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Introduction and Background

Carrier provided extensive comments back on the first public review and we are please to see some of our comments were addressed but several were not and some of the substantive comments regarding the fan power and economizer changes have not been completely address.

The following are our comments regarding the 45-day review draft.

Comment Details

Section 100.1 – Definitions and Rules of Construction, Page 57 - AIR-COOLED AIR CONDITIONER.

A definition is provided for air-cooled air conditioner, but similar definitions are not provided for water cooled and evaporatively cooled air conditioner. To be consistent three types should be included.

Section 100.1 – Definitions and Rules of Construction, Page 57 - AIR-HANDLING UNIT or AIR HANDLER

The definition is not technical complete. An air handler is more than just a blower or fan and may include a cooling coil, heating coil, filters, noise treatment, economizers and more. Should also likely include a fan coil which technical is the same but the common term used for smaller units.

Section 100.1 – Definitions and Rules of Construction, Page 58 - AIR-SOURCE HEAT PUMP

A definition is included for air source heat pumps but seems like there should also be a definition for water source and geothermal heat pumps as they are referred to in the standard requirements.

Section 100.1 – Definitions and Rules of Construction, Page 59 - AHRI 210/240 referenced standard is wrong version.

We see that AHRI 210/240 Standard was updated to the 2017 version, but you did not include the new 2023 version that will be the controlling standard as of 1/1/2023. The reference standard for AHRI 210/240-2017 will be used until the end of 2022 and then will be superseded by the AHRI 210/240-2023 and the new SEER2 and HSPF2 so both standards need to be included in the references as well as the requirements for SEER2 and HSPF2

Section 100.1 – Definitions and Rules for Construction, Page 60 – AHRI 560 referenced standards is soon going to be revised.

AHRI 560 is a standard for absorption chillers that has been update and should be published soon as version AHRI 560-2021.

Section 100.1 – Definitions and Rules for Construction, Page 60 – AHRI 920 refence standard is the wrong version.

The reference standard should be AHRI 920 with addendum 1 and not just AHRI 920.

Section 100.1 – Definitions and Rules for Construction, Page 60 – AHRI 1230 refence standard is the wrong version.

The reference standard is listed as the 2014 version. It should be the 2021 version

Section 100.1 – ASHRAE Climate Data for Regions and possible update data and zones, page 61

I suspect the weather data may be out of date and ASHRAE has developed new data and updated the climate zone information documented in ASHRAE 169-2020. Would be nice if California aligned their climate zones with the rest of the world, but it is also likely that the California climate zone boarders have changed due to global warming.

Section 10.1 Closed Circuit Cooling Tower page 65

A specific definition has been included for closed circuit cooling towers but there is no definition for open circuit cooling towers that are commonly used and referred to in the standard.

Section 100.1 – Computer Room Definition, page 66 Definition is not aligned with other standards

ASHRAE 90.1 and 90.4 have agreed on a new definition for computer rooms to have an IT equipment load larger than 10 kW vs the 20 watts/ft2 used in Title 24. It would be good to align with other standards.

Section 100.1 – Condenser Definition, page 66

The definition is included for air cooled refrigeration condensers, but no similar definitions have been included air water cooled and evaporatively cooled refrigeration condensers.

Section 100.1 – Dedicated Outdoor Air System (DOAS), page 67 – Definition not aligned with other standards

AHRI 920 has been revised to change and update the definition for DOAS. Also, it would be good to clarify when a product must comply with DOAS requirements and when it must comply with standard rooftop requirements. Do not understand how Title 24 can add requirements for the use of DOAS and have no minimum efficiency requirements?

Section 100.1 – Degree Day, Heating – Related comment, page 67

Definition for heating degree day is included by no definition for cooling degree day CDD50

Section 100.1 – DX-Dedicated Outdoor Air System (DX-DOAS), page 69 - definition question

The definition indicates that reheat is always part of a DX-DOAS. Reheat may be an option but there are other technological options that can be used to dehumidify air Propose changing the definition to that dehumidifies 100 percent outdoor air and may include reheat that is capable of controlling the supply dry-bulb temperature of the dehumidified air to the designed supply air temperature.

