DOCKETED	
Docket Number:	19-BSTD-03
Project Title:	2022 Energy Code Pre-Rulemaking
TN #:	237117
Document Title:	Mitsubishi Electric Comments on Express Terms Language of Proposed 2022 Code
Description:	N/A
Filer:	System
Organization:	Bruce Severance
Submitter Role:	Public
Submission Date:	3/10/2021 8:51:17 AM
Docketed Date:	3/10/2021

Comment Received From: Bruce Severance
Submitted On: 3/10/2021
Docket Number: 19-BSTD-03

Mitsubishi Electric Comments on Express Terms Language of Proposed 2022 Code

Additional submitted attachment is included below.

Mitsubishi Electric Comments on Express Terms Language of Proposed Draft 2022 Energy Code

Submitted by Bruce Severance, Regulatory Compliance Engineer, Mitsubishi Electric US
March 8, 2021

Introduction

Mitsubishi Electric US, Inc., Heating and Air Conditioning Division (MEUS HAD), is a leading manufacturer of ductless and Variable Refrigerant Flow (VRF) heat pumps and air conditioning systems. We appreciate the Commission's efforts to mitigate the impacts of buildings on climate change and recognize the importance of rapid mobilization strategies that produce measurable reductions in GHGs over the next thirty years as well as the broader goal to transform California's economy to carbon free and carbon negative alternatives.

CEC's Exception for DOAS on VRF Systems is Not Cost-Effective in All Climate Zones

The CEC's proposed changes in Section 120.2 (i) to lower economizer requirements on commercial systems from 54mbh to 33mbh provides an exception for VRF systems that allows for a decoupled DOAS system (including ERVs & HRVs) instead of an economizer in order to "*to prevent unintended impacts on the growing variable refrigerant flow (VRF) market segment and other large indoor units*". A coupled ERV is going to be the most cost effective option over any type of decoupled DOAS (ERV, HRV or DX-DOAS), but even this option on systems down to 33kbtu capacity will add substantial cost to VRF systems overall. The cost of VRF equipment is generally already higher than central systems, but despite this VRF systems are selected architects and system designers because of very high efficiencies, heat recovery capability and zone control. An even higher total installed system costs will lower their market share and negate the efficiency benefits provided by these systems. For this reason we ask for a three-year

postponement of the 33kbtu economizer threshold change or incrementally ease into the change by enacting a 48kbtu economizer threshold in 2025 and step down to 33kbtu in 2028. This would give industry time to rethink how to reach the integrated IAQ goal. and address it in future products.

VRF Heat Recovery Should be given Compliance Credit

The exceptions that are built into a lower economizer requirement on central systems should recognize the inherent superior efficiencies achieved by VRF zoned control and heat recovery systems. Although Table 140.4-D (below) offers some economizer exemptions for the improved efficiency of VRF systems, it doesn't go far enough. This table offers economizer exemptions for equipment that reaches 30% to 70% improvement in IEER but it doesn't also recognize the additional 20% to 30% efficiency achieved by systems equipped with "heat recovery". Not to be confused with "heat recovery" in an ERV or HRV, this heat recovery is moving "waste" heat from one zone in a VRF system calling for cooling, to another zone in the same system calling

TABLE 140.4-D ECONOMIZER TRADE-OFF TABLE FOR COOLING SYSTEMS

Climate Zone	Efficiency Improvement [a]
1	70%
2	65%
3	65%
4	65%
5	70%
6	30%
7	30%
8	30%
9	30%
10	30%
11	30%
12	30%
13	30%
14	30%
15	30%
16	70%

[a] If a unit is rated with an annualized or part-load metric, ~~IPLV, IEER or SEER,~~ then to eliminate the required ~~air or water~~ economizer, only the applicable minimum cooling efficiency of the ~~HVAC~~ unit must be increased by the percentage shown. If the ~~HVAC~~ unit is only rated with a full load metric, ~~such as~~ like EER or COP cooling, then that metric must be increased by the percentage shown. To determine the efficiency required to eliminate the economizer, when the unit equipment efficiency is rated with an energy-input divided by work-output metric, the metric shall first be converted to COP prior to multiplying by the efficiency improvement percentage and then converted back to the rated metric.

for heat and it does so through branch control boxes (valve boxes) that allow the heat to be moved elsewhere in the building through the refrigerant loops without that refrigerant going through the outdoor unit (compressor). These system efficiencies tend to be highest when loads are moderate, and not on very hot or cold days when all zones are more likely to call for heating or cooling rather than a mix. Notably, these are similar or overlapping conditions for when economizers may be operating, which is why it is so important to recognize VRF heat recovery in the requirements, otherwise the overlay of requirements create conditions wherein the overlay

of system features cancels the measurable efficiency in the field. It does not appear that the modeling that was performed for the CASE Report has factored all such variables. Economizers or DOAS systems are not designed to optimize delivery for many zones simultaneously calling for heating and cooling. An overlay of economizer requirements or DOAS may in fact lower the overall operational efficiency of a VRF system under such conditions. Additionally, the zoned control which multi-split VRF systems afford compared to central systems have the efficiency benefit of allowing only certain zones to operate when buildings are not fully occupied. More centralized systems do not allow for these partial-load energy savings, and in fact are usually very inefficient under low-load conditions. This is all to say that a compromise phase-in of the new standard will allow us time to evolve engineering solutions, and anything less than a compromise threatens to kill a critical innovative solution that already incorporates grater product advantages than the code seems to recognize.

