



Inspur Cloud Information Technology Co., Ltd.

# TPC Express Benchmark™ HS Full Disclosure Report

InspurCloud Physical Server for Data  
(with 22x InspurCloud Data-Cloud Servers)

Running

InspurCloud Data Cloud Platform 5.1.0  
on  
CentOS Linux 8.5

TPCx-HS Version  
Report Edition  
Report Submitted

2.0.3  
First  
January 30, 2024

**First Edition - January 2024**

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# Abstract

This document contains the methodology and results of the TPC Express Benchmark™ HS (TPCx-HS) test conducted in conformance with the requirements of the TPCx-HS Standard Specification, Revision 2.0.3.


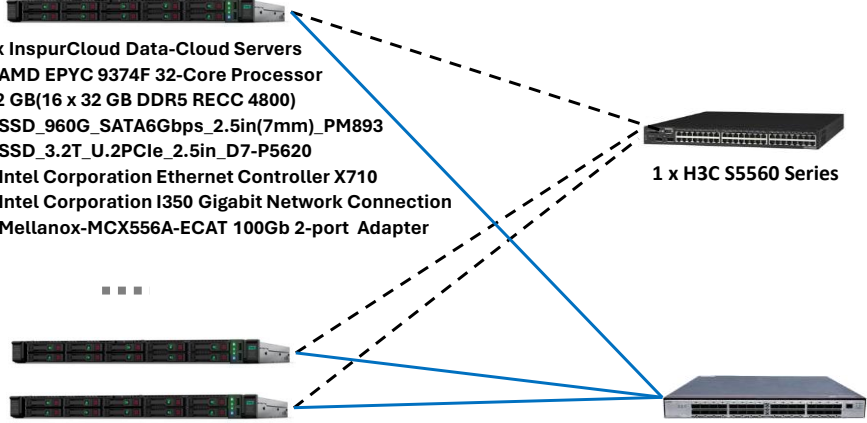
The benchmark results are summarized below.


Measured Configuration			
Company Name	Cluster Node	Hadoop Software	Operating System
Inspur Cloud	InspurCloud Data-Cloud	InspurCloud Data Cloud Platform 5.1.0	CentOS Linux 8.5


TPC Express Benchmark™ HS Metrics			
Total System Cost	HSph@1TB	Price/Performance	Availability Date
\$704,148	53.19	\$13,238.36	January 30, 2024


# Executive Summary

The [Executive Summary](#) follows on the next several pages.

	<h2>InspurCloud Physical Server for Data</h2>		TPCx-HS 2.0.3 TPC Pricing 2.9.0 Report Date Jan. 30, 2024
Availability Date <b>January 30, 2024</b>	TPCx-HS Performance <b>53.19 HSph@1TB</b>	Price/Performance <b>\$13,238.36 \$ / HSph@1TB</b>	Total System Cost <b>\$704,148 USD</b>
System Under Test Configuration Overview			
Scale Factor 1	Hadoop Software InspurCloud Data Cloud Platform 5.1.0	Operating System CentOS Linux 8.5	Other Software N/A
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>12x InspurCloud Data-Cloud Servers                      2x AMD EPYC 9374F 32-Core Processor                      512 GB(16 x 32 GB DDR5 RECC 4800)                      2x SSD_960G_SATA6Gbps_2.5in(7mm)_PM893                      8x SSD_3.2T_U.2PCIe_2.5in_D7-P5620                      1x Intel Corporation Ethernet Controller X710                      1x Intel Corporation I350 Gigabit Network Connection                      2x Mellanox-MCX556A-ECAT 100Gb 2-port Adapter</p> <p>...</p> <p>10x InspurCloud Data-Cloud Servers                      2x AMD EPYC 9374F 32-Core Processor                      512 GB(16 x 32 GB DDR5 RECC 4800)                      2x SSD_960G_SATA6Gbps_2.5in(7mm)_PM893                      8x SSD_3.2T_U.2PCIe_2.5in_D7-P5620                      1x Intel Corporation I350 Gigabit Network Connection                      2x Mellanox-MCX556A-ECAT 100Gb 2-port Adapter</p> </div> <div style="width: 45%; text-align: center;">  <p>1 x H3C S5560 Series</p> <p>1 x HUAWEI CloudEngine 8850-64CQ-EI</p> </div> </div>			
Physical Storage/Scale Factor: 605.44		Scale Factor/Physical Memory: 0.09	
Total Number of Servers: Total Processors/Cores/Threads:		22 (22x InspurCloud Data-Cloud) 44/1,408/2,816	
Server Configuration: Processors Memory Storage Controller Storage Device Network	Per InspurCloud Data-Cloud Server 2x AMD EPYC 9374F 32-Core Processor 512 GiB 1x Broadcom / LSI SAS3008 2x 960 GB SATA SSD 8x 3.2 TB NVMe 2x Mellanox MCX556A-ECAT100 Gb 2-port (all nodes) 1x Intel I350 1 Gb (all nodes) 1x Intel x710 10 Gb (12 nodes)		
Connectivity: Total Rack Units:	1x H3C S5560 Series; 1x Huawei CloudEngine 8850-64CQ-EI 22 (2U) + 1 (1U) + 1 (2U) = 47U		