Section 100.1 – Economizer, Pumped Refrigerant, page 69 – definition question and clarification

Glad to see you added the definition, but the use of refrigerant for free cooling is not limited to cooling air and is also used to cooling water for chilled water systems without running the compressor. Suggest the definition be expanded. Also recommend you remove the pump requirement as some products can provide refrigerant free cooling without the use of a pump.

Section 100.1 Enthalpy Recovery Ratio (ERR), page 71 - Definition suggestions

Change definition to align with AHRI 1060 which defines ERR as A ratio of the change in enthalpy of the Entering Supply Airflow and the Leaving Supply Airflow to the difference in enthalpy between the Entering Supply Airflow and the Entering Exhaust Airflow, with no adjustment to account for that portion of the psychrometric change in the Leaving Supply Airflow that is the result of leakage of Entering Exhaust Airflow rather than exchange of heat or moisture between the airstreams. **Section 100.1 Integrated HVAC System, page 77 – definition question**

Not sure why this definition is being added and is it just for DOAS or are you trying to require all units to have a sensible heat factor of <0.65 which is aggressive. Should this be added under DOAS definition as a further requirement or better yet in the prescriptive requirements for DOAS

Section 100.1 Integrated Energy Efficiency Ratio – missing definition, page 77

We see that you have included most of the new integrated metrics for IPLV, ISCOP and ISMRE, but the definition for Integrated Energy Efficiency Ratio (IEER) defined in AHRI 340/360 is missing and should be added. Recommend you include the following, "A weighted calculation of mechanical cooling efficiencies at full load and part-load Standard Rating Conditions, defined in AHRI 340/360, expressed in Btu/W·h."

Section 185 LOW-GWP REFRIGERANT – Definition not used in the standard, page 85

The definition for Low-GWP is listed as having a GWP less than 150. This does not align with the requirements of CARB for the phasedown of high GWP refrigerants. The definition is included but never used in the standard and we recommend it be removed as it does not impact energy efficiency.

Section 100.1 Microchannel Condenser, page 85 – Definition question

Definition is OK, but not sure why it is needed. Also, there are now microchannel evaporators.

Section 100.1 Multiple Zone System, page 86 – Definition question and suggestion

What you are defining is a multizone VAV system so it should be labeled as such and contain the requirements on minimum airflow of 40%. Should also include a definition of single zone VAV which is defined in AHRI 340/360-2021.

Section 100.1 Single Packaged Vertical Air Conditioner (SPVAC), page 97 – Definition comments and questions

This definition is directly from AHRI 390 which is good. AHRI 390 is limited to 240,000 Btu/hr. and larger units are rated per AHRI 340/360 so that might be worth clarifying. Overall, some products have definitions but title 24 does not have definitions for all products so it seems inconsistent.

Section 101.1 Thermostat Expansion Valve, page 99 – Definition comment

Definition is OK, but is it really needed. There are many other types of expansion devices including Electronic Expansion Valves, float valves for large chillers, fixed orifices, capillary tubes and many more so again if one is defined then should all options be defined.

Section 101.1 Ventilation System, Central Fan Integration or CFI – Definition comment

This definition is focused on dwelling unit space, but ventilation systems are used on all buildings so why is the definition limited to just dwelling units. This is somewhat redundant to DOAS unit definition. Maybe it would be good to have a general definition with sub-definitions.

