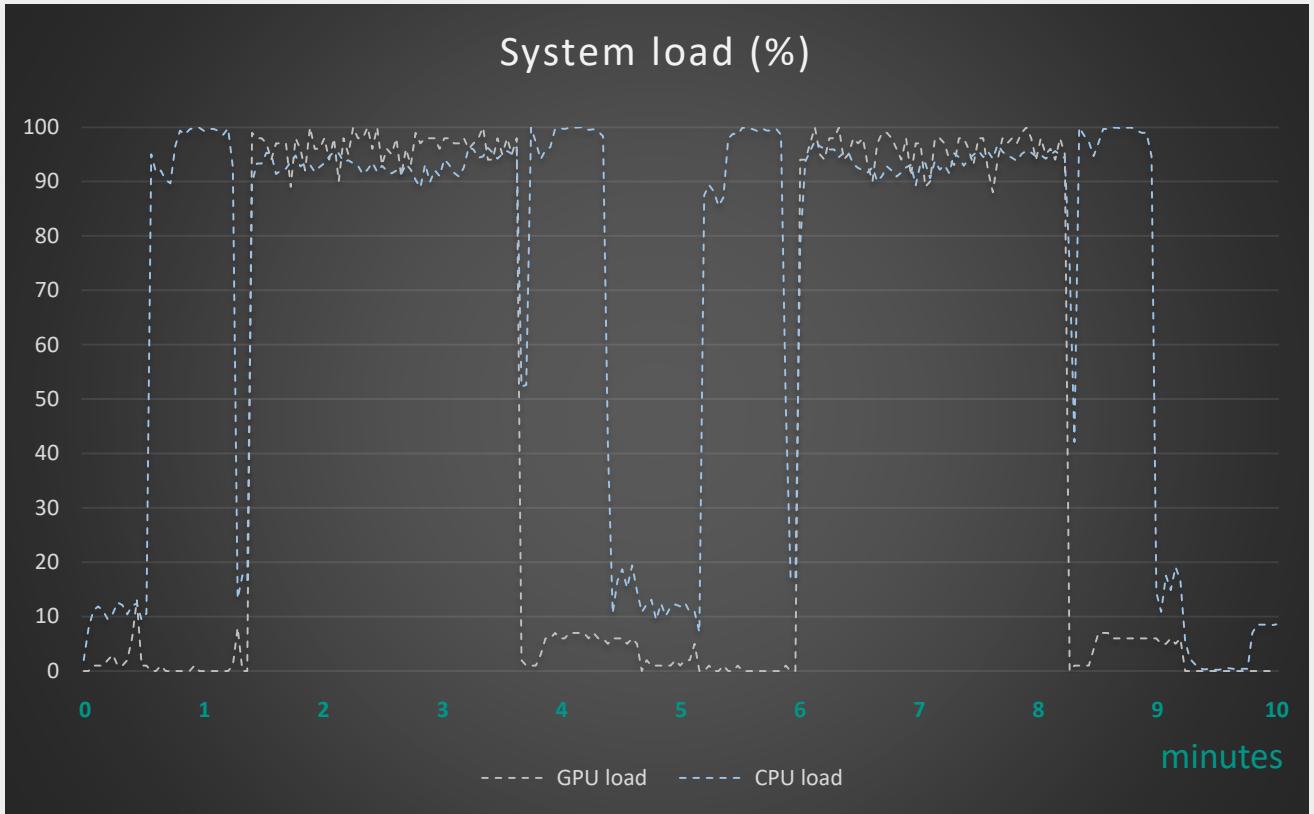
Test

With every AIO the CPU and GPU was loaded synthetically using **ASUS RealBench** with two full cycles, including Image editing, H.264 encoding, OpenGL and Heavy multitasking. Tests take approx. 9 minutes, HWinfo was used to log sensors every 2.11 seconds, after the load was removed, another 2 minutes of cool down was logged. Noise has been measured 30 cm away from the CPU-side of the case.



