

# **ASHRAE Standard 140-2017**

## **Results Comparison for Section 5.5, Airside HVAC Equipment Performance Tests AE101 through AE245**

Results for BEST  
(BEST2008dev)  
vs.  
Informative Annex B16, Section B16.7.1 Example Results

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Results Developed  
17-Nov-2020

**ASHRAE Standard 140-2017**  
**Computer Programs, Program Authors, and Producers of Example Results for**  
**Section 5.5, Airside HVAC Equipment Performance Tests AE101 through AE245**

The quasi-analytical solution and programs used to generate the example results are described in Table B17-13. The first column of the table ("Model") indicates the program name and version number, or indicates a quasi-analytical solution.

The second column ("Authoring Organization") indicates the national research facility, university, or industry organization with expertise in building science that wrote the simulation software.

The third column ("Implemented By") indicates the national research facility, university, or industry organization with expertise in building science that performed the simulations or did the quasi-analytical solutions. The organizations that performed simulations either ran software written by their organization or otherwise maintained contact with the program authors during the project.

The fourth column ("Abbreviation") indicates the identifying abbreviation used in the results tables and figures. See Standard 140, Informative Annex B17 for further details.

**Table B17-13 Airside HVAC Cases**  
**Participating Organizations and Models**

Model	Authoring Organization	Implemented by	Abbreviation
Quasi-Analytical Solution (QAS)	PSU <sup>a</sup> /UNO <sup>b</sup> /TAMU <sup>c</sup> /NREL <sup>d</sup> /JNA <sup>e</sup> /MDK <sup>f</sup> , United States	NREL <sup>d</sup> /JNA <sup>e</sup> /MDK <sup>f</sup> , United States	QAS/PSU-TAMU-NREL
DEEAP <sup>g</sup> 1.1.2	AAON, Inc., United States	AAON, Inc., United States	DEEAP/AAON
DeST <sup>h</sup> 2	Tsinghua University, China	Tsinghua University, China / LBNL <sup>i</sup> , United States	DeST/TsinghuaU-LBNL
DOE-2.2 V48L	JJH <sup>j</sup> /LBNL <sup>i</sup> /UC <sup>k</sup> , United States	NREL <sup>d</sup> /JNA <sup>e</sup> /MDK <sup>f</sup> , United States	DOE-2.2/NREL
EnergyPlus 8.2.0	DOE-BT <sup>l</sup> , United States	GARD Analytics, Inc., United States	EnergyPlus/GARD
IES-VE <sup>m</sup> 2014.2	IES <sup>n</sup> , United Kingdom	IES <sup>n</sup> , United Kingdom	IES-VE/IES
LCEM <sup>o</sup> 3.10	MLIT <sup>p</sup> , Japan	TTE <sup>q</sup> , Japan	LCEM/MLIT-TTE
TRNSYS 17.01.0028	TESS <sup>r</sup> /UWM <sup>s</sup> , United States	TESS <sup>r</sup> , United States	TRNSYS/TESS

<sup>a</sup> PSU: The Pennsylvania State University, United States

<sup>b</sup> UNO: University of Nebraska - Omaha, United States

<sup>c</sup> TAMU: Texas A&M University, United States

<sup>d</sup> NREL: National Renewable Energy Laboratory, United States

<sup>e</sup> JNA: J. Neymark & Associates, United States

<sup>f</sup> MDK: Mike D. Kennedy, Inc., United States

<sup>g</sup> DEEAP: Detailed Energy and Economic Analysis Program

<sup>h</sup> DeST: Designer's Simulation Toolkit

<sup>i</sup> LBNL: Lawrence Berkeley National Laboratory, United States

<sup>j</sup> JJH: James J. Hirsch & Associates, United States

<sup>k</sup> UC: University of California, United States

<sup>l</sup> DOE-BT: U.S. Department of Energy, Office of Building Technologies, Energy Efficiency and Renewable Energy, United States

<sup>m</sup> IES-VE: Integrated Environmental Solutions - Virtual Environment

<sup>n</sup> IES: Integrated Environmental Solutions, United Kingdom

<sup>o</sup> LCEM: Life Cycle Energy Management tool

<sup>p</sup> MLIT: Ministry of Land, Infrastructure, Transportation and Tourism, Japan

<sup>q</sup> TTE: Takasago Thermal Engineering, Japan

<sup>r</sup> TESS: Thermal Energy System Specialists, United States

<sup>s</sup> UWM: University of Wisconsin - Madison, United States

**ASHRAE Standard 140-2017, Section 5.5 - Airside HVAC Analytical Verification Tests**  
**BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results**  
**By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

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**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101-AE245  
BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results  
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**Table B16.7.1-1. FC/SZ Heating Coil Load [QH] (kWh/h)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	8.420	8.413	8.452	8.768	8.453	8.513	8.372	8.416	8.294
AE103	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE104	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE201	8.360	8.349	8.385	8.709	8.387	8.446	8.302	8.356	8.227
AE203	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE204	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE205	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE206	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE226	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE245	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

**Table B16.7.1-2. FC/SZ Total Cooling Coil Load [QCtotal] (kWh)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE103	0.783	0.784	0.778	0.777	0.766	0.762	0.763	0.780	0.780
AE104	5.551	5.553	5.836	5.533	5.673	5.607	5.646	5.548	5.776
AE201	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE203	0.856	0.853	0.845	0.840	0.833	0.830	0.830	0.852	0.834
AE204	5.628	5.623	5.897	5.711	5.739	5.675	5.713	5.625	5.799
AE205	1.916	1.910	1.929	1.908	1.913	1.915	1.911	1.913	1.893
AE206	2.677	2.664	2.818	2.731	2.738	2.696	2.699	2.671	2.730
AE226	3.362	3.335	3.643	3.405	3.418	3.377	3.391	3.355	3.434
AE245	2.208	2.202	2.216	2.188	2.207	2.210	2.202	2.209	2.179

**Table B16.7.1-3. FC/SZ Sensible Cooling Coil Load [QC\_sensible] (kWh/h)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE103	0.783	0.784	0.778	0.777	0.766	0.762	0.752	0.780	0.780
AE104	3.497	3.488	3.543	3.521	3.499	3.480	3.389	3.493	3.443
AE201	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE203	0.856	0.853	0.845	0.840	0.833	0.830	0.819	0.852	0.834
AE204	3.574	3.559	3.608	3.590	3.566	3.547	3.456	3.571	3.481
AE205	1.916	1.910	1.929	1.908	1.913	1.915	1.880	1.913	1.893
AE206	1.706	1.701	1.731	1.723	1.697	1.695	1.646	1.703	1.652
AE226	1.562	1.557	1.593	1.597	1.555	1.552	1.503	1.560	1.506
AE245	2.208	2.202	2.216	2.188	2.207	2.210	2.171	2.209	2.179

**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101-AE245  
BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results  
By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.1-4. FC/SZ Latent Cooling Coil Load [QClatent] (kWh/h)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE103	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000
AE104	2.054	2.065	2.293	2.012	2.174	2.127	2.256	2.054	2.333
AE201	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AE203	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000
AE204	2.054	2.065	2.289	2.121	2.173	2.128	2.257	2.054	2.318
AE205	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.000	0.000
AE206	0.970	0.963	1.087	1.008	1.042	1.000	1.053	0.968	1.078
AE226	1.800	1.778	2.050	1.808	1.863	1.825	1.888	1.795	1.928
AE245	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.000	0.000

**Table B16.7.1-5. FC/SZ Outdoor Air Temp (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	-29.000	-29.000	-29.000	-29.000	-29.000	-29.000	-29.000	-29.000	-29.000
AE103	15.500	15.500	15.500	15.500	15.500	15.500	15.500	15.500	15.500
AE104	26.900	26.889	26.900	26.889	26.900	26.900	26.900	26.900	26.900
AE201	-29.000	-29.000	-29.000	-29.000	-29.000	-29.000	-29.000	-29.000	-29.000
AE203	15.500	15.500	15.500	15.500	15.500	15.500	15.500	15.500	15.500
AE204	26.900	26.889	26.900	26.889	26.900	26.900	26.900	26.900	26.900
AE205	24.900	24.889	24.900	24.889	24.900	24.900	24.900	24.900	24.900
AE206	23.000	23.000	23.000	23.000	23.000	23.000	23.000	23.000	23.000
AE226	23.000	23.000	23.000	23.000	23.000	23.000	23.000	23.000	23.000
AE245	24.900	24.889	24.900	24.889	24.900	24.900	24.900	24.900	24.900

**Table B16.7.1-6. FC/SZ Outdoor Air Humidity Ratio (%)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	0.000259	0.000259	0.000260	0.000300	0.000259	0.000262	0.000344	0.000259	0.000250
AE103	0.002936	0.002895	0.002948	0.002900	0.002933	0.002947	0.002934	0.002936	0.002960
AE104	0.016774	0.016783	0.016850	0.016800	0.016772	0.016839	0.016761	0.016774	0.016890
AE201	0.000259	0.000259	0.000260	0.000300	0.000259	0.000262	0.000344	0.000259	0.000250
AE203	0.002936	0.002895	0.002948	0.002900	0.002933	0.002947	0.002934	0.002936	0.002960
AE204	0.016774	0.016783	0.016850	0.016800	0.016772	0.016839	0.016761	0.016774	0.016890
AE205	0.004491	0.004457	0.004510	0.004500	0.004481	0.004508	0.004487	0.004491	0.004580
AE206	0.015556	0.015523	0.015630	0.015600	0.015565	0.015616	0.015546	0.015556	0.015590
AE226	0.015556	0.015523	0.015630	0.015600	0.015565	0.015616	0.015546	0.015556	0.015590
AE245	0.004491	0.004457	0.004510	0.004500	0.004481	0.004508	0.004487	0.004491	0.004580

**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101-AE245  
BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results  
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**Table B16.7.1-7. FC/SZ Outdoor Air Mass Flow Rate (kgda/s)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	0.113	0.113	0.113	0.120	0.114	0.113	0.113	0.113	0.113
AE103	0.111	0.112	0.113	0.112	0.114	0.113	0.113	0.111	0.113
AE104	0.110	0.110	0.113	0.109	0.114	0.113	0.113	0.110	0.113
AE201	0.113	0.113	0.113	0.120	0.114	0.113	0.113	0.113	0.113
AE203	0.111	0.112	0.113	0.113	0.114	0.113	0.113	0.111	0.113
AE204	0.110	0.110	0.113	0.109	0.114	0.113	0.113	0.110	0.113
AE205	0.111	0.111	0.113	0.111	0.114	0.113	0.113	0.111	0.113
AE206	0.110	0.110	0.113	0.110	0.114	0.113	0.113	0.110	0.113
AE226	0.336	0.336	0.340	0.329	0.341	0.340	0.340	0.335	0.340
AE245	0.340	0.340	0.340	0.333	0.341	0.340	0.340	0.340	0.340

**Table B16.7.1-8. FC/SZ Cooling Coil Outlet Air Temperature (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	29.32	29.33	29.09	29.22	29.05	28.99	29.04	29.31	28.71
AE103	18.50	18.50	18.46	19.00	18.51	18.52	18.51	18.51	18.47
AE104	14.94	14.93	14.70	15.22	14.93	14.84	14.92	14.95	14.77
AE201	29.32	29.33	29.09	28.67	29.05	28.99	29.04	29.31	28.71
AE203	18.50	18.50	18.46	18.44	18.51	18.52	18.51	18.51	18.51
AE204	14.94	14.93	14.72	14.61	14.93	14.84	14.92	14.95	14.86
AE205	18.51	18.50	18.46	18.44	18.52	18.52	18.52	18.51	18.58
AE206	18.51	18.51	18.46	18.44	18.59	18.52	18.58	18.52	18.56
AE226	18.51	18.51	18.44	18.44	18.59	18.52	18.58	18.52	18.57
AE245	18.50	18.50	18.46	18.44	18.51	18.52	18.51	18.50	18.58

**Table B16.7.1-9. FC/SZ Relative Humidity at Cooling Coil Outlet [RHcco] (%)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	6.39	6.38		6.40	6.52	6.75	6.87	6.35	6.72
AE103	32.84	32.54	33.03	31.65	32.51	32.91	32.55	32.87	33.03
AE104	100.00	100.00	98.66	99.96	99.62	100.00	100.00	100.00	100.00
AE201	6.39	6.38		6.61	6.51	6.75	6.87	6.35	6.72
AE203	32.84	32.54	33.03	32.77	32.51	32.91	32.55	32.86	32.94
AE204	100.00	100.00	98.62	100.00	99.64	100.00	100.00	100.00	100.00
AE205	44.56	44.31	44.81	44.85	44.11	44.59	44.20	44.59	44.93
AE206	100.00	100.00	99.36	99.93	99.03	100.00	100.00	100.00	100.00
AE226	100.00	100.00	99.65	99.93	99.81	100.00	100.00	100.00	100.00
AE245	34.09	33.84	34.33	34.29	33.99	34.06	34.07	34.10	34.60

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**Table B16.7.1-10. FC/SZ Supply Fan Air Temperature Rise (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	0.6058	0.6066	0.5899	0.0000	0.5861	0.5818	0.5890	0.6057	0.6100
AE103	0.5838	0.5845	0.5899	0.0000	0.5833	0.5818	0.5890	0.5837	0.5800
AE104	0.5758	0.5765	0.5899	0.0000	0.5766	0.5818	0.5890	0.5757	0.5800
AE201	0.6058	0.6066	0.5899		0.5861	0.5818	0.5890	0.6057	0.6100
AE203	0.5838	0.5845	0.5899		0.5833	0.5818	0.5890	0.5837	0.5900
AE204	0.5758	0.5765	0.5899		0.5766	0.5818	0.5890	0.5757	0.5800
AE205	0.5836	0.5843	0.5899		0.5816	0.5818	0.5890	0.5835	0.5900
AE206	0.5826	0.5833	0.5899		0.5738	0.5818	0.5890	0.5825	0.6000
AE226	0.5826	0.5833	0.5899		0.5737	0.5818	0.5890	0.5825	0.5900
AE245	0.5838	0.5863	0.5899		0.5831	0.5818	0.5890	0.5837	0.5900

**Table B16.7.1-11. FC/SZ Supply Air Temperature (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	29.92	29.93	29.68	29.22	29.64	29.58	29.62	29.91	29.32
AE103	19.09	19.08	19.05	19.00	19.09	19.10	19.10	19.09	19.05
AE104	15.51	15.51	15.29	15.22	15.50	15.43	15.51	15.52	15.35
AE201	29.92	29.93	29.68		29.64	29.58	29.62	29.91	29.32
AE203	19.09	19.08	19.05		19.09	19.10	19.10	19.10	19.10
AE204	15.51	15.51	15.31		15.50	15.42	15.51	15.52	15.44
AE205	19.09	19.09	19.05		19.11	19.10	19.11	19.09	19.17
AE206	19.10	19.10	19.05		19.16	19.10	19.16	19.11	19.16
AE226	19.10	19.10	19.03		19.16	19.10	19.16	19.10	19.16
AE245	19.09	19.09	19.05		19.09	19.10	19.10	19.08	19.17

**Table B16.7.1-12. FC/SZ Supply Air Humidity Ratio (g/gda)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	0.001604	0.001604	0.001642	0.001600	0.001612	0.001670	0.001696	0.001595	0.001629
AE103	0.004325	0.004284	0.004337	0.004300	0.004284	0.004355	0.004285	0.004330	0.004339
AE104	0.010605	0.010599	0.010296	0.010800	0.010558	0.010581	0.010585	0.010612	0.010487
AE201	0.001604	0.001604	0.001642	0.001600	0.001612	0.001670	0.001698	0.001595	0.001629
AE203	0.004325	0.004285	0.004337	0.004300	0.004284	0.004355	0.004285	0.004330	0.004339
AE204	0.010605	0.010600	0.010306	0.010400	0.010561	0.010580	0.010585	0.010612	0.010548
AE205	0.005884	0.005850	0.005900	0.005900	0.005832	0.005916	0.005838	0.005888	0.005959
AE206	0.013368	0.013367	0.013227	0.013300	0.013302	0.013424	0.013413	0.013376	0.013411
AE226	0.013368	0.013367	0.013257	0.013300	0.013410	0.013424	0.013413	0.013373	0.013414
AE245	0.004491	0.004457	0.004510	0.004500	0.004481	0.004508	0.004487	0.004491	0.004580



**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101-AE245  
BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results  
By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.1-13. FC/SZ Supply Air Specific Volume (L/kgda)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	860.78	860.69	833.33		830.35		833.00	856.54	857.56
AE103	833.63	833.45	833.33		830.35		833.00	829.58	832.05
AE104	831.69	831.55	833.33		830.35		833.00	827.67	829.56
AE201	860.78	860.69	833.33		830.35		833.00	856.54	857.56
AE203	833.63	833.45	833.33		830.35		833.00	829.59	832.16
AE204	831.69	831.55	833.33		830.35		833.00	827.67	829.89
AE205	835.71	835.55	833.33		830.35		833.00	831.64	834.51
AE206	845.69	845.57	833.33		830.35		833.00	841.60	844.38
AE226	845.69	845.57	833.33		830.35		833.00	841.58	844.39
AE245	833.85	833.70	833.33		830.35		833.00	829.76	832.69

**Table B16.7.1-14. FC/SZ Supply Air Enthalpy (J/gda)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	34.20		34.02		33.90		34.14	34.17	33.66
AE103	30.17		30.14		30.05		30.08	30.19	30.17
AE104	42.44		41.40		42.29		42.37	42.46	41.97
AE201	34.21		34.02		33.90		34.14	34.17	33.66
AE203	30.18		30.14		30.05		30.08	30.19	30.22
AE204	42.44		41.44		42.29		42.37	42.46	42.22
AE205	34.13		34.10		33.99		34.03	34.14	34.40
AE206	53.12		52.67		53.00		53.29	53.15	53.29
AE226	53.12		52.74		53.27		53.29	53.14	53.30
AE245	30.60		30.58		30.55		30.59	30.59	30.90

**Table B16.7.1-15. FC/SZ Supply Air Mass Flow Rate (kgda/s)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	0.3296	0.3297	0.3398	0.3586	0.3410	0.3398	0.3398	0.3296	0.3398
AE103	0.3404	0.3404	0.3398	0.3372	0.3410	0.3398	0.3398	0.3404	0.3398
AE104	0.3412	0.3412	0.3398	0.3279	0.3410	0.3398	0.3398	0.3411	0.3398
AE201	0.3296	0.3297	0.3398	0.3591	0.3410	0.3398	0.3398	0.3296	0.3398
AE203	0.3404	0.3404	0.3398	0.3377	0.3410	0.3398	0.3398	0.3403	0.3398
AE204	0.3412	0.3412	0.3398	0.3284	0.3410	0.3398	0.3398	0.3411	0.3398
AE205	0.3395	0.3396	0.3398	0.3333	0.3410	0.3398	0.3398	0.3395	0.3398
AE206	0.3355	0.3356	0.3398	0.3295	0.3410	0.3398	0.3398	0.3355	0.3398
AE226	0.3355	0.3356	0.3398	0.3294	0.3410	0.3398	0.3398	0.3355	0.3398
AE245	0.3403	0.3403	0.3398	0.3331	0.3410	0.3398	0.3398	0.3403	0.3398

**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101-AE245  
BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results  
By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.1-16. FC/SZ Outdoor Air Mass Flow to Supply Air Mass Flow Ratio (fraction)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	0.342	0.342	0.333	0.333	0.333	0.333	0.334	0.342	0.333
AE103	0.328	0.328	0.333	0.333	0.333	0.333	0.333	0.328	0.333
AE104	0.323	0.323	0.333	0.333	0.333	0.333	0.334	0.323	0.333
AE201	0.342	0.342	0.333	0.333	0.333	0.333	0.333	0.342	0.333
AE203	0.328	0.328	0.333	0.333	0.333	0.333	0.333	0.328	0.333
AE204	0.323	0.323	0.333	0.333	0.333	0.333	0.333	0.323	0.333
AE205	0.328	0.328	0.333	0.333	0.333	0.333	0.333	0.328	0.333
AE206	0.328	0.328	0.333	0.333	0.333	0.333	0.333	0.328	0.333
AE226	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AE245	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

**Table B16.7.1-17. FC/SZ Zone Air Temperature (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	21.11	21.11	21.10	21.11	21.12	21.11	21.11	21.11	21.11
AE103	23.33	23.33	23.35	23.33	23.33	23.33	23.33	23.33	23.33
AE104	23.89	23.89	23.88	23.89	23.88	23.89	23.89	23.89	23.89
AE201	21.11	21.11	21.10	21.11	21.12	21.11	21.11	21.11	21.11
AE203	23.33	23.33	23.35	23.33	23.33	23.33	23.33	23.34	23.33
AE204	23.89	23.89	23.90	23.89	23.88	23.89	23.89	23.89	23.89
AE205	23.33	23.33	23.35	23.33	23.33	23.33	23.33	23.33	23.33
AE206	23.33	23.33	23.34	23.33	23.33	23.33	23.33	23.34	23.33
AE226	23.33	23.33	23.33	23.33	23.33	23.33	23.33	23.33	23.33
AE245	23.33	23.33	23.35	23.33	23.33	23.33	23.33	23.32	23.33

**Table B16.7.1-18. FC/SZ Zone Humidity Ratio (g/gda)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	0.002304	0.002304	0.002332	0.002200	0.002289	0.002370	0.002373	0.002291	0.002319
AE103	0.005002	0.004961	0.005031	0.005000	0.004960	0.005059	0.004960	0.005009	0.005029
AE104	0.011280	0.011274	0.010986	0.011500	0.011233	0.011285	0.011261	0.011291	0.011177
AE201	0.002304	0.002304	0.002332	0.002200	0.002289	0.002374	0.002374	0.002291	0.002319
AE203	0.005002	0.004961	0.005031	0.005000	0.004960	0.005059	0.004960	0.005009	0.005029
AE204	0.011280	0.011274	0.010995	0.011100	0.011236	0.011284	0.011261	0.011291	0.011237
AE205	0.006562	0.006528	0.006593	0.006600	0.006507	0.006620	0.006513	0.006569	0.006649
AE206	0.014054	0.014053	0.013921	0.014000	0.013978	0.014128	0.014089	0.014065	0.014102
AE226	0.014054	0.014053	0.013951	0.014100	0.014086	0.014128	0.014089	0.014062	0.014103
AE245	0.005168	0.005134	0.005204	0.005200	0.005156	0.005212	0.005162	0.005170	0.005270

**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101-AE245  
BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results  
By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.1-19. FC/SZ Moisture Added to Zone by Latent Gains (g/s)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE101	0.231	0.231	0.235	0.215	0.231	0.238	0.230	0.229	0.234
AE103	0.230	0.230	0.236	0.236	0.230	0.239	0.230	0.231	0.234
AE104	0.230	0.230	0.234	0.229	0.230	0.239	0.229	0.232	0.234
AE201	0.231	0.231	0.235	0.215	0.231	0.239	0.230	0.229	0.234
AE203	0.230	0.230	0.236	0.236	0.230	0.239	0.230	0.231	0.234
AE204	0.230	0.230	0.234	0.230	0.230	0.239	0.229	0.232	0.234
AE205	0.230	0.230	0.236	0.233	0.230	0.239	0.230	0.231	0.234
AE206	0.230	0.230	0.236	0.231	0.230	0.239	0.230	0.231	0.235
AE226	0.230	0.230	0.236	0.264	0.230	0.239	0.230	0.231	0.234
AE245	0.230	0.230	0.236	0.233	0.230	0.239	0.230	0.231	0.234

[(Zone Supply Air Mass Flow) × {(Zone Humidity Ratio) – (Zone Supply Air Humidity Ratio)} × 1000 g/kg]

**Table B16.7.1-20. FC/SZ Return Fan Air Temperature Rise (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE201	0.2721	0.2950	0.2950	0.2778	0.2897	0.2909	0.2950	0.2720	0.3000
AE203	0.3126	0.2970	0.2950	0.2778	0.2913	0.2909	0.2950	0.3125	0.3000
AE204	0.3261	0.2972	0.2950	0.2778	0.2880	0.2909	0.2950	0.3260	0.3000
AE205	0.3125	0.2969	0.2950	0.3333	0.2904	0.2909	0.2950	0.3123	0.3000
AE206	0.3119	0.2964	0.2950	0.2778	0.2865	0.2909	0.2950	0.3118	0.3100
AE226	0.3119	0.2964	0.2950	0.3333	0.2865	0.2909	0.2950	0.3118	0.3100
AE245	0.3126	0.2970	0.2950	0.3333	0.2912	0.2909	0.2950	0.3125	0.3000

**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101-AE245**  
**BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results**  
**By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.1-21. FC/SZ Delta Coil Load: SZ - FC (kWh/h)**

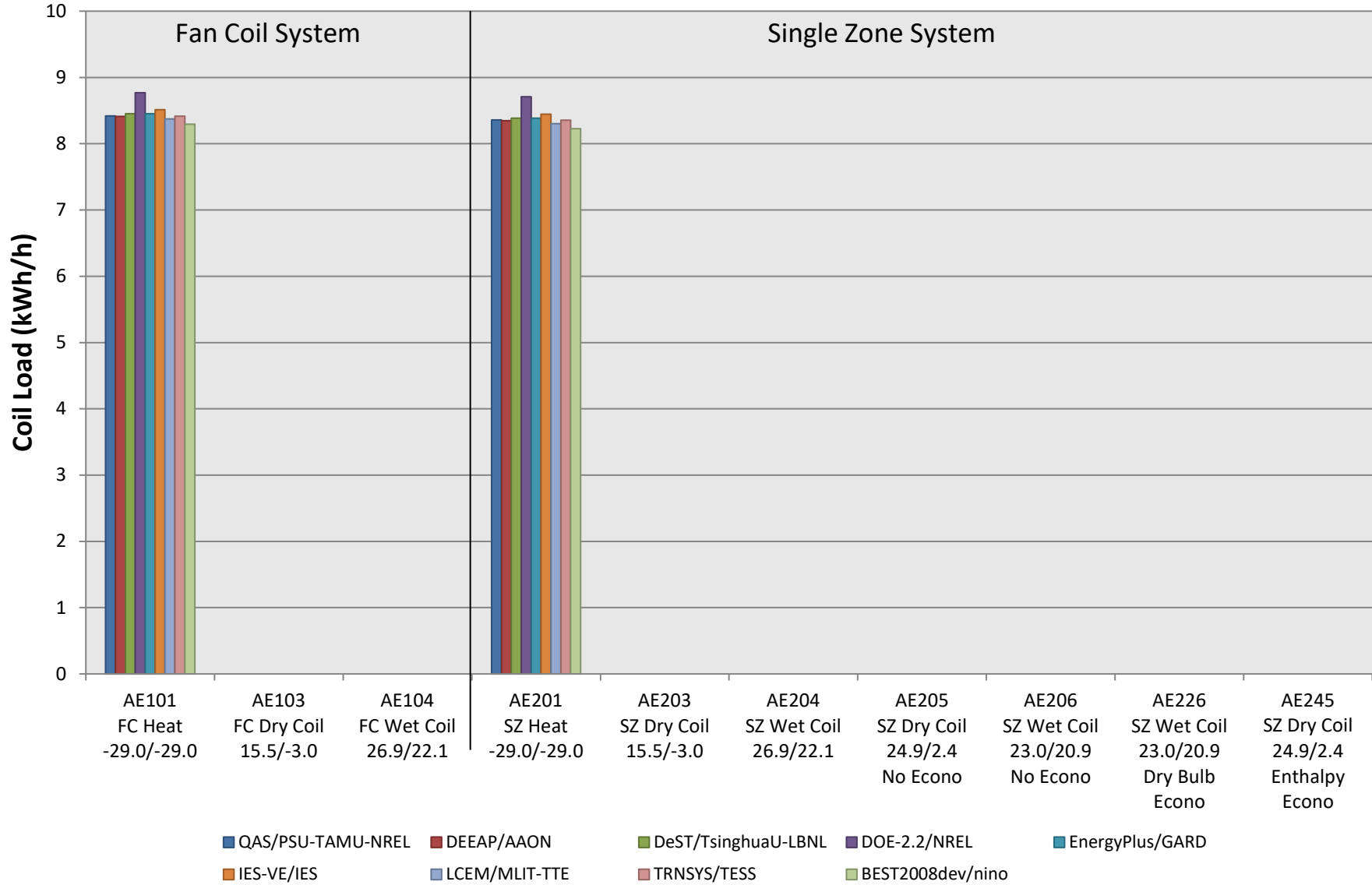
Test Case	Load	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE201-AE101	Heating	-0.060	-0.065	-0.067	-0.058	-0.066	-0.067	-0.070	-0.060	-0.068
AE203-AE103	Sensible Cooling	0.073	0.069	0.068	0.063	0.067	0.068	0.068	0.072	0.055
AE204-AE104	Total Cooling	0.077	0.070	0.061	0.178	0.066	0.068	0.068	0.077	0.023
	Sensible Cooling	0.077	0.070	0.065	0.069	0.067	0.067	0.067	0.077	0.039
	Latent Cooling	0.000	-0.000	-0.004	0.109	-0.001	0.001	0.001	-0.000	-0.016