Section 110.2 (a) Exception 1 to Section 110.2(a)

Th Kadj equation has been revised by ASHRAE 90.1 to allow for higher water temperatures now used for data centers and to expand the scope of Kadj. This has been released and is currently out for the second public review ISC and will close on July 5th. Recommend that the following revised language be used which is the ASHRAE 90.1 addendum X language modified to reference the Title 24 tables. Note that ASHRAE also changed water to liquid to allow for freeze protection

Liquid-cooled centrifugal chiller packages not designed for cooling operation at AHRI Standard 550/590 test and rating conditions of 44.00°F leaving and 54.00°F entering chilled-liquid temperatures, and with 85.00°F entering

and 94.30°F leaving condenser liquid temperatures, shall have maximum full-load (FL) *kW*/ton and part-load cooling energy *efficiency (IPLV.*IP*)* rating requirements, table 110.2-D adjusted using the following equations:

$$FL.IP_{adj} = FL.IP/K_{adj}$$
$$PLV.IP_{adj} = IPLV.IP/K_{adj}$$
$$K_{adj} = A \times B$$

where

FL.IP = full-load *kW*/ton value from 110.2-D

$FL.IP_{adj}$ = maximum full-load *kW*/ton rating, adjusted for nonstandard conditions

IPLV.IP = *IPLV*.IP value from Table 110.2D

$PLV.IP_{adj}$ = maximum *NPLV*.IP rating, adjusted for nonstandard conditions

$A = 0.00000014592 \times (LIFT)^4 - 0.0000346496 \times (LIFT)^3 + 0.00314196 \times (LIFT)^2 - 0.147199 \times (LIFT) + 3.93073$

$B = 0.0015 \times LvgEvap + 0.934$

LIFT = LvgCond – LvgEvap

LvgCond = full-load condenser leaving liquid temperature (°F)

LvgEvap = full-load evaporator leaving liquid temperature (°F)

The FL_{adj} and $_jPLV.IP_{adj}$ values are only applicable for centrifugal chilling packages meeting all of the following full-load design ranges:

- 36.00°F ≤ LvgEvap ≤ 70.00°F and
- 60.00°F≤ LvgCond ≤135.00 °F and
- 20.00°F ≤LIFT ≤ 80.00°F and

Manufacturers shall calculate the FL_{adj} and $PLV.IP_{adj}$ before determining whether to label the chiller per Section 6.4.1.5. Compliance with 90.1-2007, 2010, 2013, 2016, 2019, 2022 or combinations thereof, shall be *labeled* on chilling packages within the scope of the standard.

Section 110.2(a) – Efficiency – page 4 – missing efficiency requirements

Several tables for equipment efficiency have not been included in Title 24 but would be good to add to align with what is in ASHRAE 90.1-2019. There are also issues with some of the tables which I will cover in separate comments. The following are comments regarding the tables in title 24 review document.

Table 110.2-A Air Conditioners and Condensing Units -Minimum Efficiency Requirements, page 110

- The requirements for <65,000 Btu/hr are missing. We know these are also defined on Title 20 but Title 20 is out of date and does not reflect the new SEER2 requirements going into effect federally on 1/1/2023 for single phase and for 3 phase they are schedule to go into effect on 1/1/2025 per the DOE ruling.
- Note a should be removed as the IEER applies to all products and the note appears to be left from old requirements with IPLV

Table 110.2-B Heat Pumps, Minimum Efficiency Requirements, page 113

- The requirements for <65,000 Btu/hr are missing. We know these are also defined on Title 20 but Title 20 is out of date and does not reflect the new SEER2 and HSPF2 requirements going into effect federally on 1/1/2023 for single phase and for 3 phase they are schedule to go into effect on 1/1/2025 per the DOE ruling.
- Note a should be removed as the IEER applies to all products and the note appears to be left from old requirements with IPLV

Table 110.2-C Water Chilling Packages – Minimum Efficiency, page 118

The efficiencies in the table are correct and align with ASHRAE 90.1-2019. But there are some notes changes that should be made.

The exception for centrifugal chillers with design leaving evaporator temperature <36 F should be combined with positive displacement chillers with design leaving fluid temperature ≤32 F as it now applies to all chillers per the new ASHRAE 90.1 addendum X and change to AHRI 550/590 rating procedures. The word fluid should be changed to liquid as fluid can be both a gas and a liquid. ASHRAE 90.1 and AHRI 550/590 made this change.