	<h2>InspurCloud Physical Server for Data</h2>				TPCx-HS	2.0.3	
					TPC Pricing	2.9.0	
					Report Date	Jan. 30, 2024	
Description		Part Number	Source	Unit Price	Qty	Extended Price	3 Yr. Maint. Price
<b>Server Hardware</b>							
InspurCloud Data-Cloud Server		P54199-B21		1 \$5,566.00	22	\$122,452.00	
AMD EPYC 9374F 3.85GHz 32-core 320W Processor		P54199-B21		1 \$2,514.00	44	\$110,616.00	
2U Passive CPU Heat Sink for AMD Socket SP5 Processors		SNK-P0083P		1 \$42.00	44	\$1,848.00	
Middle Cooling Fan for 2U Hyper-S Systems 80x80x38mm 13.5K RPM		FAN-0209L4-1		1 \$28.00	88	\$2,464.00	
32GB DDR5 RECC 4800B 2R*8(M321R4GA3BB6-CQKMS)		M321R4GA3BB6		1 \$140.00	352	\$49,280.00	
SSD 960G SATA 6Gbps 2.5in(7mm) PM893(MZ7L3960HCJR-00B7C)		MZ7L3960HCJR		1 \$140.00	44	\$6,160.00	
SSD 3.2T U.2PCIe 2.5in D7-P5620(SSDPF2KE032T1N1)		SSDPF2KE032T1N1		1 \$420.00	176	\$73,920.00	
1600W redundant single output power supply with inp		PWS-1K63A-1R		1 \$210.00	44	\$9,240.00	
Intel Corporation Ethernet Controller X710		Intel-X710		1 \$360.00	12	\$4,320.00	
Intel Corporation I350 Gigabit Network Connection		Intel-I350		1 \$84.00	22	\$1,848.00	
Mellanox-MCX556A-ECAT 100Gb 2-port Adapter		MCX556A-ECAT		1 \$698.00	44	\$30,712.00	
<b>Software</b>							
InspurCloud Data Cloud Platform 5.1.0 Subscription Edition - 3 Years				1 \$10,475.00	22		\$230,450.00
InspurCloud 7x24 On-site Service, 3 years (includes all hardware)				1 \$1,617.00	22		\$35,574.00
<b>Other Hardware Components</b>							
HUAWEI CloudEngine 8850-64CQ-EI		CE8850		1 \$23,040.00	1	\$23,040.00	
H3C S5560 Series Switch		S5560		1 \$1,120.00	1	\$1,120.00	
Rack 48U Advanced Pallet				1 \$418.00	1	\$418.00	
Mellanox 100Gb 5m Direct Attach Copper Cable				1 \$11.00	22	\$242.00	
H3C S5560 10m Network Cable				1 \$6.00	22	\$132.00	
Keyboard and Mouse				1 \$32.00	1	\$32.00	
Monitor				1 \$280.00	1	\$280.00	
<b>Subtotal</b>						\$438,124.00	\$266,024.00
Pricing: 1 = Inspur Cloud				<b>Three-Year Cost of Ownership:</b>		<b>\$704,148</b>	
<b>Audited by Doug Johnson, InfoSizing</b>				<b>HSph@1TB:</b>		<b>53.19</b>	
				<b>\$ / HSph@1TB:</b>		<b>\$13,238.36</b>	
<p><i>Prices used in TPC benchmarks reflect the actual prices a customer would pay for a one-time purchase of the stated Line Items. Individually negotiated discounts are not permitted. Special prices based on assumptions about past or future purchases are not permitted. All discounts reflect standard pricing policies for the listed Line Items. For complete details, see the pricing section of the TPC Benchmark Standard. If you find that the stated prices are not available according to these terms, please inform the TPC at <a href="mailto:pricing@tpc.org">pricing@tpc.org</a>. Thank you.</i></p>							