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RealBench is a benchmark that uses open source applications and simple scripting to simulate real-world performance of a PC system. Below are curves describing CPU and GPU loads during the performed test



Software screen dump used for this report, HWinfo and ASUS RealBench

Current	Minimum	Maximum	Average
2,217 MB	2,202 MB	4,867 MB	3,529 MB
20,261 MB	17,611 MB	20,276 MB	18,949 MB
9.8 %	9.7 %	21.6 %	15.6 %
2,187 MB	2,169 MB	3,771 MB	3,041 MB
14,147 MB	12,563 MB	14,165 MB	13,293 MB
13.3 %	13.2 %	23.0 %	18.6 %
0.0 %	0.0 %	0.0 %	0.0 %

Current	Minimum	Maximum	Average
1.203 V	1.093 V	1.240 V	1.152 V
1.223 V	1.093 V	1.234 V	1.150 V
1.188 V	1.094 V	1.249 V	1.152 V
1.188 V	1.093 V	1.245 V	1.151 V
1.218 V	1.093 V	1.240 V	1.149 V
1.218 V	1.093 V	1.237 V	1.150 V
4,500.0 MHz	4,295.8 MHz	4,700.0 MHz	4,376.9 MHz
4,600.0 MHz	4,295.8 MHz	4,701.1 MHz	4,361.9 MHz
4,400.0 MHz	4,295.8 MHz	4,701.1 MHz	4,368.8 MHz
4,400.0 MHz	4,295.8 MHz	4,701.1 MHz	4,367.7 MHz
4,600.0 MHz	4,295.8 MHz	4,701.1 MHz	4,360.7 MHz
4,600.0 MHz	4,295.8 MHz	4,700.0 MHz	4,362.6 MHz
100.0 MHz	99.9 MHz	100.1 MHz	100.0 MHz
3,700.0 MHz	3,696.4 MHz	3,702.7 MHz	3,699.7 MHz
1,000.0 MHz	999.0 MHz	1,000.7 MHz	999.9 MHz
0.0 %	0.0 %	100.0 %	67.3 %
0.0 %	0.0 %	100.0 %	62.4 %
0.0 %	0.0 %	100.0 %	66.6 %
0.0 %	0.0 %	100.0 %	64.0 %
0.0 %	0.0 %	100.0 %	67.0 %
95.9 %	0.0 %	100.0 %	66.9 %
4.1 %	0.0 %	100.0 %	66.5 %
0.0 %	0.0 %	100.0 %	63.3 %
1.3 %	0.0 %	100.0 %	65.6 %
0.6 %	0.0 %	100.0 %	64.3 %
0.6 %	0.0 %	100.0 %	66.0 %
0.6 %	0.0 %	100.0 %	63.4 %
95.9 %	0.6 %	100.0 %	77.5 %
8.6 %	0.2 %	100.0 %	65.3 %
100.0 %	100.0 %	100.0 %	100.0 %
45 x	43 x	47 x	44 x
46 x	43 x	47 x	44 x
44 x	43 x	47 x	44 x
44 x	43 x	47 x	44 x
46 x	43 x	47 x	44 x
46 x	43 x	47 x	44 x
37 x	37 x	37 x	37 x

Sensor	Current	Minimum	Maximum	Average
Core #0 Distance to TMAX	53 °C	26 °C	67 °C	45 °C
Core #1 Distance to TMAX	55 °C	28 °C	66 °C	45 °C
Core #2 Distance to TMAX	32 °C	24 °C	66 °C	44 °C
Core #3 Distance to TMAX	54 °C	23 °C	65 °C	43 °C
Core #4 Distance to TMAX	54 °C	27 °C	65 °C	43 °C
Core #5 Distance to TMAX	32 °C	27 °C	68 °C	44 °C
CPU Package	69 °C	41 °C	77 °C	61 °C
Core Max	68 °C	41 °C	77 °C	60 °C
Core #0 Thermal Throttling	No	No	No	No
Core #1 Thermal Throttling	No	No	No	No
Core #2 Thermal Throttling	No	No	No	No
Core #3 Thermal Throttling	No	No	No	No
Core #4 Thermal Throttling	No	No	No	No
Core #5 Thermal Throttling	No	No	No	No
Core #0 Critical Temperature	No	No	No	No
Core #1 Critical Temperature	No	No	No	No
Core #2 Critical Temperature	No	No	No	No
Core #3 Critical Temperature	No	No	No	No
Core #4 Critical Temperature	No	No	No	No
Core #5 Critical Temperature	No	No	No	No
Core #0 Power Limit Exceeded	No	No	No	No
Core #1 Power Limit Exceeded	No	No	No	No
Core #2 Power Limit Exceeded	No	No	No	No
Core #3 Power Limit Exceeded	No	No	No	No
Core #4 Power Limit Exceeded	No	No	No	No
Core #5 Power Limit Exceeded	No	No	No	No
Package/Ring Thermal Throttling	No	No	No	No
Package/Ring Critical Temperature	No	No	No	No
Package/Ring Power Limit Exceeded	No	No	No	No