Table 110.2-F – Heat Transfer Equipment, page 123

The table has been deleted from ASHRAE 90.1-2019 as there are no minimum efficiency requirements have been defined and there are no plans. Recommend you delete from Title 24

Table 110.2-G – Performance Requirements for Heat Rejection Equipment, page 123

ASHRAE 90.1 has made several changes to this table and recommend you include the changes in title 24 update.

- A new category has been added for propeller or axial dry-coolers with a minimum efficiency of 4.5 gpm/HP
- The refrigerant used for propeller or axial fan evaporative condensers has changed from R-507A to R-448A and the minimum performance has changed. R-507A can no longer be used.
- ASHRAE 90.1 revised the category for air cooled condensers to remove the reference to R-22 that can longer be used. The following is a copy of the table

Equipment Type	Total *System* Heat-Rejection Capacity at Rated Conditions	Subcategory or Rating Condition [h]	Performance Required [a,b,c,f,g]	Test Procedure [d,e]
Propeller or axial fan open-circuit cooling towers	All	95°F entering water 85°F leaving water 75°F entering wb	≥40.2 gpm/hp	CTI ATC-105 and CTI STD-201 RS
Centrifugal fan open-circuit cooling towers	All	95°F entering water 85°F leaving water 75°F entering wb	≥20.0 gpm/hp	CTI ATC-105 and CTI STD-201 RS
Propeller or axial fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75°F entering wb	≥16.1 gpm/hp	CTI ATC-105S and CTI STD-201 RS
Centrifugal fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75°F entering wb	≥7.0 gpm/hp	CTI ATC-105S and CTI STD-201 RS
Propeller or axial fan dry coolers (air-cooled fluid coolers)	All	115°F entering water 105°F leaving water 95°F entering wb	≥4.5 gpm/hp	CTI ATC-105DS
Propeller or axial fan evaporative condensers	All	R-448A test fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb	≥160,000 Btu/h·hp	CTI ATC-106
Propeller or axial fan evaporative condensers	All	Ammonia test fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F entering wb	≥134,000 Btu/h·hp	CTI ATC-106
Centrifugal fan evaporative condensers	All	R-448A test fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb	≥137,000 Btu/h·hp	CTI ATC-106
Centrifugal fan evaporative condensers	All	Ammonia test fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F entering wb	≥110,000 Btu/h·hp	CTI ATC-106
Air cooled condensers	All	125°F condensing temperature 190°F entering gas temperature 15°F subcooling 95°F entering db	≥176,000 Btu/h·hp	AHRI 460

Table 110.2-H – Electrically Operated Variable Refrigerant Flow (VRF) Air Conditioners Minimum Efficiency Requirements, page 126

This table aligns with ASHRAE 90.1, but when you look at the AHRI directory there are no products listed for cooling only units and all units are heat pumps. Title 24 should consider removing the table.

Table 110.2-I – Electrically Operated Variable Refrigerant Flow Air-to-Air and Applied Heat Pumps - Minimum Efficiency Requirements, page 129

As of 1/1/2023 the efficiency metric for <65,0000 will change from SEER and HSPF to SEER2 and HSPF2 so the requirements should be updated.

Efficiency Tables 110.2 – Missing Efficiency Tables

The following tables are missing. Some of these are also duplicated in title 20.

1. Floor-Mounted Air Conditioners and Condensing Units Servicing Computer Rooms – See ASHRAE 90.1 table 6.8.1-10
2. Commercial Refrigerators, Commercial Freezers and Refrigeration – See ASHRAE 90.1-2019 table 6.8.1-11
3. Vapor-Compression-Based Indoor Pool Dehumidifiers - See ASHRAE 90.1-2019 table 6.8.1-12

4. Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, without Energy Recovery— See ASHRAE 90.1-2019 table 6.8.1-13. All the definitions for the metrics were added but then there are no efficiency requirements.
5. Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, with Energy Recovery— See ASHRAE 90.1-2019 table 6.8.1-13. All the definitions for the metrics were added but then there are no efficiency requirements.
6. Heat Pump and Heat Recovery Chiller Packages – See ASHRAE 90.1-2019 table 6.8.1-16 and a new addendum X
7. Ceiling-Mounted Computer-Room Air Conditioners – See ASHRAE 90.1-2019 table 6.8.1-17
8. Walk-In Cooler and Freezer Display Door Efficiency Requirements – See ASHRAE 90.1-2019 table 6.8.1-18
9. Walk-In Cooler and Freezer Nondisplay Door Efficiency Requirements – See ASHRAE 90.1-2019 table 6.8.1-19
10. Walk-In Cooler and Freezer Refrigeration System Efficiency Requirements - See ASHRAE 90.1-2019 table 6.8.1-20
11. Performance Requirements for Water-Heating Equipment—Minimum Efficiency Requirements - See ASHRAE 90.1-2019 table 7.8
12. Minimum Nominal Efficiency Levels for Low-Voltage Dry-Type Distribution Transformers – See ASHRAE 90.1 table 6.8.4.4 (Note there is a new addendum being developed)
13. Motor Efficiency Tables – See ASHRAE 90.1 tables 10.8-1 thru 10.8.1-6
14. Minimum Efficiency Requirements for Single-Phase Central Air Conditioners and Heat Pumps - See ASHRAE 90.1 table F-1. These are also in Title 20 but title 20 is out of date
15. Minimum Energy Efficiency Requirements for Water Heaters and Pool Heaters - See ASHRAE 90.1 table F-2 These are also in Title 20 but title 20 is out of date
16. Residential Boiler a Minimum Efficiency Requirements – See ASHRAE 90.1 table F-5

Section 120.1 (C)(1)(D) v – Filter Rack Gasket – comment on new requirements for gaskets, page 161

We have concerns with compliance in the language for the prescriptive requirements in 120.1(c)(1)(D) for gasket filter racks. Specifically, as written there is no tolerance in the requirement, it is unclear on how this requirement would be enforced, and with applications that utilize side loading filters, complying with this clause may inadvertently increase the amount of bypass around the filters due to crushing or binding during installation or service.

Section 120.2 (i) Economizer Fault Detection and Diagnostics (FDD), page 175

Expanding economizers down to 33,000 Btu/h is justified for units outside the building and for units adjacent to an outside wall but is not cost justified for units located inside the building. As this is section is just a requirement for diagnostics it might be appropriate to just require diagnostics for all air side economizers. You also should clarify that this is just for air economizers and does not apply to water or refrigerant economizers.

Section 120.10 a) Requirements for FEI – comments, page 207

In general, Carrier feels that removing the exemption for all embedded fans that are in a certification program that is currently in AHSRAE 90.1 is not justified. While Carrier acknowledges the updates to T24 to exempt regulated products and future regulated products, it is believed that the removal of the exemption is targeted at Air Handling Units. AHU's are comprised of embedded fans, and the applied nature of the product can require 1000's of variations that can effect the air flow patterns of that equipment. With no clear and consistent approach to test embedded fans in a standalone condition according to AMCA 208, Carrier recommends that all embedded fans be exempted from this requirement.

Carrier believes that not exempting all embedded fans will lead to regulator and consumer confusion, as there is no sound approach to determining which units contain fans which are exempted, and which do not.

Carrier also suggests adding all efficiency tables from product efficiency tables from ASHRAE 90.1, in doing so will exempt those future regulated products and increase clarity in the T24 code.

The following exemption notes are in ASHRAE 90.1 and should be added:

- Fans used for moving gases at temperatures above 482°F.
- Fans used for operation in explosive atmospheres.
- Reversible fans used for tunnel ventilation.
- Fans outside the scope of AMCA 208.
- Fans that are intended to only operate during emergency conditions.

