# SPEC CPU®2017 Floating Point Rate Result

**Lenovo Global Technology**  
ThinkSystem ST250  
(3.40 GHz, Intel Xeon E-2226G)

| SPECrate®2017_fp_base | 39.9 | SPECrate®2017_fp_peak | 40.4 |

**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology  
**Test Date:** May-2020  
**Hardware Availability:** Mar-2020  
**Software Availability:** Apr-2020

| SPECrate®2017_fp_peak | 40.4 |

## Hardware

| Copy | 503.bwaves_r | 6 | 507.cactuBSSN_r | 6 | 508.namd_r | 6 | 510.parest_r | 6 | 511.povray_r | 6 | 519.blm_r | 6 | 521.wrf_r | 6 | 526.blender_r | 6 | 527.cam4_r | 6 | 538.imagick_r | 6 | 544.nab_r | 6 | 549.fotonik3d_r | 6 | 554.roms_r | 6 |
|------|--------------|---|---------------|---|------------|---|-------------|---|-------------|---|----------|---|----------|---|-------------|---|-------------|---|-------------|---|-------------|---|-------------|---|
|      |              |   |               |   |            |   |             |   |             |   |          |   |          |   |             |   |             |   |             |   |             |   |             |   |

| SPECrate®2017_fp_base (39.9) | SPECrate®2017_fp_peak (40.4)

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

## Software

<table>
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<tr>
<th>OS:</th>
<th>SUSE Linux Enterprise Server 12 SP5 (x86_64)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kernel 4.12.14-120-default</td>
</tr>
<tr>
<td></td>
<td>Compiler: C/C++: Version 19.1.1.217 of Intel</td>
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<tr>
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<td>C/C++ Compiler for Linux;</td>
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<tr>
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<td>Fortran: Version 19.1.1.217 of Intel Fortran</td>
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<tr>
<td></td>
<td>Compiler for Linux</td>
</tr>
<tr>
<td></td>
<td>Parallel: No</td>
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<tr>
<td></td>
<td>Firmware: Lenovo BIOS Version ISE115D 2.10 released Apr-2020</td>
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<tr>
<td></td>
<td>File System: xfs</td>
</tr>
<tr>
<td></td>
<td>System State: Run level 3 (multi-user)</td>
</tr>
<tr>
<td></td>
<td>Base Pointers: 64-bit</td>
</tr>
<tr>
<td></td>
<td>Peak Pointers: 64-bit</td>
</tr>
<tr>
<td></td>
<td>Other: jemalloc memory allocator V5.0.1</td>
</tr>
<tr>
<td></td>
<td>Power Management: BIOS set to prefer performance at the cost of additional power usage</td>
</tr>
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</table>

**CPU Name:** Intel Xeon E-2226G  
**Max MHz:** 4700  
**Nominal:** 3400  
**Enabled:** 6 cores, 1 chip  
**Orderable:** 1 chip  
**Cache L1:** 32 KB I + 32 KB D on chip per core  
**L2:** 256 KB I+D on chip per core  
**L3:** 12 MB I+D on chip per chip  
**Other:** None  
**Memory:** 128 GB (4 x 32 GB 2Rx4 PC4-2666V-E)  
**Storage:** 1 x 960 GB SATA SSD  
**Other:** None

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**Page 1**  
Standard Performance Evaluation Corporation (info@spec.org)  
https://www.spec.org/
## Results Table

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<th>Benchmark</th>
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<td>16.2</td>
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</tbody>
</table>

**SPECrate®2017_fp_base** = 39.9  
**SPECrate®2017_fp_peak** = 40.4

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

## Compiler Notes

The inconsistent Compiler version information under Compiler Version section is due to a discrepancy in Intel Compiler. The correct version of C/C++ compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux

The correct version of Fortran compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux

## Submit Notes

The taskset mechanism was used to bind copies to processors. The config file option 'submit' was used to generate taskset 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/cpu2017-1.1.0-ic19.1.1/lib/intel64:/home/cpu2017-1.1.0-ic19.1.1/jre5.0.1-64"
MALLOC_CONF = "retain:true"
```
### Lenovo Global Technology

**ThinkSystem ST250**

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- **CPU2017 License:** 9017
- **Test Sponsor:** Lenovo Global Technology
- **Tested by:** Lenovo Global Technology
- **Test Date:** May-2020
- **Hardware Availability:** Mar-2020
- **Software Availability:** Apr-2020

### General Notes

- Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Redhat Enterprise Linux 8.0
- Transparent Huge Pages enabled by default
- Prior to runcpu invocation
- Filesystem page cache synced and cleared with:
  ```bash
  sync; echo 3>/proc/sys/vm/drop_caches
  ```

**Yes:** 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.

**Yes:** The test sponsor attests, as of date of publication, that CVE-2018-3640 (Spectre variant 3a) is mitigated in the system as tested and documented.

**Yes:** The test sponsor attests, as of date of publication, that CVE-2018-3639 (Spectre variant 4) is mitigated in the system as tested and documented.


### Platform Notes

**BIOS configuration:**

Choose Operating Mode set to Maximum Performance

