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Daikin Comments on 45-Day Language of Proposed Draft 2022 California Energy Code

Additional submitted attachment is included below.

DAIKIN U.S. CORPORATION
601 13TH STREET NW, SUITE 200 SOUTH
WASHINGTON, DC 20005
PHONE: (202) 383-8740

June 21, 2021

Mr. J. Andrew McAllister, Ph.D.
Commissioner
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512
Docket Unit, MS-4
Re: Docket No. 21-BSTD-01

(Submitted electronically to Docket 21-BSTD-01: Daikin Comments on 45-Day Language of Proposed Draft 2022 California Energy Code)

Dear Commissioner McAllister:

Daikin U.S. Corporation ("Daikin") hereby submits the following comments in response to 45-Day Language of Proposed Draft 2022 California Energy Code. Daikin U.S. Corporation is a subsidiary of Daikin Industries, Ltd., the world's largest air conditioning equipment manufacturer. The Daikin Group includes Daikin Applied, Daikin North America LLC, and Goodman Manufacturing Company, L.P.

I. Introduction

Daikin supports the Commission's efforts to accelerate building electrification and decarbonization through the improvements made to Title 24, Part 6, to help the state meet its greenhouse gas (GHG) reduction goals. Daikin believes that heat pumps are the proven technology to achieve substantial GHG reduction in both residential and nonresidential buildings and appreciates that Section 150.1(c)7 sets prescriptive baselines to mandate the installations of either air-source heat pumps ("heat pumps" hereinafter) or heat pump water heaters (HPWHs) in each climate zone. However, while Daikin understands that the baselines were set based on cost-effectiveness tests, Daikin is unclear about how the cost-effectiveness was calculated and how heat pumps and HPWHs were allocated to each climate zone as its

baseline. Therefore, Daikin is concerned that the section likely undermines the performance of heat pumps in the given space heating applications, observing the zone allocations. Please see Section II for details.

In addition, Daikin believes that Section 140.4(e) of CEC Title 24 45-day language proposes a modification to the economizer requirement by lowering the air handler cooling capacity threshold from 54,000 Btu/h to 33,000 Btu/h. As a result, air handlers of commercial HVAC systems with cooling capacity greater than 33,000 Btu/h will require an economizer installation. Exception 6 to Section 140.4(e)1 addresses air handlers with cooling capacity less than 54,000 Btu/h coupled with a dedicated outdoor air system (e.g. DX-DOAS, HRV or ERV) for ventilation in accordance with 140.4(p)1B and 140.4(p)2 through 140.4(p)6. This exception does not address air handlers with cooling capacity greater than 54,000 Btu/h.. Several variable refrigerant flow (VRF) air handlers (hereinafter referenced as "indoor units") have cooling capacities greater than 54,000 Btu/h[1]. Therefore, Daikin is also concerned about the new provision and submits our comments as below. Please see Section III for details.

Lastly, Daikin wants to emphasize that we support AHRI's comments made in Section D. Fan Power Budget – Sections 140.4(c), 170 of the letter they posted to the docket.

II. Climate Zone-based Heat Pump Baselines

Single Family Buildings

As mentioned above, Daikin believes that the baseline allocations to heat pumps undermine the heating performance of heat pumps. In Section 150.1 (c)7, new prescriptive requirements for heat pumps were added for climate zones 3, 4, 10, 13, and 14. In addition, climate zone 10 is expected to switch to HPWHs in the 15-day language proposal. NRDC submitted a wholesale base cost comparison of a baseline code-compliant gas furnace/AC system and a heat pump system to the pre-rule making docket, and the comparison presents that the former is 14% more expensive than the latter. The gap increases to 29% in regions of the state where ultra-low

[1] Example of VRF air-handler/indoor unit product offerings: https://www.daikinac.com/content/resources/submittal-data-sheets/vrv-indoor-units/

DAIKIN U.S. CORPORATION
601 13TH STREET NW, SUITE 200 SOUTH
WASHINGTON, DC 20005
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NOx furnaces are required, including the South Coast and San Joaquin Valley air districts. In addition, the comparison states that installation cost "would typically be higher for gas appliances due to the installation of three, instead of two, pieces of equipment, as well as venting and installation of a second fuel type." This study alone suggests that heat pumps should be considered as baselines at least in all regions that do not require cold climate heat pumps or gas furnaces; in other words, heat pumps should be qualified for climate zones 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, and 15.