**Table B16.7.1-22. SZ Delta Coil Load: Economizer Operation (kWh/h)**

Test Case	Load	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	LCEM MLIT-TTE	TRNSYS TESS	BEST2008dev nino
AE245-AE205	Total Cooling	0.291	0.292	0.287	0.279	0.295	0.295	0.291	0.296	0.286
	Sensible Cooling	0.291	0.292	0.287	0.279	0.295	0.295	0.292	0.296	0.286
	Latent Cooling	0.000	0.000	0.000	0.000	0.000	0.000	-0.000	0.000	0.000
AE226-AE206	Total Cooling	0.685	0.671	0.825	0.673	0.680	0.681	0.692	0.684	0.704
	Sensible Cooling	-0.145	-0.144	-0.138	-0.126	-0.142	-0.143	-0.142	-0.143	-0.145
	Latent Cooling	0.830	0.815	0.963	0.799	0.822	0.825	0.835	0.827	0.850

ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101 - AE245  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.1-1. FC/SZ Heating Coil Load [QH]**

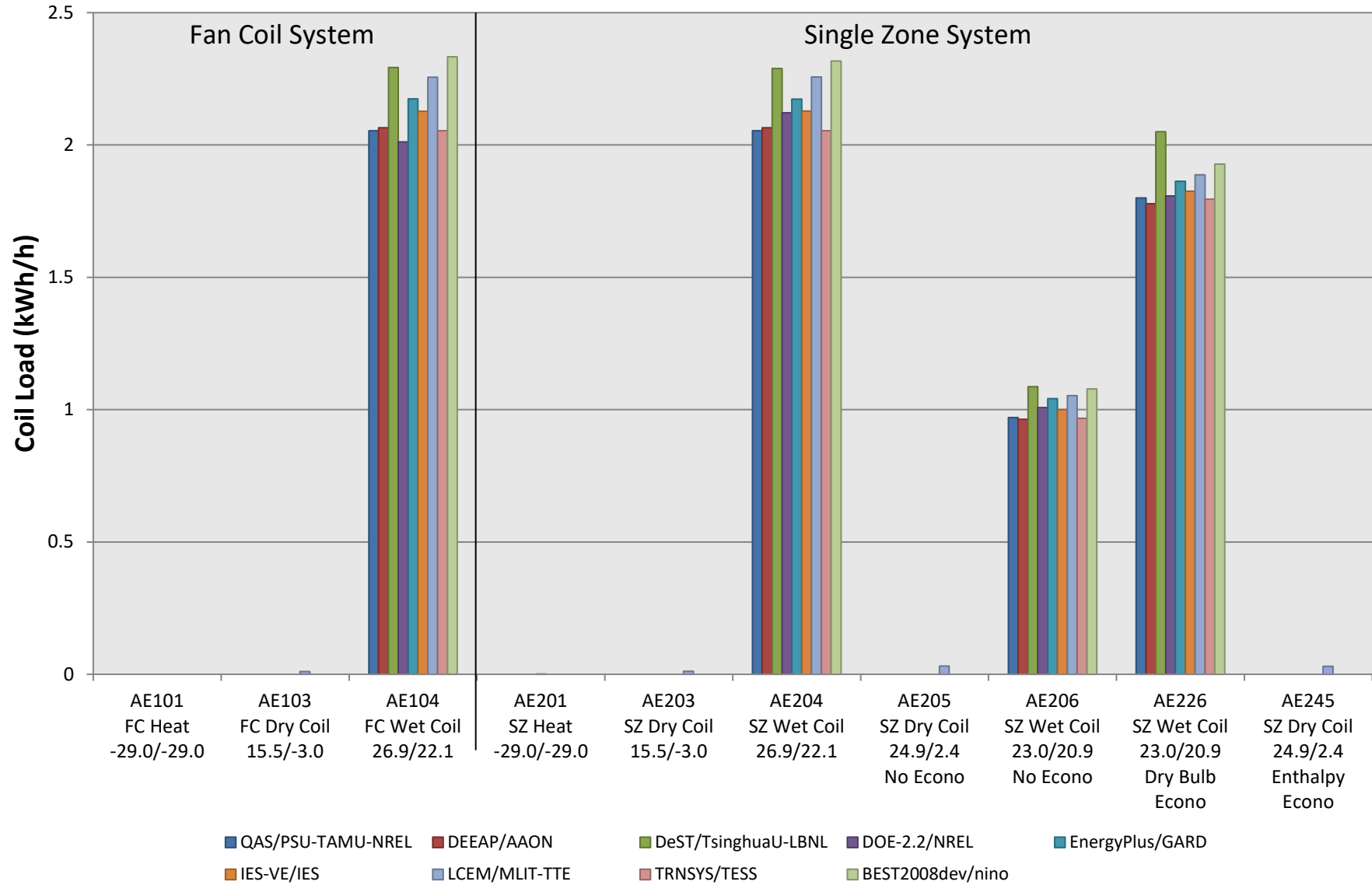






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 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

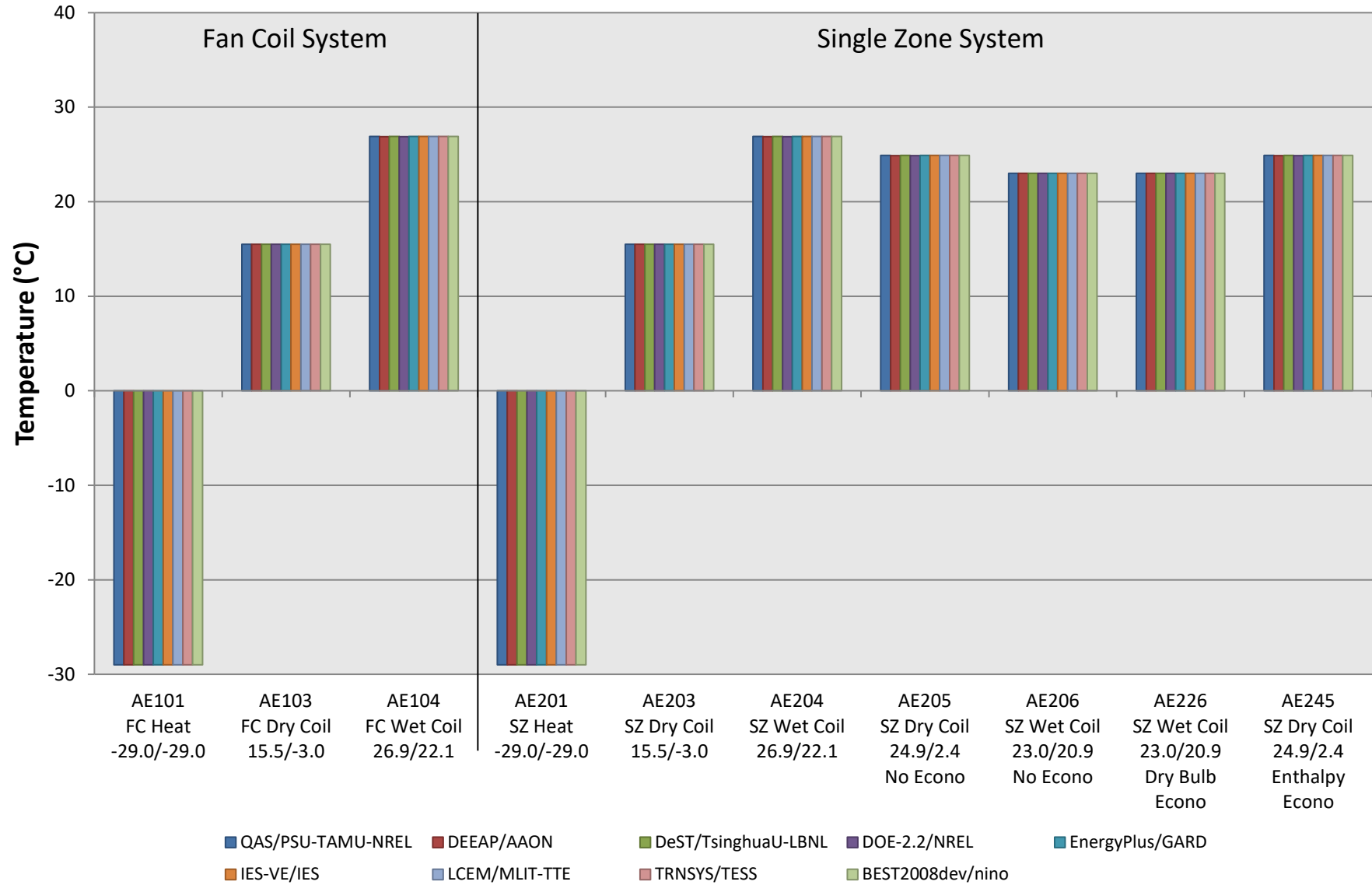
**Figure B16.7.1-4. FC/SZ Cooling Coil Load, Latent [QClatent]**





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 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

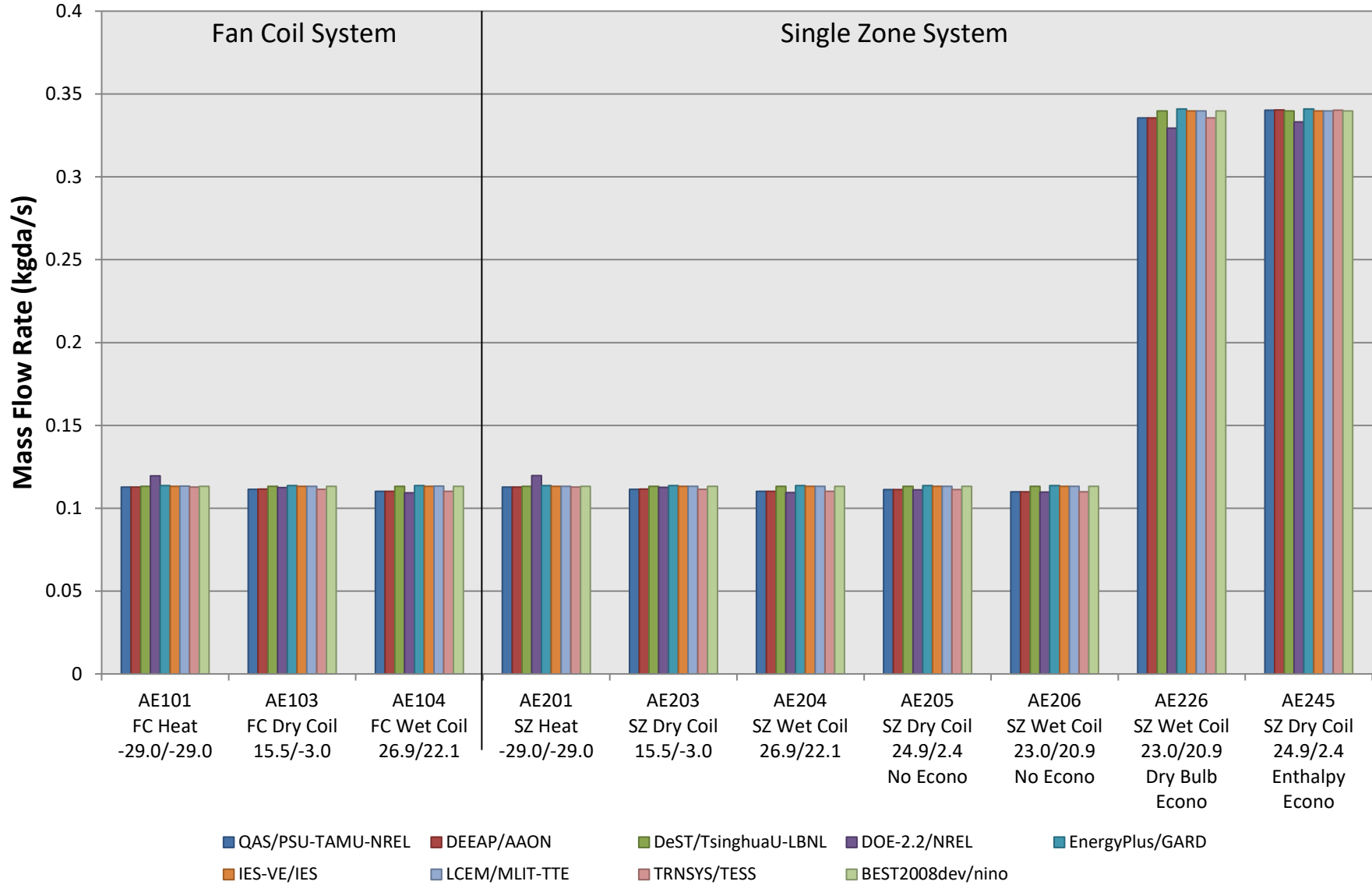
**Figure B16.7.1-5. FC/SZ Outdoor Air Temperature**





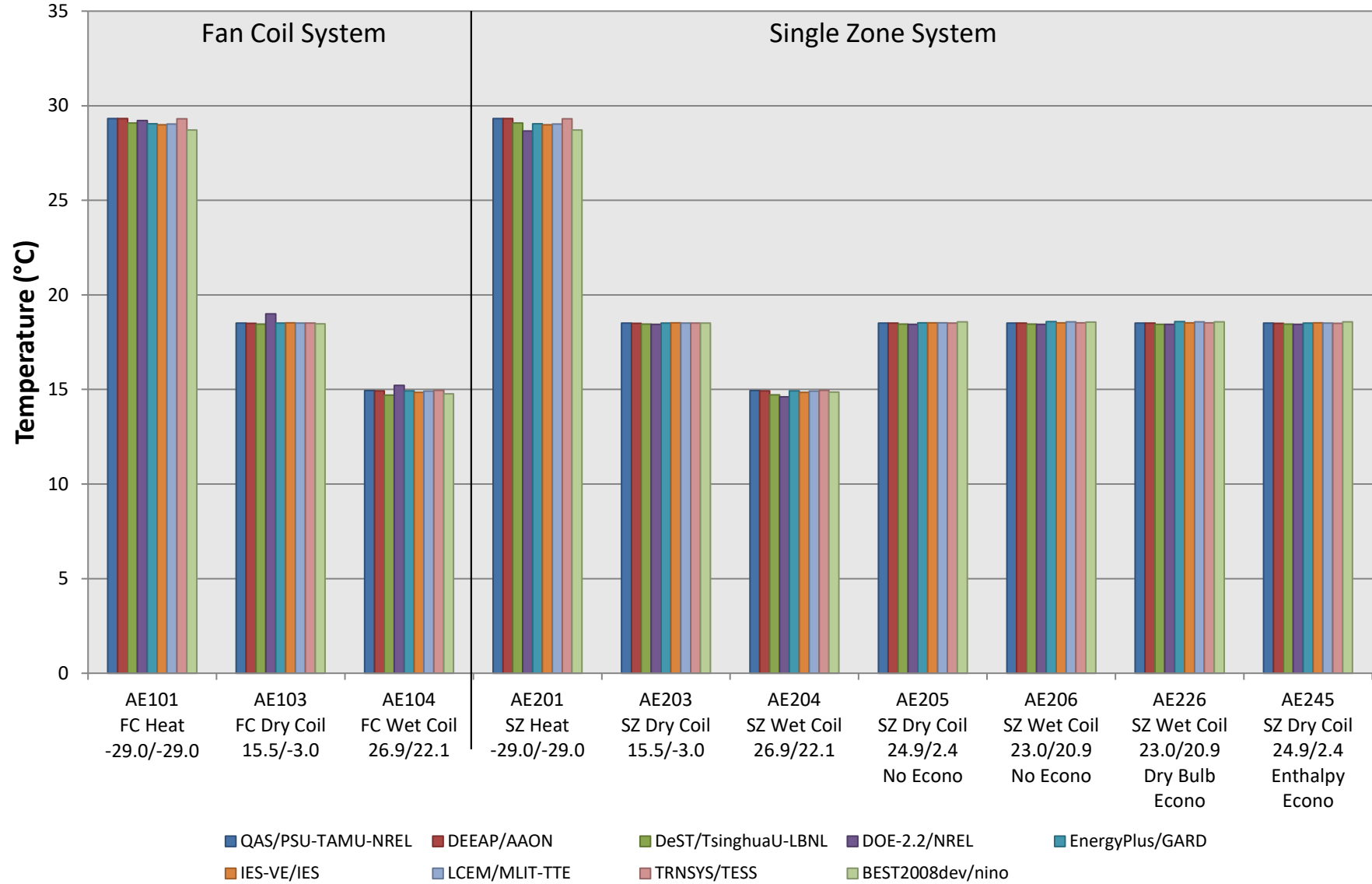
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101 - AE245  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.1-7. FC/SZ Outdoor Air Mass Flow Rate**



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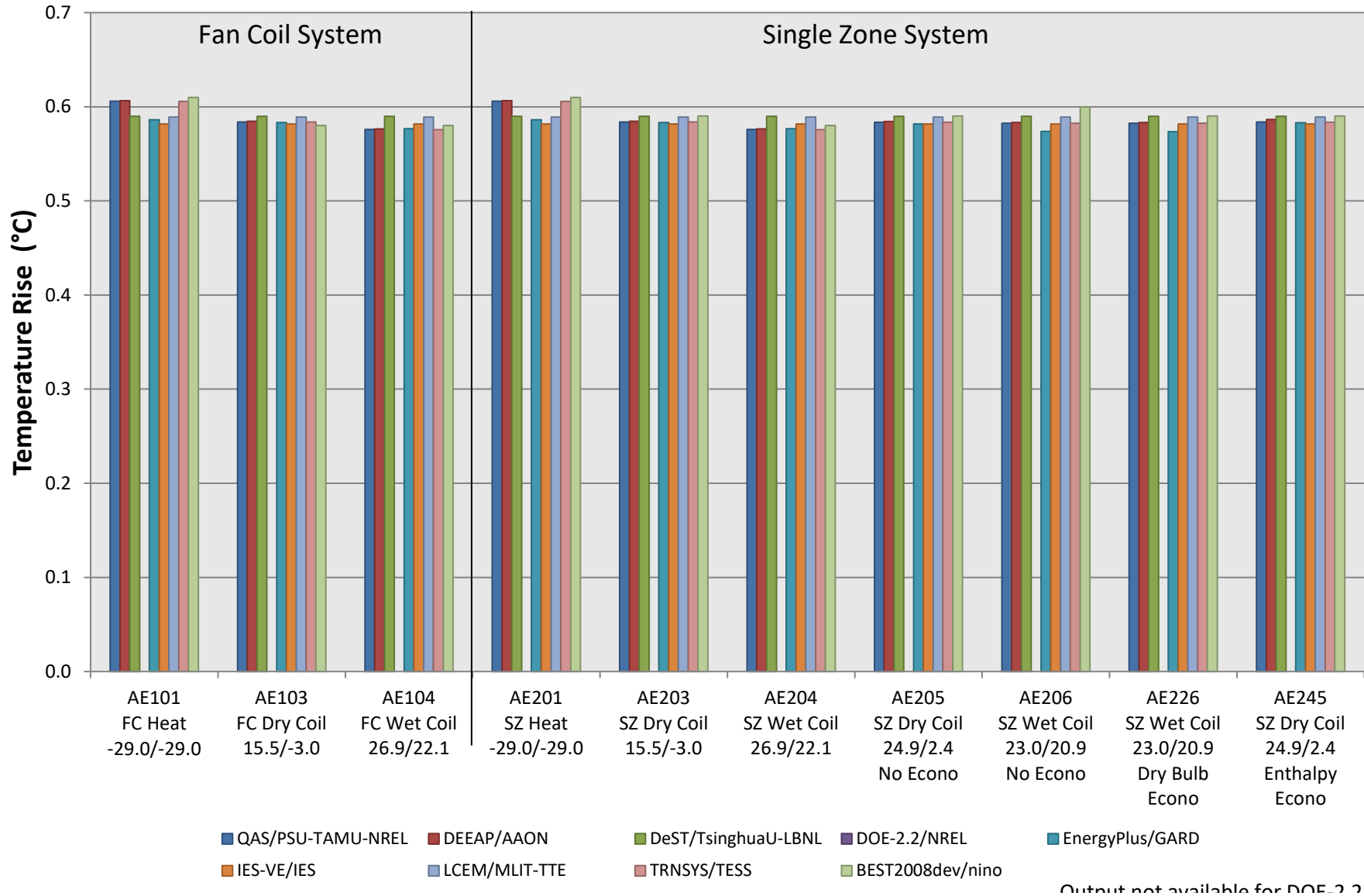
**Figure B16.7.1-8. FC/SZ Cooling Coil Outlet Air Temperature**





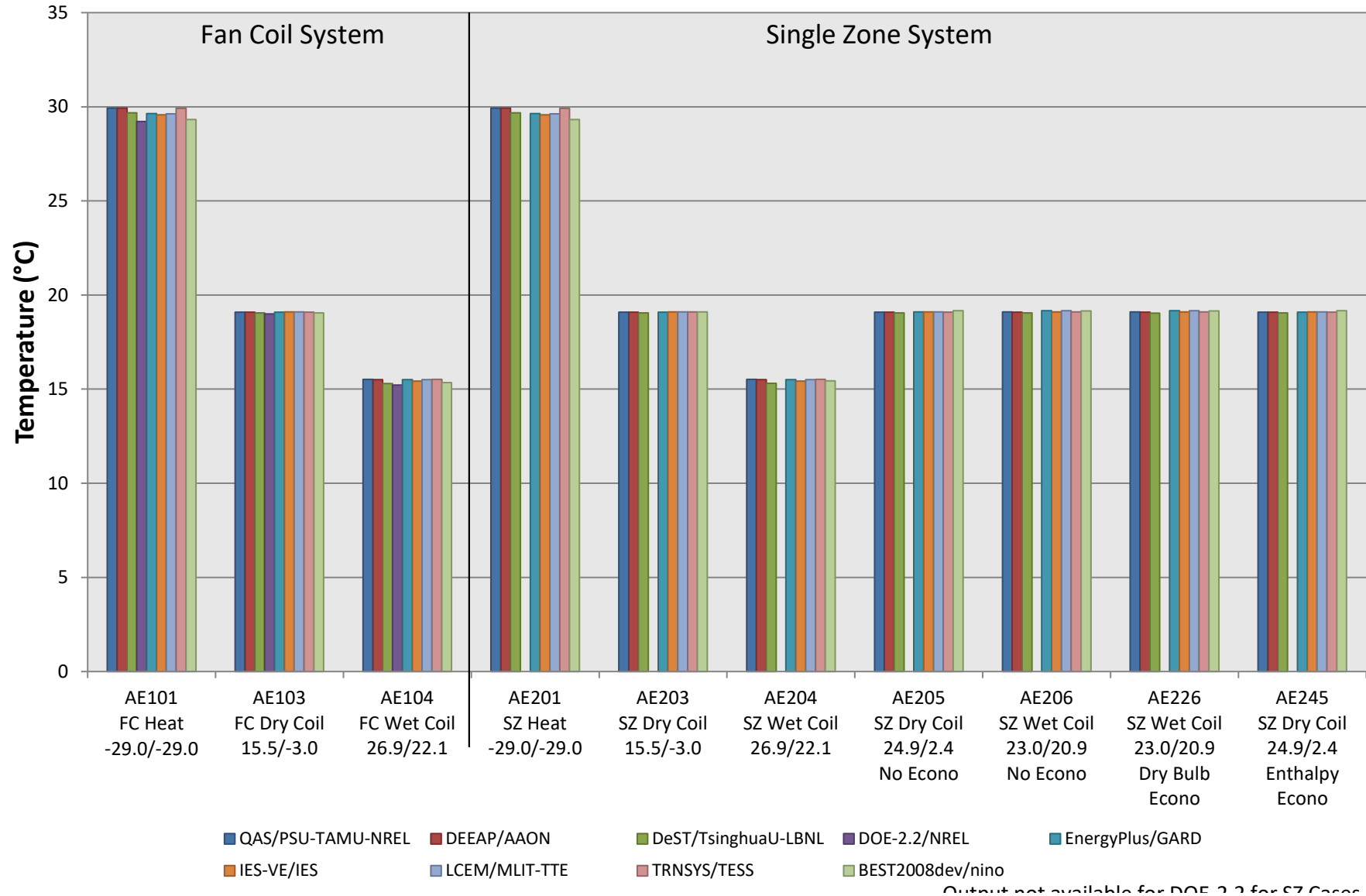
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101 - AE245  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.1-10. FC/SZ Supply Fan Air Temperature Rise**



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 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.1-11. FC/SZ Supply Air Temperature**

