**SPEC CPU®2017 Floating Point Rate Result**

**NEC Corporation**

Express5800/R120i-1M (Intel Xeon Gold 6326)

<table>
<thead>
<tr>
<th>Software Availability:</th>
<th>DEC-2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor:</td>
<td>NEC Corporation</td>
</tr>
<tr>
<td>Tested by:</td>
<td>NEC Corporation</td>
</tr>
<tr>
<td>CPU2017 License:</td>
<td>9006</td>
</tr>
<tr>
<td>Test Date:</td>
<td>Jul-2021</td>
</tr>
</tbody>
</table>

- **SPECrate®2017_fp_base = 289**
- **SPECrate®2017_fp_peak = 299**

### Hardware

<table>
<thead>
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</tr>
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<tr>
<td>OS: Red Hat Enterprise Linux release 8.3 (Ootpa) 4.18.0-240.el8.x86_64</td>
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<td>Parallel: No</td>
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<td>Firmware: NEC BIOS Version U46 v1.40 04/28/2021 released Jul-2021</td>
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<tr>
<td>File System: ext4</td>
</tr>
<tr>
<td>System State: Run level 3 (multi-user)</td>
</tr>
<tr>
<td>Base Pointers: 64-bit</td>
</tr>
<tr>
<td>Peak Pointers: 64-bit</td>
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<td>Power Management: jemalloc memory allocator V5.0.1</td>
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### Hardware

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<tbody>
<tr>
<td>CPU Name: Intel Xeon Gold 6326</td>
</tr>
<tr>
<td>Max MHz: 3500</td>
</tr>
<tr>
<td>Nominal: 2900</td>
</tr>
<tr>
<td>Enabled: 32 cores, 2 chips, 2 threads/core</td>
</tr>
<tr>
<td>Orderable: 1.2 chips</td>
</tr>
<tr>
<td>Cache L1: 32 KB I + 48 KB D on chip per core</td>
</tr>
<tr>
<td>Cache L2: 1.25 MB I+D on chip per core</td>
</tr>
<tr>
<td>Cache L3: 24 MB I+D on chip per chip</td>
</tr>
<tr>
<td>Other: None</td>
</tr>
<tr>
<td>Memory: 1 TB (32 x 32 GB 2Rx4 PC4-3200AA-R)</td>
</tr>
<tr>
<td>Storage: 1 x 800 GB SAS SSD, RAID 0</td>
</tr>
<tr>
<td>Other: None</td>
</tr>
</tbody>
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### Results Table

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<thead>
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<td>148</td>
<td>341</td>
<td>149</td>
<td>32</td>
<td>342</td>
</tr>
</tbody>
</table>