It is also important to emphasize that Daikin believes a major barrier to heat pump adoption is the market's reliance on air conditioners (ACs) for cooling and gas furnaces for heating. As such, creating pathways to phase away from cooling-only ACs by instead requiring heat pump condensing units, supports both the effective and transitional use of gas furnaces in dual fuel scenarios, and boosts the install base of heat pumps to support the long term decarbonization goals. This approach can be accommodated and effective in all climate zones in California. Daikin also believes that cold-climate heat pumps can sufficiently provide space heating in all regions in California. Therefore, Daikin suggests that Section 150.1 (c)7 should require the use of dual-fuel or cold-climate heat pumps in climate zones 1, 2, 11, and 16.

Multifamily Buildings

The same notion outlined above also applies to multifamily buildings. The prescriptive requirements for dwelling unit space conditioning systems for multifamily buildings are defined in Section 170.2(c)3A. Section 170.2(c)3Ai notes that the system should be a heat pump for climate zones 1 through 15 and a gas furnace/AC system for climate zone 16, where the building has three or fewer habitable stories. Daikin suggests that the use of dual-fuel or cold-climate heat pumps for climate zone 16 should be required in such buildings. In addition, Section 170.2(c)3Aii notes that the system should be a heat pump for climate zones 2 through 15 and a dual-fuel heat pump for climate zones 1 and 16, where the building has four or more habitable stories. Daikin suggests that the dual-fuel heat pump should remain as the baseline for climate zones 1 and 16 in such buildings, and that the baseline can be substituted with the use of a cold-climate heat pump.

Nonresidential buildings

The same notion applies to nonresidential buildings as well. For Section 140.4, which defines the prescriptive requirements for space-conditioning systems in nonresidential buildings, a gas furnace/AC system is required in Retail and Grocery Building Spaces in climate zones 1 and 16 as well as in Office, Financial Institution, and Library Building Spaces in climate zone 16 when the cooling capacity is less than 65,000 Btu/hr. Daikin suggests that the gas furnace/AC systems be removed from the prescriptive system type for this section, and that dual-fuel heat pumps be set as the prescriptive system type, while also allowing the substitution of cold-climate heat pumps.

Lastly, in the same section (140.4), a duel-fuel system is set as the prescriptive system type in Retail and Grocery Building Spaces in climate zones 1 and 16 as well as in Office, Financial Institution, and Library Building Spaces in climate zone 16 when the cooling capacity is greater than 65,000 Btu/hr. A dual-fuel system is also set as the system typein School Building Spaces in climate zones 1 and 16. Using the forementioned notion, Daikin suggests that this section be modified to allow a cold-climate heat pump to be used as the substitute for a duel-fuel heat pump.

III. Economizer Requirements

Installation of Economizers with VRF Systems

Imposing an economizer requirement for VRF indoor units raises significant and severe installation barriers. Typically, VRF indoor units are categorized as either: (1) ducted indoor units; or (2) non-ducted (i.e. ductless) indoor units. Definitions for these categories can be found in AHRI Standard 1230[2]. For ducted indoor units, the ductwork is often limited with little-to-no ducting for return or supply air within a single zone. For ductless indoor units, return air and supply air are passed through the indoor units without any ductwork. Figure 1 provides with a visual representation of the two indoor unit categories. VRF ductless indoor units are physically unable to incorporate the use of economizers.