RealBench 2.41

Heavy Multitasking
188102
Time: 21.593

System Score
158895

Image Editing
195905
Time: 25.985

Encoding
248451
Time: 38.591

IA Cores Power
21.881 W

RealBench 2.41

Upload Results About

Heavy Multitasking
183313
Time: 25.985

Encoding
196472
Time: 49.778

System Score
165347

Unable to properly parse system specs. Please report in RealBench forum.

0.1 % 100.0 % 65.9 %

0.0 % 0.0 % 9.4 % 0.3 %

0.0 % 0.0 % 7.8 % 0.2 %

0.0 % 0.0 % 1.8 % 0.1 %

The Line-up

NZXT Kraken X52



Specifications

Radiator height	30 mm
Fan heights	25 mm
CPU block height	53 mm
Max fan speed	~2000 RPM

Fractal Design S24



Specifications

Radiator height	31 mm
Fan heights	25 mm
CPU block height	44 mm
Max fan speed	~2000 RPM

Corsair H100i v2



Specifications

Radiator height	30 mm
Fan heights	25 mm
CPU block height	44 mm
Max fan speed	~2400 RPM

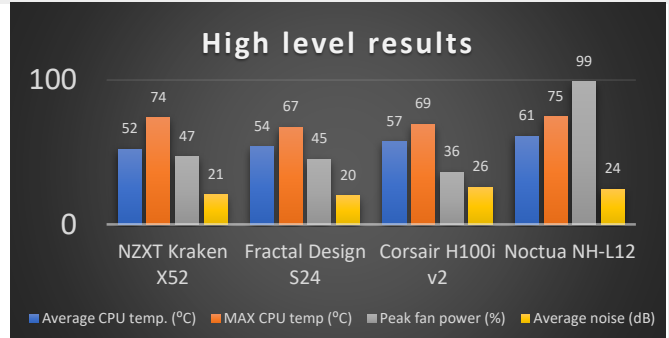
Noctua NH-L12 (bottom fan only)



Specifications

Total height	66 mm
Fan distance from side wall	25 mm
RAM clearance	43 mm
Max fan speed	~1600 RPM

High level results



NZXT Kraken X52

Easy but messy installation



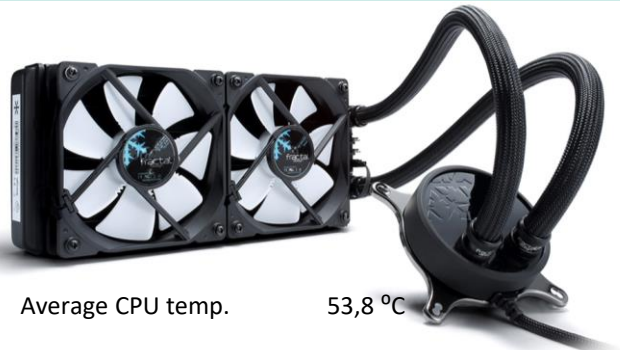
Average CPU temp.	52,2 °C
MAX CPU temp	74,0 °C
Peak fan power*	47%
Average noise **	20,6 dB

Comments

Many cables, internal USB 2.0 connection and peripheral power drawn from PSU. Quiet, most flexible pipes in test with angled/turnable connections – smooth installation

Fractal Design S24

Clean installation



Average CPU temp.	53,8 °C
MAX CPU temp	67,3 °C
Peak fan power*	45%*
Average noise **	19,7 dB

Comments

With the internal fan hub there is only one cable running from the AOI making it the most clean installation, non tunable pump connectors is a drawback, the most quiet cooler