**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 = "/home/cpu2017/lib/intel64:/home/cpu2017/je5.0.1-64"
MALLOC_CONF = "retain:true"
```

**General Notes**

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Red Hat Enterprise Linux 8.1

NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown) is mitigated in the system as tested and documented.
General Notes (Continued)

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.

This benchmark result is intended to provide perspective on past performance using the historical software and/or firmware described on this result page.

The system as described on this result page was formerly generally available. At the time of this publication, it may not be shipping, and/or may not be supported, and/or may fail to meet other tests of General Availability described in the SPEC OSG Policy document, http://www.spec.org/osg/policy.html

This measured result may not be representative of the result that would be measured were this benchmark run with software and firmware available as of the publication date.

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.:
umactl --interleave=all runcpu <etc>
jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

Platform Notes

BIOS Settings:
Thermal Configuration: Maximum Cooling
Workload Profile: General Throughput Compute
Advanced Memory Protection: Advanced ECC Support
Memory Patrol Scrubbing: Disabled
Minimum Processor Idle Power Core C-State: C6 State
LLC Dead Line Allocation: Disabled
LLC Prefetch: Enabled
Enhanced Processor Performance: Enabled
XPT Prefetcher: Enabled
Workload Profile: Custom
DCU Stream Prefetcher: Disabled
Energy/Performance Bias: Balanced Performance

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e6a1cafc64d

(Continued on next page)
SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2023 Standard Performance Evaluation Corporation

NEC Corporation

Express5800/R120i-1M (Intel Xeon Gold 6326)

SPECrate®2017_fp_base = 289
SPECrate®2017_fp_peak = 299

CPU2017 License: 9006
Test Sponsor: NEC Corporation
Test Date: Jul-2021
Tested by: NEC Corporation
Hardware Availability: Jul-2021
Software Availability: Dec-2020

Platform Notes (Continued)

running on r120i1m Wed Jul 14 10:36:16 2021

SUT (System Under Test) info as seen by some common utilities.
For more information on this section, see
https://www.spec.org/cpu2017/Docs/config.html#sysinfo

From /proc/cpuinfo
model name : Intel(R) Xeon(R) Gold 6326 CPU @ 2.90GHz
  2 "physical id"s (chips)
  64 "processors"
cores, siblings (Caution: counting these is hw and system dependent. The following excerpts from /proc/cpuinfo might not be reliable. Use with caution.)
cpu cores : 16
siblings : 32
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

From lscpu from util-linux 2.32.1:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 64
On-line CPU(s) list: 0-63
Thread(s) per core: 2
Core(s) per socket: 16
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 106
Model name: Intel(R) Xeon(R) Gold 6326 CPU @ 2.90GHz
Stepping: 6
CPU MHz: 3016.325
BogoMIPS: 5800.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 24576K
NUMA node0 CPU(s): 0-7,32-39
NUMA node1 CPU(s): 8-15,40-47
NUMA node2 CPU(s): 16-23,48-55
NUMA node3 CPU(s): 24-31,56-63
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 arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
aperfmperf pni pclmulqdq dtst64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16

(Continued on next page)
NEC Corporation

Express5800/R120i-1M (Intel Xeon Gold 6326)

**SPEC CPU®2017 Floating Point Rate Result**

**Copyright 2017-2023 Standard Performance Evaluation Corporation**

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**Express5800/R120i-1M (Intel Xeon Gold 6326)**

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**SPECrater®2017_fp_base = 289**

**SPECrater®2017_fp_peak = 299**

**Platform Notes (Continued)**

xtpr pdcn pcd 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 invpcid_single ssbd
ml ibrs ibpb stibp ibrs_enhanced tpr_shadow vnumi flexpriority ept vpid ept_ad
fsqsb tsc_adjust bmi1 hle 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 wbench dtherm ida arat pin pts avx512vbm1 umip pku
ospe avx512_vbmi2 gfni vaes vpcclmuqdq avx512_vnni avx512_vbmi avx512_vpopcntdq
la57 rdpid md_clear pconfig flush_lld arch_capabilities

/proc/cpuinfo cache data
cache size: 24576 KB

From numactl --hardware
WARNING: a numactl 'node' might or might not correspond to a physical chip.
available: 4 nodes (0-3)
node 0 cpus: 0 1 2 3 4 5 6 7 32 33 34 35 36 37 38 39
node 0 size: 253439 MB
node 0 free: 257122 MB
node 1 cpus: 8 9 10 11 12 13 14 15 40 41 42 43 44 45 46 47
node 1 size: 253887 MB
node 1 free: 257727 MB
node 2 cpus: 16 17 18 19 20 21 22 23 48 49 50 51 52 53 54 55
node 2 size: 253861 MB
node 2 free: 257631 MB
node 3 cpus: 24 25 26 27 28 29 30 31 56 57 58 59 60 61 62 63
node 3 size: 254015 MB
node 3 free: 257655 MB
node distances:
node 0 1 2 3
0: 10 20 30 30
1: 20 10 30 30
2: 30 30 10 20
3: 30 30 20 10

From /proc/meminfo
MemTotal: 1056523360 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

/sbin/tuned-adm active
Current active profile: throughput-performance

From /etc/*release* /etc/*version*
   os-release:
   NAME="Red Hat Enterprise Linux"
   VERSION="8.3 (Ootpa)"

(Continued on next page)
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Software Availability: Dec-2020

Platform Notes (Continued)

ID="rhel"
ID_LIKE="fedora"
VERSION_ID="8.3"
PLATFORM_ID="platform:el8"
PRETTY_NAME="Red Hat Enterprise Linux 8.3 (Ootpa)"
ANSI_COLOR="0;31"
redhat-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
system-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
system-release-cpe: cpe:/o:redhat:enterprise_linux:8.3:ga

uname -a:
Linux r120i1m 4.18.0-240.el8.x86_64 #1 SMP Wed Sep 23 05:13:10 EDT 2020 x86_64_x86_64_x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit): Not affected