```
Sysinfo program /home/cpu2017-1.1.0-ic19.1.1/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edbl1e6e46a485a0011
running on linux-tzna Sat May 30 19:15:53 2020
```

**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

- model name: Intel(R) Xeon(R) E-2226G CPU @ 3.40GHz
  - 1 "physical id"s (chips)
  - 6 "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: 6
    - siblings: 6
    - physical 0: cores 0 1 2 3 4 5

- From lscpu:
  - Architecture: x86_64
  - CPU op-mode(s): 32-bit, 64-bit

(Continued on next page)
Lenovo Global Technology  
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**Platform Notes (Continued)**

Byte Order: Little Endian  
Address sizes: 39 bits physical, 48 bits virtual  
CPU(s): 6  
On-line CPU(s) list: 0-5  
Thread(s) per core: 1  
Core(s) per socket: 6  
Socket(s): 1  
NUMA node(s): 1  
Vendor ID: GenuineIntel  
CPU family: 6  
Model: 158  
Model name: Intel(R) Xeon(R) E-2226G CPU @ 3.40GHz  
Stepping: 10  
CPU MHz: 3400.000  
CPU max MHz: 4700.0000  
CPU min MHz: 800.0000  
BogoMIPS: 6816.00  
Virtualization: VT-x  
L1d cache: 32K  
L1i cache: 32K  
L2 cache: 256K  
L3 cache: 12288K  
NUMA node0 CPU(s): 0-5  
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 aperfmperp tsc_known_freq pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb invpcid_single pti ssbd ibrs ibpb stibp tpr_shadow vmm clinflushopt intel_pt xsaveopt xsavec xsetbv1 xsaves dtherm ida arat pln pts hwp hwp_notify hwp_act_window hwp_epp md_clear flush_l1d

/proc/cpuinfo cache data  
cache size : 12288 KB

From numactl --hardware  
WARNING: a numactl 'node' might or might not correspond to a physical chip.  
available: 1 nodes (0)  
node 0 cpus: 0 1 2 3 4 5  
node 0 size: 128865 MB  
node 0 free: 128290 MB  
node distances:  
node 0  
0: 10

(Continued on next page)
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Platform Notes (Continued)

From /proc/meminfo
MemTotal: 131958660 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
SuSE-release:
SUSE Linux Enterprise Server 12 (x86_64)
VERSION = 12
PATCHLEVEL = 5
# This file is deprecated and will be removed in a future service pack or release.
# Please check /etc/os-release for details about this release.
os-release:
NAME="SLES"
VERSION="12-SP5"
VERSION_ID="12.5"
PRETTY_NAME="SUSE Linux Enterprise Server 12 SP5"
ID="sles"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:12:sp5"

uname -a:
x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

itlb_multihit: KVM: Mitigation: Split huge pages
CVE-2018-3620 (L1 Terminal Fault): Mitigation: PTE Inversion; VMX: conditional
Microarchitectural Data Sampling: cache flushes, SMT disabled
CVE-2017-5754 (Meltdown): Mitigation: PTI
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
CVE-2017-5715 (Spectre variant 2): pointer sanitization
tsx_async_abort: Mitigation: Clear CPU buffers; SMT disabled

run-level 3 May 30 19:14

SPEC is set to: /home/cpu2017-1.1.0-ic19.1.1
Filesystem Type Size Used Avail Use% Mounted on
/dev/sdb3 xfs 893G 64G 829G 8% /

(Continued on next page)
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Platform Notes (Continued)

From /sys/devices/virtual/dmi/id
BIOS: Lenovo -[ISE115D-2.10]- 04/24/2020
Vendor: Lenovo
Product: ThinkSystem ST250 -[7Y45CT00WW]-
Product Family: ThinkSystem
Serial: 1234567890

Additional information from dmidecode 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:
4x SK Hynix HMAA4GU7AJR8N-VK 32767 MB 2 rank 2666

(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) C Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
-----------------------------------------------------------------------------

==============================================================================
| C++              | 508.namd_r(base, peak) 510.parest_r(base, peak) |
-----------------------------------------------------------------------------
Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
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-----------------------------------------------------------------------------

==============================================================================
| C++, C           | 511.povray_r(base) 526.blender_r(base, peak) |
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(Continued on next page)
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Compiler Version Notes (Continued)

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

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Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
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C++, C | 511.povray_r(base) 526.blender_r(base, peak)

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

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

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(Continued on next page)
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### Compiler Version Notes (Continued)

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

Intel (R) C Intel (R) 64 Compiler for applications running on Intel (R) 64,  
Version 19.1.1.217 Build 20200306

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---

