



# SPEC CPU®2017 Integer Rate Result

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## xFusion

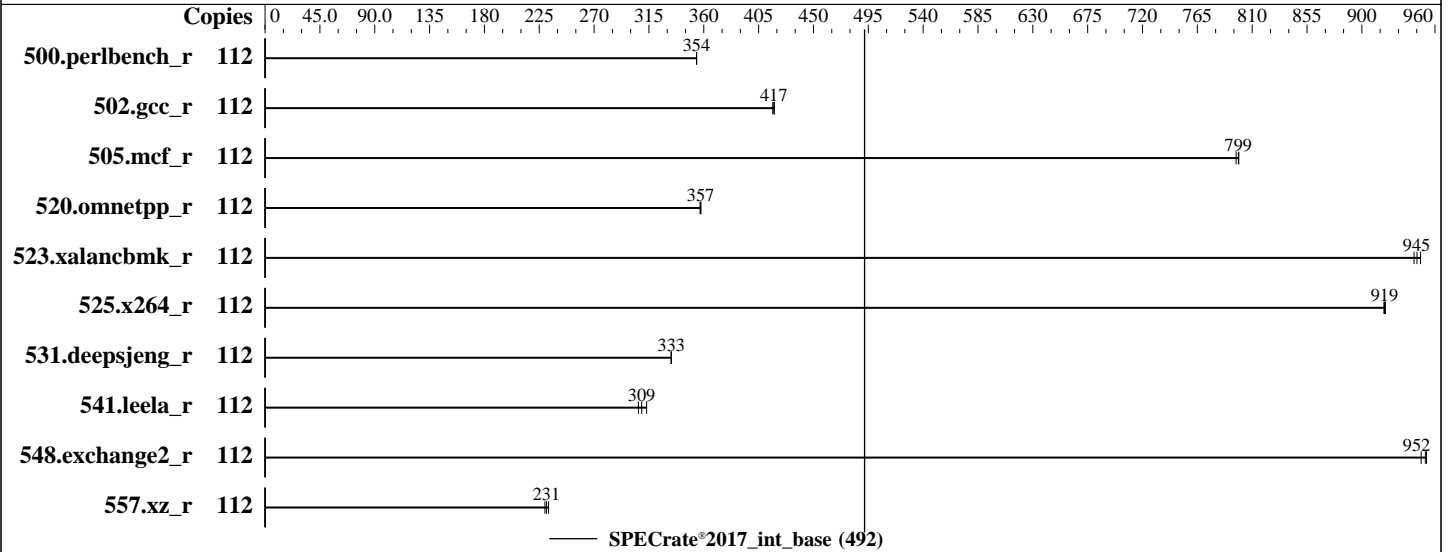
SPECrate®2017\_int\_base = 492

FusionServer 2288H V7 (Intel Xeon Gold 5420+)

SPECrate®2017\_int\_peak = Not Run

CPU2017 License: 6488  
Test Sponsor: xFusion  
Tested by: xFusion

Test Date: Jun-2023  
Hardware Availability: Jan-2023  
Software Availability: Dec-2022



### Hardware

CPU Name: Intel Xeon Gold 5420+  
 Max MHz: 4100  
 Nominal: 2000  
 Enabled: 56 cores, 2 chips, 2 threads/core  
 Orderable: 1,2 chips  
 Cache L1: 32 KB I + 48 KB D on chip per core  
 L2: 2 MB I+D on chip per core  
 L3: 52.5 MB I+D on chip per chip  
 Other: None  
 Memory: 512 GB (16 x 32 GB 2Rx8 PC5-4800B-R, running at 4400)  
 Storage: 1 x 1920 GB SATA SSD  
 Other: None

### Software

OS: Red Hat Enterprise Linux release 9.0 (Plow)  
 5.14.0-70.13.1.el9\_0.x86\_64  
 Compiler: C/C++: Version 2023.0 of Intel oneAPI DPC++/C++ Compiler for Linux;  
 Fortran: Version 2023.0 of Intel Fortran Compiler for Linux;  
 Parallel: No  
 Firmware: Version 2.00.55 Released Mar-2023  
 File System: xfs  
 System State: Run level 5 (multi-user)  
 Base Pointers: 64-bit  
 Peak Pointers: Not Applicable  
 Other: None  
 Power Management: BIOS and OS set to prefer performance at the cost of additional power usage