Section 140.4(c)1 Determining Fan System Electrical Input Power comments, page 252

The following comments apply to 140.4(c)1 but also apply to the duplicate requirements in 170.2 4

Overall, we understand the desire to improve on the old fan power allowances that were derived from ASHRAE 90.1, but we have some serious issues with the resulting limitations it will impose on the HVAC fan systems. The approach is a good approach, but the required improvements have been taken to an extremely and even our very best fan system that was just introduced with vane axile fans will have significant range restrictions placed on the equipment. We do not feel that this proposal as written should be implemented in the 2022 standard without significant changes.

This is a very complex proposal to evaluate and numbers keep changing and not sure what is in the standard aligns with the pervious shared Case studies and assumptions. We know from these discussions that they pushed everything to the ultimate limit and then also assumed that the fan efficiency (FEI) was 15% better than an FEI of 1.0 which is required by Title 24 for standalone fans. They also assumed relatively low applied external statics although none of the documentation was clear on what they used.

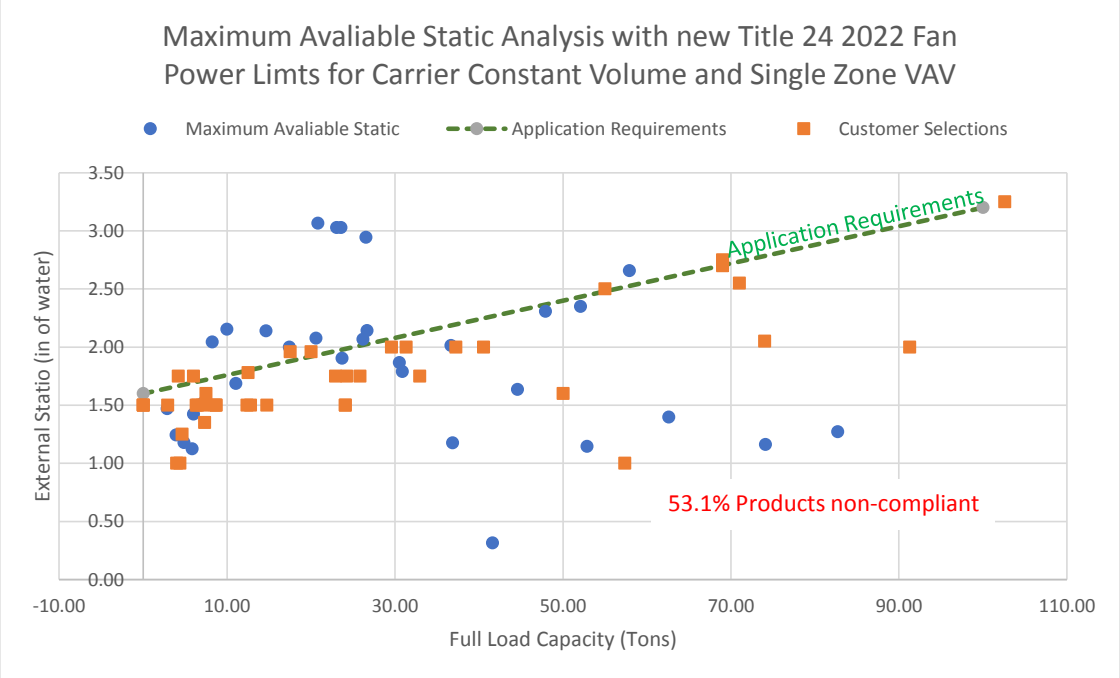
To understand the requirements, we first compared the new requirements to the current requirements for a basic rooftop with cooling, gas heat and an economizer. We used rooftops as they typically are more space constrained than air handlers. The performance improvements are significant are more than shared during some of the preliminary case reviews. The results are shown in the following table