	<b>InspurCloud Physical Server for Data</b>	TPCx-HS 2.0.3
		TPC Pricing 2.9.0
		Report Date Jan. 30, 2024
<b>Numerical Quantities</b>		
Performance Run – Run 1		
Scale Factor		1TB
Run Start Time	2024-01-29 18:47:33.000	
Run End Time	2024-01-29 18:48:40.000	
Run Elapsed Time		68.000
HSGen Start Time	2024-01-29 18:47:34.000	
HSGen End Time	2024-01-29 18:47:47.000	
HSGen Elapsed Time		14.815
HSSort Start Time	2024-01-29 18:47:49.000	
HSSort End Time	2024-01-29 18:48:30.000	
HSSort Elapsed Time		41.650
HSValidate Start Time	2024-01-29 18:48:32.000	
HSValidate End Time	2024-01-29 18:48:40.000	
HSValidate Elapsed Time		8.771
Repeatability Run – Run 2		
Scale Factor		1TB
Run Start Time	2024-01-29 18:48:53.000	
Run End Time	2024-01-29 18:49:59.000	
Run Elapsed Time		68.000
HSGen Start Time	2024-01-29 18:48:54.000	
HSGen End Time	2024-01-29 18:49:08.000	
HSGen Elapsed Time		15.218
HSSort Start Time	2024-01-29 18:49:10.000	
HSSort End Time	2024-01-29 18:49:50.000	
HSSort Elapsed Time		41.546
HSValidate Start Time	2024-01-29 18:49:52.000	
HSValidate End Time	2024-01-29 18:49:59.000	
HSValidate Elapsed Time		7.969

	<h2>InspurCloud Physical Server for Data</h2>	<table> <tr><td>TPCx-HS</td><td>2.0.3</td></tr> <tr><td>TPC Pricing</td><td>2.9.0</td></tr> <tr><td>Report Date</td><td>Jan. 30, 2024</td></tr> </table>	TPCx-HS	2.0.3	TPC Pricing	2.9.0	Report Date	Jan. 30, 2024
TPCx-HS	2.0.3							
TPC Pricing	2.9.0							
Report Date	Jan. 30, 2024							

Run Reports

Run Report for Performance Run – Run 1

=====

TPCx-HS Performance Metric (HSph@SF) Report

Test Run 1 Details	Total Time =	68
	Total Size =	10000000000
	Scale-Factor =	1

TPCx-HS Performance Metric (HSph@SF): 53.1914

=====

Run Report for Repeatability Run – Run 2


=====

TPCx-HS Performance Metric (HSph@SF) Report

Test Run 2 Details	Total Time =	68
	Total Size =	10000000000
	Scale-Factor =	1

TPCx-HS Performance Metric (HSph@SF): 53.1914

=====

	<h2>InspurCloud Physical Server for Data</h2>	TPCx-HS 2.0.3 TPC Pricing 2.9.0 Report Date Jan. 30, 2024
<b>Revision History</b>		
Date	Edition	Description
January 30, 2024	First	Initial Publication



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# Clause 0 – Preamble

## 0.1 TPC Express Benchmark™ HS Overview

The TPC Express Benchmark™ HS (TPCx-HS) was developed to provide an objective measure of hardware, operating system and commercial Apache Hadoop File System API compatible software distributions, and to provide the industry with verifiable performance, price-performance and availability metrics. The benchmark models a continuous system availability of 24 hours a day, 7 days a week.

Even though the modeled application is simple, the results are highly relevant to hardware and software dealing with Big Data systems in general. TPCx-HS stresses both hardware and software including Hadoop run-time, Hadoop File-system API compatible systems and MapReduce layers. This workload can be used to assess a broad range of system topologies and implementation of Hadoop clusters. TPCx-HS can be used to assess a broad range of system topologies and implementation methodologies in a technically rigorous and directly comparable and vendor-neutral manner.

The TPCx-HS kit is available from the TPC (See [www.tpc.org/tpcx-hs](http://www.tpc.org/tpcx-hs) for more information). Users must sign-up and agree to the TPCx-HS User Licensing Agreement (ULA) to download the kit. Re-distribution of the kit is prohibited. All related work (such as collaterals, papers, derivatives) must acknowledge the TPC and include TPCx-HS copyright. The TPCx-HS Kit includes: TPCx-HS Specification document, TPCx-HS Users Guide documentation, shell scripts to set up the benchmark environment and Java code to execute the benchmark load.