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## Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	112	504	354	504	354	<b>504</b>	<b>354</b>							
502.gcc_r	112	<b>380</b>	<b>417</b>	381	417	379	418							
505.mcf_r	112	227	797	<b>227</b>	<b>799</b>	227	799							
520.omnetpp_r	112	411	358	412	357	<b>411</b>	<b>357</b>							
523.xalancbmk_r	112	125	943	125	948	<b>125</b>	<b>945</b>							
525.x264_r	112	<b>214</b>	<b>919</b>	214	918	213	919							
531.deepsjeng_r	112	<b>385</b>	<b>333</b>	385	333	385	333							
541.leela_r	112	592	313	<b>600</b>	<b>309</b>	605	306							
548.exchange2_r	112	<b>308</b>	<b>952</b>	309	949	308	953							
557.xz_r	112	520	233	<b>524</b>	<b>231</b>	527	230							

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Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

## Compiler Notes

SPEC has ruled that the compiler used for this result was performing a compilation that specifically improves the performance of the 523.xalancbmk\_r / 623.xalancbmk\_s benchmarks using a priori knowledge of the SPEC code and dataset to perform a transformation that has narrow applicability.

In order to encourage optimizations that have wide applicability (see rule 1.4 [https://www.spec.org/cpu2017/Docs/runrules.html#rule\\_1.4](https://www.spec.org/cpu2017/Docs/runrules.html#rule_1.4)), SPEC will no longer publish results using this optimization.

This result is left in the SPEC results database for historical reference.

## Submit Notes

The numactl mechanism was used to bind copies to processors. The config file option 'submit' was used to generate numactl commands to bind each copy to a specific processor. For details, please see the config file.

## Operating System Notes

Stack size set to unlimited using "ulimit -s unlimited"

## Environment Variables Notes

Environment variables set by runcpu before the start of the run:

LD\_LIBRARY\_PATH =  
"/spec2017-icc2023.0/lib/intel64:/spec2017-icc2023.0/lib/ia32:/spec2017-icc2023.0/je5.0.1-32"  
MALLOC\_CONF = "retain:true"



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## General Notes

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM memory using Red Hat Enterprise Linux 8.4  
Transparent Huge Pages enabled by default  
Prior to runcpu invocation  
Filesystem page cache synced and cleared with:  
sync; echo 3> /proc/sys/vm/drop\_caches  
runcpu command invoked through numactl i.e.:  
numactl --interleave=all runcpu <etc>  
NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown) is mitigated in the system as tested and documented.  
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5753 (Spectre variant 1) is mitigated in the system as tested and documented.  
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5715 (Spectre variant 2) is mitigated in the system as tested and documented.

## Platform Notes

BIOS configuration:  
Performance Profile Set to Performance  
SNC Set to Enable SNC2 (2-clusters)

Sysinfo program /spec2017-icc2023.0/bin/sysinfo  
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197  
running on localhost.localdomain Tue Jun 13 06:36:04 2023

SUT (System Under Test) info as seen by some common utilities.

-----  
Table of contents  
-----

1. uname -a
2. w
3. Username
4. ulimit -a
5. sysinfo process ancestry
6. /proc/cpuinfo
7. lscpu
8. numactl --hardware
9. /proc/meminfo
10. who -r
11. Systemd service manager version: systemd 250 (250-6.e19\_0)
12. Services, from systemctl list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline
14. cpupower frequency-info
15. sysctl
16. /sys/kernel/mm/transparent\_hugepage
17. /sys/kernel/mm/transparent\_hugepage/khugepaged
18. OS release
19. Disk information
20. /sys/devices/virtual/dmi/id
21. dmidecode
22. BIOS

-----  
1. uname -a  
Linux localhost.localdomain 5.14.0-70.13.1.e19\_0.x86\_64 #1 SMP PREEMPT Thu Apr 14 12:42:38 EDT 2022 x86\_64  
x86\_64 x86\_64 GNU/Linux  
-----

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### Platform Notes (Continued)

```

-----
2. w
   06:36:04 up 13:44,  3 users,  load average: 0.39, 0.28, 0.11
USER      TTY      LOGIN@  IDLE   JCPU   PCPU   WHAT
root      tty1     Mon16   12.00s  1.34s  0.06s  -bash
root      pts/0   06:30   1:24   0.02s  0.02s  -bash