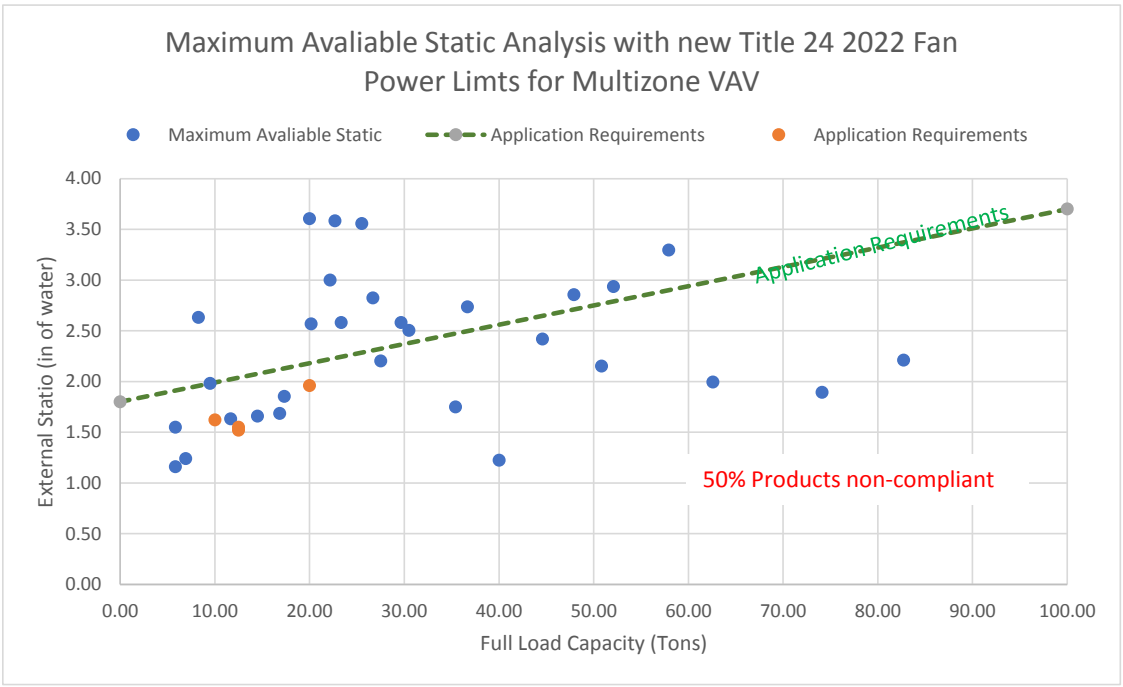
Airflow Range	Single Zone	Variable Volume
≤5,000 cfm	-32.0%	-30.2%
>5,000 and ≤10,000 cfm	-32.0%	-29.9%
>10,000 cfm	-34.0%	-33.6%

This seems to be excessive and even with significant redesign we do not expect that these number can be obtained and still allow for applications requirements that customers need. With less than 2 years and the current activity to comply with new efficiency requirements and refrigerant changes this likely is not possible.

To understand the customer requirements we took all our planned rooftop design for 2023 efficiency requirements and for a basic rooftop with gas heat, economizers and down supply on new construction we determined what external static that could be supplied We did this for constant volume and variable volume and the results are shown in the following two plots. We also gathered data from customer specifications and developed a curve of what we believe the minimum external static requirement allowance should be as shown by the orange squares

and the green curve fit line. We were able to get significant data for constant volume, but only limited data for VAV. We believe VAV should be slightly higher due to the added pressure losses of terminals.





As you can see 53.1% of the CV units and 50% of the VAV would not even be able to provide the assumed customer requirements specification line.

Overall, we understand the need to improve fan power, and have good low-pressure ductwork used with design but it was based on very optimistic assumptions. It was also based on full load operation just like the FEI but most equipment run at reduced load and with variable speed fans and two speed fans the power decreases to the cube

of the speed and there were no allowance for this to encourage the use of new part load fan technology that could save significantly more energy than the full load approach used by this proposal.

Section 140.2(e) 1 Economizers, page 263 – reduction in minimum capacity for air economizers

We agree that extending the economizers down to 33,000 Btu/h from 54,000 Btu/h is appropriate, but we would recommend you limit this to units outside a building or adjacent to an outside wall. We do not feel it is cost justified to run ventilation and exhaust ductwork to fan coils located inside a building especially for replacement applications.