[2] Section 3, Definitions, under AHRI Standard 1230: https://www.ahrinet.org/App_Content/ahri/files/STANDARDS/AHRI/AHRI_Standard_1230-2021.pdf

DAIKIN U.S. CORPORATION
601 13TH STREET NW, SUITE 200 SOUTH
WASHINGTON, DC 20005
PHONE: (202) 383-8740

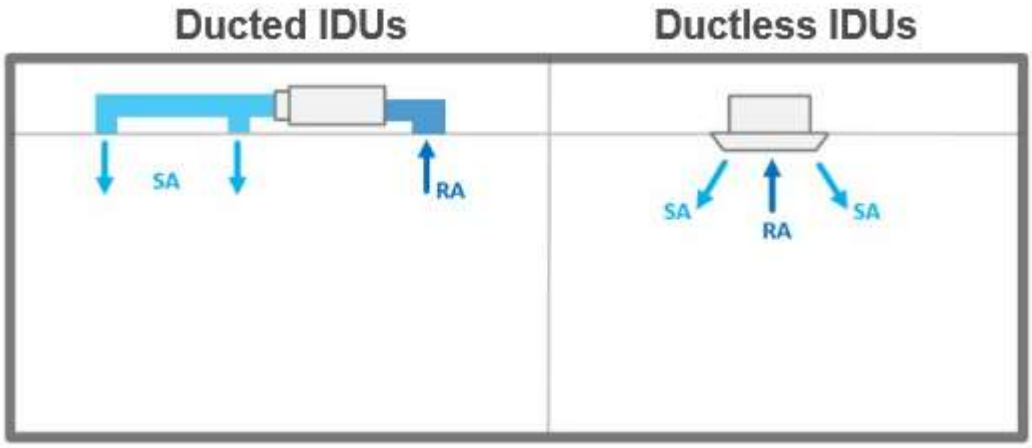


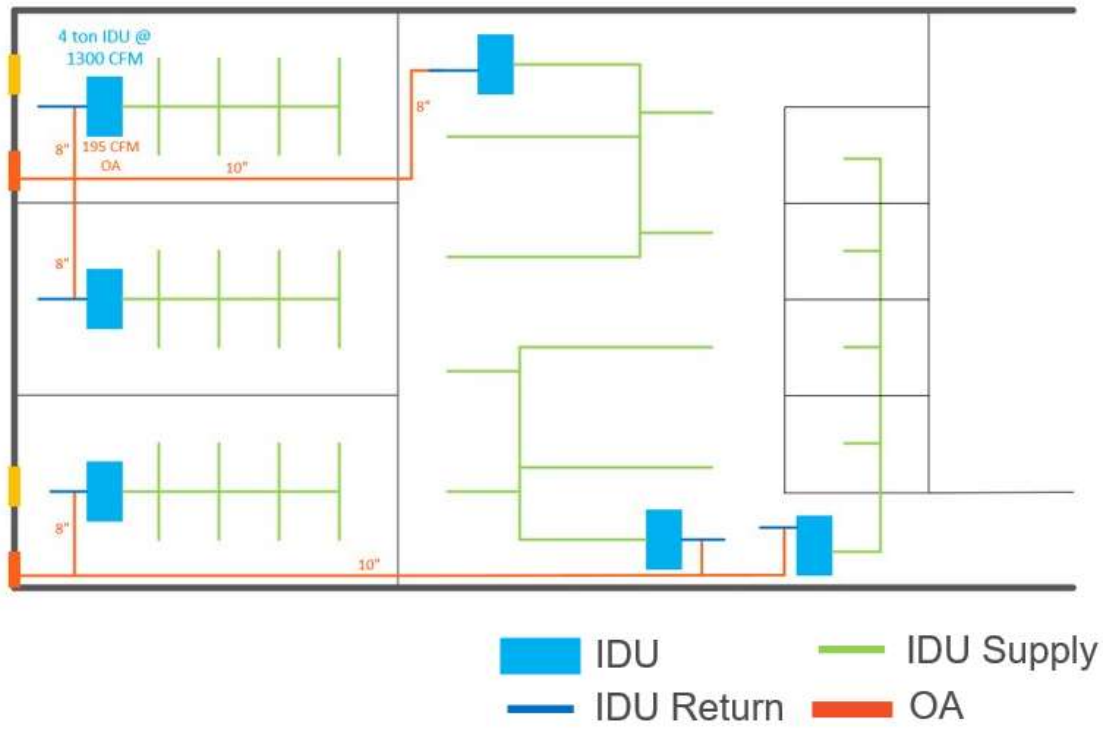
Figure 1. Ducted and Ductless VRF Indoor Units