The purpose of TPC benchmarks is to provide relevant, objective performance data to industry users. To achieve that purpose, TPC benchmark specifications require that benchmark tests be implemented with systems, products, technologies and pricing that:

- Are generally available to users;
- Are relevant to the market segment that the individual TPC benchmark models or represents (e.g., TPCx-HS models and represents Hadoop run-time and Hadoop File-system API compatible systems);
- Would plausibly be implemented by a significant number of users in the market segment the benchmark models or represents.

The use of new systems, products, technologies (hardware or software) and pricing is encouraged so long as they meet the requirements above. Specifically prohibited are benchmark systems, products, technologies or pricing (hereafter referred to as "implementations") whose primary purpose is performance optimization of TPC benchmark results without any corresponding applicability to real-world applications and environments. In other words, all "benchmark special" implementations that improve benchmark results but not real-world performance or pricing, are prohibited.

The rules for pricing are included in the TPC Pricing Specification and rules for energy measurement are included in the TPC Energy Specification. Further information is available at [www.tpc.org](http://www.tpc.org).

# Clause 1 – General Items

## 1.1 Test Sponsor

*A statement identifying the benchmark sponsor(s) and other participating companies must be provided*

This benchmark was sponsored by Inspur Cloud Information Technology Co., Ltd..

## 1.2 Parameter Settings

*Settings must be provided for all customer-tunable parameters and options which have been changed from the defaults found in actual products, including by not limited to:*

- *Configuration parameters and options for server, storage, network and other hardware component incorporated into the pricing structure;*
- *Configuration parameters and options for operating system and file system component incorporated into the pricing structure;*
- *Configuration parameters and options for any other software component incorporated into the pricing structure;*
- *Compiler optimization options.*

*Comment 1: In the event that some parameters and options are set multiple times, it must be easily discernible by an interested reader when the parameter or option was modified and what new value it received each time.*

*Comment 2: This requirement can be satisfied by providing a full list of all parameters and options, as long as all those that have been modified from their default values have been clearly identified and these parameters and options are only set once.*

The supporting files contain the parameters and options used to configure the components involved in this benchmark.

## 1.3 Configuration Diagrams

*Diagrams of both measured and priced configurations must be provided, accompanied by a description of the differences. This includes, but is not limited to:*

- *Total number of nodes used;*
- *Total number and type of processors used/total number of cores used/total number of threads used (including sizes of L2 and L3 caches);*
- *Size of allocated memory, and any specific mapping/partitioning of memory unique to the test;*
- *Number and type of disk units (and controllers, if applicable);*
- *Number of channels or bus connections to disk units, including their protocol type;*
- *Number of LAN (e.g., Ethernet) connections and speed for switches and other hardware components physically used in the test or are incorporated into the pricing structure;*
- *Type and the run-time execution location of software components.*

### 1.3.1 Measured Configuration

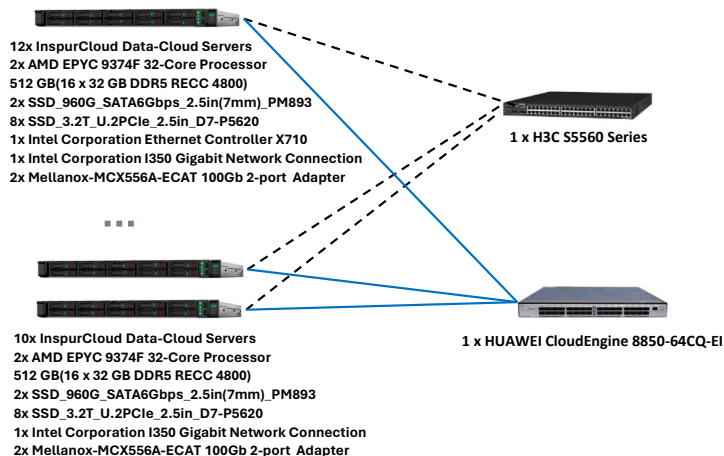


Figure 1-1 Measured Configuration

The measured configuration consisted of:

- Total Nodes: 22 (22x InspurCloud Data-Cloud)
- Total Processors/Cores/Threads: 44/1,408/2,816
- Total Memory: 11.00TiB
- Total Number of Storage Drives/Devices: 220
- Total Storage Capacity: 605.44TB