We do understand that except 6 provides an alternative to not require an economizer of a DOAS unit is installed, but DOAS units in the California climate zones are not very effective and the requirement to have excess ventilation air to provide some free cooling at 0.3 cfm/ft2 will in some cases be less than the ventilation air required by ASHRAE 62.1. Also, there are no minimum efficiency requirements for the DOAS unit.

The following is some analysis we did of the ASHRAE 90.1 reference buildings.

Title 24 DOAS Proposal for Elimination of Economizer using 0.3 cfm/ft2

Building Type	Area	Load Intensity			Design % OA			0.3 cfm/ton %OA			% increase		
	ft2/ton	ft2/ton			% Ventilation Air			% Economizer Air			%		
		Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min
Large Office	498,600	860	1249	639	18.6%	25.7%	13.9%	60.4%	83.5%	45.2%	225.0%	225.0%	225.0%
Medium Office	53,600	737	984	595	25.7%	13.9%	41.8%	82.9%	41.8%	45.2%	225.0%	225.0%	225.0%
Small Office	5,500	864	1235	654	19.0%	25.4%	14.6%	51.9%	60.8%	41.5%	177.9%	199.9%	112.6%
Hospital	241,410	591	971	373	33.2%	34.2%	31.5%	36.7%	41.9%	32.7%	10.5%	22.4%	3.8%
Primary School	73,960	542	820	409	51.8%	61.2%	42.0%	44.2%	52.1%	42.0%	-14.8%	-14.2%	-14.9%
Secondary School	210,900	468	647	283	72.6%	81.2%	64.1%	41.1%	45.9%	36.2%	-43.5%	-42.8%	-43.6%
Stand Alone Retail	24,695	490	743	347	27.1%	30.0%	22.6%	29.7%	32.9%	22.6%	9.7%	9.7%	9.7%
Fast Food	2,500	223	499	138	42.3%	51.1%	31.2%	19.1%	42.8%	11.9%	-54%	5%	-76%

As for offices the 0.3 cfm/ft provides reasonable free cooling, but not as good as a standard economizer at 100% economizer air. For the hospital, schools, retail and fast food the 0.3 cfm/ft2 is equal to or less than the normal ventilation air.

We would not recommend that the economizer requirements be extended down to 33,000 Btu/h for units inside the building and the DOAS exemption should not be added.

We would also recommend you consider some of the following suggested changes.

- The requirements for 100% outdoor air on a VAV system should be revised to more like 80% because the VAV terminals are never going to be full open during periods when the economizer is bein g used. The 100% requirement for VAV is not appropriate and adds additional cost with no benefit.
- There should be an exemption for applications where the ventilation is 80% or more of the full load airflow as the incremental benefit is very small and not cost justified.
- With the reduction to 33,000 Btu/h there should be an exemption for residential as the load profiles due not really show significant benefits for air economizers like we see with commercial buildings.
- In the definitions there was an added definition for refrigerant pump economizers but there is no requirement listed in this section.

Section 140.2 (p) Dedicated Outdoor Air Systems (DOAS) page 274 – comments on new requirements

The way we read the new requirements is that all spaces shall have a separate DOAS system with either exhaust air energy or energy recovery with 0.3 cfm/ft2 economizer air.

We know that the justification for this was to cycle the fans on the rooftops, but we are not clear if the analysis considered that the base units have 2 speed fans and in some cases 3 speed or even variable speed fans. The cost justification analysis has not been shared. We do not feel this is cost justified and appropriate and the mandatory requirements for DOAS should be removed.

The requirements for energy recovery are marginal in many of the California climate zones as energy recovery is not very effective in mild temperature operating conditions.

Delivering the air downstream from the fan coils is not how most systems are applied and the ventilation air is to the inlet to the coils so that integrated economizer operation can be used and the air is delivered effectively to the space. The added cost for this was ignored in the evaluation by the case team