Furthermore, economizer installations with VRF ducted indoor units would lead to an increase in: (1) penetrations in the building roof and/or walls; (2) ductwork; and (3) system power input. These ducted indoor units are generally installed in their intended space conditioning zone, which may not be close to the building perimeter walls. Therefore, economizer installations with ducted indoor units present considerable complexities. Conventional packaged HVAC systems do not face the same complexities as the ventilation air is directly connected to these packaged systems with minimal impact to their installation.

Figure 2 shows a side-by-side comparison using sample building layouts of: (1) VRF ducted indoor units with economizers; and (2) VRF ducted indoor units with direct method to bring in outside air. As observed from these layouts, the number of penetrations, ductwork, and the complexities increase significantly with the installation of economizers. Based on these additional ductwork, penetrations, and complexities, the estimated differential in installation cost between the two sample layouts can go up to 5X[3].

[3] Installation cost estimates based on data retrieved from RSMeans. https://www.rsmeans.com/?gclid=Cj0KCQjw5auGBhDEARIsAFyNm9HzkvZh9AX45-YpDixNHU_XkwBe6arc9e6fflkJvyr98zzOa8kvbRgaAisgEALw_wcB

VRF Ducted Indoor Units Using a Direct Method with 15% Outside Air



VRF Ducted Indoor Units Installed with Economizers

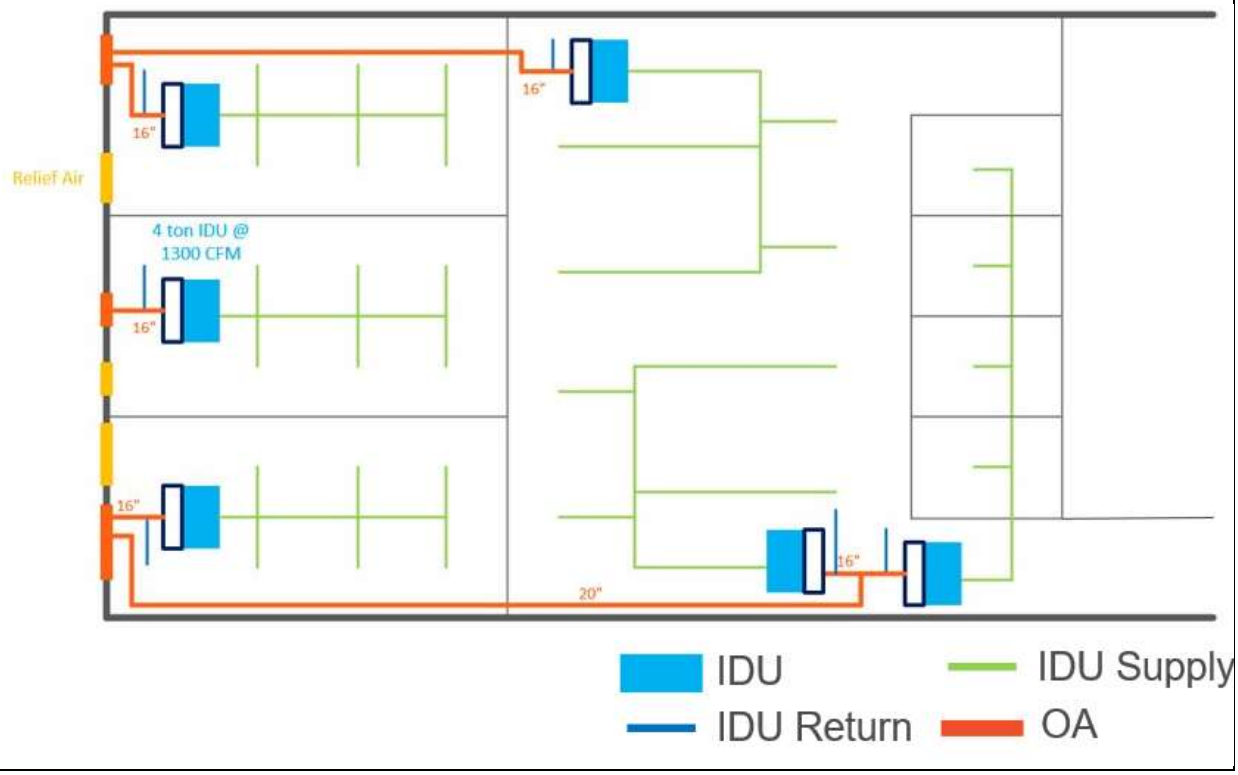


Figure 2. Sample VRF Ducted Indoor Units Layout with OA and Economizer

DAIKIN U.S. CORPORATION
601 13TH STREET NW, SUITE 200 SOUTH
WASHINGTON, DC 20005
PHONE: (202) 383-8740

In addition to installation difficulties, the efficiency and effectiveness of certain VRF systems may be impacted due to the use of economizers. VRF systems with heat recovery modules facilitate exchange of energy between different individual space conditioning zones to provide simultaneous cooling and heating, thereby increasing energy use effectiveness. The use of economizers compromises this energy recovery from individual zones, therefore preventing a system from delivering that same level of effectiveness and efficiency.