```

```

-----
3. Username
   From environment variable $USER:  root

```

```

-----
4. ulimit -a
real-time non-blocking time (microseconds, -R) unlimited
core file size              (blocks, -c) 0
data seg size                (kbytes, -d) unlimited
scheduling priority         (-e) 0
file size                    (blocks, -f) unlimited
pending signals              (-i) 2060116
max locked memory            (kbytes, -l) 64
max memory size              (kbytes, -m) unlimited
open files                   (-n) 1024
pipe size                    (512 bytes, -p) 8
POSIX message queues         (bytes, -q) 819200
real-time priority           (-r) 0
stack size                   (kbytes, -s) unlimited
cpu time                     (seconds, -t) unlimited
max user processes           (-u) 2060116
virtual memory                (kbytes, -v) unlimited
file locks                   (-x) unlimited

```

```

-----
5. sysinfo process ancestry
/usr/lib/systemd/systemd rhgb --switched-root --system --deserialize 31
login -- root
-bash
-bash
runcpu --define default-platform-flags --copies 112 -c ic2023.0-lin-sapphirerapids-rate-20221201.cfg
--define smt-on --define cores=56 --define physicalfirst --define invoke_with_interleave --define
drop_caches --tune base --iterations 3 -o all intrate
runcpu --define default-platform-flags --copies 112 --configfile
ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=56 --define physicalfirst
--define invoke_with_interleave --define drop_caches --tune base --iterations 3 --output_format all
--nopower --runmode rate --tune base --size refrate intrate --nopreenv --note-preenv --logfile
$SPEC/tmp/CPU2017.004/templogs/preenv.intrate.004.0.log --lognum 004.0 --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /spec2017-icc2023.0

```

```

-----
6. /proc/cpuinfo
model name      : Intel(R) Xeon(R) Gold 5420+
vendor_id      : GenuineIntel
cpu family     : 6
model          : 143
stepping       : 7
microcode      : 0x2b000111
bugs           : spectre_v1 spectre_v2 spec_store_bypass swapgs
cpu cores      : 28
siblings       : 56
2 physical ids (chips)

```

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### Platform Notes (Continued)

112 processors (hardware threads)  
physical id 0: core ids 0-27  
physical id 1: core ids 0-27  
physical id 0: apicids 0-55  
physical id 1: apicids 128-183

Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for virtualized systems. Use the above data carefully.

#### 7. lscpu

From lscpu from util-linux 2.37.4:

```

Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Address sizes:         46 bits physical, 57 bits virtual
Byte Order:            Little Endian
CPU(s):                112
On-line CPU(s) list:   0-111
Vendor ID:             GenuineIntel
BIOS Vendor ID:       Intel(R) Corporation
Model name:            Intel(R) Xeon(R) Gold 5420+
BIOS Model name:      Intel(R) Xeon(R) Gold 5420+
CPU family:            6
Model:                 143
Thread(s) per core:    2
Core(s) per socket:    28
Socket(s):             2
Stepping:              7
BogoMIPS:              4000.00
Flags:                 fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36
                        clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp
                        lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology
                        nonstop_tsc cpuid aperfmperf tsc_known_freq pni pclmulqdq dtes64 ds_cpl
                        vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2
                        x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm
                        abm 3dnowprefetch cpuid_fault epb cat_l3 cat_l2 cdp_l3 invpcid_single
                        intel_ppin cdp_l2 ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi
                        flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep bmi2 erms
                        invpcid cqm rdt_a avx512f avx512dq rdseed adx smap avx512ifma clflushopt
                        clwb intel_pt avx512cd sha_ni avx512bw avx512vl xsaveopt xsavec xgetbv1
                        xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local split_lock_detect
                        avx_vnni avx512_bf16 wbnoinvd dtherm ida arat pln pts avx512vbmi umip pku
                        ospke waitpkg avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg
                        tme avx512_vpopcntdq la57 rdpid bus_lock_detect cldemote movdiri movdir64b
                        enqcmd fsrm md_clear serialize tsxldtrk pconfig arch_lbr avx512_fp16
                        amx_tile flush_lld arch_capabilities
Virtualization:        VT-x
L1d cache:             2.6 MiB (56 instances)
L1i cache:             1.8 MiB (56 instances)
L2 cache:              112 MiB (56 instances)
L3 cache:              105 MiB (2 instances)
NUMA node(s):         4
NUMA node0 CPU(s):    0-13,56-69
NUMA node1 CPU(s):    14-27,70-83
NUMA node2 CPU(s):    28-41,84-97
NUMA node3 CPU(s):    42-55,98-111
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf:    Not affected
Vulnerability Mds:     Not affected
Vulnerability Meltdown: Not affected

```

(Continued on next page)



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### Platform Notes (Continued)

Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl  
Vulnerability Spectre v1: Mitigation; usercopy/swaps barriers and \_\_user pointer sanitization  
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling  
Vulnerability Srbds: Not affected  
Vulnerability Tsx async abort: Not affected

From lscpu --cache:

NAME	ONE-SIZE	ALL-SIZE	WAYS	TYPE	LEVEL	SETS	PHY-LINE	COHERENCY-SIZE
L1d	48K	2.6M	12	Data	1	64	1	64
L1i	32K	1.8M	8	Instruction	1	64	1	64
L2	2M	112M	16	Unified	2	2048	1	64
L3	52.5M	105M	15	Unified	3	57344	1	64

8. numactl --hardware

NOTE: a numactl 'node' might or might not correspond to a physical chip.

```

available: 4 nodes (0-3)
node 0 cpus: 0-13,56-69
node 0 size: 128043 MB
node 0 free: 125984 MB
node 1 cpus: 14-27,70-83
node 1 size: 129017 MB
node 1 free: 127635 MB
node 2 cpus: 28-41,84-97
node 2 size: 129017 MB
node 2 free: 127579 MB
node 3 cpus: 42-55,98-111
node 3 size: 129007 MB
node 3 free: 127572 MB
node distances:
node  0  1  2  3
0:  10  12  21  21
1:  12  10  21  21
2:  21  21  10  12
3:  21  21  12  10

```

9. /proc/meminfo

MemTotal: 527448656 kB

10. who -r

run-level 3 Jun 12 16:53 last=5

11. Systemd service manager version: systemd 250 (250-6.el9\_0)

```

Default Target Status
graphical      running

```

12. Services, from systemctl list-unit-files

```

STATE UNIT FILES
enabled ModemManager NetworkManager NetworkManager-dispatcher NetworkManager-wait-online
accounts-daemon atd auditd avahi-daemon bluetooth chronyd crond cups dbus-broker gdm
getty@ insights-client-boot irqbalance iscsi iscsi-onboot kdump libstoragemgmt
low-memory-monitor lvm2-monitor mcelog mdmonitor microcode multipathd nis-domainname
nvme-fc-boot-connections ostree-remount power-profiles-daemon qemu-guest-agent rhsmcertd
rsyslog rtkit-daemon selinux-autorelabel-mark smartd sshd sssd switcheroo-control sysstat
systemd-network-generator udisks2 upower vgauthd vmtoolsd
enabled-runtime systemd-remount-fs

```

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### Platform Notes (Continued)

```

disabled      arp-ethers blk-availability brltty canberra-system-bootup canberra-system-shutdown
               canberra-system-shutdown-reboot chrony-wait cni-dhcp console-getty cpupower cups-browsed
               dbus-daemon debug-shell dnsmasq firewallld iprdump iprinit iprupdate iscsid iscsiui kpatch
               kvm_stat ledmon man-db-restart-cache-update nftables nvme-autoconnect podman
               podman-auto-update podman-restart psacct ras-mc-ctl rasdaemon rdisc rhcd rhsm rhsm-facts
               rpmdm-rebuild serial-getty@ speech-dispatcherd sshd-keygen@ systemd-boot-check-no-failures
               systemd-pstore systemd-sysext wpa_supplicant
indirect      spice-vdagentd sssd-autofs sssd-kcm sssd-nss sssd-pac sssd-pam sssd-ssh sssd-sudo

```

```

-----
13. Linux kernel boot-time arguments, from /proc/cmdline
BOOT_IMAGE=(hd0,gpt3)/boot/vmlinuz-5.14.0-70.13.1.el9_0.x86_64
root=UUID=cc4bab05-907e-44ef-b818-2b2874390234
ro
crashkernel=1G-4G:192M,4G-64G:256M,64G-:512M
resume=UUID=5ba347ca-8beb-4f6e-9c11-de63dc4ddf5f
rhgb
quiet

```

```

-----
14. cpupower frequency-info
analyzing CPU 0:
  Unable to determine current policy
  boost state support:
    Supported: yes
    Active: yes

```

```

-----
15. sysctl
kernel.numa_balancing          1
kernel.randomize_va_space     2
vm.compaction_proactiveness    20
vm.dirty_background_bytes      0
vm.dirty_background_ratio      10
vm.dirty_bytes                 0
vm.dirty_expire_centisecs     3000
vm.dirty_ratio                 20
vm.dirty_writeback_centisecs   500
vm.dirtytime_expire_seconds    43200
vm.extfrag_threshold           500
vm.min_unmapped_ratio          1
vm.nr_hugepages                0
vm.nr_hugepages_mempolicy      0
vm.nr_overcommit_hugepages     0
vm.swappiness                   60
vm.watermark_boost_factor      15000
vm.watermark_scale_factor      10
vm.zone_reclaim_mode           0