Server node details:

- 22x InspurCloud Data-Cloud Servers, each with:
  - Processors/Cores/Threads: 2/64/128
  - Processor Model: AMD EPYC 9374F 32-Core Processor
  - Memory: 512 GiB
  - Controller: 1x Broadcom / LSI SAS3008
  - Drives:
    - 2x 960 GB SATA SSD
    - 8x 3.2 TB NVMe
  - Network:
    - 2x Mellanox MCX556A-ECAT100 Gb 2-port (all nodes)
    - 1x Intel I350 1 Gb (all nodes)
    - 1x Intel X710 10 Gb (12 nodes)

Network connectivity detail:

- 1x H3C S5560 Series
- 1x Huawei CloudEngine 8850-64CQ-EI

The distribution of software components over server nodes is detailed in section 1.5.

### 1.3.2 Priced Configuration

There are no differences between the priced configuration and the measured configuration.

## 1.4 Dataset Distribution

*The distribution of dataset across all media must be explicitly described.*

Table 1-1 describes the distribution of the dataset across all media in the system.

Server Node	Controller	Disk Drive	Description of Content
1-22	SATA	1x 960 GB SATA	OS, Root
1-22	NVMe	8x 3.2 TB NVMe	Data, Temp

*Table 1-1 Dataset Distribution*

## 1.5 Software Components Distribution

*The distribution of various software components across the system must be explicitly described.*

Table 1-2 Describes the distribution of the software components across the system.

Node	HDFS		ZooKeeper	Spark	
	NameNode	DataNode	QuorumPeer	Master	Worker
1, 2	X	X	X		X
3		X	X		X
4		X		X	X
5-22		X			X

*Table 1-2 Software Component Distribution*

*Distributed file system implementation and corresponding Hadoop File System API version must be disclosed.*

InspurCloud Data Cloud Platform 5.1.0 (fully HDFS compatible at the API level).

*Map/Reduce implementation and corresponding version must be disclosed.*

InspurCloud Data Cloud Platform 5.1.0 (compatible equivalent to Hadoop 3.1.4).

## Clause 2 – Workload Related Items

### 2.1 Hardware & Software Tunables

*Script or text used to set for all hardware and software tunable parameters must be reported.*

The Supporting File Archive contains all configuration scripts.

### 2.2 Run Report

*The run report generated by TPCx-HS benchmark kit must be reported.*

The Supporting File Archive contains the full run report. Following are extracts from the run report that lists the performance summary for both runs.

```
Run Report for Run 1 – Performance Run
=====
TPCx-HS Performance Metric (HSph@SF) Report

Test Run 1 Details      Total Time =                68
                        Total Size =                10000000000
                        Scale-Factor =                1

TPCx-HS Performance Metric (HSph@SF):                53.1914
=====
```

```
Run Report for Run 2 – Repeatability Run
=====
TPCx-HS Performance Metric (HSph@SF) Report

Test Run 2 Details      Total Time =                68
                        Total Size =                10000000000
                        Scale-Factor =                1

TPCx-HS Performance Metric (HSph@SF):                53.1914
=====
```

### 2.3 Benchmark Kit Identification

*Version number of TPCx-HS kit and checksum for HSGen, HSSort and HSValidate Programs must be reported.*

```
Kit Version                2.0.3

File                        MD5
-----
BigData_cluster_validate_suite.sh  57f7cd68251a9aba0feb6648630ff5da
HSDDataCheck.sh                faeff3091759aac98080be4e39f7896a
TPCx-HS-master_Spark.jar        19f3ce092066e056b884a85ee92fb7fc
TPCx-HS-master.sh                b776e15d2d187186ea7911d9ce87e3a7
```

### 2.4 Benchmark Kit Changes

TPCx-HS-master.sh had minor syntax modifications to properly redirect stderr to stdout.

## Clause 3 – SUT Related Items

### 3.1 Data Storage Ratio

*The data storage ratio must be disclosed.*

Table 3-1 describes the details of the storage devices configured on the system and their capacity.