Corsair H100i v2

Tough install



Average CPU temp.	57,2 °C
MAX CPU temp	69,3 °C
Peak fan power*	36%
Average noise **	25,7 dB

Comments

No fan hub and relatively tough pipes making it interfere more with other components and need more work tying down to fit. This AOI is the loudest one in the test, S24 is dead silent and the X52 is just barely audible – The H100i v2 is **NOT RECOMMENDED**

Noctua NH-L12

Reference cooler



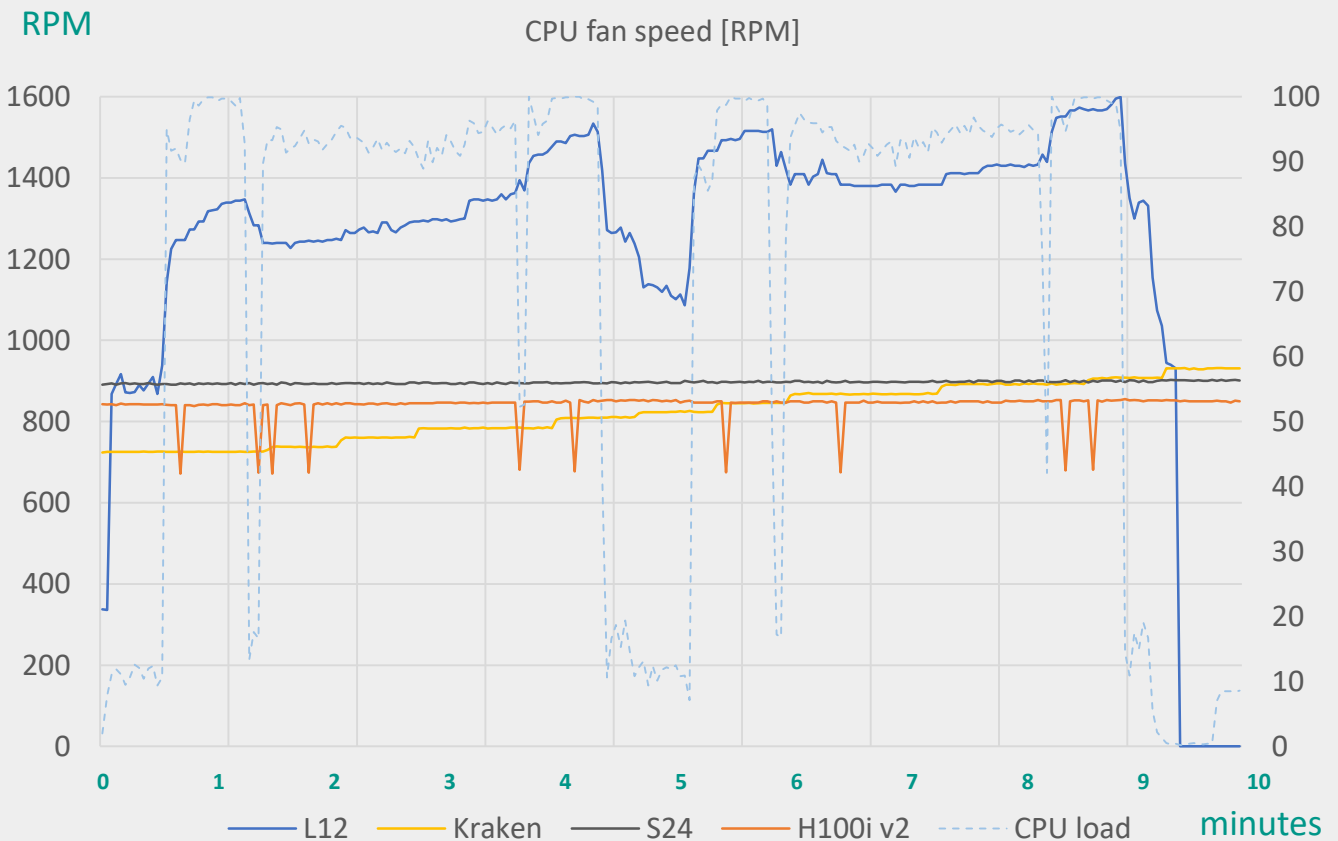
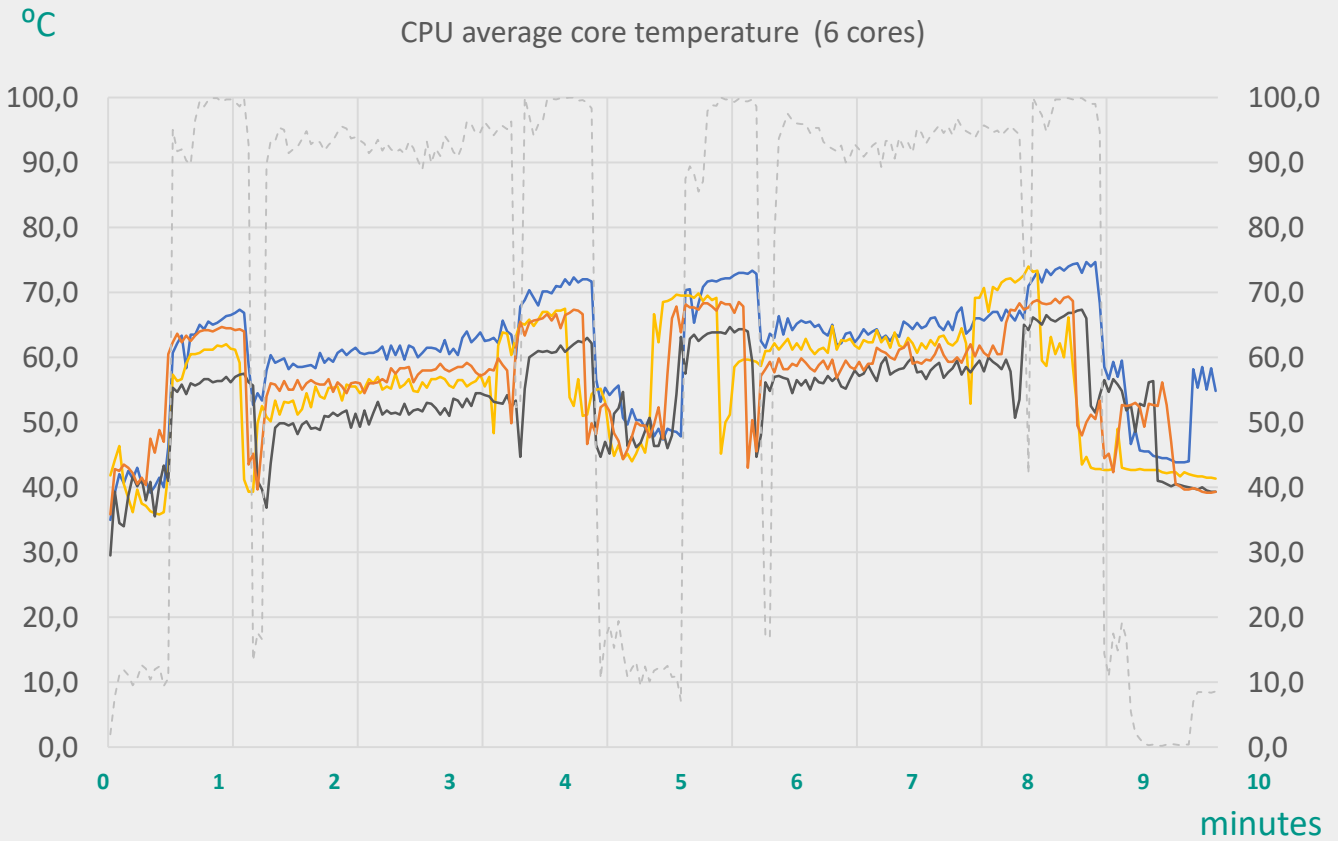
Average CPU temp.	61,2 °C
MAX CPU temp	74,7 °C
Peak fan power*	99%
Average noise **	24,3 dB



* Peak fan power reached during test ** Measured 30 cm (1 ft.) from CPU side of case

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Detailed result



— L12 — Kraken — S24 — H100i v2 - - - CPU load