## Base Compiler Invocation

C benchmarks:
icc

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using both C and C++:
icpc icc

Benchmarks using Fortran, C, and C++:
icpc icc 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  
519.bbm_r: -DSPEC_LP64  
521.wrf_r: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian  
526.blender_r: -DSPEC_LP64 -DSPEC_LINUX -funsigned-char  
527.cam4_r: -DSPEC_LP64 -DSPEC_CASE_FLAG  
538.imagick_r: -DSPEC_LP64  
544.nab_r: -DSPEC_LP64  
549.fotonik3d_r: -DSPEC_LP64  
554.roms_r: -DSPEC_LP64
Lenovo Global Technology
ThinkSystem ST250
(3.40 GHz, Intel Xeon E-2226G)

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Test Date: May-2020
Hardware Availability: Mar-2020
Tested by: Lenovo Global Technology
Software Availability: Apr-2020

SPECrate®2017_fp_base = 39.9
SPECrate®2017_fp_peak = 40.4

Base Optimization Flags

C benchmarks:
-m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-fuse-ld=gold -xCORE-AVX2 -Ofast -ffast-math -flto -mfpmath=sse
-funroll-loops -qopt-mem-layout-trans=4
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

C++ benchmarks:
-m64 -qnextgen -Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefs -fuse-ld=gold -xCORE-AVX2 -Ofast -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Fortran benchmarks:
-m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-fuse-ld=gold -xCORE-AVX2 -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
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Benchmarks using both Fortran and C:
-m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-fuse-ld=gold -xCORE-AVX2 -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 -nostandard-realloc-lhs
-align array32byte -auto -mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Benchmarks using both C and C++:
-m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-fuse-ld=gold -xCORE-AVX2 -Ofast -ffast-math -flto -mfpmath=sse
-funroll-loops -qopt-mem-layout-trans=4
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Benchmarks using Fortran, C, and C++:
-m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-fuse-ld=gold -xCORE-AVX2 -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 -nostandard-realloc-lhs
-align array32byte -auto -mbranches-within-32B-boundaries
Lenovo Global Technology
ThinkSystem ST250
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Baseline Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Peak Compiler Invocation

C benchmarks:
  icc
C++ benchmarks:
  icpc

Fortran benchmarks:
  ifort

Benchmarks using both Fortran and C:
  ifort icc

Benchmarks using both C and C++:
  icpc icc

Benchmarks using Fortran, C, and C++:
  icpc icc ifort

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:
  519.lbm_r: basepeak = yes
  538.imagick_r: basepeak = yes
  544.nab_r: basepeak = yes

C++ benchmarks:

(Continued on next page)
Lenovo Global Technology
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**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology

**SPECrate®2017_fp_base = 39.9**
**SPECrate®2017_fp_peak = 40.4**

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<th>Test Date:</th>
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<td>Hardware Availability:</td>
<td>Mar-2020</td>
</tr>
<tr>
<td>Software Availability:</td>
<td>Apr-2020</td>
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</tbody>
</table>

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**Peak Optimization Flags (Continued)**

508.namd_r: `basepeak = yes`

510.parest_r: `-m64 -qnextgen`  
`-Wl,-plugin-opt=-x86-branches-within-32B-boundaries`  
`-Wl,-z,muldefs -fuse-li=gold -xCORE-AVX2 -Ofast`  
`-ffast-math -flto -mfpmath=sse -funroll-loops`  
`-qopt-mem-layout-trans=4 -L/usr/local/jemalloc64-5.0.1/lib`  
`-ljemalloc`

**Fortran benchmarks:**

503.bwaves_r: `-m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries`  
`-Wl,-z,muldefs -fuse-li=gold -xCORE-AVX2 -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`  
`-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`

549.fotonik3d_r: `basepeak = yes`

554.roms_r: Same as 503.bwaves_r

**Benchmarks using both Fortran and C:**

521.wrf_r: `-prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2 -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`  
`-nostandard-realloc-lhs -align array32byte -auto`  
`-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`

527.cam4_r: `basepeak = yes`

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

511.povray_r: `-prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2 -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`  
`-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`

526.blender_r: `basepeak = yes`

**Benchmarks using Fortran, C, and C++:**

(Continued on next page)
Lenovo Global Technology
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Peak Optimization Flags (Continued)

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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-SKL-J.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-SKL-J.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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