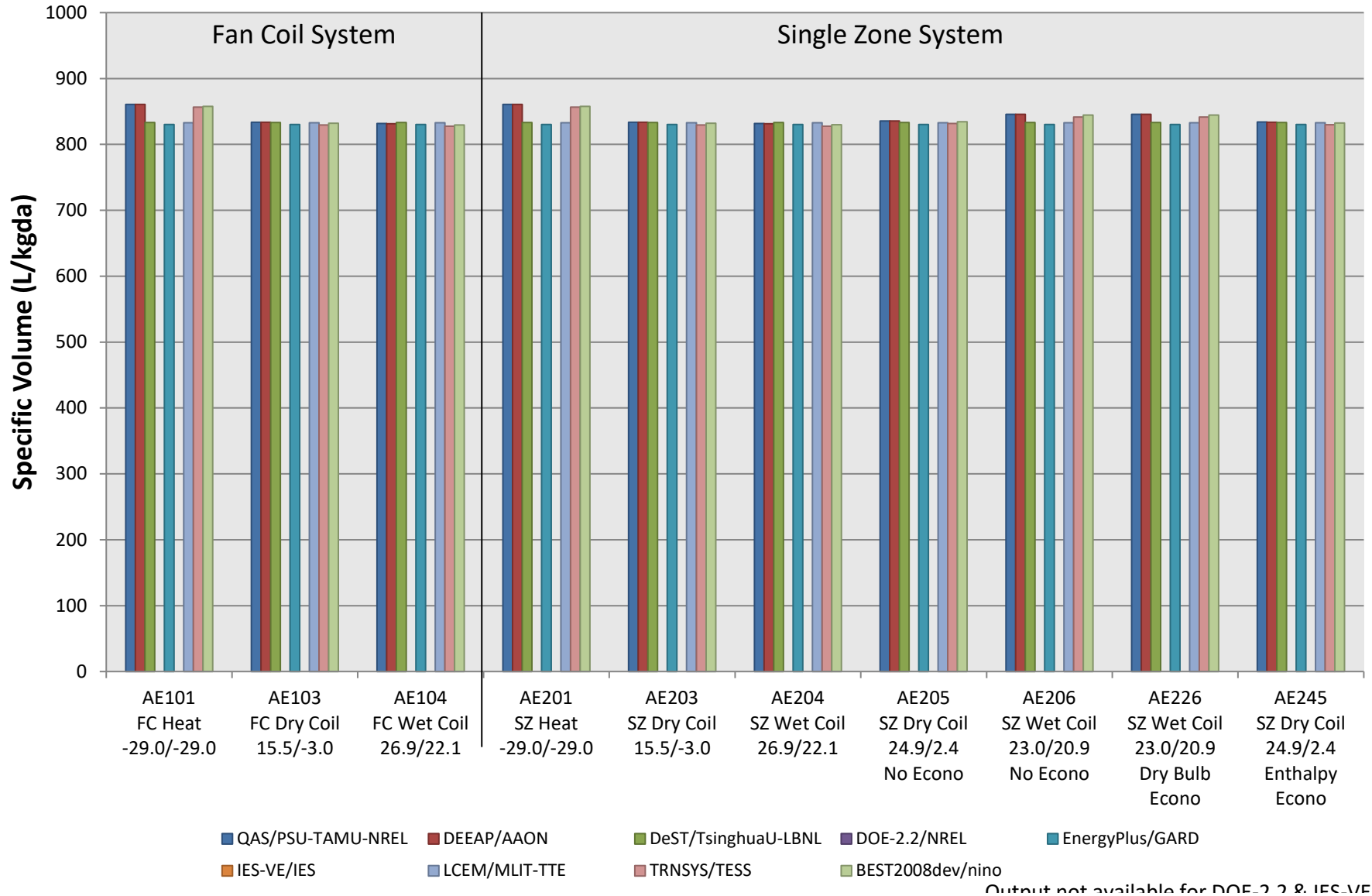






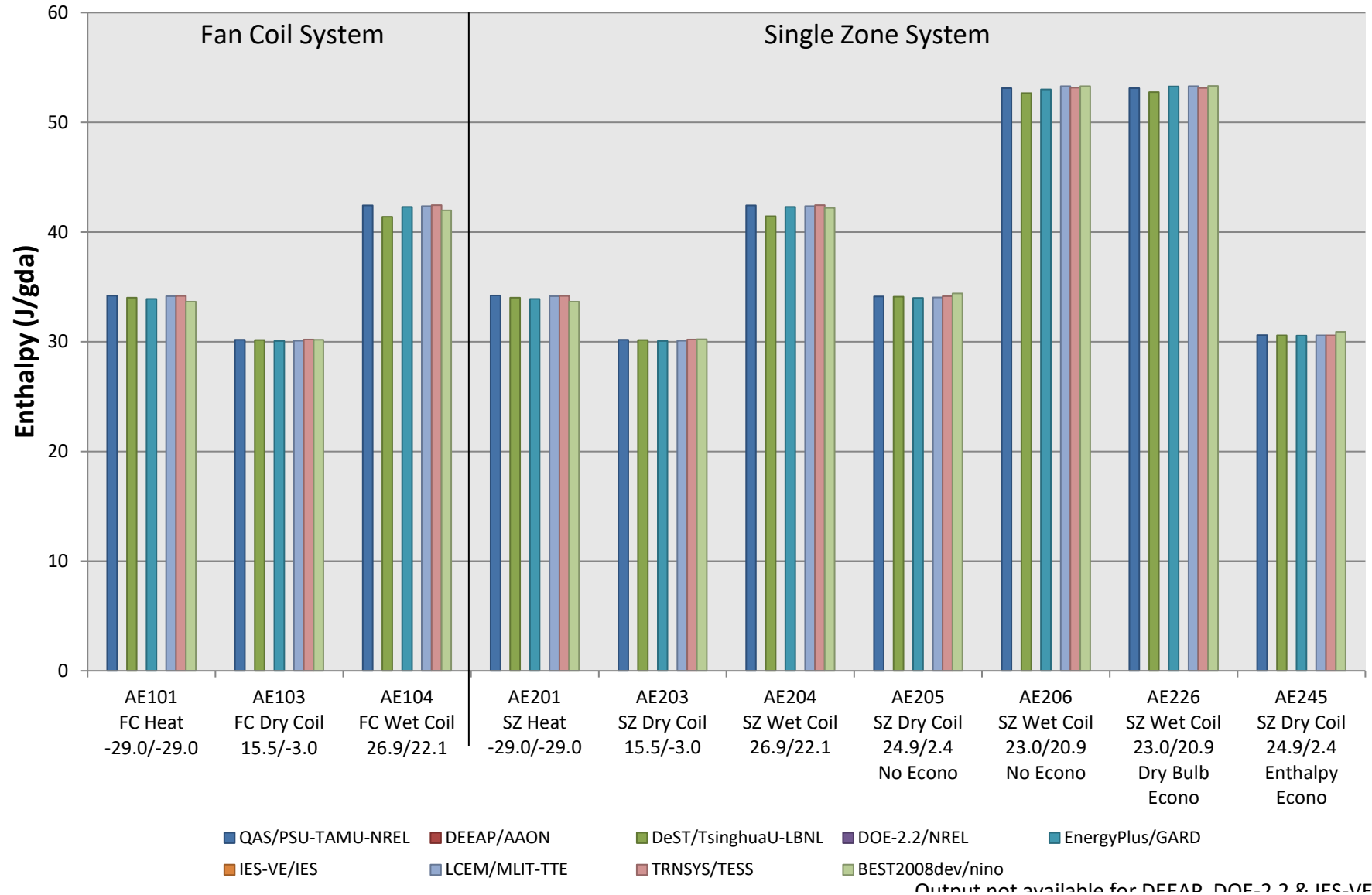
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101 - AE245  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.1-13. FC/SZ Supply Air Specific Volume**



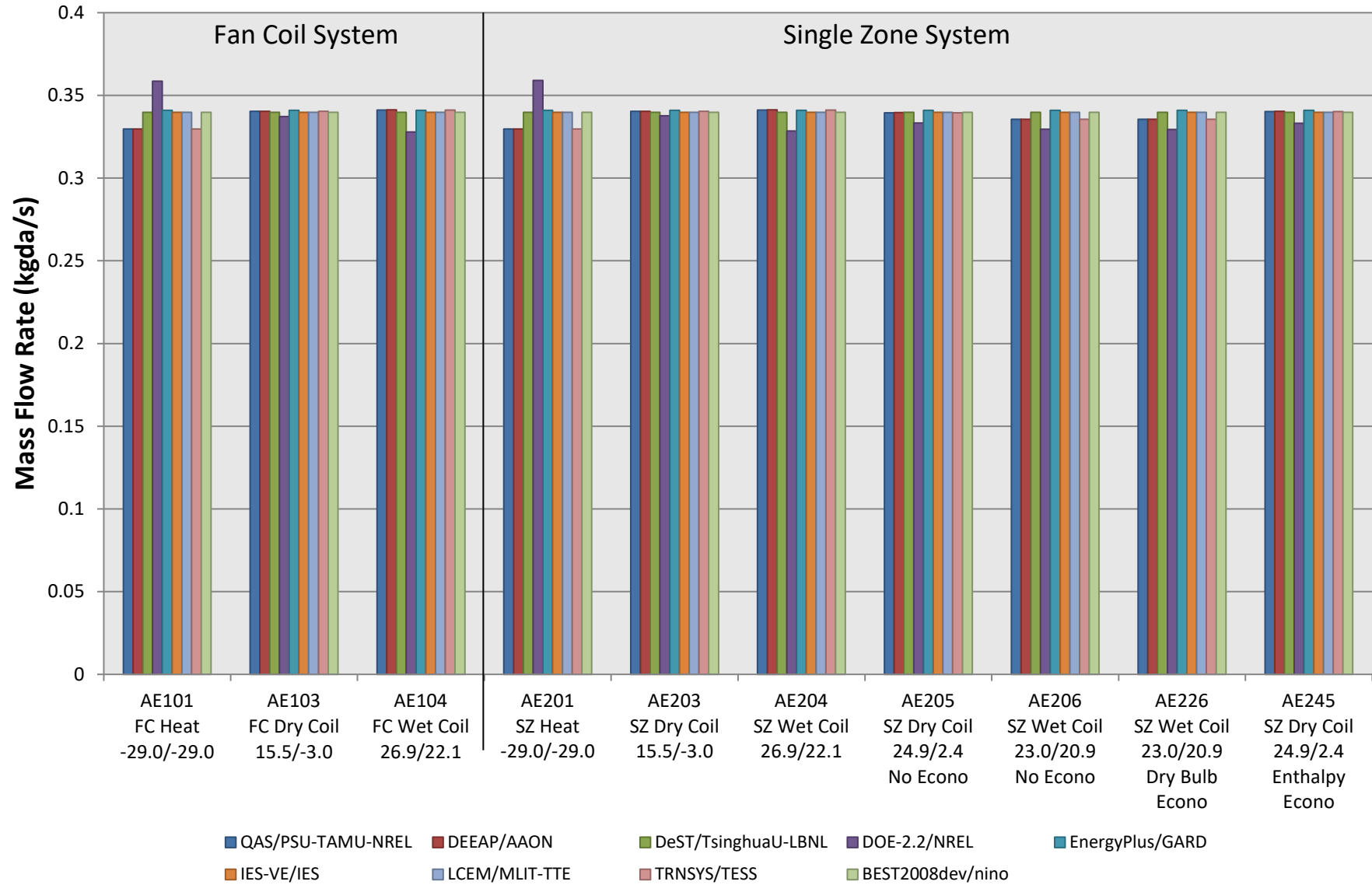
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101 - AE245  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.1-14. FC/SZ Supply Air Enthalpy**



ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101 - AE245  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

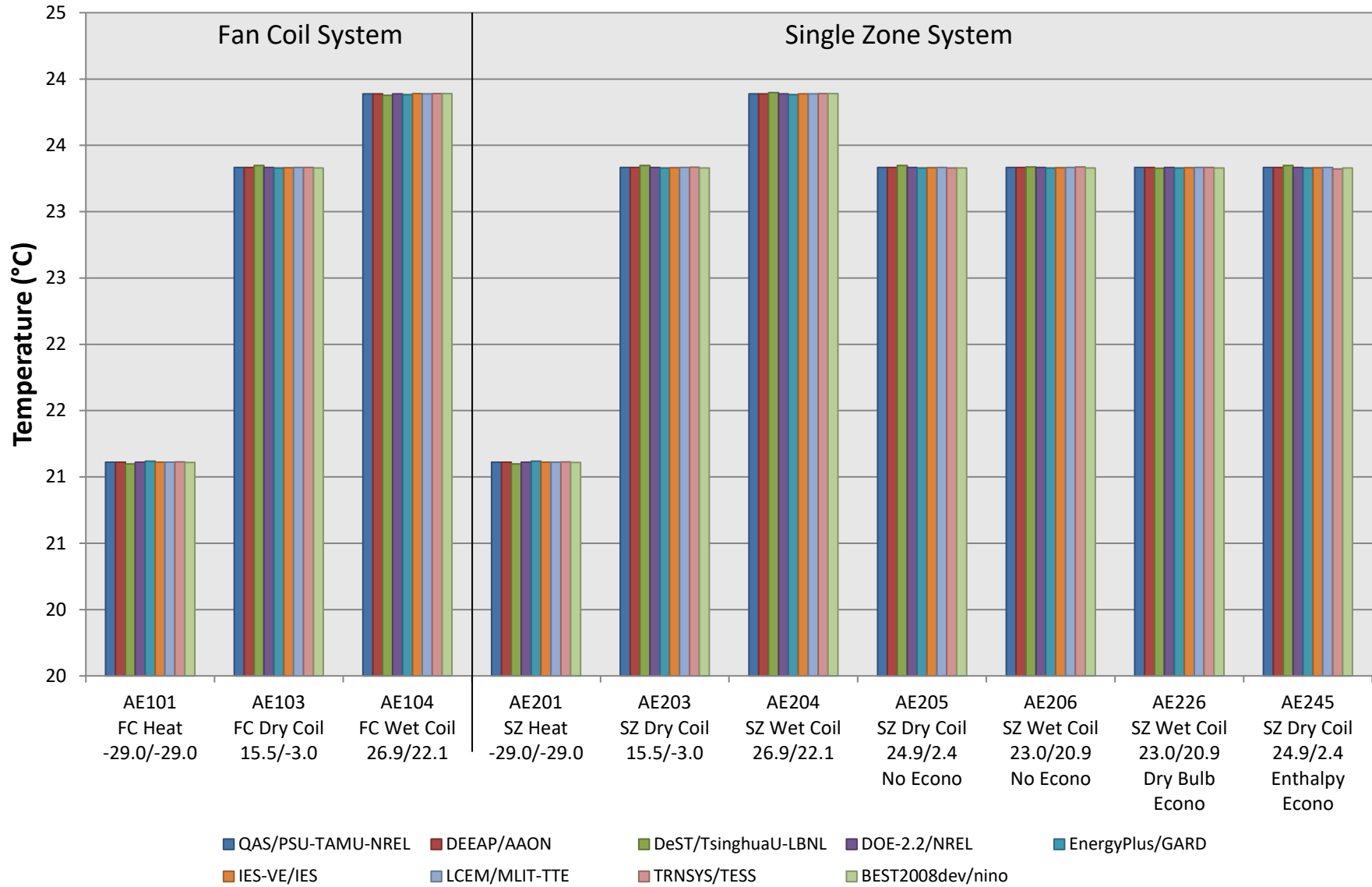
**Figure B16.7.1-15. FC/SZ Supply Air Mass Flow Rate**





ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101 - AE245  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.1-17. FC/SZ Zone Air Temperature**

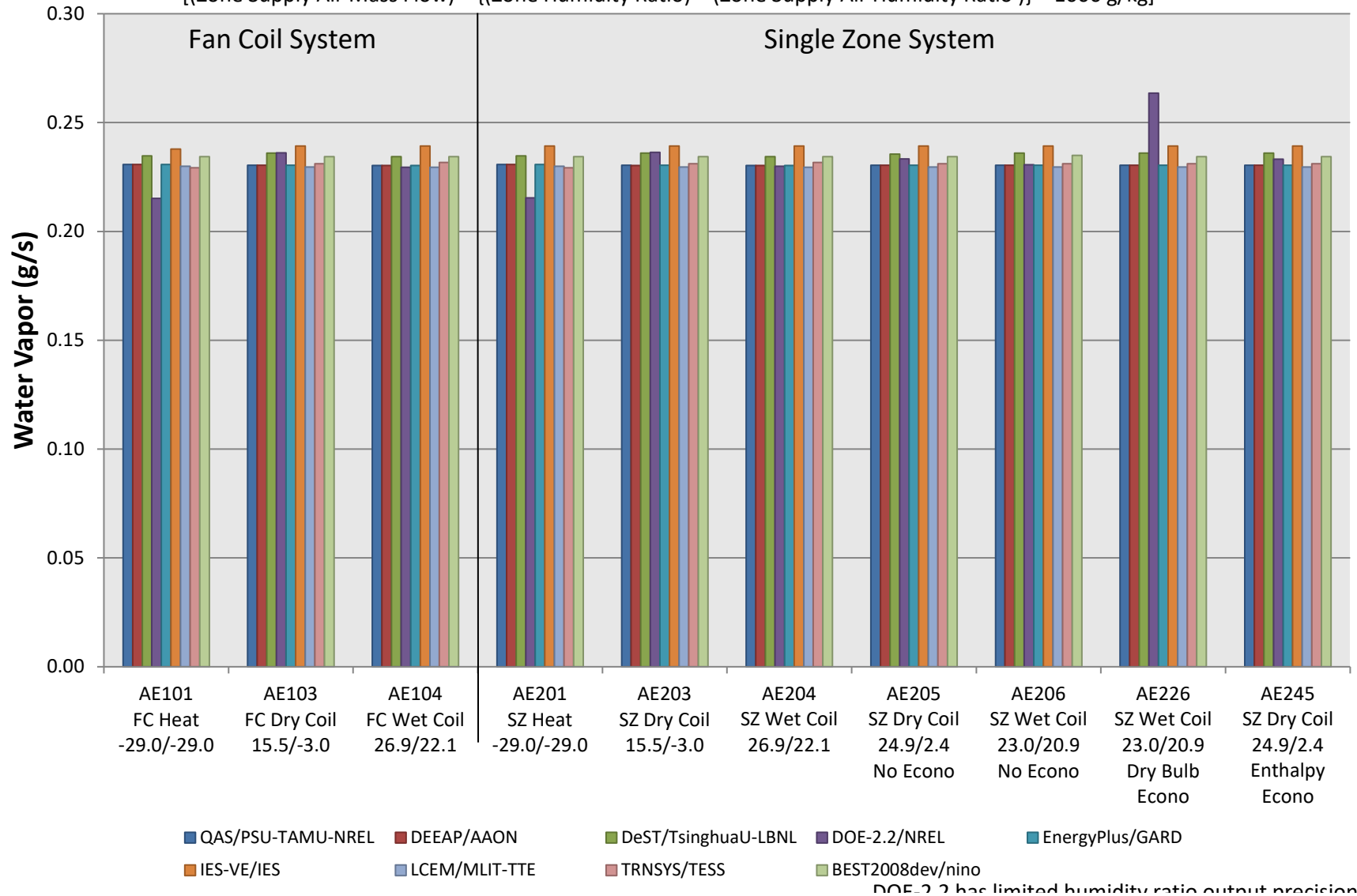




ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101 - AE245  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

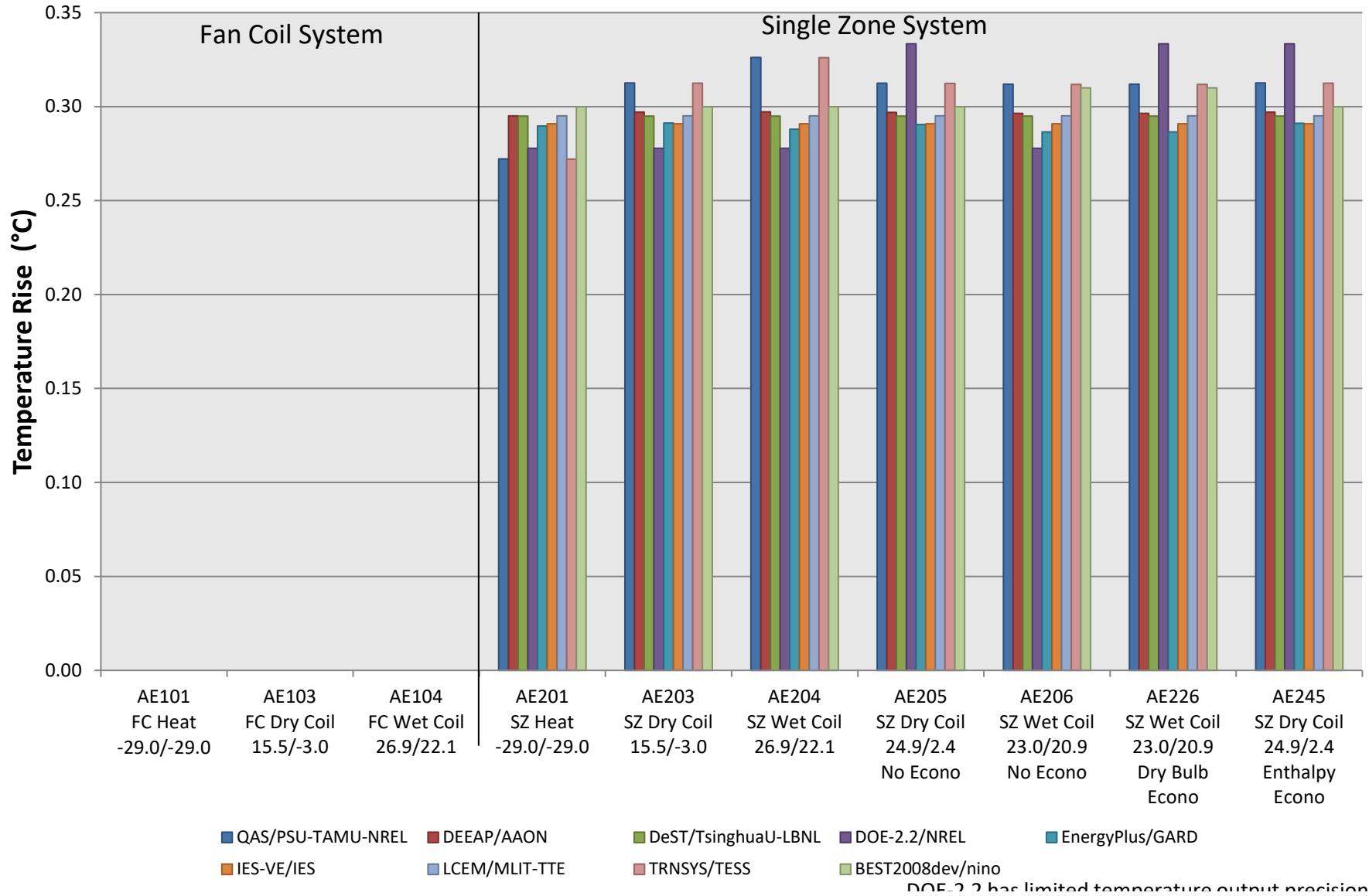
### Figure B16.7.1-19. FC/SZ Moisture Added to Zone by Latent Gains

$$[(\text{Zone Supply Air Mass Flow}) \times \{(\text{Zone Humidity Ratio}) - (\text{Zone Supply Air Humidity Ratio})\}] \times 1000 \text{ g/kg}$$



ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101 - AE245  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.1-20. FC/SZ Return Fan Air Temperature Rise**

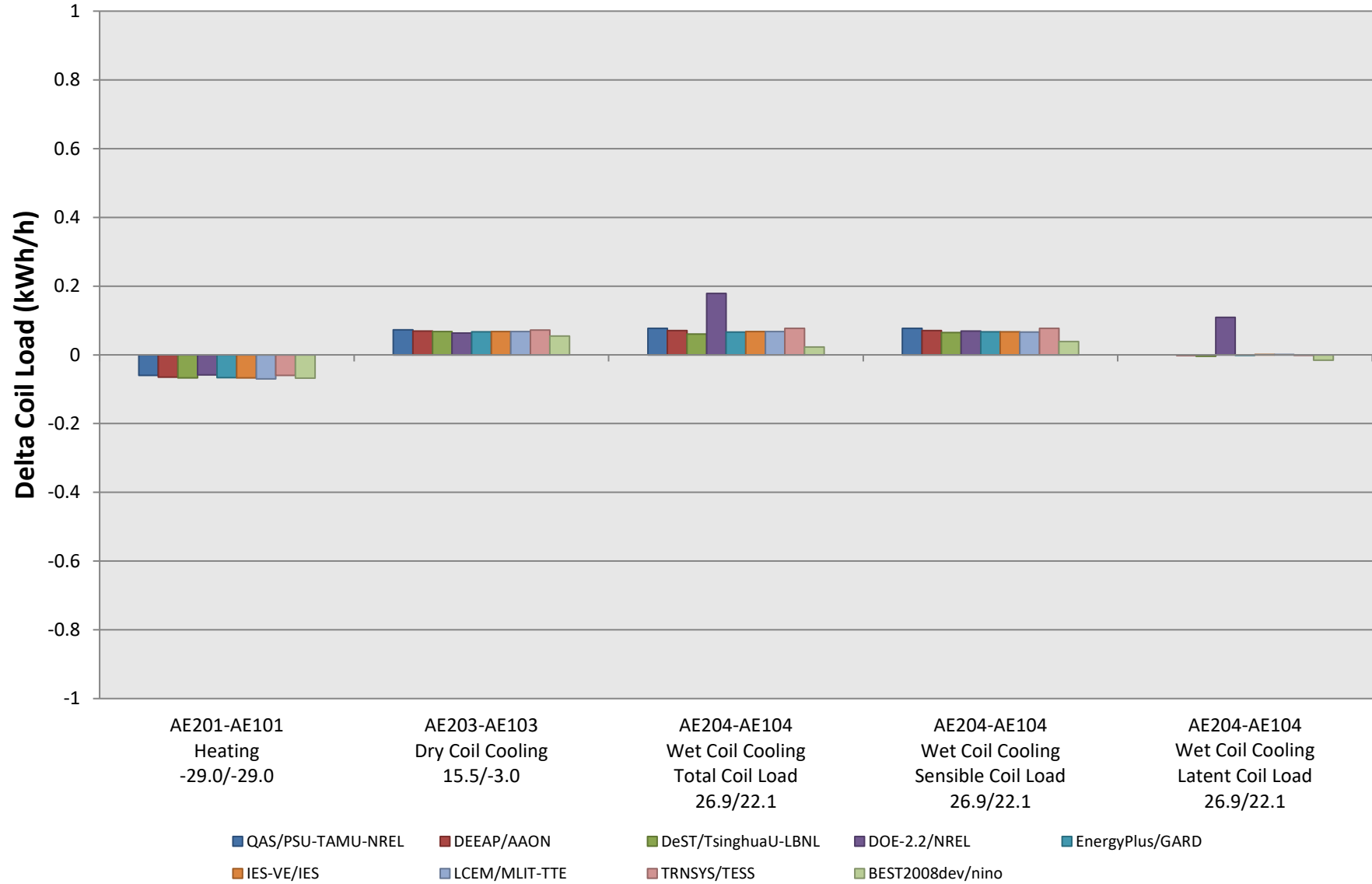


DOE-2.2 has limited temperature output precision



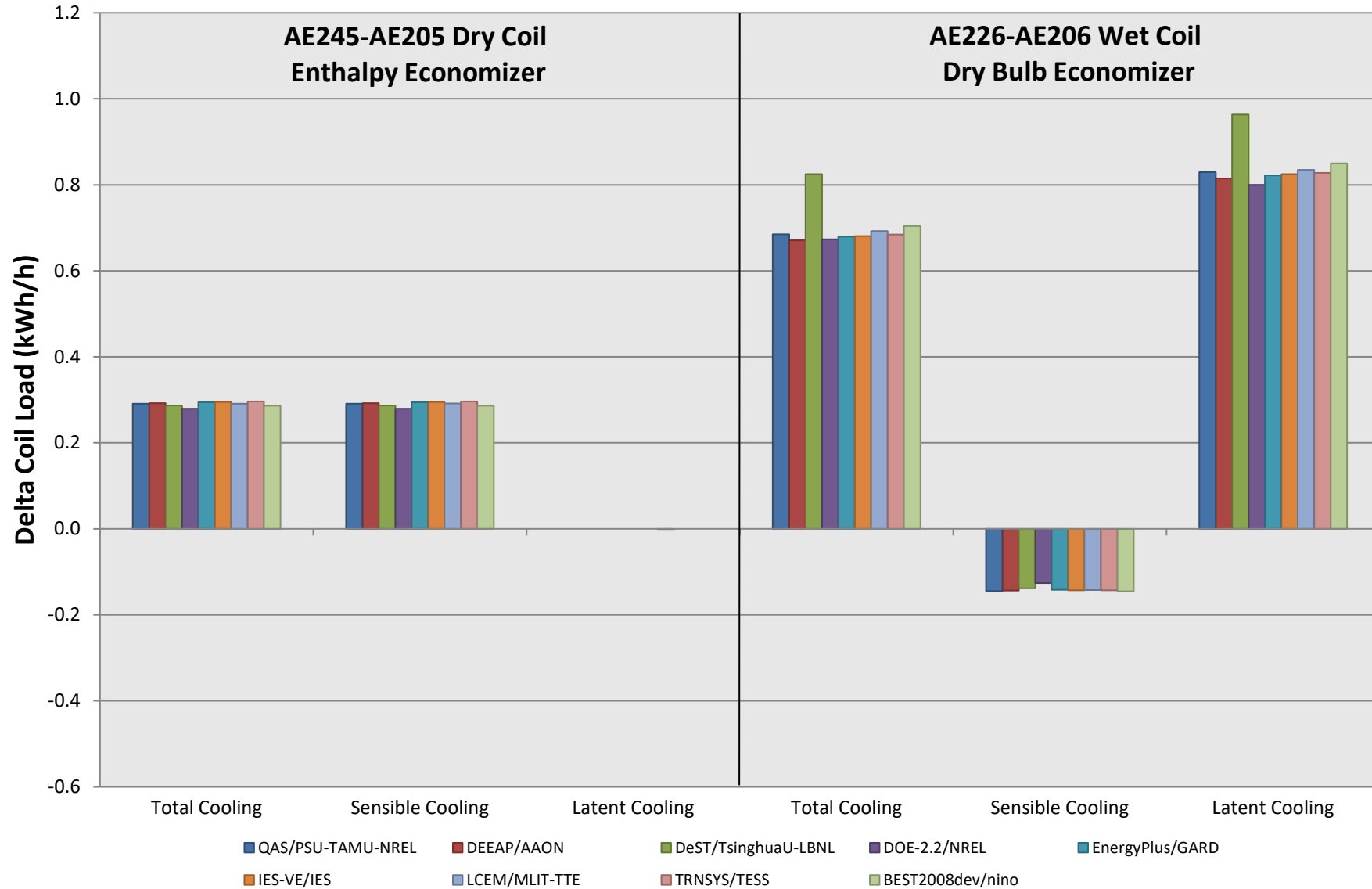
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101 - AE245  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.1-21. FC/SZ Delta Coil Load, SZ - FC**



ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE101 - AE245  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.1 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.1-22. FC/SZ Delta Coil Load, Economizer Operation**



# **ASHRAE Standard 140-2017**

## **Results Comparison for Section 5.5, Airside HVAC Equipment Performance Tests AE301 through AE445**

Results for BEST  
(BEST2008dev)  
vs.  
Informative Annex B16, Section B16.7.2 Example Results

Prepared By  
NIKKEN SEKKEI LTD nino  
(nino)

Results Developed  
17-Nov-2020

**ASHRAE Standard 140-2017**  
**Computer Programs, Program Authors, and Producers of Example Results for**  
**Section 5.5, Airside HVAC Equipment Performance Tests AE301 through AE445**

The quasi-analytical solution and programs used to generate the example results are described in Table B17-13. The first column of the table ("Model") indicates the program name and version number, or indicates a quasi-analytical solution.