CVE-2018-3620 (L1 Terminal Fault): Not affected
Microarchitectural Data Sampling: Not affected
CVE-2017-5754 (Meltdown): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2017-5753 (Spectre variant 1): Mitigation: usercopy/swapgs barriers and __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

run-level 3 Jul 14 10:34

SPEC is set to: /home/cpu2017

From /sys/devices/virtual/dmi/id
Vendor: NEC
Product: Express5800/R120i-1M
Product Family: Express5800
Serial: CN70450X8H

Additional information from dmidecode 3.2 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.

(Continued on next page)
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Software Availability: Dec-2020

Platform Notes (Continued)

Memory:
32x Hynix HMA84GR7CJR4N-XN 32 GB 2 rank 3200

BIOS:
BIOS Vendor: NEC
BIOS Version: U46
BIOS Date: 04/28/2021
BIOS Revision: 1.40
Firmware Revision: 2.44

(End of data from sysinfo program)

Compiler Version Notes

C
| 519.lbm\_r(base, peak) 538.imagick\_r(base, peak)
| 544.nab\_r(base, peak)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

C++
| 508.namd\_r(base, peak) 510.parest\_r(base, peak)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

C++, C
| 511.povray\_r(peak)

Intel(R) C++ Intel(R) 64 Compiler Classic for applications running on
Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

C++, C
| 511.povray\_r(base) 526.blender\_r(base, peak)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
NEC Corporation

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**Compiler Version Notes (Continued)**

Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel® oneAPI DPC++/C++ Compiler for applications running on Intel® 64,
Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

------------------------------------------------------------------------------

**C++, C** | 511.povray_r(peak)

------------------------------------------------------------------------------

Intel® C++ Intel® 64 Compiler Classic for applications running on
Intel® 64, Version 2021.1 Build 20201112_000000
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Intel® C Intel® 64 Compiler Classic for applications running on Intel®
64, Version 2021.1 Build 20201112_000000
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------------------------------------------------------------------------------

**C++, C** | 511.povray_r(base) 526.blender_r(base, peak)

------------------------------------------------------------------------------

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Intel® oneAPI DPC++/C++ Compiler for applications running on Intel® 64,
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Intel® Fortran Intel® 64 Compiler Classic for applications running on
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------------------------------------------------------------------------------

**C++, C, Fortran** | 507.cactuBSSN_r(base, peak)

------------------------------------------------------------------------------

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Intel® Fortran Intel® 64 Compiler Classic for applications running on
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------------------------------------------------------------------------------

**Fortran** | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)

------------------------------------------------------------------------------

(Continued on next page)
NEC Corporation

Express5800/R120i-1M (Intel Xeon Gold 6326)

| SPECrate®2017_fp_base = 289 |
| SPECrate®2017_fp_peak = 299 |

CPU2017 License: 9006
Test Sponsor: NEC Corporation
Tested by: NEC Corporation

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Base</th>
<th>Peak</th>
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<tbody>
<tr>
<td>icx</td>
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<tr>
<td>icpx</td>
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<td></td>
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<tr>
<td>ifort</td>
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Compiler Version Notes (Continued)

Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
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------------------------------------------------------------------
Fortran, C | 521.wrf_r(base, peak) 527.cam4_r(base, peak) 527.cam5_r(base, peak)
------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
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------------------------------------------------------------------

Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifort

Benchmark using both Fortran and C:
ifort icx

Benchmark using both C and C++:
icpx icx

Benchmark using Fortran, C, and C++:
icpx icx ifort

Base Portability Flags

503.bwaves_r: -DSPEC_LP64
507.cactuBSSN_r: -DSPEC_LP64
508.namd_r: -DSPEC_LP64
510.parest_r: -DSPEC_LP64
511.povray_r: -DSPEC_LP64

(Continued on next page)
<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Compilation Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>519.lbm_r</td>
<td>-DSPEC_LP64</td>
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<tr>
<td>521.wrf_r</td>
<td>-DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian</td>
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<tr>
<td>526.blender_r</td>
<td>-DSPEC_LP64 -DSPEC_LINUX -funsigned-char</td>
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<tr>
<td>527.cam4_r</td>
<td>-DSPEC_LP64 -DSPEC_CASE_FLAG</td>
</tr>
<tr>
<td>538.imagick_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>544.nab_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>549.fotonik3d_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>554.roms_r</td>
<td>-DSPEC_LP64</td>
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</table>

**Base Optimization Flags**

**C benchmarks:**