```

```

-----
16. /sys/kernel/mm/transparent_hugepage
defrag      always defer defer+madvice [madvice] never
enabled     [always] madvice never
hpage_pmd_size  2097152
shmem_enabled always within_size advise [never] deny force

```

```

-----
17. /sys/kernel/mm/transparent_hugepage/khugepaged
alloc_sleep_millisecs  60000
defrag                  1

```

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### Platform Notes (Continued)

max_ptes_none	511
max_ptes_shared	256
max_ptes_swap	64
pages_to_scan	4096
scan_sleep_millisecs	10000

-----

18. OS release  
 From /etc/\*-release /etc/\*-version  
 os-release Red Hat Enterprise Linux 9.0 (Plow)  
 redhat-release Red Hat Enterprise Linux release 9.0 (Plow)  
 system-release Red Hat Enterprise Linux release 9.0 (Plow)

-----

19. Disk information  
 SPEC is set to: /spec2017-icc2023.0  

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/sda3	xf	420G	17G	404G	4%	/

-----

20. /sys/devices/virtual/dmi/id  
 Vendor: XFUSION  
 Product: 2288H V7  
 Product Family: Eagle Stream  
 Serial: 2106181991X3N5000001

-----

21. dmidecode  
 Additional information from dmidecode 3.3 follows. WARNING: Use caution when you interpret this section. The 'dmidecode' program reads system data which is "intended to allow hardware to be accurately determined", but the intent may not be met, as there are frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.  
 Memory:  
 16x Samsung M321R4GA3BB6-CQKDG 32 GB 2 rank 4800, configured at 4400

-----

22. BIOS  
 (This section combines info from /sys/devices and dmidecode.)  
 BIOS Vendor: XFUSION  
 BIOS Version: 2.00.55  
 BIOS Date: 03/07/2023  
 BIOS Revision: 0.55

### Compiler Version Notes

=====  
 C | 500.perlbench\_r(base) 502.gcc\_r(base) 505.mcf\_r(base) 525.x264\_r(base) 557.xz\_r(base)

-----  
 Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201  
 Copyright (C) 1985-2022 Intel Corporation. All rights reserved.

=====  
 C++ | 520.omnetpp\_r(base) 523.xalancbmk\_r(base) 531.deepsjeng\_r(base) 541.leela\_r(base)

-----  
 Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201  
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## Compiler Version Notes (Continued)

=====  
Fortran | 548.exchange2\_r(base)  
=====

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201  
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.  
=====

## Base Compiler Invocation

C benchmarks:

icx

C++ benchmarks:

icpx

Fortran benchmarks:

ifx

## Base Portability Flags

500.perlbench\_r: -DSPEC\_LP64 -DSPEC\_LINUX\_X64  
502.gcc\_r: -DSPEC\_LP64  
505.mcf\_r: -DSPEC\_LP64  
520.omnetpp\_r: -DSPEC\_LP64  
523.xalancbmk\_r: -DSPEC\_LP64 -DSPEC\_LINUX  
525.x264\_r: -DSPEC\_LP64  
531.deepsjeng\_r: -DSPEC\_LP64  
541.leela\_r: -DSPEC\_LP64  
548.exchange2\_r: -DSPEC\_LP64  
557.xz\_r: -DSPEC\_LP64

## Base Optimization Flags

C benchmarks:

-w -std=c11 -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math  
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4  
-L/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64\_lin  
-lqkmalloc

C++ benchmarks:

-w -std=c++14 -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math  
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4

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**Test Sponsor:** xFusion

**Tested by:** xFusion

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## Base Optimization Flags (Continued)

C++ benchmarks (continued):

```
-L/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin
-lqkmalloc
```

Fortran benchmarks:

```
-w -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-L/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin
-lqkmalloc
```

The flags files that were used to format this result can be browsed at

<http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.html>

<http://www.spec.org/cpu2017/flags/xFusion-Platform-Settings-SPR-V1.1-revC.html>

You can also download the XML flags sources by saving the following links:

<http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.xml>

<http://www.spec.org/cpu2017/flags/xFusion-Platform-Settings-SPR-V1.1-revC.xml>

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For questions about this result, please contact the tester. For other inquiries, please contact [info@spec.org](mailto:info@spec.org).

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