The second column ("Authoring Organization") indicates the national research facility, university, or industry organization with expertise in building science that wrote the simulation software.

The third column ("Implemented By") indicates the national research facility, university, or industry organization with expertise in building science that performed the simulations or did the quasi-analytical solutions. The organizations that performed simulations either ran software written by their organization or otherwise maintained contact with the program authors during the project.

The fourth column ("Abbreviation") indicates the identifying abbreviation used in the results tables and figures. See Standard 140, Informative Annex B17 for further details.

**Table B17-13 Airside HVAC Cases**  
**Participating Organizations and Models**

Model	Authoring Organization	Implemented by	Abbreviation
Quasi-Analytical Solution (QAS)	PSU <sup>a</sup> /UNO <sup>b</sup> /TAMU <sup>c</sup> /NREL <sup>d</sup> /JNA <sup>e</sup> /MDK <sup>f</sup> , United States	NREL <sup>d</sup> /JNA <sup>e</sup> /MDK <sup>f</sup> , United States	QAS/PSU-TAMU-NREL
DEEAP <sup>g</sup> 1.1.2	AAON, Inc., United States	AAON, Inc., United States	DEEAP/AAON
DeST <sup>h</sup> 2	Tsinghua University, China	Tsinghua University, China / LBNL <sup>i</sup> , United States	DeST/TsinghuaU-LBNL
DOE-2.2 V48L	JJH <sup>j</sup> /LBNL <sup>i</sup> /UC <sup>k</sup> , United States	NREL <sup>d</sup> /JNA <sup>e</sup> /MDK <sup>f</sup> , United States	DOE-2.2/NREL
EnergyPlus 8.2.0	DOE-BT <sup>l</sup> , United States	GARD Analytics, Inc., United States	EnergyPlus/GARD
IES-VE <sup>m</sup> 2014.2	IES <sup>n</sup> , United Kingdom	IES <sup>n</sup> , United Kingdom	IES-VE/IES
LCEM <sup>o</sup> 3.10	MLIT <sup>p</sup> , Japan	TTE <sup>q</sup> , Japan	LCEM/MLIT-TTE
TRNSYS 17.01.0028	TESS <sup>r</sup> /UWM <sup>s</sup> , United States	TESS <sup>r</sup> , United States	TRNSYS/TESS

<sup>a</sup> PSU: The Pennsylvania State University, United States

<sup>b</sup> UNO: University of Nebraska - Omaha, United States

<sup>c</sup> TAMU: Texas A&M University, United States

<sup>d</sup> NREL: National Renewable Energy Laboratory, United States

<sup>e</sup> JNA: J. Neymark & Associates, United States

<sup>f</sup> MDK: Mike D. Kennedy, Inc., United States

<sup>g</sup> DEEAP: Detailed Energy and Economic Analysis Program

<sup>h</sup> DeST: Designer's Simulation Toolkit

<sup>i</sup> LBNL: Lawrence Berkeley National Laboratory, United States

<sup>j</sup> JJH: James J. Hirsch & Associates, United States

<sup>k</sup> UC: University of California, United States

<sup>l</sup> DOE-BT: U.S. Department of Energy, Office of Building Technologies, Energy Efficiency and Renewable Energy, United States

<sup>m</sup> IES-VE: Integrated Environmental Solutions - Virtual Environment

<sup>n</sup> IES: Integrated Environmental Solutions, United Kingdom

<sup>o</sup> LCEM: Life Cycle Energy Management tool; *LCEM was not run for the CV and VAV system cases (AE301 through AE445)*

<sup>p</sup> MLIT: Ministry of Land, Infrastructure, Transportation and Tourism, Japan

<sup>q</sup> TTE: Takasago Thermal Engineering, Japan

<sup>r</sup> TESS: Thermal Energy System Specialists, United States

<sup>s</sup> UWM: University of Wisconsin - Madison, United States

**ASHRAE Standard 140-2017, Section 5.5 - Airside HVAC Analytical Verification Tests**  
**BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results**  
**By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

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**ASHRAE Standard 140-2017, Section 5.5 - Airside HVAC Analytical Verification Tests**  
**BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results**  
**By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

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**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301-AE445  
BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results  
By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.2-7. CV/VAV Zone 1 Reheat Coil Load [QH1reheat] (kWh/h)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	7.71	7.71	7.47	7.71	7.51	7.54	7.71	7.36
AE303	2.26	2.25	2.14	2.15	2.18	2.19	2.26	2.15
AE304	0.99	0.99	0.86	0.80	0.94	0.92	0.99	0.89
AE305	2.26	2.26	2.14	2.07	2.19	2.19	2.26	2.15
AE306	2.26	2.26	2.14	2.11	2.21	2.19	2.26	2.15
AE326	2.26	2.26	2.14	2.13	2.21	2.19	2.27	2.15
AE345	2.26	2.25	2.14	2.09	2.18	2.19	2.26	2.15
AE401	4.50	4.50	4.50	4.58	4.50	4.52	4.49	4.37
AE403	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE404	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE405	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE406	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE426	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE445	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table B16.7.2-8. CV/VAV Zone 2 Reheat Coil Load [QH2reheat] (kWh/h)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	8.39	8.38	8.08	8.38	8.13	8.17	8.38	7.97
AE303	2.46	2.45	2.30	2.32	2.36	2.37	2.45	2.31
AE304	1.52	1.51	1.35	1.27	1.46	1.42	1.52	1.37
AE305	2.46	2.45	2.30	2.22	2.37	2.37	2.46	2.32
AE306	2.46	2.46	2.30	2.27	2.40	2.37	2.46	2.32
AE326	2.46	2.46	2.30	2.29	2.40	2.37	2.47	2.32
AE345	2.46	2.45	2.30	2.24	2.36	2.37	2.46	2.32
AE401	4.88	4.87	4.89	5.01	4.90	4.93	4.87	4.76
AE403	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE404	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE405	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE406	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE426	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE445	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table B16.7.2-9. CV/VAV Outdoor Air Temperature (°F)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	-29.00	-29.00	-29.00	-29.00	-29.00	-29.00	-29.00	-29.00
AE303	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50
AE304	26.90	26.89	26.90	26.89	26.90	26.90	26.90	26.90
AE305	24.90	24.89	24.90	24.89	24.90	24.90	24.90	24.90
AE306	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
AE326	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
AE345	24.90	24.89	24.90	24.89	24.90	24.90	24.90	24.90
AE401	-29.00	-29.00	-29.00	-29.00	-29.00	-29.00	-29.00	-29.00
AE403	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50
AE404	26.90	26.89	26.90	26.89	26.90	26.90	26.90	26.90
AE405	24.90	24.89	24.90	24.89	24.90	24.90	24.90	24.90
AE406	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
AE426	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
AE445	24.90	24.89	24.90	24.89	24.90	24.90	24.90	24.90

**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301-AE445  
BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results  
By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.2-10. CV/VAV Outdoor Air Humidity Ratio (g/gda)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	0.000259	0.000259	0.000260	0.000300	0.000259	0.000262	0.000259	0.000250
AE303	0.002936	0.002895	0.002948	0.002900	0.002933	0.002947	0.002936	0.002960
AE304	0.016774	0.016783	0.016850	0.016800	0.016772	0.016839	0.016774	0.016890
AE305	0.004491	0.004457	0.004510	0.004500	0.004481	0.004508	0.004491	0.004580
AE306	0.015556	0.015523	0.015630	0.015600	0.015565	0.015616	0.015556	0.015590
AE326	0.015556	0.015523	0.015630	0.015600	0.015565	0.015616	0.015556	0.015590
AE345	0.004491	0.004457	0.004510	0.004500	0.004481	0.004508	0.004491	0.004580
AE401	0.000259	0.000259	0.000260	0.000300	0.000259	0.000262	0.000259	0.000250
AE403	0.002936	0.002895	0.002948	0.002900	0.002933	0.002947	0.002936	0.002960
AE404	0.016774	0.016783	0.016850	0.016800	0.016772	0.016839	0.016774	0.016890
AE405	0.004491	0.004457	0.004510	0.004500	0.004481	0.004508	0.004491	0.004580
AE406	0.015556	0.015523	0.015630	0.015600	0.015565	0.015616	0.015556	0.015590
AE426	0.015556	0.015523	0.015630	0.015600	0.015565	0.015616	0.015556	0.015590
AE445	0.004491	0.004457	0.004510	0.004500	0.004481	0.004508	0.004491	0.004580

**Table B16.7.2-11. CV/VAV Outdoor Air Mass Flow Rate (kgda/s)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	0.2814	0.2814	0.2832	0.2965	0.2842	0.2832	0.2814	0.2832
AE303	0.2781	0.2781	0.2832	0.2815	0.2842	0.2832	0.2781	0.2832
AE304	0.2755	0.2756	0.2832	0.2735	0.2842	0.2832	0.2755	0.2832
AE305	0.2774	0.2774	0.2832	0.2774	0.2842	0.2832	0.2774	0.2832
AE306	0.2761	0.2761	0.2832	0.2754	0.2842	0.2832	0.2760	0.2832
AE326	0.7483	0.7484	0.7362	0.7137	0.7389	0.7362	0.7483	0.7362
AE345	0.7535	0.7537	0.7362	0.7217	0.7389	0.7362	0.7535	0.7362
AE401	0.2814	0.2814	0.2832	0.2971	0.2842	0.2832	0.2814	0.2832
AE403	0.2781	0.2781	0.2832	0.2860	0.2842	0.2832	0.2781	0.2832
AE404	0.2753	0.2754	0.2832	0.2729	0.2842	0.2832	0.2753	0.2832
AE405	0.2774	0.2775	0.2832	0.2776	0.2842	0.2832	0.2774	0.2832
AE406	0.2755	0.2756	0.2832	0.2747	0.2842	0.2832	0.2755	0.2832
AE426	0.3321	0.3325	0.3384	0.3294	0.3314	0.3335	0.3313	0.3338
AE445	0.3350	0.3354	0.3383	0.3359	0.3343	0.3335	0.3341	0.3337

**Table B16.7.2-12. CV/VAV Cooling Coil Outlet Air Temperature (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	7.22	7.22	7.22	7.22	7.22	7.22	7.22	7.10
AE303	12.21	12.21	12.20	12.17	12.20	12.20	12.21	12.20
AE304	12.21	12.21	12.20	12.22	12.20	12.20	12.21	12.20
AE305	12.21	12.21	12.20	12.28	12.20	12.20	12.21	12.20
AE306	12.21	12.21	12.18	12.22	12.20	12.20	12.21	12.21
AE326	12.21	12.21	12.20	12.22	12.20	12.20	12.20	12.20
AE345	12.21	12.21	12.20	12.22	12.20	12.20	12.20	12.20
AE401	7.22	7.22	7.22	7.22	7.20	7.22	7.22	7.22
AE403	12.66	12.65	12.67	12.67	12.66	12.66	12.67	12.66
AE404	12.48	12.46	12.46	12.44	12.47	12.47	12.49	12.46
AE405	12.66	12.65	12.67	12.67	12.66	12.66	12.67	12.66
AE406	12.66	12.65	12.67	12.67	12.66	12.66	12.66	12.66
AE426	12.66	12.65	12.66	12.67	12.66	12.66	12.67	12.66
AE445	12.66	12.65	12.67	12.67	12.66	12.66	12.67	12.66

**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301-AE445  
BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results  
By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.2-13. CV/VAV Cooling Coil Outlet Relative Humidity [RHcco] (%)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	24.73	24.73		23.96	23.89	24.65	24.64	24.35
AE303	48.15	47.69	48.22	47.92	47.46	48.02	48.18	48.05
AE304	100.00	100.00	95.49	100.00	99.13	100.00	100.00	100.00
AE305	65.72	65.34	65.84	65.53	64.91	65.57	65.75	66.34
AE306	100.00	100.00	96.21	100.00	99.25	100.00	100.00	100.00
AE326	100.00	100.00	98.89	100.00	99.93	100.00	100.00	100.00
AE345	51.09	50.71	51.33	51.14	50.99	51.10	51.11	52.11
AE401	4.14	4.15		4.80	4.15	4.17	4.15	4.00
AE403	36.39	36.01	36.39	34.29	35.85	35.98	36.37	36.26
AE404	100.00	100.00	97.24	100.00	98.71	100.00	100.00	100.00
AE405	53.46	53.17	53.52	51.85	52.78	53.05	53.43	53.98
AE406	100.00	100.00	99.38	100.00	99.76	100.00	100.00	100.00
AE426	100.00	100.00	99.58	100.00	99.95	100.00	100.00	100.00
AE445	49.58	49.24	49.78	49.66	49.46	49.58	49.56	50.56

**Table B16.7.2-14. CV/VAV Supply Fan Air Temperature Rise (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	0.56	0.56	0.59	0.56	0.59	0.58	0.56	0.56
AE303	0.57	0.57	0.59	0.61	0.58	0.58	0.57	0.58
AE304	0.57	0.57	0.59	0.61	0.58	0.58	0.57	0.58
AE305	0.57	0.57	0.59	0.61	0.58	0.58	0.57	0.58
AE306	0.57	0.57	0.59	0.56	0.58	0.58	0.57	0.58
AE326	0.57	0.57	0.59	0.56	0.58	0.58	0.57	0.58
AE345	0.57	0.57	0.59	0.56	0.58	0.58	0.57	0.58
AE401	0.07	0.09	0.09	0.06	0.09	0.09	0.07	0.08
AE403	0.11	0.13	0.13	0.11	0.12	0.12	0.11	0.12
AE404	0.30	0.32	0.33	0.33	0.31	0.31	0.29	0.32
AE405	0.11	0.13	0.12	0.11	0.12	0.12	0.11	0.12
AE406	0.11	0.13	0.12	0.11	0.12	0.12	0.11	0.12
AE426	0.11	0.13	0.12	0.11	0.12	0.12	0.11	0.12
AE445	0.11	0.13	0.12	0.11	0.12	0.12	0.11	0.12

**Table B16.7.2-15. CV/VAV Supply Air Temperature (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	7.78	7.78	7.81	7.78	7.81	7.80	7.78	7.66
AE303	12.78	12.78	12.79	12.78	12.78	12.78	12.79	12.78
AE304	12.78	12.78	12.79	12.83	12.78	12.78	12.78	12.78
AE305	12.78	12.78	12.79	12.89	12.78	12.78	12.78	12.78
AE306	12.78	12.78	12.77	12.78	12.78	12.78	12.78	12.79
AE326	12.78	12.78	12.79	12.78	12.78	12.78	12.77	12.78
AE345	12.78	12.78	12.79	12.78	12.78	12.78	12.77	12.78
AE401	7.30	7.31	7.31	7.28	7.29	7.31	7.29	7.30
AE403	12.78	12.78	12.79	12.78	12.78	12.78	12.78	12.78
AE404	12.78	12.78	12.79	12.78	12.78	12.78	12.78	12.78
AE405	12.78	12.78	12.79	12.78	12.78	12.78	12.78	12.78
AE406	12.78	12.78	12.79	12.78	12.78	12.78	12.77	12.78
AE426	12.78	12.78	12.78	12.78	12.78	12.78	12.78	12.78
AE445	12.78	12.78	12.79	12.78	12.78	12.78	12.78	12.78

**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301-AE445  
BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results  
By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.2-16. CV/VAV Supply Air Humidity Ratio (g/gda)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	0.001548	0.001548	0.001534	0.001500	0.001496	0.001549	0.001542	0.001510
AE303	0.004231	0.004190	0.004235	0.004200	0.004168	0.004234	0.004236	0.004220
AE304	0.008852	0.008852	0.008443	0.008900	0.008773	0.008891	0.008854	0.008850
AE305	0.005789	0.005755	0.005797	0.005800	0.005716	0.005795	0.005794	0.005840
AE306	0.008852	0.008852	0.008492	0.008900	0.008784	0.008888	0.008856	0.008850
AE326	0.008852	0.008852	0.008747	0.008900	0.008845	0.008909	0.008848	0.008850
AE345	0.004491	0.004457	0.004510	0.004500	0.004481	0.004508	0.004491	0.004580
AE401	0.000259	0.000259	0.000260	0.000300	0.000259	0.000262	0.000259	0.000250
AE403	0.003291	0.003252	0.003288	0.003100	0.003241	0.003265	0.003289	0.003280
AE404	0.009015	0.009004	0.008749	0.009000	0.008894	0.009056	0.009017	0.009000
AE405	0.004846	0.004814	0.004851	0.004700	0.004784	0.004826	0.004835	0.004890
AE406	0.009126	0.009116	0.009068	0.009200	0.009106	0.009175	0.009122	0.009120
AE426	0.009126	0.009116	0.009080	0.009200	0.009124	0.009184	0.009129	0.009120
AE445	0.004491	0.004457	0.004510	0.004500	0.004481	0.004508	0.004491	0.004580

**Table B16.7.2-17. CV/VAV Supply Air Specific Volume (L/kgda)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	797.83	797.73	833.33		830.35		793.92	797.60
AE303	815.50	815.34	833.33		830.35		811.55	815.66
AE304	821.52	821.42	833.33		830.35		817.53	821.69
AE305	817.53	817.38	833.33		830.35		813.57	817.77
AE306	821.52	821.42	833.33		830.35		817.53	821.72
AE326	821.52	821.42	833.33		830.35		817.48	821.70
AE345	815.84	815.69	833.33		830.35		811.84	816.13
AE401	794.80	794.73	833.33		830.35		794.28	794.97
AE403	814.28	814.12	833.33		830.35		813.51	814.44
AE404	821.73	821.61	833.33		830.35		819.66	821.90
AE405	816.31	816.16	833.33		830.35		815.52	816.54
AE406	821.88	821.76	833.33		830.35		821.07	822.06
AE426	821.88	821.76	833.33		830.35		821.11	822.06
AE445	815.84	815.69	833.33		830.35		815.07	816.14

**Table B16.7.2-18. CV/VAV Supply Air Enthalpy (J/gda)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	11.73		11.71		11.61		11.71	11.51
AE303	23.54		23.55		23.37		23.56	23.51
AE304	35.20		34.16		34.99		35.21	35.19
AE305	27.47		27.49		27.27		27.49	27.60
AE306	35.20		34.26		35.02		35.22	35.22
AE326	35.20		34.93		35.17		35.19	35.20
AE345	24.19		24.24		24.16		24.19	24.42
AE401	7.99		8.00		7.98		7.99	7.98
AE403	21.16		21.16		21.02		21.16	21.13
AE404	35.62		34.93		35.30		35.62	35.59
AE405	25.09		25.10		24.92		25.07	25.21
AE406	35.90		35.74		35.83		35.88	35.89
AE426	35.90		35.76		35.88		35.91	35.89
AE445	24.19		24.24		24.16		24.20	24.42

**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301-AE445  
BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results  
By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.2-19. CV/VAV Supply Air Mass Flow Rate (kgda/s)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	0.7705	0.7706	0.7362	0.7709	0.7389	0.7362	0.7705	0.7362
AE303	0.7538	0.7540	0.7362	0.7319	0.7389	0.7362	0.7538	0.7362
AE304	0.7483	0.7484	0.7362	0.7111	0.7389	0.7362	0.7483	0.7362
AE305	0.7520	0.7521	0.7362	0.7213	0.7389	0.7362	0.7519	0.7362
AE306	0.7483	0.7484	0.7362	0.7160	0.7389	0.7362	0.7483	0.7362
AE326	0.7483	0.7484	0.7362	0.7137	0.7389	0.7362	0.7483	0.7362
AE345	0.7535	0.7537	0.7362	0.7217	0.7389	0.7362	0.7535	0.7362
AE401	0.2814	0.2814	0.2832	0.2971	0.2842	0.2832	0.2814	0.2832
AE403	0.3357	0.3361	0.3385	0.3369	0.3351	0.3335	0.3350	0.3346
AE404	0.5392	0.5399	0.5492	0.5354	0.5384	0.5414	0.5388	0.5441
AE405	0.3347	0.3352	0.3383	0.3359	0.3342	0.3335	0.3339	0.3337
AE406	0.3321	0.3325	0.3384	0.3297	0.3315	0.3335	0.3314	0.3338
AE426	0.3321	0.3325	0.3384	0.3294	0.3314	0.3335	0.3313	0.3338
AE445	0.3350	0.3354	0.3383	0.3359	0.3343	0.3335	0.3341	0.3337

**Table B16.7.2-20. CV/VAV Outdoor Air Mass Flow to Supply Air Mass Flow Ratio (fraction)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	0.365	0.365	0.385	0.385	0.385	0.385	0.365	0.385
AE303	0.369	0.369	0.385	0.385	0.385	0.385	0.369	0.385
AE304	0.368	0.368	0.385	0.385	0.385	0.385	0.368	0.385
AE305	0.369	0.369	0.385	0.385	0.385	0.385	0.369	0.385
AE306	0.369	0.369	0.385	0.385	0.385	0.385	0.369	0.385
AE326	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AE345	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AE401	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AE403	0.828	0.828	0.837	0.849	0.848	0.849	0.830	0.846
AE404	0.511	0.510	0.516	0.510	0.528	0.523	0.511	0.520
AE405	0.829	0.828	0.837	0.826	0.850	0.849	0.831	0.849
AE406	0.830	0.829	0.837	0.833	0.857	0.849	0.831	0.848
AE426	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AE445	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

**Table B16.7.2-21. CV/VAV Zone 1 Supply Air Temperature (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	29.28	29.29	29.67		29.65	29.58	29.27	29.31
AE303	19.18	19.18	19.05		19.10	19.10	19.18	19.10
AE304	15.59	15.58	15.31		15.48	15.42	15.59	15.39
AE305	19.18	19.18	19.05		19.11	19.10	19.18	19.11
AE306	19.18	19.18	19.02		19.14	19.10	19.19	19.12
AE326	19.18	19.18	19.05		19.14	19.10	19.19	19.11
AE345	19.18	19.18	19.05		19.10	19.10	19.18	19.11
AE401	46.92	46.95	46.85		46.70	46.50	46.83	45.90
AE403	12.78	12.78	12.79		12.78	12.78	12.78	12.78
AE404	12.78	12.78	12.79		12.78	12.78	12.79	12.78
AE405	12.78	12.78	12.79		12.78	12.78	12.78	12.78
AE406	12.78	12.78	12.79		12.79	12.78	12.77	12.78
AE426	12.78	12.78	12.78		12.79	12.78	12.78	12.78
AE445	12.78	12.78	12.79		12.78	12.78	12.78	12.78

**ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301-AE445  
BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results  
By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.2-22. CV/VAV Zone 1 Air Temperature (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	21.11	21.11	21.11	21.11	21.13	21.11	21.11	21.11
AE303	23.33	23.33	23.33	23.33	23.34	23.33	23.33	23.33
AE304	23.89	23.89	23.89	23.89	23.89	23.89	23.88	23.89
AE305	23.33	23.33	23.33	23.33	23.34	23.33	23.33	23.33
AE306	23.33	23.33	23.33	23.33	23.34	23.33	23.33	23.33
AE326	23.33	23.33	23.33	23.33	23.34	23.33	23.33	23.33
AE345	23.33	23.33	23.33	23.33	23.34	23.33	23.33	23.33
AE401	21.11	21.11	21.11	21.11	21.15	21.11	21.12	21.11
AE403	23.33	23.33	23.33	23.33	23.34	23.33	23.33	23.33
AE404	23.89	23.89	23.89	23.89	23.90	23.89	23.88	23.89
AE405	23.33	23.33	23.33	23.33	23.34	23.33	23.33	23.33
AE406	23.33	23.33	23.33	23.33	23.34	23.33	23.32	23.33
AE426	23.33	23.33	23.33	23.33	23.34	23.33	23.33	23.33
AE445	23.33	23.33	23.33	23.33	23.34	23.33	23.33	23.33

**Table B16.7.2-23. CV/VAV Zone 1 Humidity Ratio (g/gda)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	0.002197	0.002197	0.002225		0.002172	0.002253	0.002187	0.002201
AE303	0.004893	0.004852	0.004930		0.004844	0.004938	0.004900	0.004911
AE304	0.009518	0.009519	0.009140		0.009448	0.009595	0.009525	0.009538
AE305	0.006453	0.006419	0.006492		0.006391	0.006499	0.006460	0.006531
AE306	0.009519	0.009519	0.009190		0.009459	0.009592	0.009525	0.009538
AE326	0.009519	0.009519	0.009442		0.009520	0.009613	0.009517	0.009538
AE345	0.005153	0.005119	0.005204		0.005156	0.005212	0.005155	0.005270
AE401	0.002304	0.002303	0.002332		0.002289	0.002374	0.002269	0.002319
AE403	0.004970	0.004930	0.004996		0.004925	0.005021	0.004988	0.004996
AE404	0.009908	0.009895	0.009651		0.009788	0.009980	0.009921	0.009906
AE405	0.006530	0.006497	0.006557		0.006473	0.006582	0.006537	0.006618
AE406	0.010823	0.010812	0.010775		0.010803	0.010931	0.010838	0.010848
AE426	0.010823	0.010812	0.010787		0.010825	0.010940	0.010844	0.010848
AE445	0.006174	0.006139	0.006216		0.006169	0.006264	0.006192	0.006305