```bash
-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```

**C++ benchmarks:**

```bash
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```

**Fortran benchmarks:**

```bash
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ipo -no-prec-div
-qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```

**Benchmarks using both Fortran and C:**

```bash
-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -O3 -ipo
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles
-mbranches-within-32B-boundaries -nostandard-realloc-lhs
-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib
```

**Benchmarks using both C and C++:**

```bash
-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```
NEC Corporation
Express5800/R120i-1M (Intel Xeon Gold 6326)

SPECrate®2017_fp_base = 289
SPECrate®2017_fp_peak = 299

Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++:
-\texttt{-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math}
-\texttt{-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -O3}
-\texttt{-no-prec-div -qopt-prefetch -ffinite-math-only}
-\texttt{-qopt-multiple-gather-scatter-by-shuffles}
-\texttt{-mbranches-within-32B-boundaries -nostandard-realloc-lhs}
-\texttt{-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib}

Peak Compiler Invocation

C benchmarks:
\texttt{icx}

C++ benchmarks:
\texttt{icpx}

Fortran benchmarks:
\texttt{ifort}

Benchmarks using both Fortran and C:
\texttt{ifort icx}

Benchmarks using both C and C++:
\texttt{511.povray_r icpc icc}
\texttt{526.blender_r icpx icx}

Benchmarks using Fortran, C, and C++:
\texttt{icpx icx ifort}

Peak Portability Flags

Same as Base Portability Flags
**NEC Corporation**

**Express5800/R120i-1M (Intel Xeon Gold 6326)**

**SPEC CPU®2017 Floating Point Rate Result**

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<th>CPU2017 License: 9006</th>
<th>Test Date: Jul-2021</th>
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<td>Hardware Availability: Jul-2021</td>
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<tr>
<td>Tested by: NEC Corporation</td>
<td>Software Availability: Dec-2020</td>
</tr>
</tbody>
</table>

**SPECrate®2017_fp_base = 289**

**SPECrate®2017_fp_peak = 299**

---

**Peak Optimization Flags**

**C benchmarks:**

519.lbm_r: basepeak = yes

538.imagick_r: basepeak = yes


**C++ benchmarks:**

508.namd_r: basepeak = yes


**Fortran benchmarks:**

503.bwaves_r: basepeak = yes

549.fotonik3d_r: basepeak = yes


**Benchmarks using both Fortran and C:**

521.wrf_r: basepeak = yes

527.cam4_r: basepeak = yes

**Benchmarks using both C and C++:**

511.povray_r: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX512 -O3 -ipo -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-multiple-gather-scatter-by-shuffles -qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries

(Continued on next page)
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Spec CPU®2017 Floating Point Rate Result

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Express5800/R120i-1M (Intel Xeon Gold 6326)

SPECrater®2017_fp_base = 289

SPECrater®2017_fp_peak = 299

CPU2017 License: 9006
Test Sponsor: NEC Corporation
Tested by: NEC Corporation

Test Date: Jul-2021
Hardware Availability: Jul-2021
Software Availability: Dec-2020

Peak Optimization Flags (Continued)

511.povray_r (continued):
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

526.blender_r: basepeak = yes

Benchmarks using Fortran, C, and C++:

507.cactuBSSN_r: basepeak = yes

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/NEC-Platform-Settings-V1.2-R120i-RevE.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.xml
http://www.spec.org/cpu2017/flags/NEC-Platform-Settings-V1.2-R120i-RevE.xml

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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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