Therefore, we request the CEC consider modifying Exception 6 to 140.4(e)1 to include all VRF indoor units, including units with cooling capacity > 54,000 Btu/h. Alternatively, we support the proposed approach outlined in the AHRI comments on 2022 Title 24 45-day language to limit economizer requirements to only outdoor systems (i.e. indoor units inside building spaces should be exempt from using economizers).

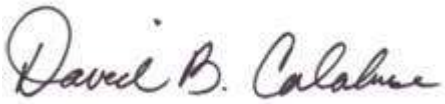
Bringing in Outside Air and the Use of Dedicated Outdoor Air Systems with VRF Systems

Outside air can be brought into VRF space-conditioned zones via a direct method, integrated method, and decoupled DOAS method. These approaches have their own advantages and disadvantages, and the choice is generally application and space-dependent. The 45-day language currently allows for decoupled DOAS method with space-conditioning systems to be exempted from the economizer requirements. For regions (climate zones) and applications that do not need 100% dedicated outside air to be brought into the space-conditioning zone, we request the CEC to consider providing an option for use of other approaches to bring in outside air, such as the direct or integrated outside air method.

IV. Conclusion

Daikin appreciates the opportunity to provide these comments. If you have any questions regarding this submission, please do not hesitate to contact me.

Sincerely,



David Calabrese
Senior Vice President, Government Affairs
Deputy General Manager, Washington, D.C. Office
Daikin U.S. Corporation
601 13th Street, N.W., Suite 200 South
Washington, D.C. 20005
E-Mail: david.calabrese@daikinus.com

Cc: Nathan Walker (Goodman Manufacturing Company, L.P.), Phil Johnston (Daikin Applied), Rusty Tharp (Goodman Manufacturing Company, L.P.), Lee Smith (Daikin U.S. Corporation), Charlie McCrudden (Daikin U.S. Corporation), and Ryohei Hinokuma (Daikin U.S. Corporation)