**Table B16.7.2-24. CV/VAV Zone 2 Supply Air Temperature (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	27.82	27.83	28.08		28.09	28.03	27.81	27.77
AE303	18.75	18.74	18.57		18.64	18.64	18.75	18.61
AE304	16.46	16.46	16.19		16.36	16.29	16.48	16.24
AE305	18.75	18.74	18.57		18.66	18.64	18.75	18.62
AE306	18.75	18.75	18.54		18.69	18.64	18.76	18.63
AE326	18.75	18.75	18.57		18.69	18.64	18.76	18.62
AE345	18.75	18.74	18.57		18.64	18.64	18.75	18.62
AE401	36.04	36.05	35.95		35.89	35.77	35.99	35.30
AE403	12.78	12.78	12.79		12.78	12.78	12.78	12.78
AE404	12.78	12.78	12.79		12.78	12.78	12.79	12.78
AE405	12.78	12.78	12.79		12.78	12.78	12.78	12.78
AE406	12.78	12.78	12.79		12.79	12.78	12.77	12.78
AE426	12.78	12.78	12.78		12.79	12.78	12.78	12.78
AE445	12.78	12.78	12.79		12.78	12.78	12.78	12.78

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BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results  
By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.2-25. CV/VAV Zone 2 Air Temperature (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	22.22	22.22	22.22	22.22	22.25	22.22	22.22	22.22
AE303	24.44	24.44	24.44	24.44	24.45	24.44	24.44	24.44
AE304	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
AE305	24.44	24.44	24.44	24.44	24.45	24.44	24.44	24.44
AE306	24.44	24.44	24.44	24.44	24.45	24.44	24.44	24.44
AE326	24.44	24.44	24.44	24.44	24.45	24.44	24.44	24.44
AE345	24.44	24.44	24.44	24.44	24.45	24.44	24.44	24.44
AE401	22.22	22.22	22.22	22.22	22.26	22.22	22.22	22.22
AE403	24.44	24.44	24.44	24.44	24.46	24.44	24.44	24.44
AE404	25.00	25.00	25.00	25.00	25.02	25.00	25.00	25.00
AE405	24.44	24.44	24.44	24.44	24.46	24.44	24.44	24.44
AE406	24.44	24.44	24.44	24.44	24.46	24.44	24.43	24.44
AE426	24.44	24.44	24.44	24.44	24.46	24.44	24.44	24.44
AE445	24.44	24.44	24.44	24.44	24.46	24.44	24.44	24.44

**Table B16.7.2-26. CV/VAV Zone 2 Humidity Ratio (g/gda)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	0.002382	0.002382	0.002421		0.002365	0.002454	0.002372	0.002398
AE303	0.005081	0.005040	0.005135		0.005036	0.005139	0.005090	0.005108
AE304	0.009708	0.009708	0.009340		0.009640	0.009796	0.009716	0.009735
AE305	0.006642	0.006608	0.006697		0.006584	0.006700	0.006650	0.006728
AE306	0.009709	0.009709	0.009390		0.009652	0.009793	0.009716	0.009735
AE326	0.009709	0.009709	0.009650		0.009713	0.009814	0.009708	0.009735
AE345	0.005342	0.005308	0.005409		0.005349	0.005413	0.005345	0.005467
AE401	0.002310	0.002310	0.002330		0.002287	0.002374	0.002289	0.002319
AE403	0.005029	0.004989	0.005071		0.004985	0.005084	0.005049	0.005051
AE404	0.010241	0.010229	0.009998		0.010124	0.010327	0.010261	0.010242
AE405	0.006590	0.006556	0.006633		0.006533	0.006645	0.006598	0.006670
AE406	0.010883	0.010871	0.010849		0.010863	0.010994	0.010900	0.010901
AE426	0.010883	0.010871	0.010861		0.010885	0.011003	0.010906	0.010901
AE445	0.006234	0.006197	0.006292		0.006229	0.006327	0.006253	0.006357

**Table B16.7.2-27. CV/VAV Moisture Added to Zone 1 by Latent Gains (g/s)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	0.231	0.231	0.235		0.231	0.239	0.229	0.234
AE303	0.230	0.230	0.236		0.230	0.239	0.231	0.234
AE304	0.230	0.230	0.237		0.230	0.239	0.232	0.234
AE305	0.230	0.230	0.236		0.230	0.239	0.231	0.234
AE306	0.230	0.230	0.237		0.230	0.239	0.231	0.233
AE326	0.230	0.230	0.236		0.230	0.239	0.231	0.234
AE345	0.230	0.230	0.236		0.230	0.239	0.231	0.234
AE401	0.231	0.231	0.235		0.231	0.239	0.226	0.234
AE403	0.230	0.230	0.236		0.230	0.239	0.232	0.234
AE404	0.230	0.230	0.237		0.230	0.239	0.232	0.234
AE405	0.230	0.230	0.236		0.230	0.239	0.232	0.234
AE406	0.230	0.230	0.236		0.230	0.239	0.232	0.234
AE426	0.230	0.230	0.236		0.230	0.239	0.232	0.234
AE445	0.230	0.230	0.236		0.230	0.239	0.232	0.234

$[(\text{Zone Supply Air Mass Flow}) \times \{(\text{Zone Humidity Ratio}) - (\text{Zone Supply Air Humidity Ratio})\}] \times 1000 \text{ g/kg}$

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By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.2-28. CV/VAV Moisture Added to Zone 2 by Latent Gains (g/s)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	0.346	0.346	0.352		0.346	0.359	0.344	0.351
AE303	0.345	0.345	0.356		0.345	0.359	0.347	0.351
AE304	0.345	0.345	0.356		0.345	0.359	0.347	0.352
AE305	0.345	0.345	0.356		0.345	0.359	0.347	0.351
AE306	0.345	0.345	0.356		0.345	0.359	0.347	0.350
AE326	0.345	0.345	0.358		0.345	0.359	0.347	0.352
AE345	0.345	0.345	0.356		0.345	0.359	0.347	0.352
AE401	0.346	0.346	0.352		0.346	0.359	0.342	0.352
AE403	0.345	0.345	0.357		0.345	0.359	0.349	0.351
AE404	0.345	0.345	0.358		0.345	0.359	0.348	0.352
AE405	0.345	0.345	0.356		0.345	0.359	0.348	0.352
AE406	0.345	0.345	0.356		0.345	0.359	0.349	0.352
AE426	0.345	0.345	0.356		0.345	0.359	0.348	0.352
AE445	0.345	0.345	0.357		0.345	0.359	0.348	0.352

[(Zone Supply Air Mass Flow) × {(Zone Humidity Ratio) – (Zone Supply Air Humidity Ratio)} × 1000 g/kg]

**Table B16.7.2-29. CV/VAV Return Fan Air Temperature Rise (°C)**

Test Case	QAS PSU-TAMU-NREL	DEEAP AAON	DeST TsinghuaU-LBNL	DOE-2.2 NREL	EnergyPlus GARD	IES-VE IES	TRNSYS TESS	BEST2008dev nino
AE301	0.35	0.30	0.29		0.29	0.29	0.35	0.30
AE303	0.34	0.30	0.29		0.29	0.29	0.34	0.30
AE304	0.34	0.30	0.29		0.29	0.29	0.34	0.31
AE305	0.34	0.30	0.29		0.29	0.29	0.34	0.30
AE306	0.34	0.30	0.29		0.29	0.29	0.34	0.30
AE326	0.34	0.30	0.29		0.29	0.29	0.34	0.30
AE345	0.34	0.30	0.29		0.29	0.29	0.34	0.30
AE401								0.00
AE403	0.00	0.03	0.00		0.00	0.01	0.00	0.00
AE404	0.11	0.11	0.10		0.09	0.10	0.11	0.10
AE405	0.00	0.01	0.00		0.00	0.01	0.00	0.00
AE406	0.00	0.01	0.00		0.00	0.01	0.00	0.00
AE426	0.00	0.01	0.00		0.00	0.01	0.00	0.00
AE445	0.00	0.01	0.00		0.00	0.01	0.00	0.00



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By NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020**

**Table B16.7.2-30. CV/VAV Delta Preheat Coil Load, CV - VAV (kWh/h)**

Test case	QAS	DEEAP	DeST	DOE-2.2	EnergyPlus	IES-VE	TRNSYS	BEST2008dev
	PSU-TAMU-NREL	AAON	TsinghuaU-LBNL	NREL	GARD	IES	TESS	
AE301 - AE401	-7.31	-7.28	-6.73	-7.03	-6.77	-6.80	-7.31	-6.84
AE303 - AE403	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE304 - AE404	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE305 - AE405	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE306 - AE406	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE326 - AE426	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE345 - AE445	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table B16.7.2-31. CV/VAV Delta Sensible Cooling Coil Load, CV - VAV (kWh/h)**

Test case	QAS	DEEAP	DeST	DOE-2.2	EnergyPlus	IES-VE	TRNSYS	BEST2008dev
	PSU-TAMU-NREL	AAON	TsinghuaU-LBNL	NREL	GARD	IES	TESS	
AE301 - AE401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE303 - AE403	5.28	5.24	5.02	5.02	5.08	5.08	5.28	5.06
AE304 - AE404	2.92	2.88	2.61	2.43	2.79	2.70	2.93	2.63
AE305 - AE405	5.28	5.24	5.04	4.81	5.10	5.08	5.28	5.08
AE306 - AE406	5.29	5.26	5.07	4.92	5.16	5.09	5.29	4.98
AE326 - AE426	4.87	4.79	4.54	4.59	4.71	4.58	4.89	4.50
AE345 - AE445	5.55	5.52	5.28	5.11	5.36	5.37	5.56	5.34

**Table B16.7.2-32. CV/VAV Delta Latent Cooling Coil Load, CV - VAV (kWh/h)**

Test case	QAS	DEEAP	DeST	DOE-2.2	EnergyPlus	IES-VE	TRNSYS	BEST2008dev
	PSU-TAMU-NREL	AAON	TsinghuaU-LBNL	NREL	GARD	IES	TESS	
AE301 - AE401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE303 - AE403	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE304 - AE404	0.33	0.32	0.43	0.30	0.30	0.32	0.34	0.38
AE305 - AE405	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE306 - AE406	0.86	0.84	1.13	0.94	0.91	0.88	0.85	0.99
AE326 - AE426	7.07	7.08	7.25	6.52	7.14	7.10	7.09	7.24
AE345 - AE445	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table B16.7.2-33. CV/VAV Delta Total Cooling Coil Load, CV - VAV (kWh/h)**

Test case	QAS	DEEAP	DeST	DOE-2.2	EnergyPlus	IES-VE	TRNSYS	BEST2008dev
	PSU-TAMU-NREL	AAON	TsinghuaU-LBNL	NREL	GARD	IES	TESS	
AE301 - AE401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE303 - AE403	5.28	5.24	5.02	5.02	5.08	5.08	5.28	5.06
AE304 - AE404	3.26	3.20	3.04	2.73	3.09	3.02	3.27	3.01
AE305 - AE405	5.28	5.24	5.04	4.81	5.10	5.08	5.28	5.08
AE306 - AE406	6.14	6.10	6.21	5.86	6.07	5.97	6.14	5.97
AE326 - AE426	11.93	11.87	11.79	11.11	11.85	11.68	11.97	11.74
AE345 - AE445	5.55	5.52	5.28	5.11	5.36	5.37	5.56	5.34

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**Table B16.7.2-34. CV Delta Cooling Coil Load, Economizer Operation (kWh/h)**

Test case	Load	QAS	DEEAP	DeST	DOE-2.2	EnergyPlus	IES-VE	TRNSYS	BEST2008dev
		SU-TAMU-NRE	AAON	TsinghuaU-LBNL	NREL	GARD	IES	TESS	nino
AE345-AE305	Total Cooling	0.32	0.33	0.29	0.36	0.31	0.33	0.33	0.30
	Sensible Cooling	0.32	0.33	0.29	0.36	0.31	0.33	0.33	0.30
	Latent Cooling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE326 - AE306	Total Cooling	6.40	6.38	6.19	5.91	6.29	6.25	6.42	6.32
	Sensible Cooling	-0.46	-0.52	-0.58	-0.37	-0.50	-0.56	-0.44	-0.53
	Latent Cooling	6.86	6.90	6.78	6.28	6.78	6.81	6.86	6.85

**Table B16.7.2-35. VAV Delta Cooling Coil Load, Economizer Operation (kWh/h)**

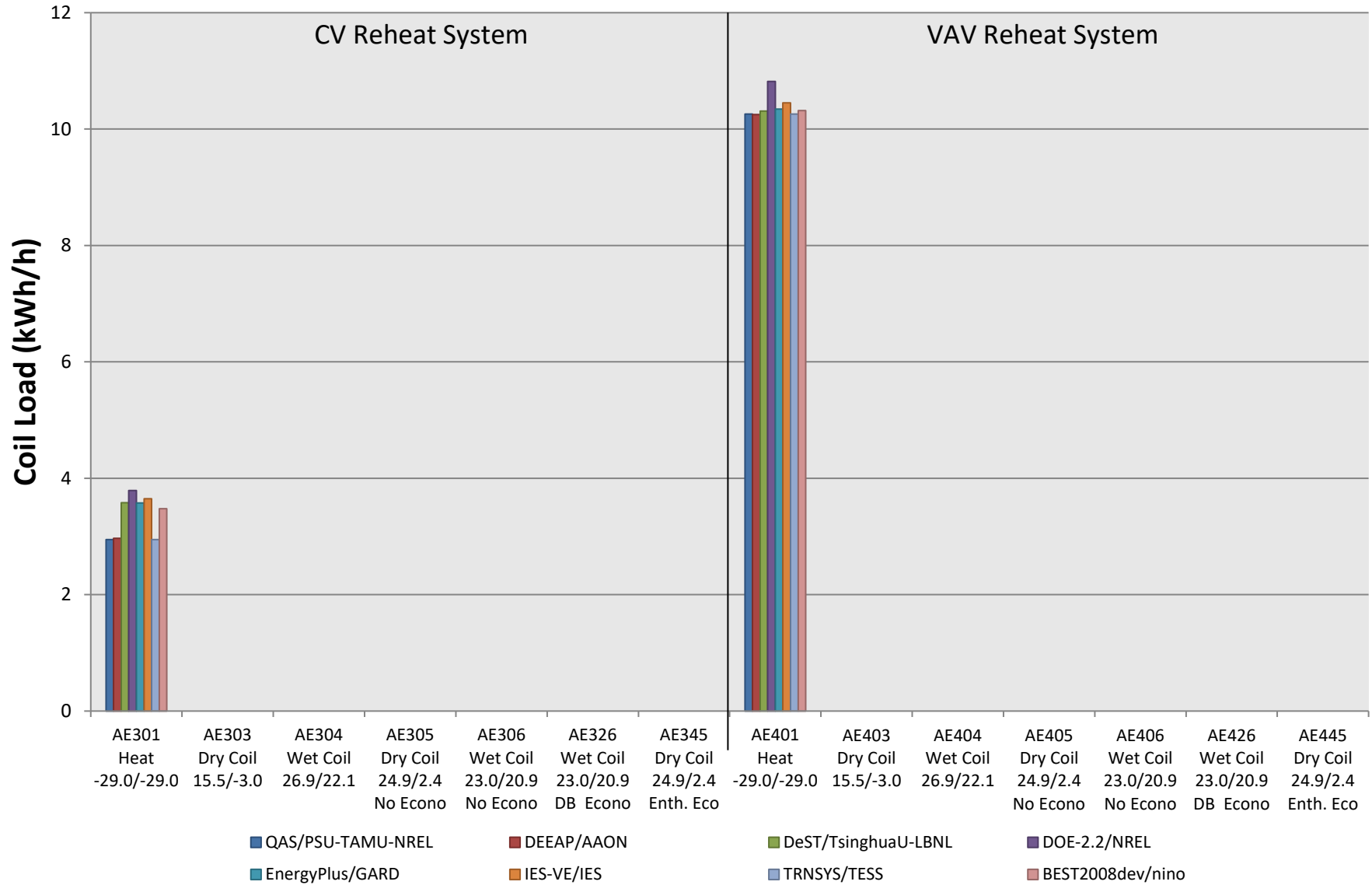
Test case	Load	QAS	DEEAP	DeST	DOE-2.2	EnergyPlus	IES-VE	TRNSYS	BEST2008dev
		SU-TAMU-NRE	AAON	TsinghuaU-LBNL	NREL	GARD	IES	TESS	nino
AE445-AE405	Total Cooling	0.06	0.05	0.05	0.06	0.05	0.05	0.05	0.05
	Sensible Cooling	0.06	0.05	0.05	0.06	0.05	0.05	0.05	0.05
	Latent Cooling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AE426 - AE406	Total Cooling	0.61	0.61	0.61	0.66	0.51	0.54	0.59	0.56
	Sensible Cooling	-0.04	-0.05	-0.05	-0.04	-0.04	-0.05	-0.04	-0.05
	Latent Cooling	0.65	0.66	0.66	0.69	0.55	0.59	0.63	0.61





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**Figure B16.7.2-3. CV/VAV Pre-Heating Coil Load [QHpreheat]**

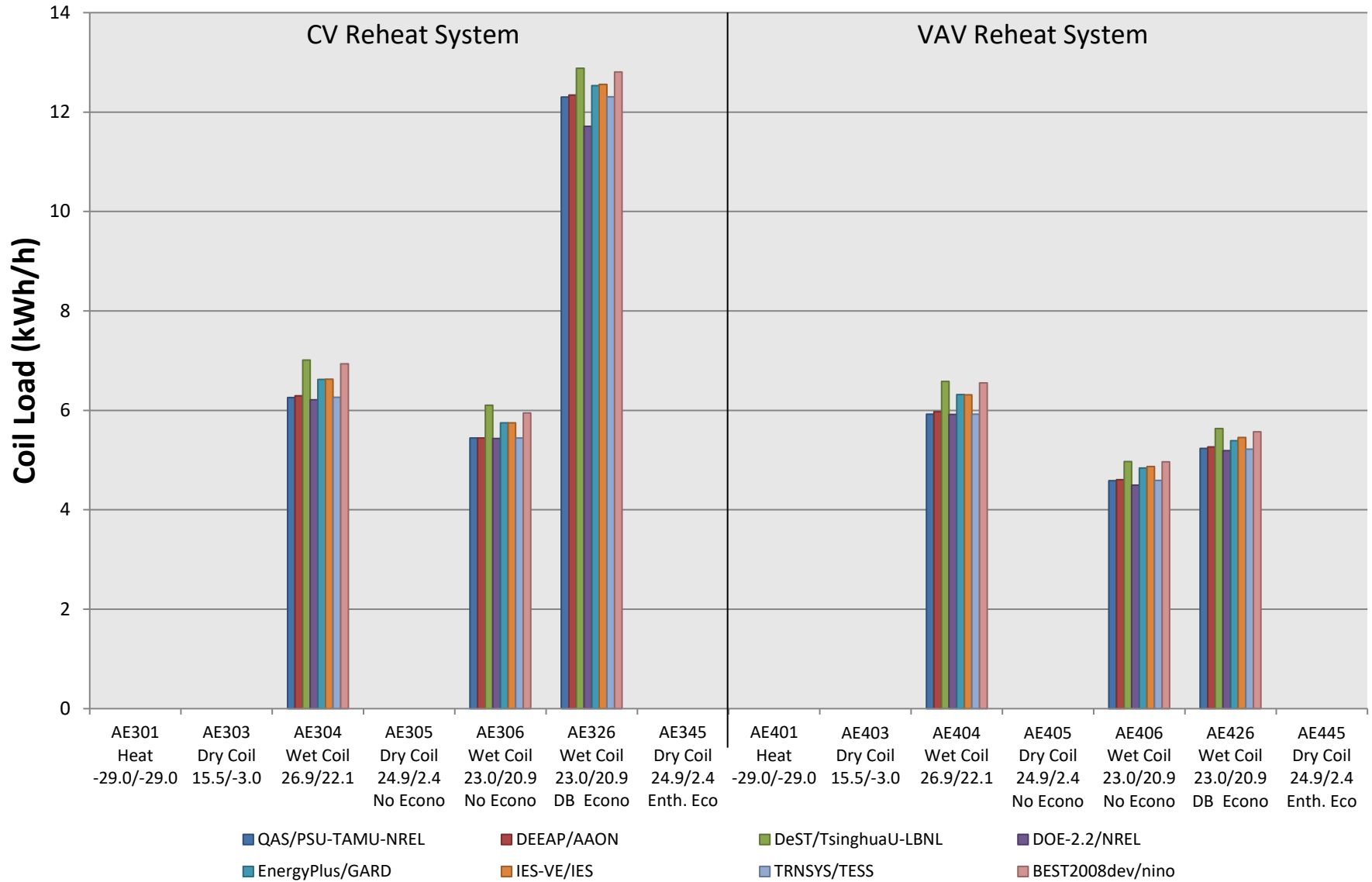






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 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

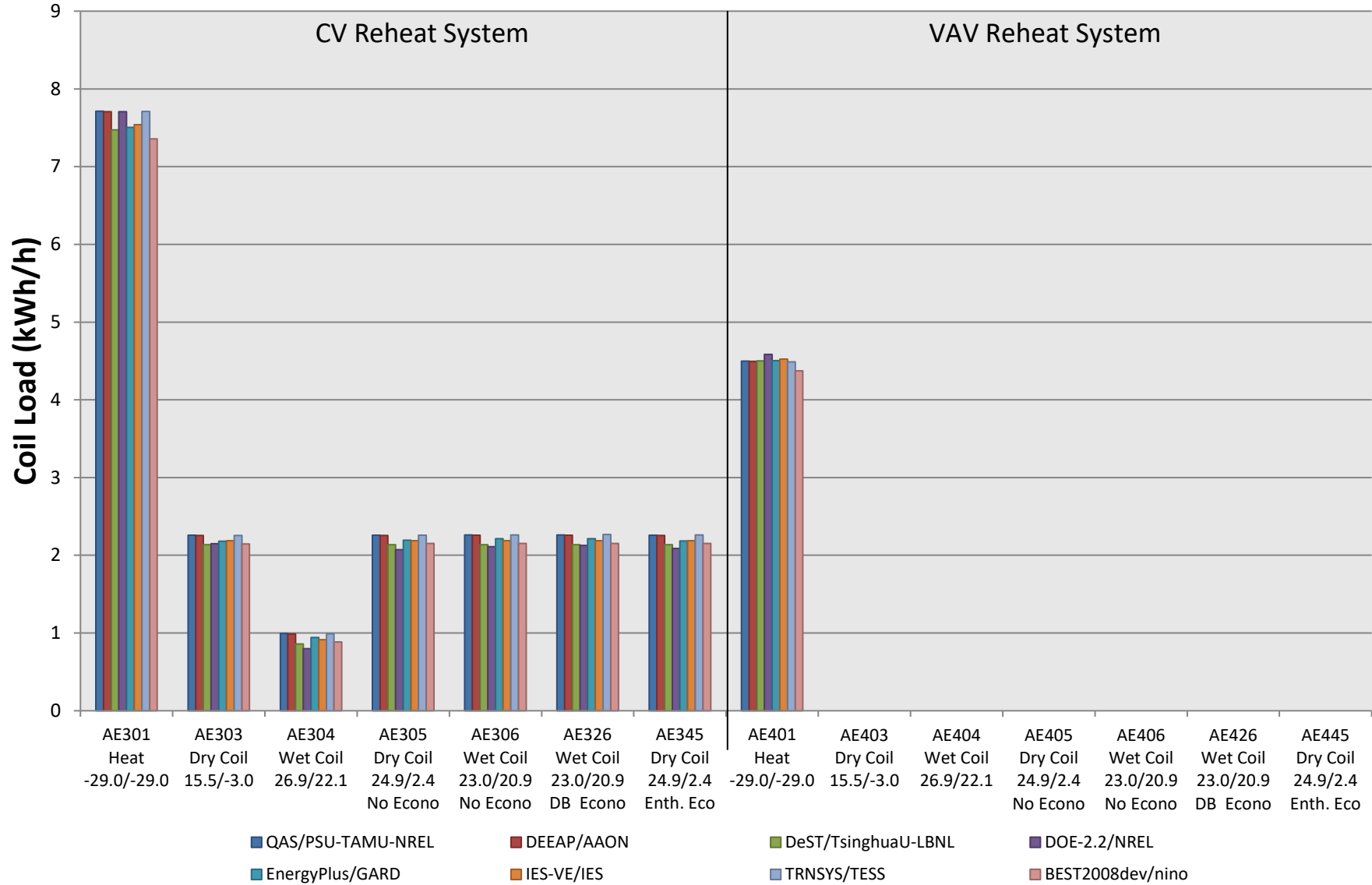
**Figure B16.7.2-6. CV/VAV Cooling Coil Load, Latent [QClatent]**





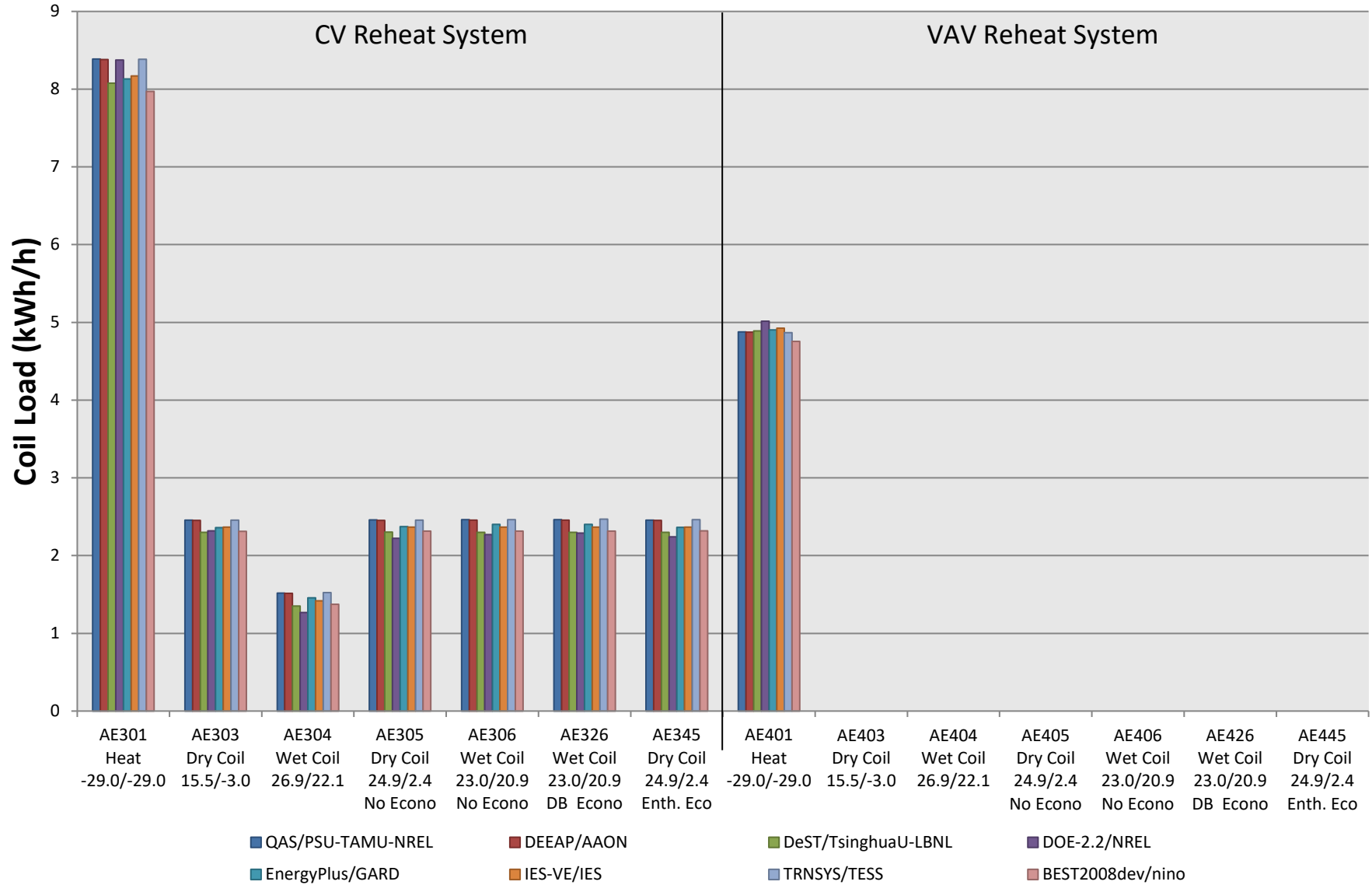
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-7. CV/VAV Zone 1 Reheat Load [QH1reheat]**