Quantity	Capacity (TB)	Total (TB)
44	0.96	42.24
176	3.20	563.20
<b>Total Storage (TB)</b>		<b>605.44</b>

*Table 3-1 Storage Device Capacities*

Scale Factor = 1

**Data Storage Ratio** = (Total Storage (TB) / SF) = **605.44**

### 3.2 Memory Ratio

*The Scale Factor to memory ratio must be disclosed.*

Total Configured Memory (TiB) = 11.00

**Scale Factor to Memory Ratio** = (SF / Total Memory(TiB)) = **0.09**

## Clause 4 – Metrics Related Items

### 4.1 HSGen Time

The HSGen time must be disclosed for Run1 and Run2.

	Run 1	Run 2
HSGen	14.815	15.218

Table 4-1 HSGen Times

### 4.2 HSSort Time

The HSSort time must be disclosed for Run1 and Run2.

	Run 1	Run 2
HSSort	41.650	41.546

Table 4-2 HSSort Times

### 4.3 HSValidate Time

The HSValidate time must be disclosed for Run1 and Run2.

	Run 1	Run 2
HSValidate	8.771	7.969

Table 4-3 HSValidate Times

### 4.4 HSDataCheck Times

Both HSDataCheck times must be disclosed for Run1 and Run2.

	Run 1	Run 2
HSDataCheck (pre-sort)	2.000	2.000
HSDataCheck (post-sort)	2.000	2.000

Table 4-4 HSDataCheck Times

### 4.5 Performance & Price-Performance

The performance metric (HSph@SF) must be disclosed for Run 1 and Run 2. Price-performance metric (\$/HSph@SF) must be disclosed for the performance run.

	Run 1	Run 2
HSph@1TB	53.19	53.19

Table 4-5 Performance Metrics

Run 1 Price-Performance: 13,238.36 \$/ HSph@1TB



## Auditor's Information & Letter of Attestation

*The auditor's agency name, address, phone number, and Attestation letter must be included in the full disclosure report. A statement should be included specifying who to contact in order to obtain further information regarding the audit process.*

This benchmark was audited by Doug Johnson, InfoSizing.

www.sizing.com  
63 Lourdes Drive  
Leominster, MA 10453  
978-343-6562

This benchmark's Full Disclosure Report (FDR) can be downloaded from [www.tpc.org](http://www.tpc.org).

A copy of the auditor's Letter of Attestation follows.



Zheng Wei  
 Inspur Cloud Information Technology Co., Ltd.  
 No.1036 Inspur Road  
 Jinan City  
 China

January 30, 2024

I verified the TPC Express Benchmark™ HS v2.0.3 performance of the following configuration:

Platform: InspurCloud Physical Server for Data with  
 22x InspurCloud Data-Cloud Servers  
 Operating System: CentOS Linux 8.5  
 Apache Hadoop InspurCloud Data Cloud Platform 5.1.0 (using Spark)  
 Compatible Software:

The results were:

**Performance 53.19 HSph@1TB**

**Metric**

Run Elapsed Time 68.00 Seconds

**Cluster 22x InspurCloud Data-Cloud Servers; each with:**

CPU	2x AMD® EPYC 9374F 32-Core Processor		
Memory	512 GiB		
Storage	<b>Qty</b>	<b>Size</b>	<b>Type</b>
	2	960 GB	SATA SSD
	8	3.2 TB	NVMe

In my opinion, these performance results were produced in compliance with the TPC requirements for the benchmark.

The following verification items were given special attention:

- All TPC-provided components were verified to be v2.0.3.
- No modifications were made to any of the Java code.
- Any and all modifications to shell scripts were reviewed for compliance.
- All checksums were validated for compliance.
- The generated dataset was properly scaled to 1 TB.

63 Lourdes Dr. | Leominster, MA 01453 | 978-343-6562 | www.sizing.com

- The generated dataset and the sorted dataset were replicated 3-ways.
- The elapsed times for all phases and runs were correctly measured and reported.
- The Storage and Memory Ratios were correctly calculated and reported.
- The system pricing was verified for major components and maintenance.
- The major pages from the FDR were verified for accuracy.

Additional Audit Notes:

None.

Respectfully Yours,



Doug Johnson, Certified TPC Auditor

63 Lourdes Dr. | Leominster, MA 01453 | 978-343-6562 | [www.sizing.com](http://www.sizing.com)

## Supporting Files Index

Clause	Description	Archive File Pathname
Clause 1	Parameters and options used to configure the system	SupportingFiles/Clause1
Clause 2	Configuration scripts and Run Report	SupportingFiles/Clause2
Clause 3	System configuration details	SupportingFiles/Clause3

# Third-Party Price Quotes

All components are available directly through the test sponsor, Inspur Cloud.