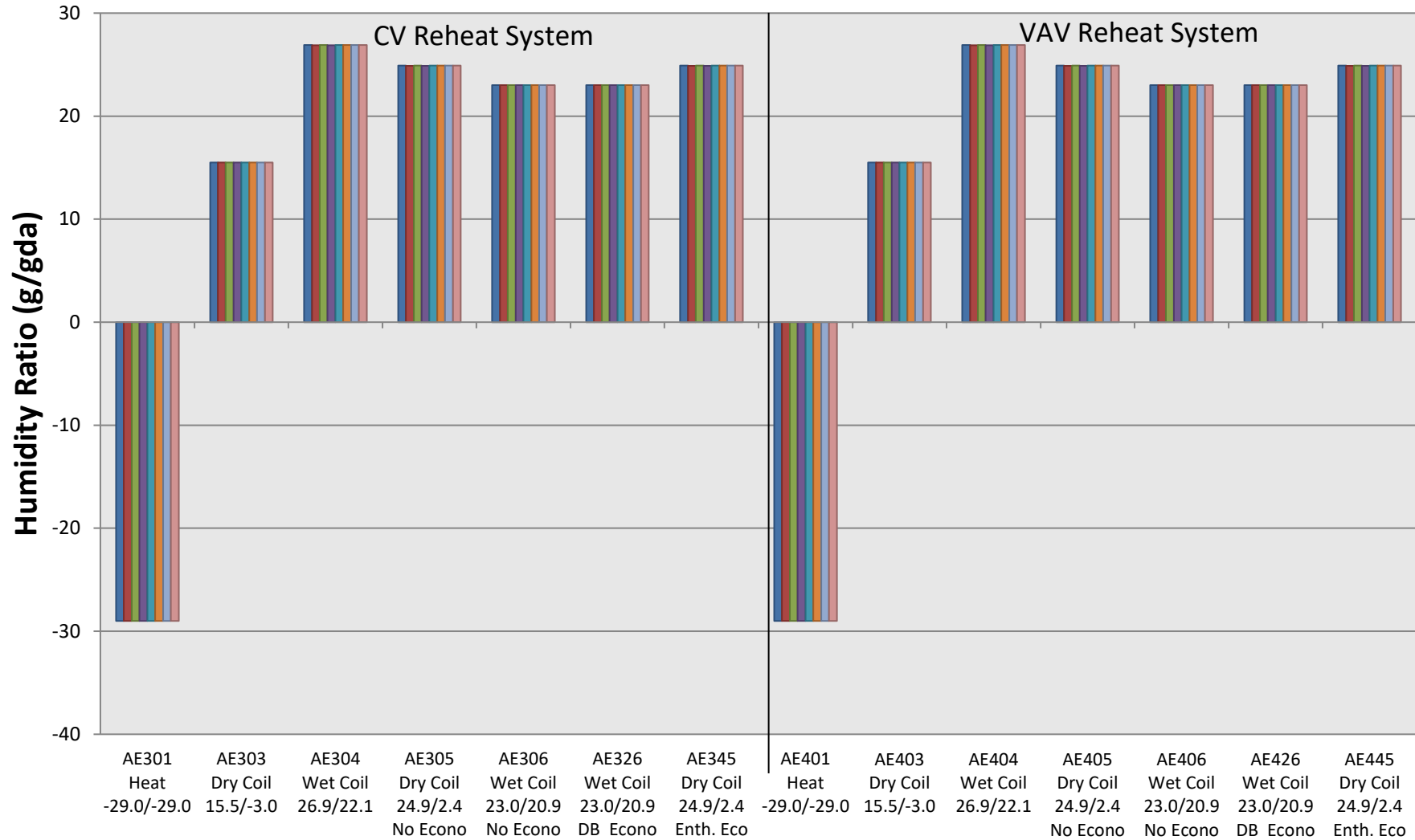
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 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-8. CV/VAV Zone 2 Reheat Load [QH2reheat]**



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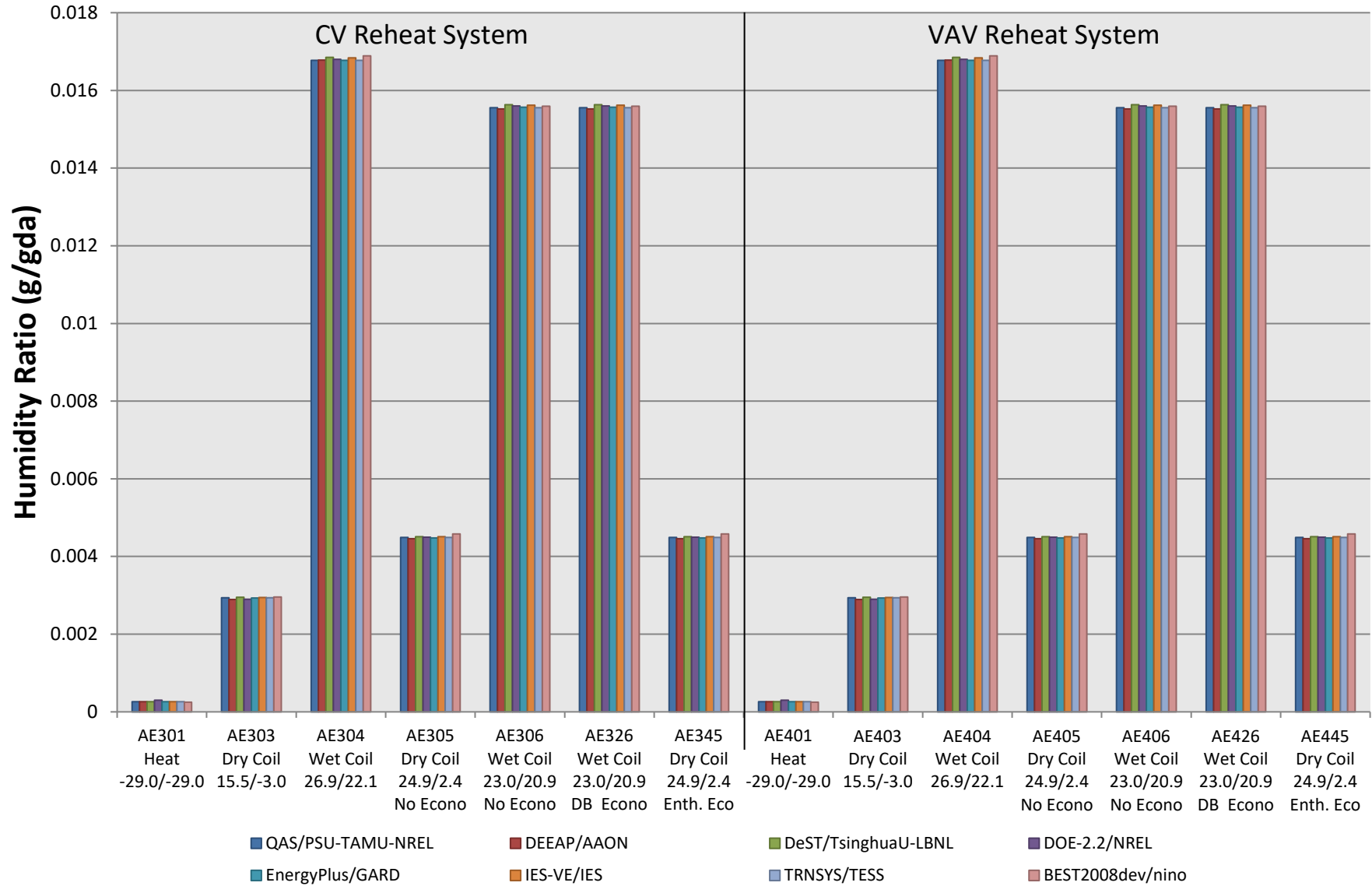
**Figure B16.7.2-9. CV/VAV Outdoor Air Temperature**



- QAS/PSU-TAMU-NREL
- DEEAP/AAON
- DeST/TsinghuaU-LBNL
- DOE-2.2/NREL
- EnergyPlus/GARD
- IES-VE/IES
- TRNSYS/TESS
- BEST2008dev/nino

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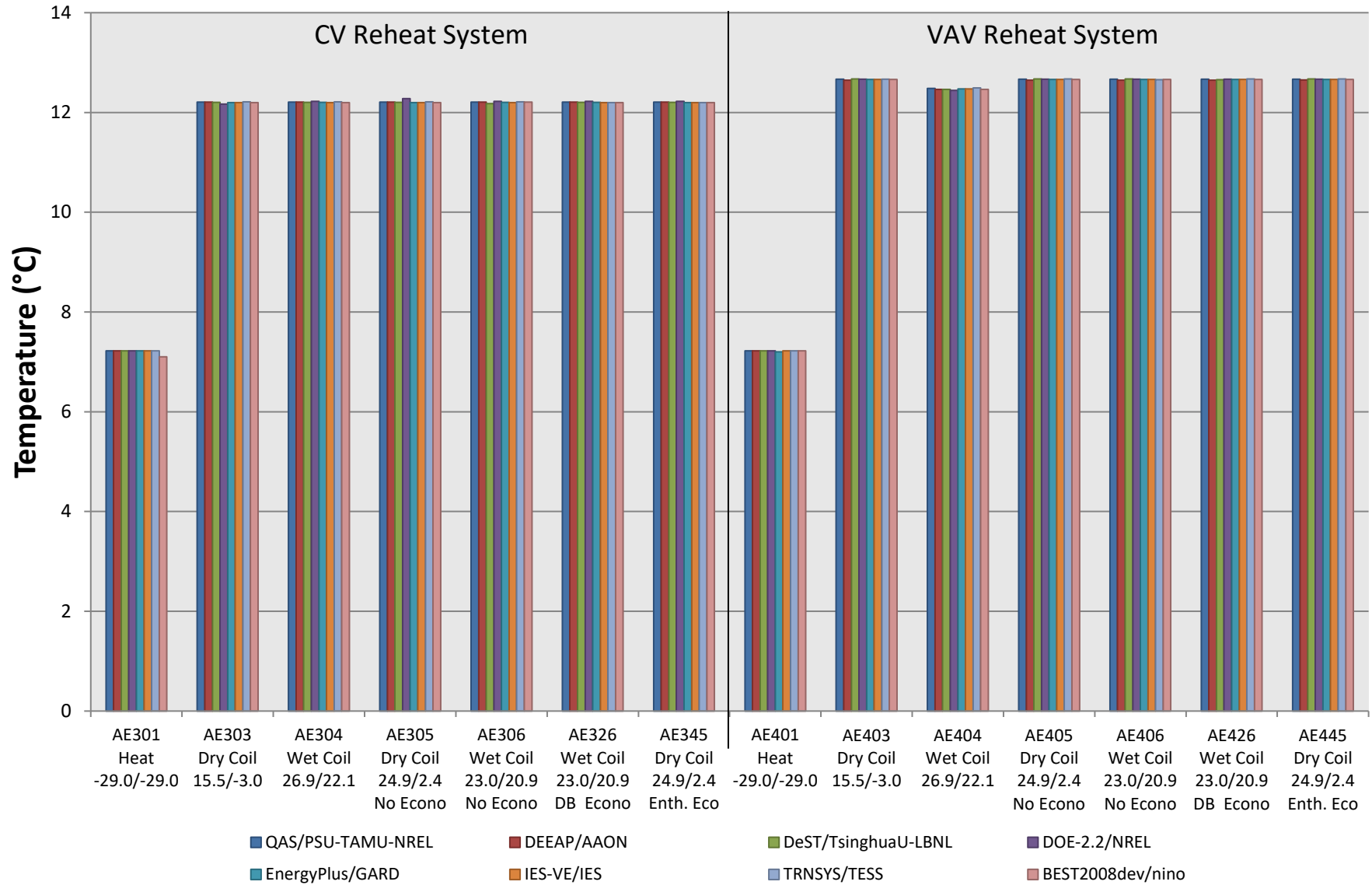
**Figure B16.7.2-10. CV/VAV Outdoor Air Humidity Ratio**





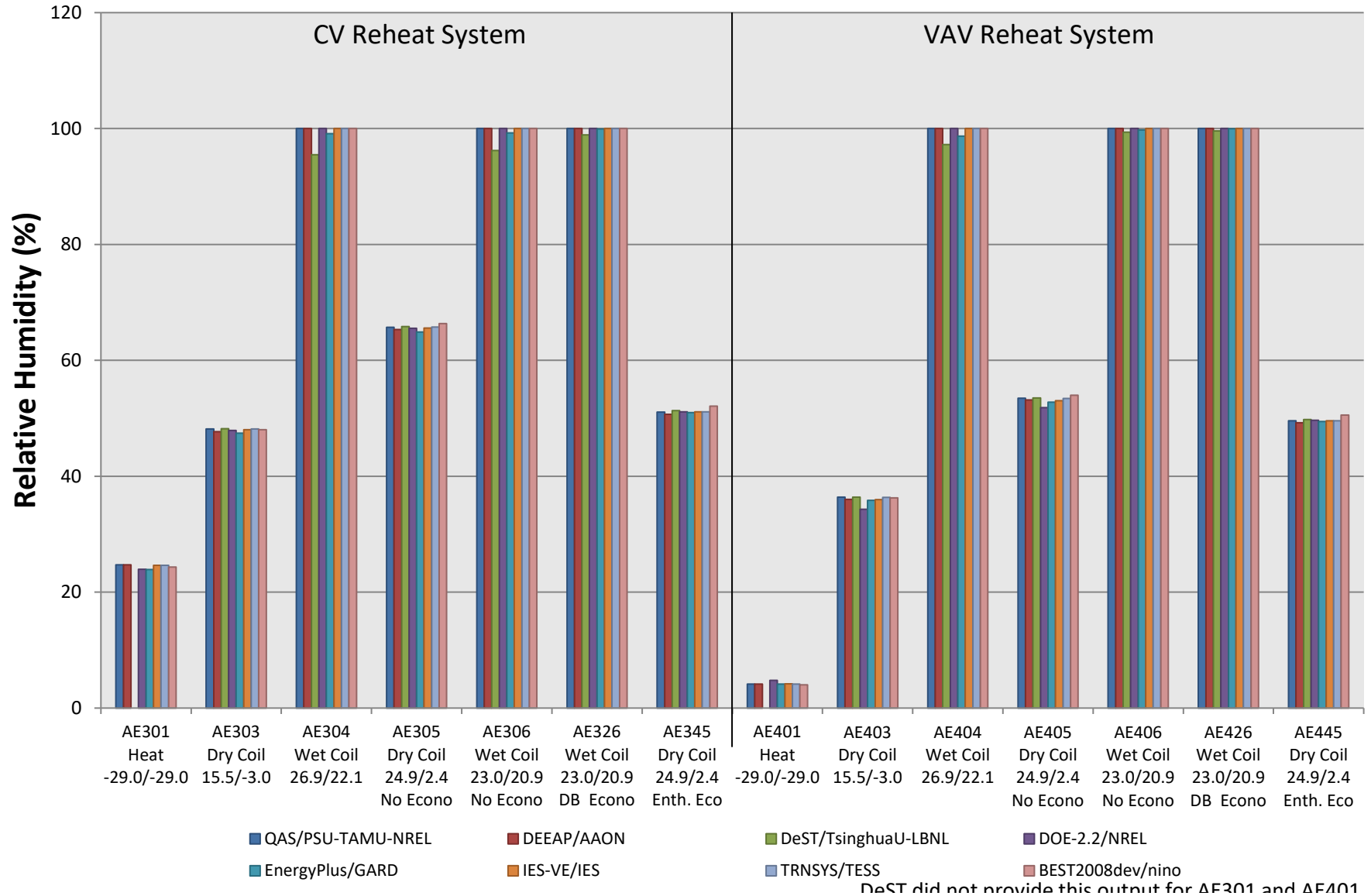
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 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-12. CV/VAV Cooling Coil Outlet Air Temperature**



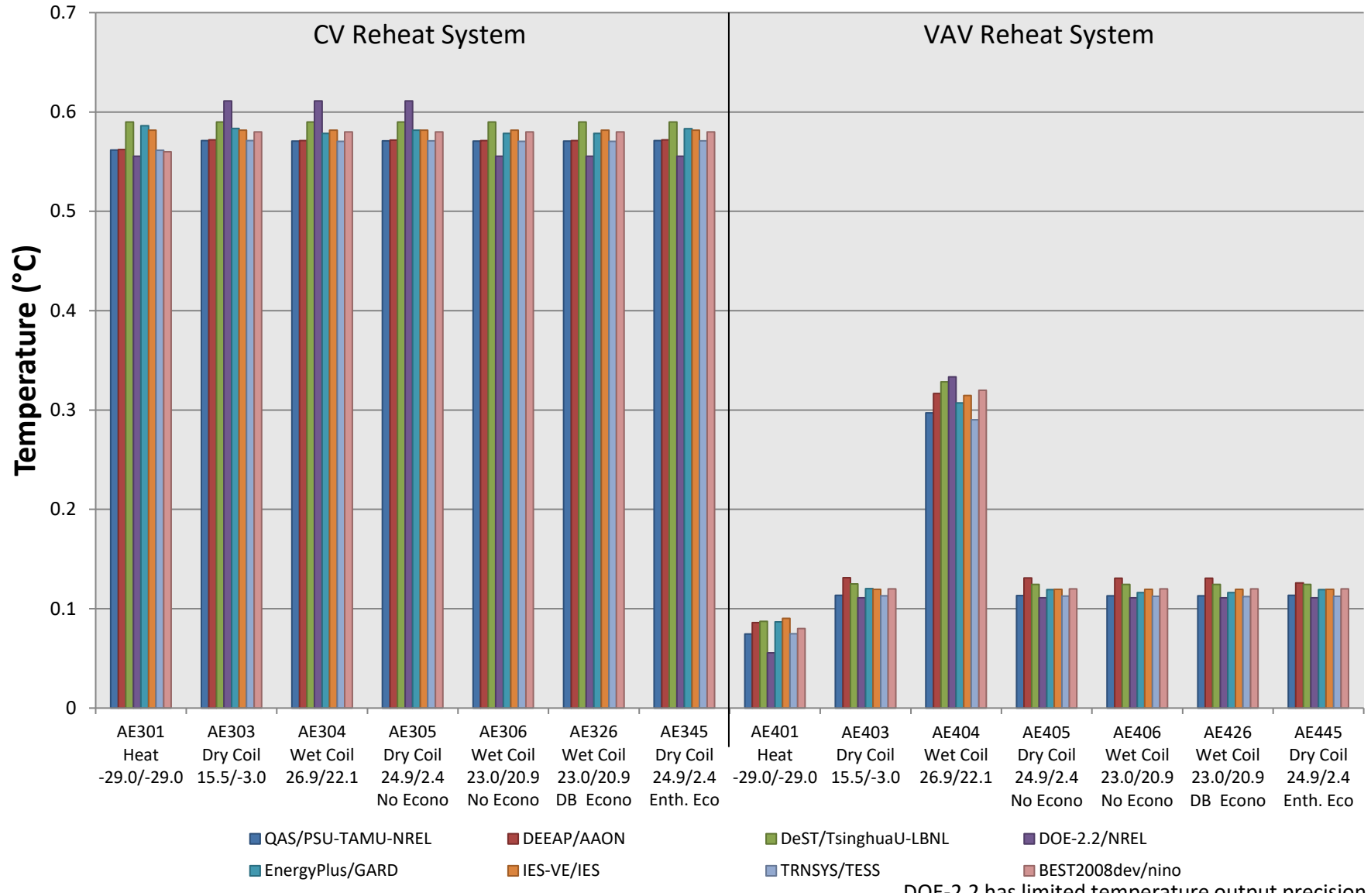
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-13. CV/VAV Cooling Coil Outlet Relative Humidity [RH<sub>cco</sub>]**



ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

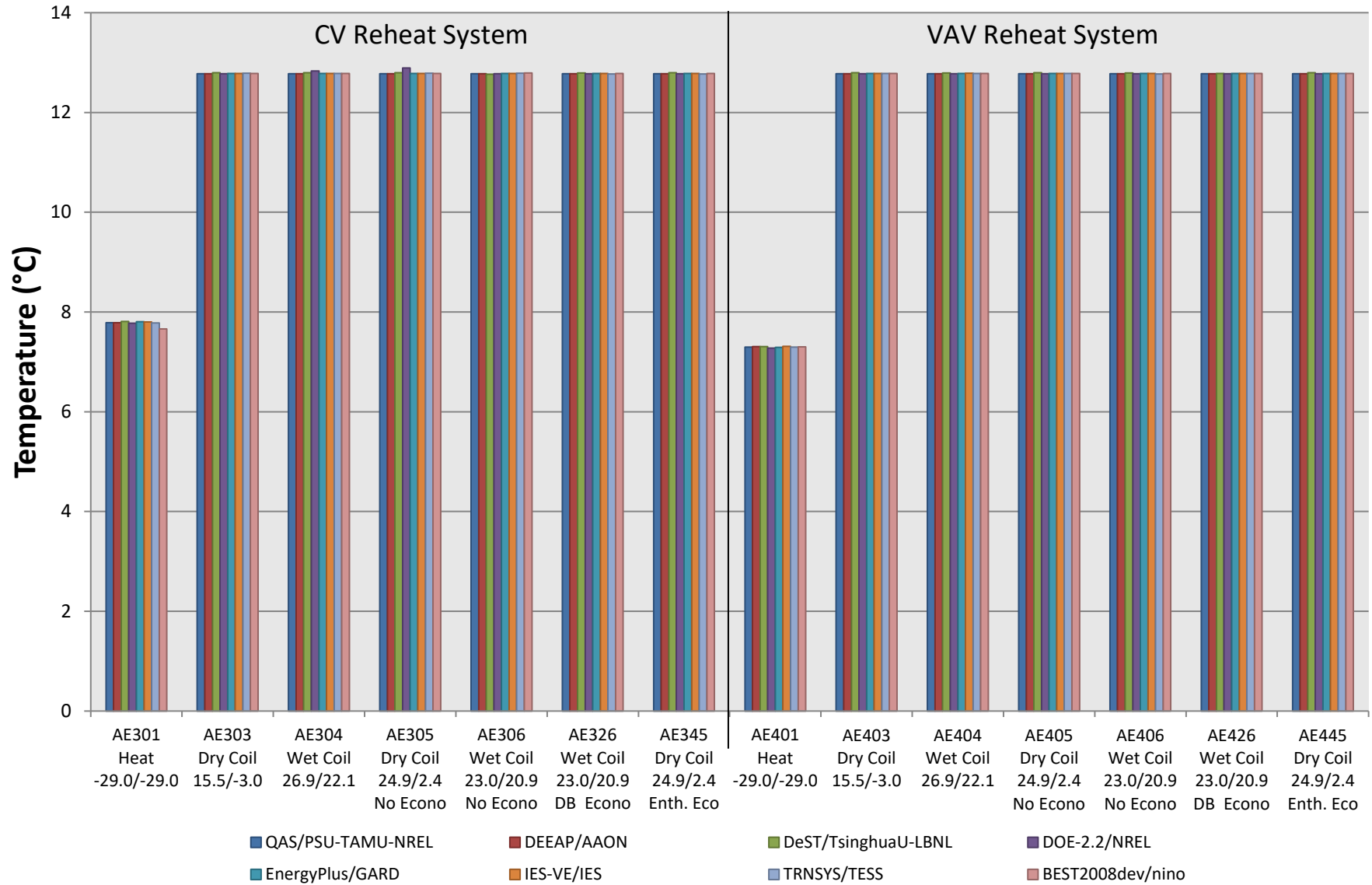
**Figure B16.7.2-14. CV/VAV Supply Fan Air Temperature Rise**





ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

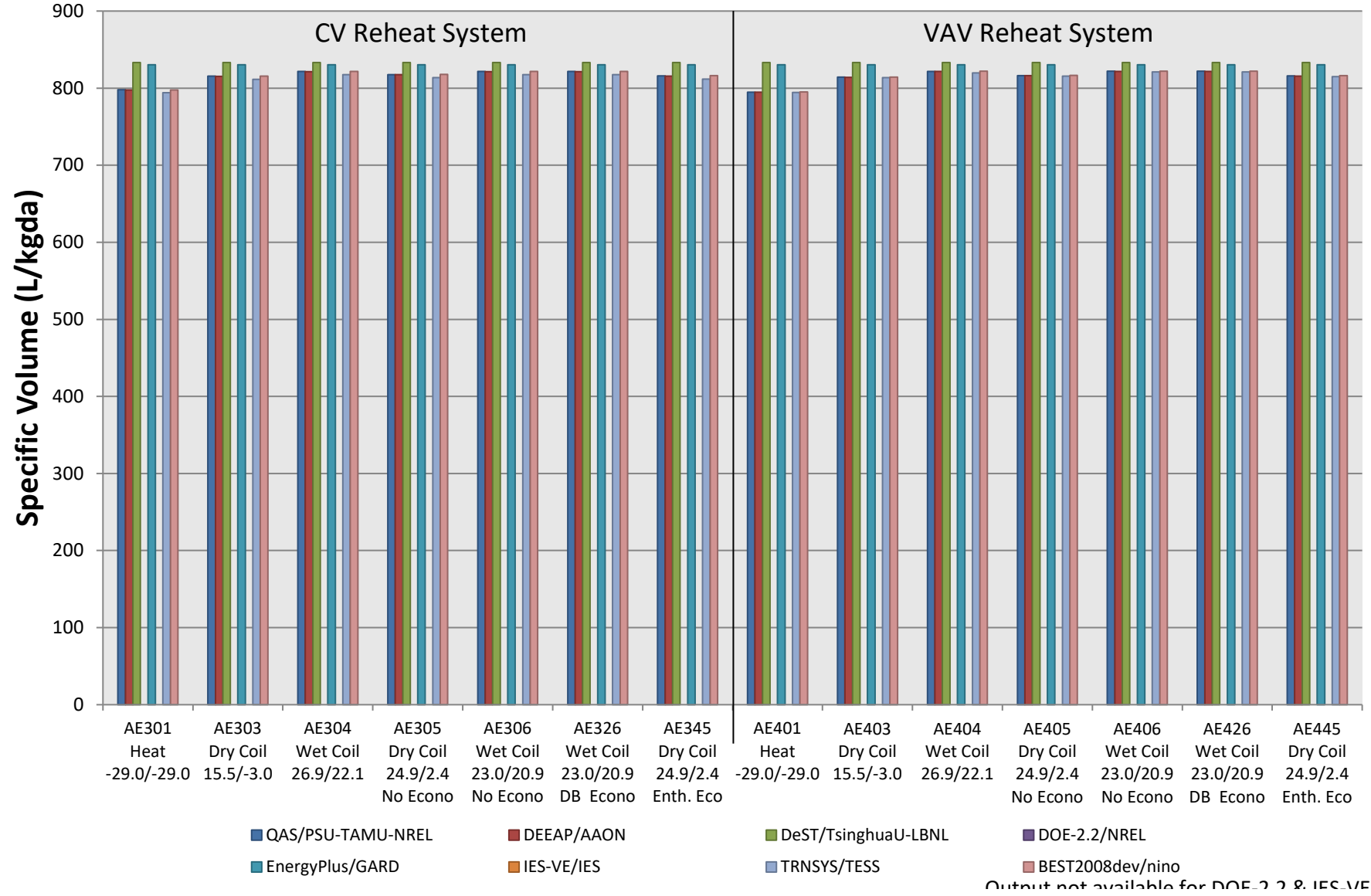
**Figure B16.7.2-15. CV/VAV Supply Air Temperature**





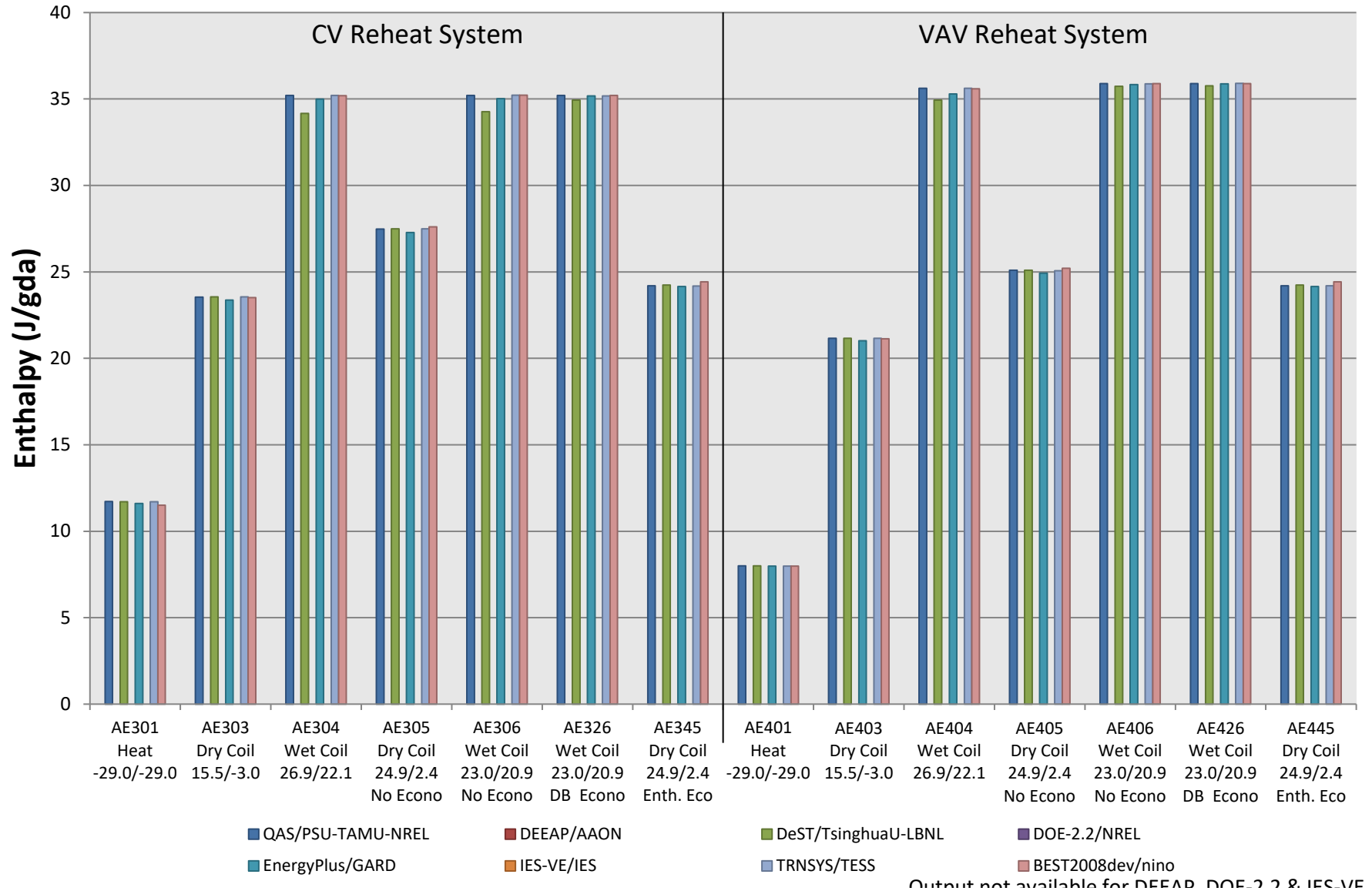
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-17. CV/VAV Supply Air Specific Volume**



ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-18. CV/VAV Supply Air Enthalpy**



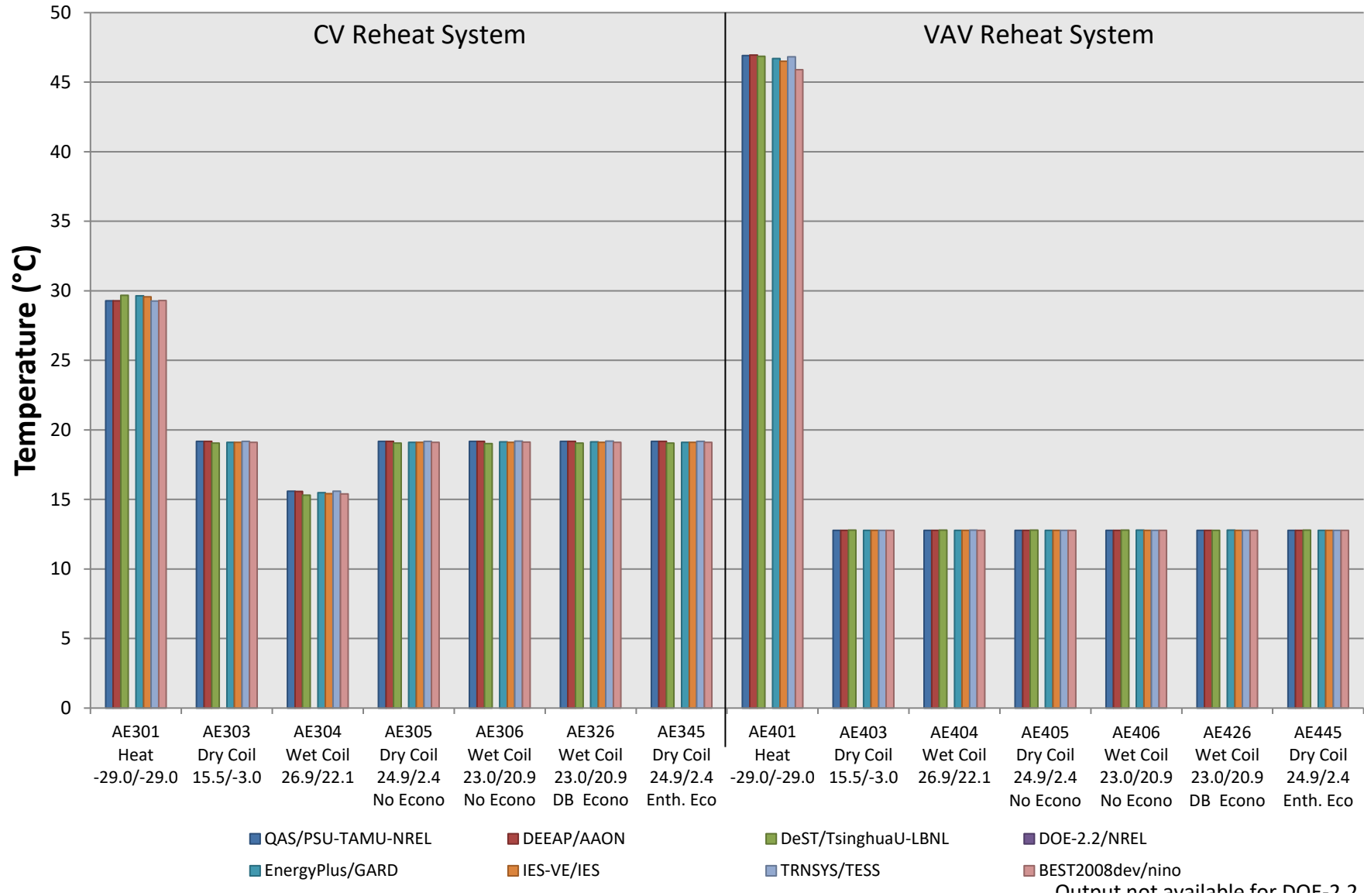
Output not available for DEEAP, DOE-2.2 & IES-VE





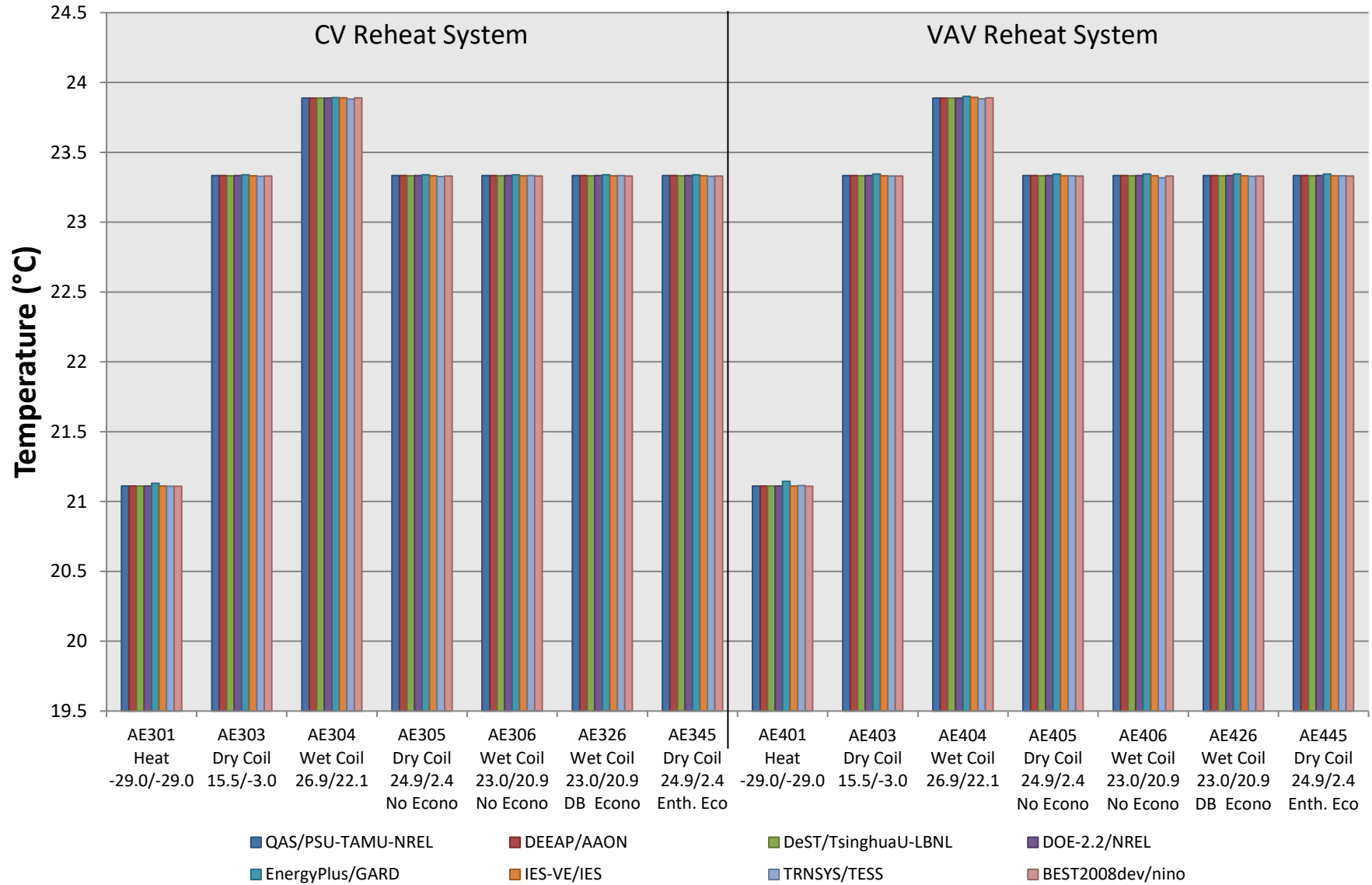
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-21. CV/VAV Zone 1 Supply Air Temperature**



ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

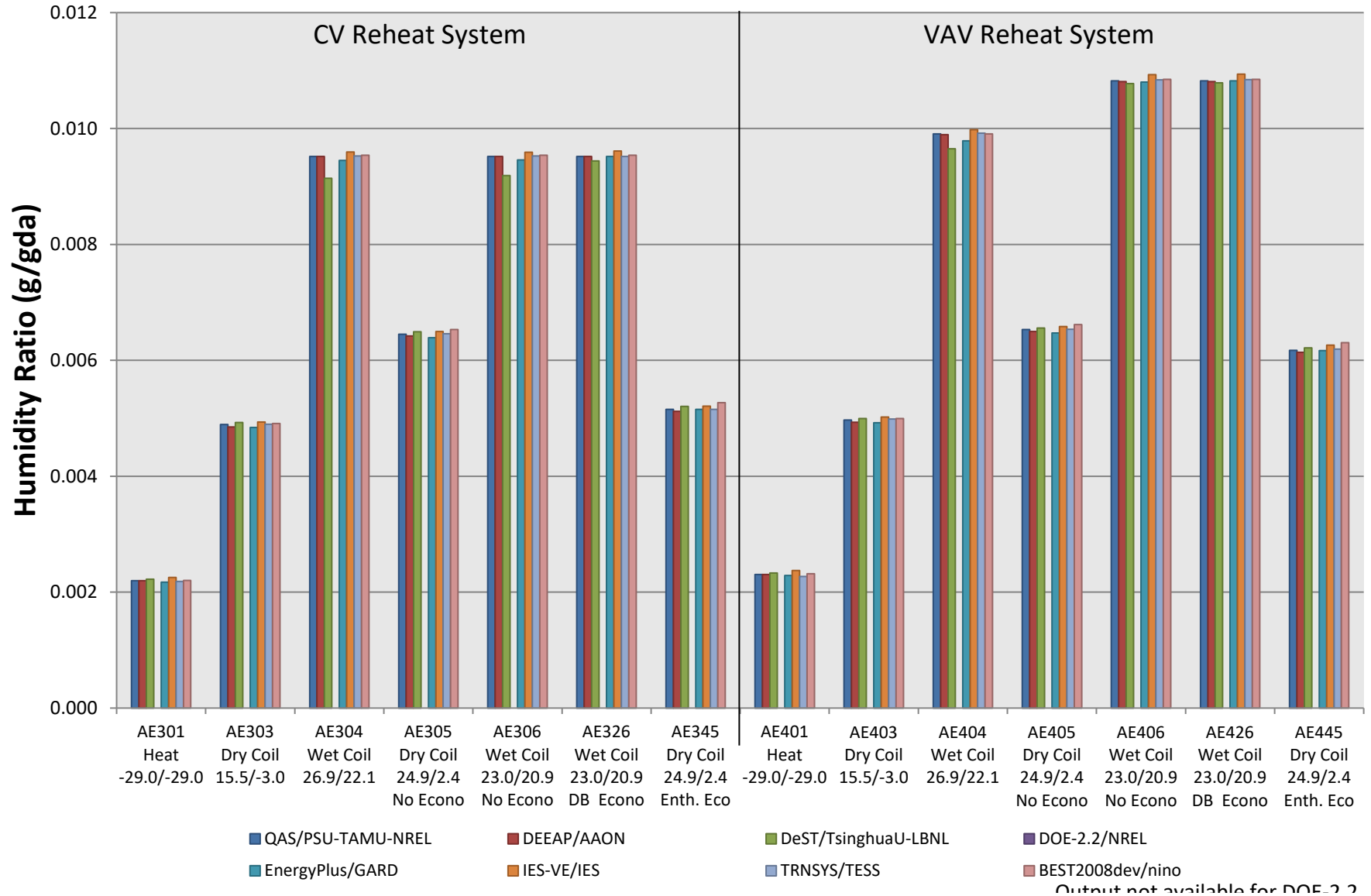
**Figure B16.7.2-22. CV/VAV Zone 1 Air Temperature**





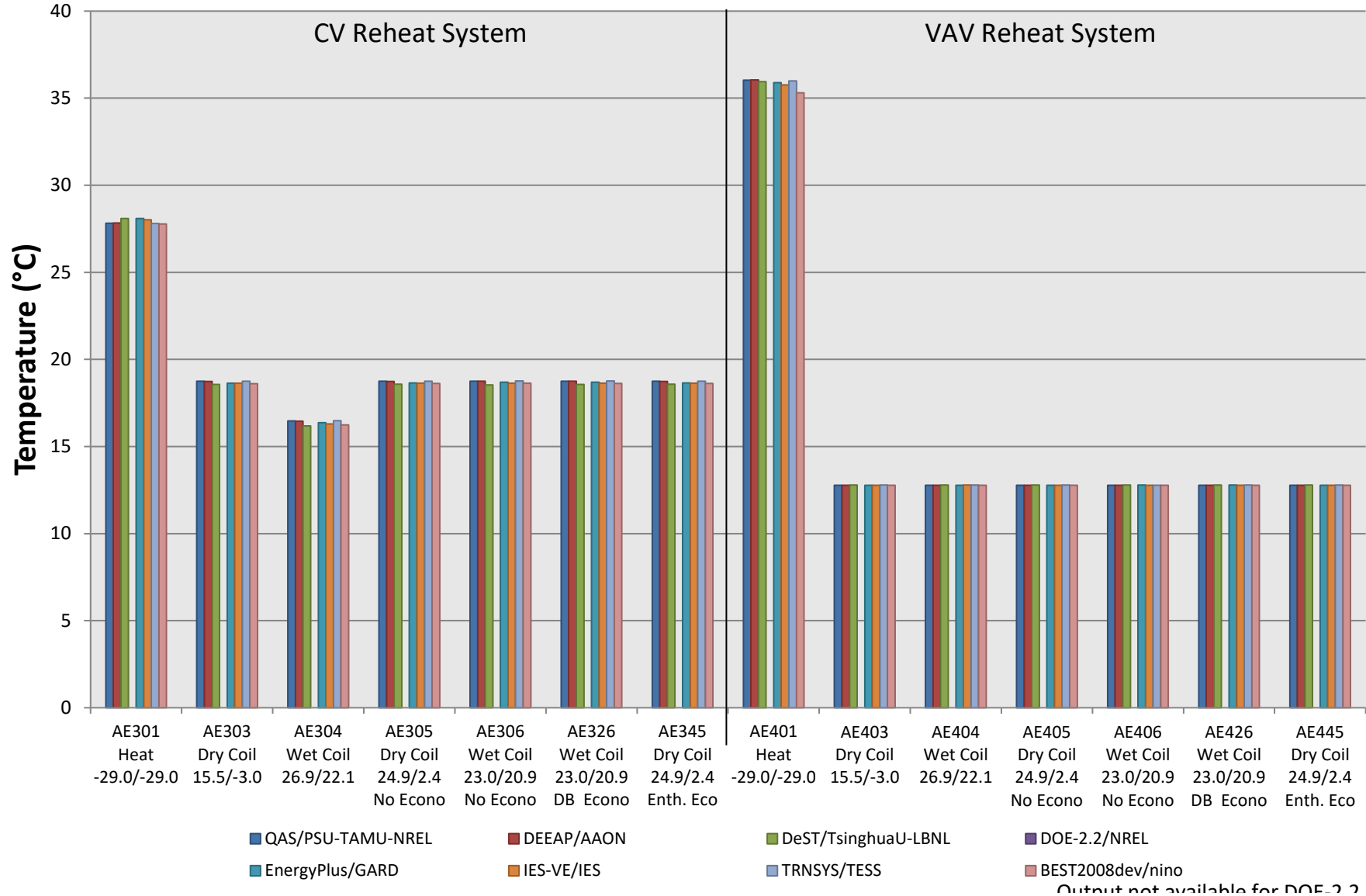
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-23. CV/VAV Zone 1 Humidity Ratio**



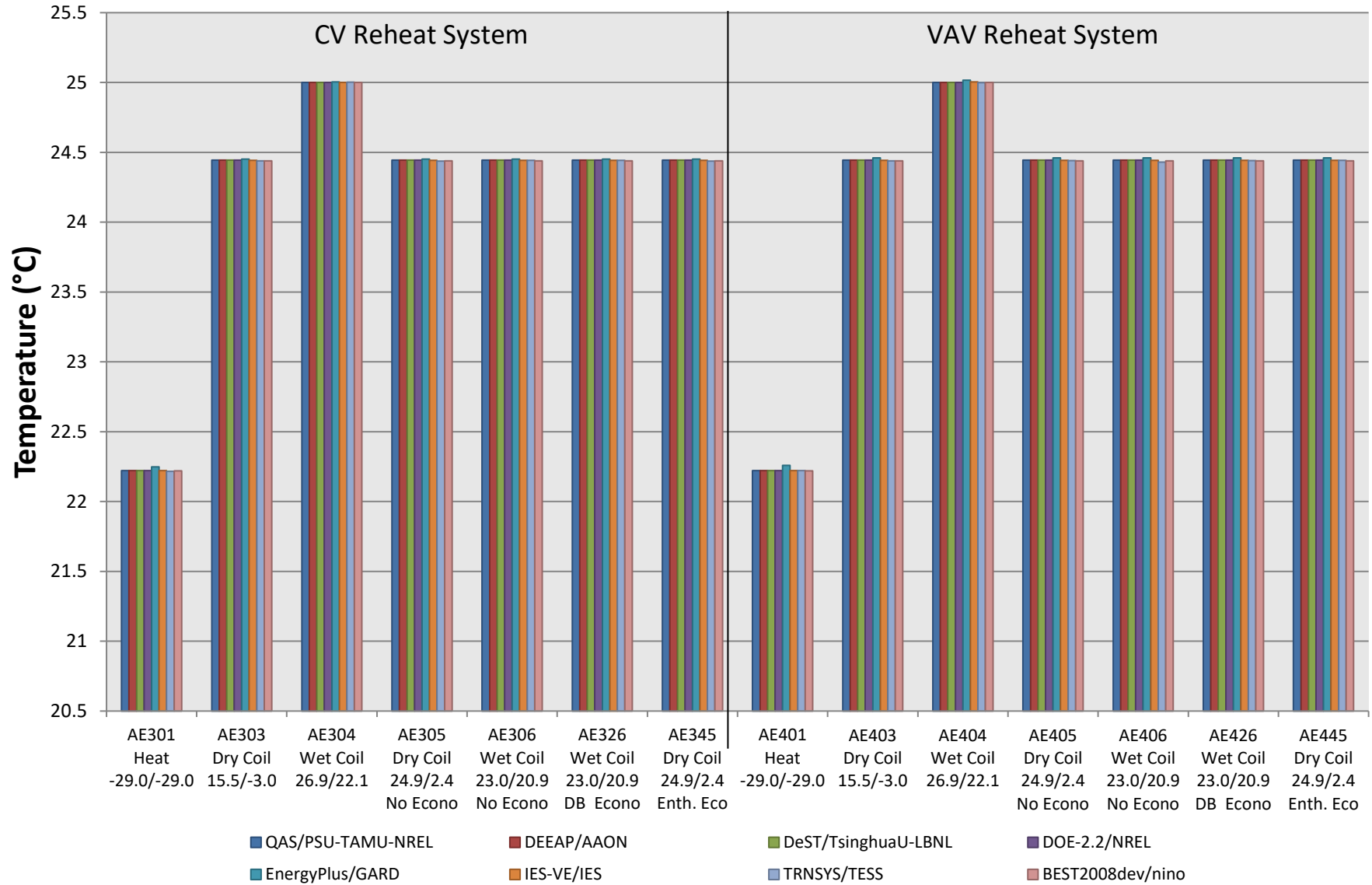
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-24. CV/VAV Zone 2 Supply Air Temperature**



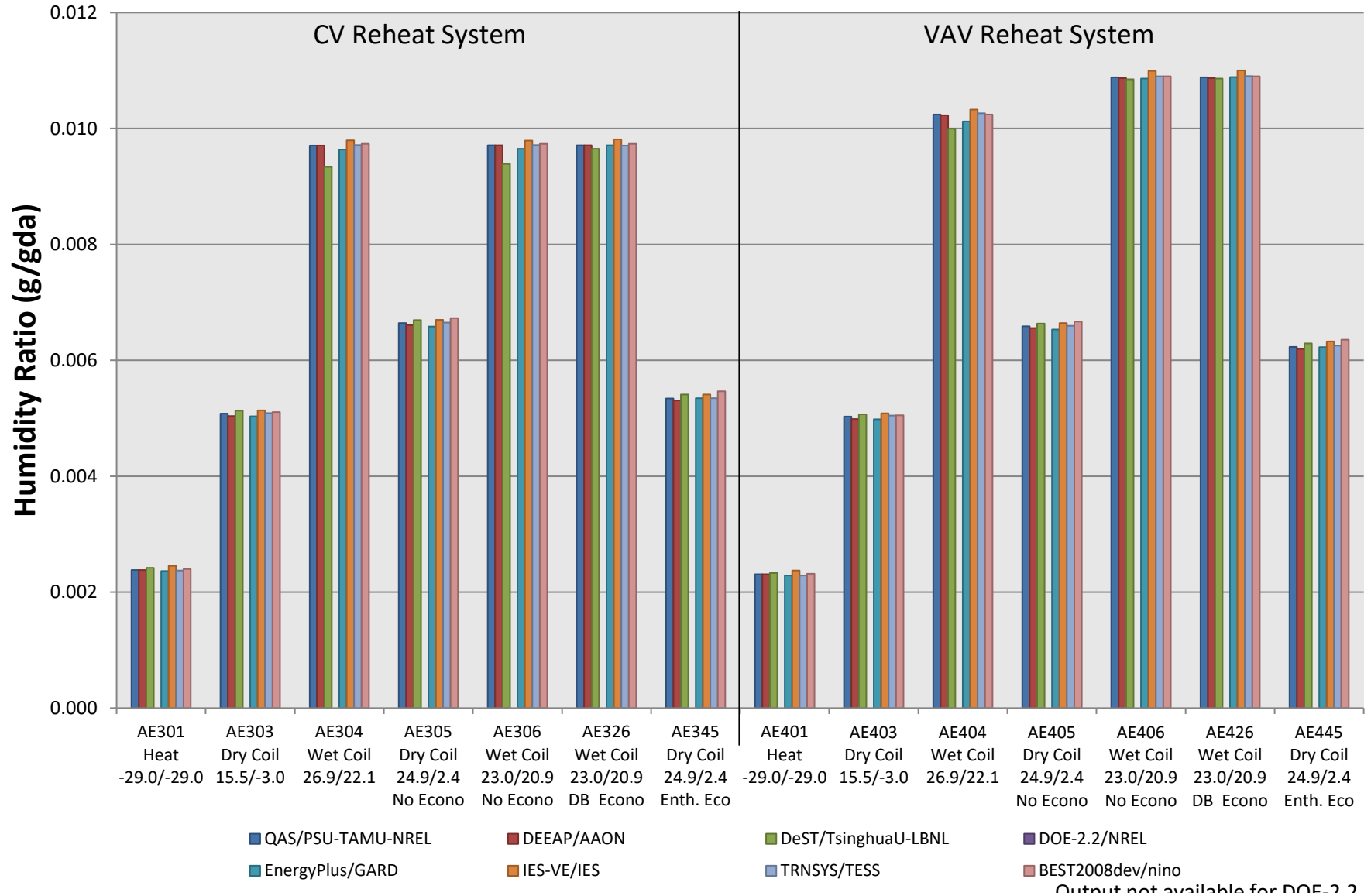
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-25. CV/VAV Zone 2 Air Temperature**



ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

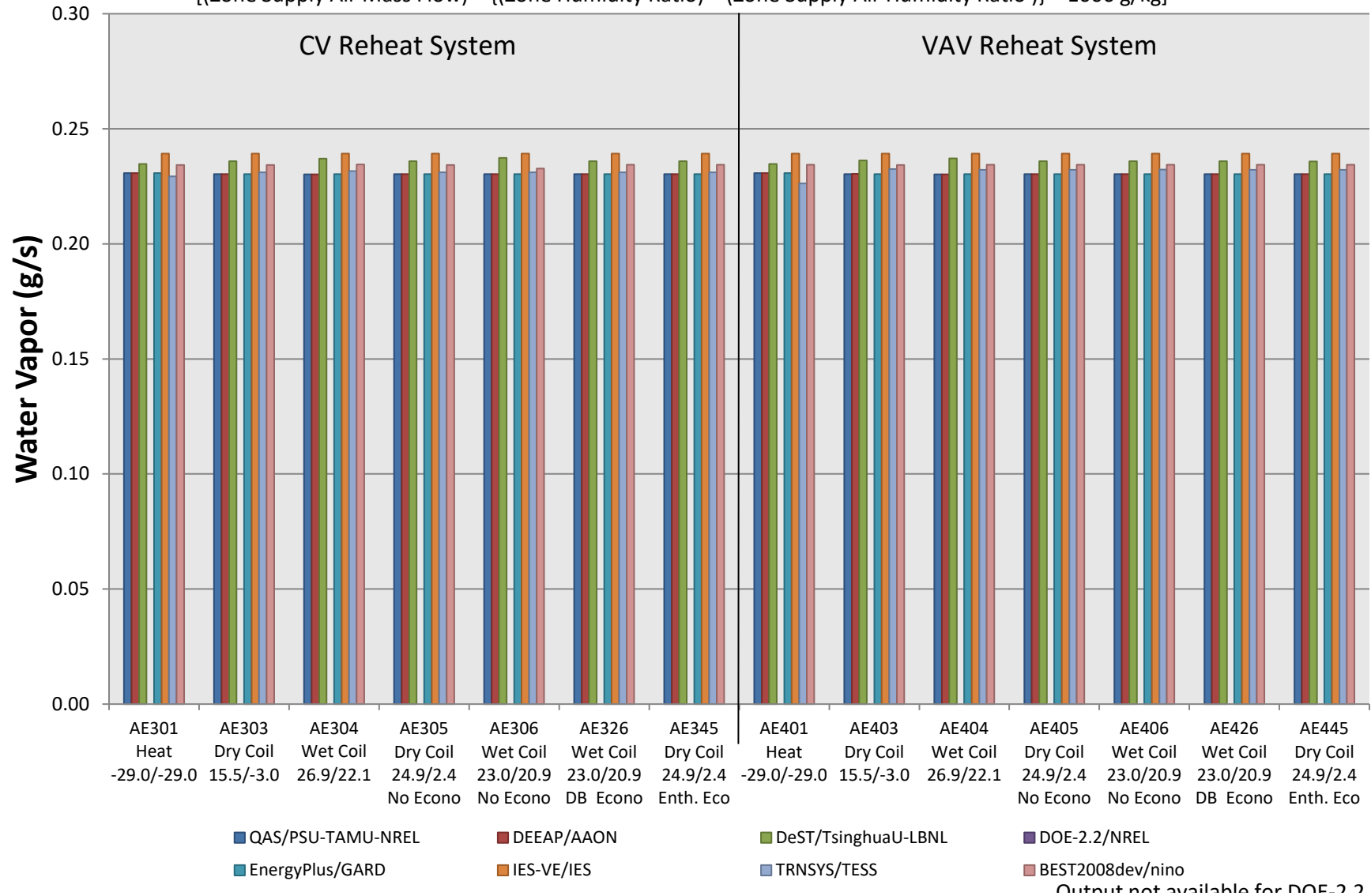
**Figure B16.7.2-26. CV/VAV Zone 2 Humidity Ratio**



ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

### Figure B16.7.2-27. CV/VAV Moisture Added to Zone 1 by Latent Gains

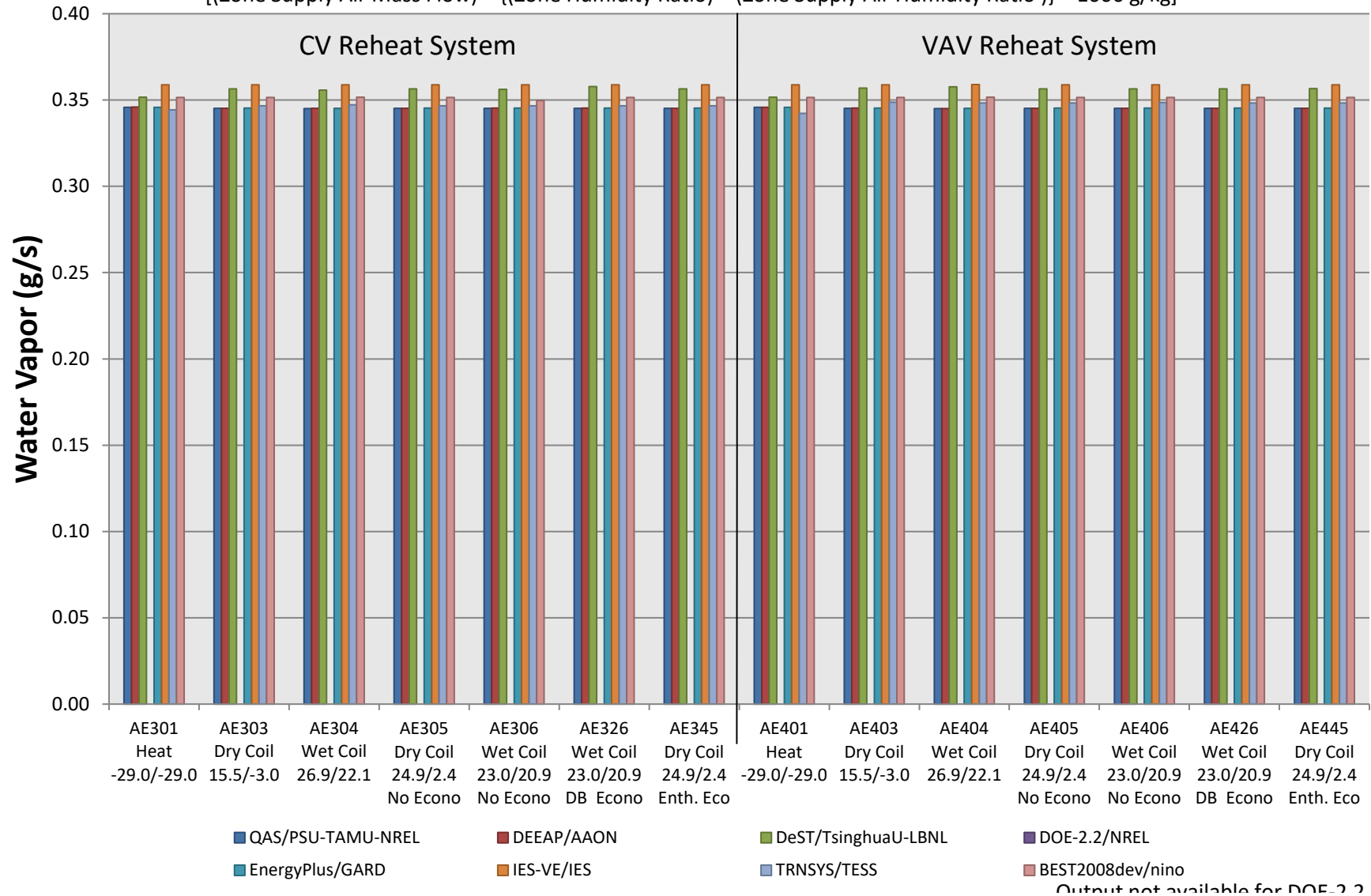
$$[(\text{Zone Supply Air Mass Flow}) \times \{(\text{Zone Humidity Ratio}) - (\text{Zone Supply Air Humidity Ratio})\}] \times 1000 \text{ g/kg}$$



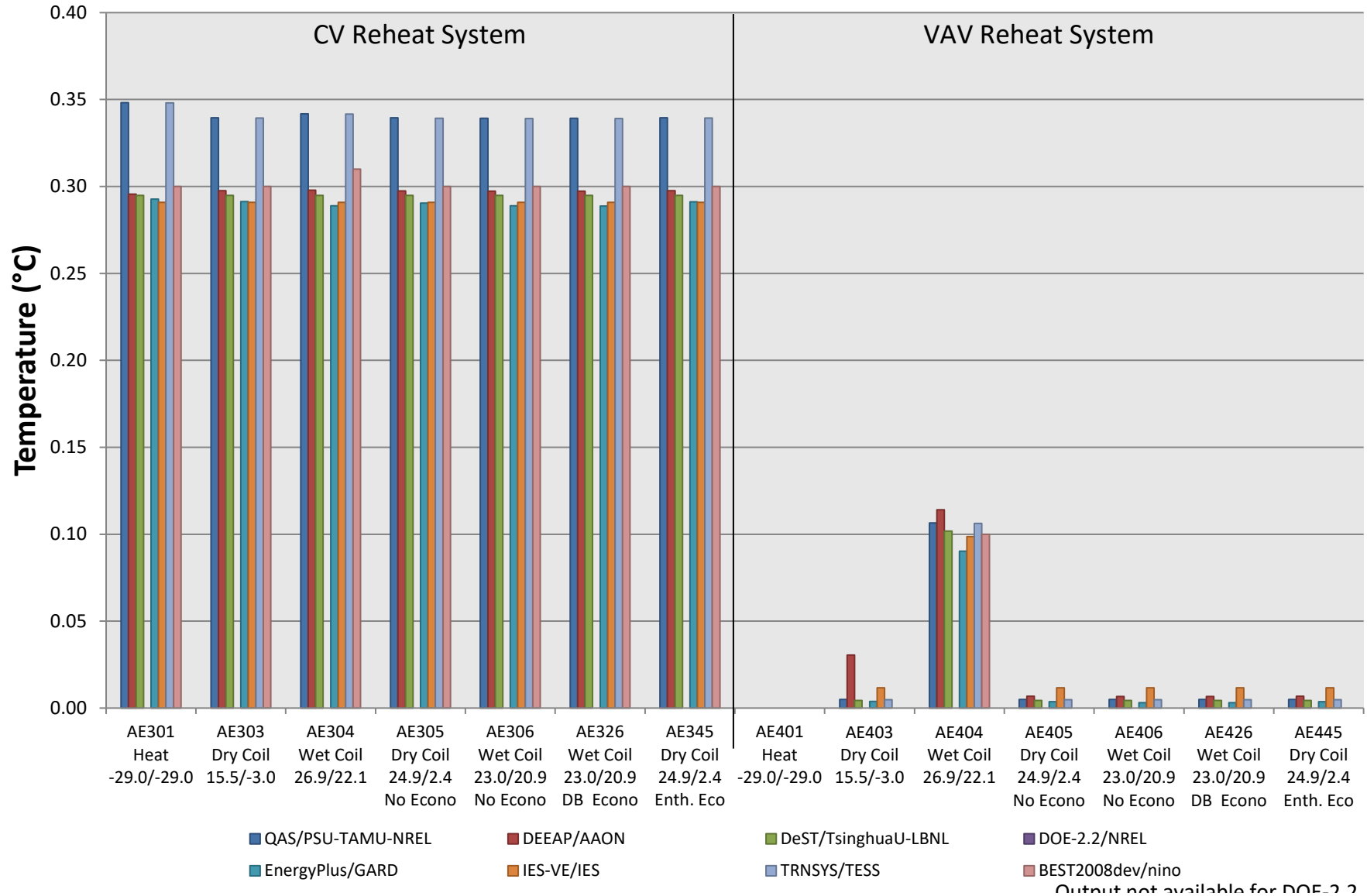
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

### Figure B16.7.2-28. CV/VAV Moisture Added to Zone 2 by Latent Gains

$$[(\text{Zone Supply Air Mass Flow}) \times \{(\text{Zone Humidity Ratio}) - (\text{Zone Supply Air Humidity Ratio})\}] \times 1000 \text{ g/kg}$$

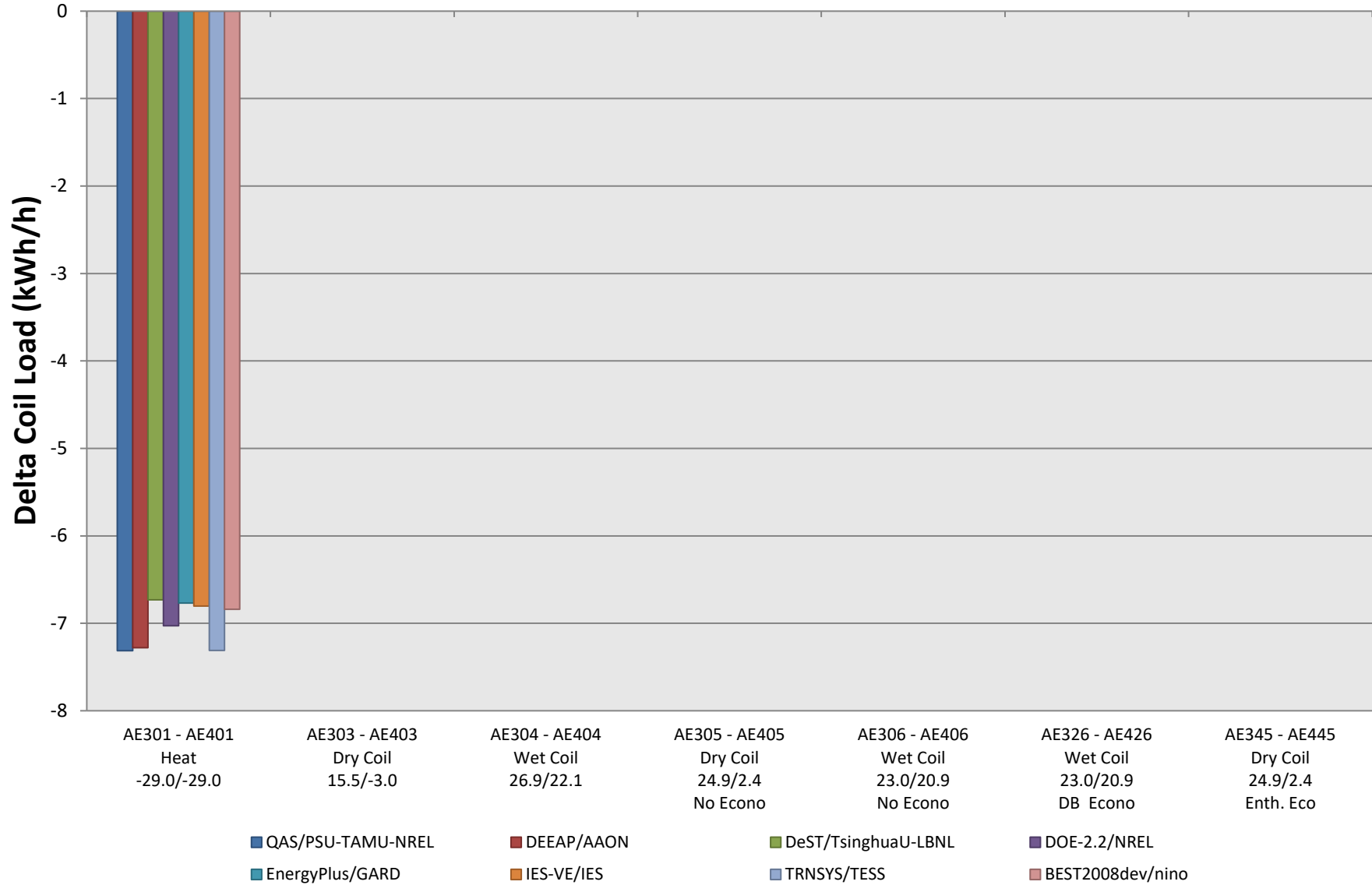


**Figure B16.7.2-29. CV/VAV Return Fan Air Temperature Rise**



ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

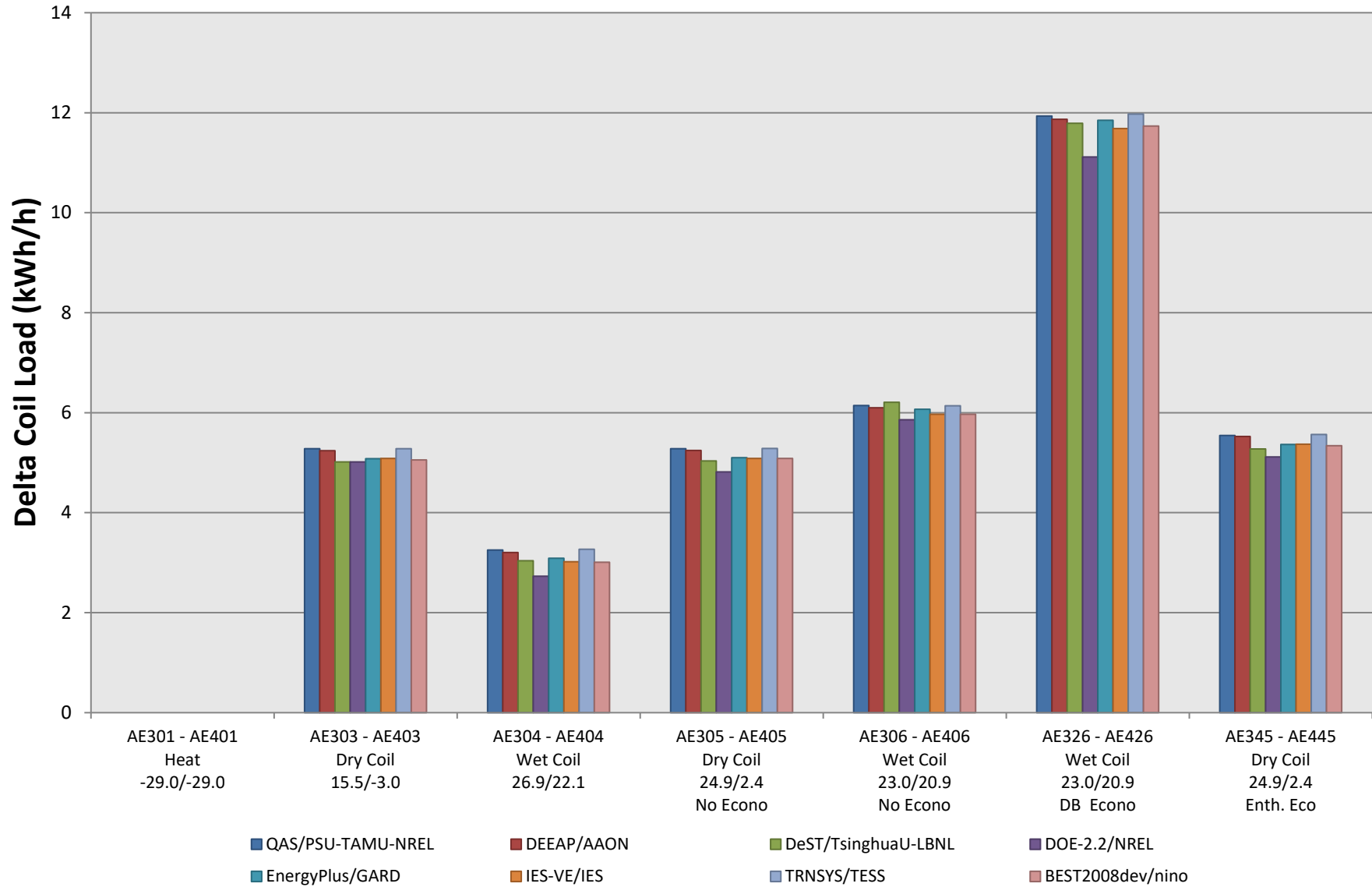
**Figure B16.7.2-30. CV/VAV Delta Pre-Heating Coil Load, CV-VAV**





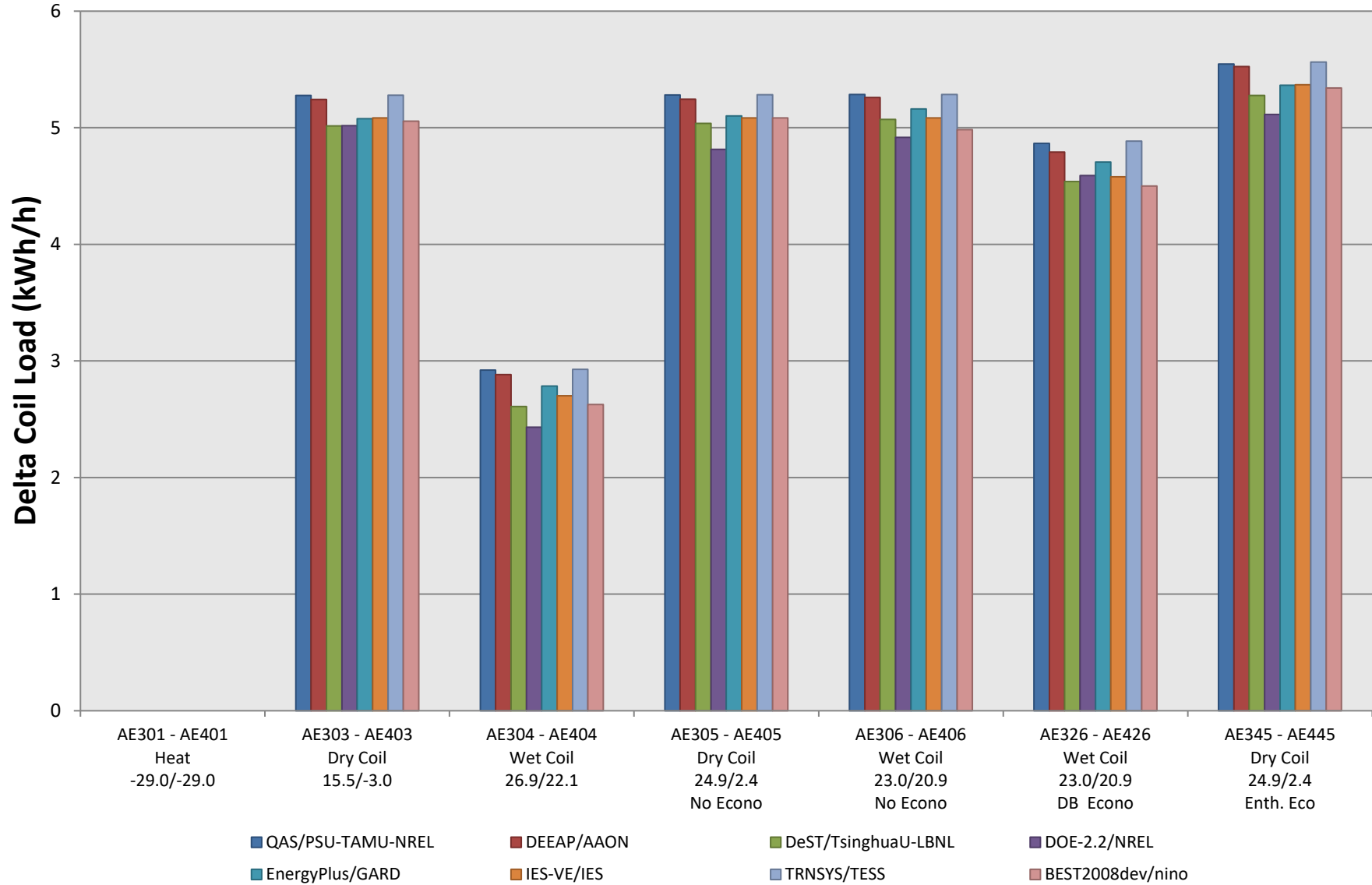
ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-31. CV/VAV Delta Total Cooling Coil Load, CV-VAV**



ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

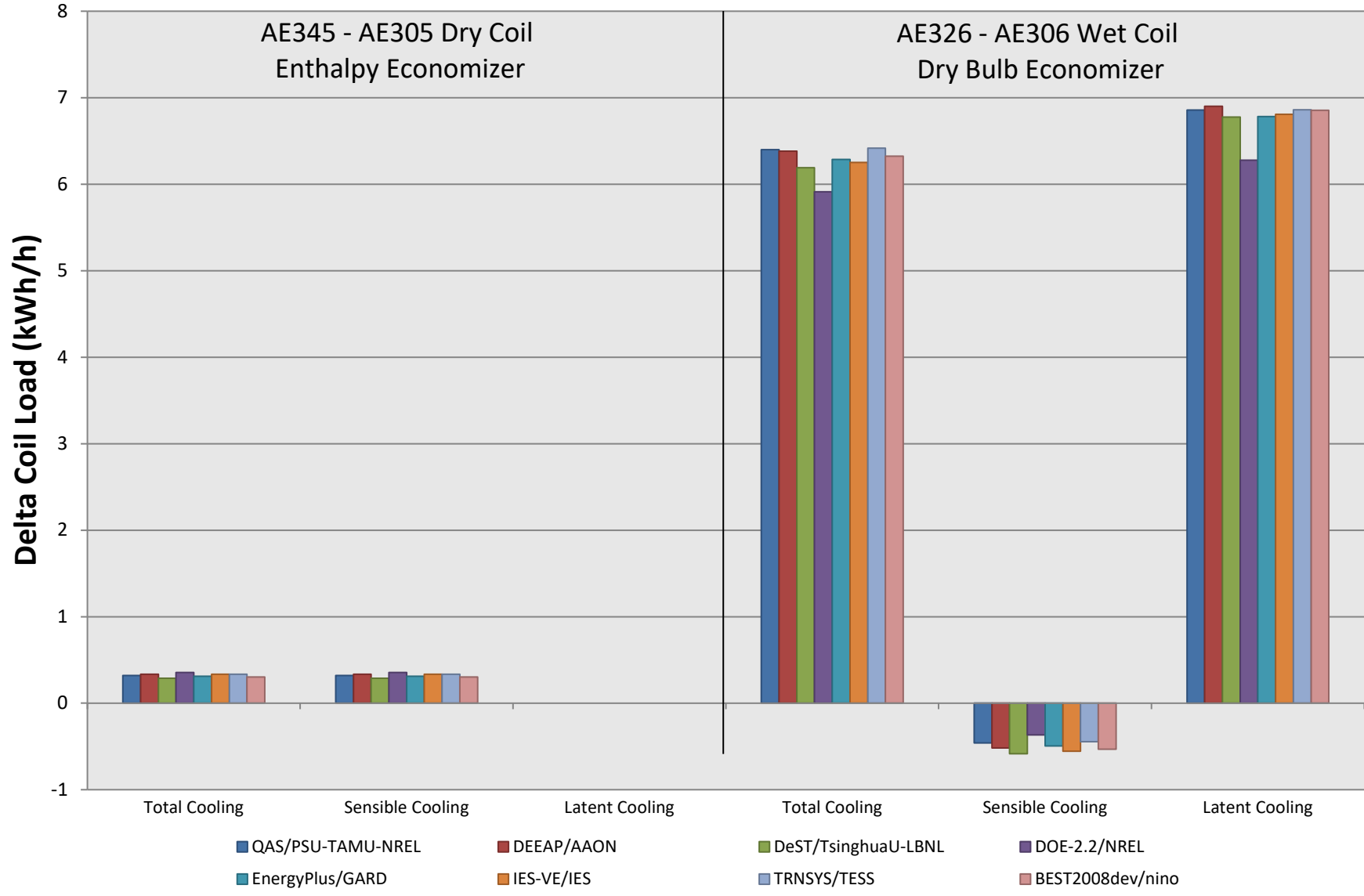
**Figure B16.7.2-32. CV/VAV Delta Sensible Cooling Coil Load, CV-VAV**





ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-34. CV Delta Cooling Coil Load, Economizer Operation**



ASHRAE Standard 140-2017, Results Comparison for Airside HVAC BESTEST Cases AE301 - AE445  
 BEST (BEST2008dev) vs. Annex B16, Section B16.7.2 Example Results, by NIKKEN SEKKEI LTD nino (nino), 17-Nov-2020

**Figure B16.7.2-35. VAV Delta Cooling Coil Load, Economizer Operation**