Modulating Fan Speed Control on DOAS Systems

The stated purpose of the proposed language is to "modulating fan speed" (page 123, item 2 under Subsection 140.4(p)) on DOAS systems but does not define what is meant by "modulating". This should be clarified for specific product applications. When ERV are coupled with VRF, they usually use a 3 to 5-speed fan with up to three static pressure presets as this is more customary on these types of systems. This is because coupled VRF-ERV systems already benefit from the continuous modulation of VRF fan coil units and this functionality does not need to be redundant. Decoupled DOAS/ERV systems often utilize plenum fans, which have a stable operating range of 50%-100% of nominal airflow and can modulate continuously throughout this range based upon DCV with CO2 sensor(s) or based upon building static pressure. The proposed Express Terms language should refer to these applications separately and clearly define "modulating" as a 3-speed of 5-speed fan.

DOAS Air Supply Location

The proposed language in Section 140.4(p) 4 also requires that "the DOAS supply air shall be delivered directly to the occupied space or downstream of the terminal heating/or cooling coils" and the reason for this requirement is not at all clear. Mitsubishi recommends that a coupled DOAS deliver air upstream of the terminal unit fan coil as this provides for more a controlled

and comfortable environment. There are no clear reasons stated for this requirement, and the proposed language warrants justification and technical explanation as to data that would support such a requirement.

Non-Continuous Fan Operation of Coupled and Decoupled ERV or DOAS Systems

The CASE Team's report references the intent or purpose of the 140.4(p) code changes as including: "*3) Zone terminal fans for cooling or heating must cycle to off if no call for conditioning*", and: "*4) Decoupled ventilation pathway for outdoor air to each space*." (pg. 123). We would propose that VRF systems not only be granted mild climate and system efficiency exemptions, but also that coupled VRF-ERV systems be allowed to operate fans continuously at a speed that exceeds no more than 110% of the ASHRAE 62.1 airflow requirements for the specific building design requirements. There is little energy gained by forcing the fans to off while a decoupled system continues to run, as compared to coupling VRF with an ERV, and setting the lowest fan coil fan speed to meet minimum ventilation requirements. (Note: This assertion is supported by fan affinity laws where power input is proportional to the cube of shaft speed.)

Prescriptive Requirements for Space Conditioning Systems

Under Section 140.4 (a) 2B, The CEC has specified that retail and grocery applications in climate zones 1 or 16 with systems with cooling capacities less than 54kbtu *MUST* be served by a furnace plus AC system and specifically doesn't allow either an air-source heat pump (ASHP) or a dual fuel system. There is no apparent reason for this requirement in these climate zones. Mitsubishi Electric, as well as many of our competitors manufacture "cold-climate heat pumps (CCHPs) which have two stage compressors which make them capable of extracting heat at much colder temperatures a very high rates of efficiency. Every application in all of California's climate zones can be met with these higher performing CCHPs and the price premiums (additional cost of equipment) range from about 25% in residential equipment to about 50% in commercial equipment. There is no reason to specifically *require* furnaces in these climate zones and even less obvious reason to specify only these applications. Section 140.4 (a) 2E imposes similarly arbitrary applications for offices, banks and libraries in climate zone 16. We recommend requiring CCHPs in any cold climates that see -20 F. and any climate that sees below -20 F. should have

dual fuel systems with cold climate compressors, so the temperature at which the furnace is set to go on is in the neighborhood of -10 F.

Partial Electric Baselines

We are deeply appreciative that Section 150.1(c)7, sets partial electric baselines with compliance credit (EDR) to highly motivate the specification of either a heat pump hot water heater (HPWH) or an air-source heat pump for HVAC applications. However, our team doesn't understand the logic of the climate zones that have been chosen. It appears that the CEC may have set a very low bar for how well they expect the ASHP systems to perform. From a future retrofit point of view, it is far easier to replace a gas hot water heater with an electric provided that the install location is in the garage and 240V/30a feed is already in a J-box at the HPWH location, than it is to replace a furnace with a central ASHP. The primary reason is ducting. Heat pumps have a lower temperature rise in heat mode than furnaces and require more air volume (and bigger ducts) to move the same amount of btus (if static pressure and fan watt draw are to remain unaffected. Therefore we recommend that central ASHPs be encouraged in climate zones 3,4,5,6,7,8,9,10,12,13,14,15 and that dual fuel furnace-HP systems be encouraged in climate zones 1, 2, 11 and 16. These latter climate zones would also be those for which HPWHs are encouraged under the partial electrification plan.

Restrict Use of Integrated HPWH Units in Indoor Closets

There have been a number of CEC staff and energy trainer PowerPoint presentations circulating that show pictures of integrated HPWH units located in 3' x 4' sized closets inside the house with a simple louvre door on the closet. We strongly recommend that the code be modified to prohibit this type of indoor installation. This configuration will cause severe uneven temperatures in the interior and excessive dehumidification which can cause severe discomfort and even eye irritation for those who wear contacts. Actively cooling the interior of a home during cold weather by locating an HPWH in a closet is simply a poor application of the technology and is extremely difficult to fix after the fact. The negative impacts on HVAC performance are significant, and there is no way to design or integrate an ASHP to adjust for a heat exchanger of that size randomly cycling on or off inside conditioned space. There is also significant consumer feedback

that people are irritated by the sound of HPWH compressors located in their living space. This is an obvious problem, and it should be prohibited in this code cycle.

Conclusions

There has been substantial growth in the VRF market in the last decade. Mitsubishi Electric is very concerned that rushing to implement ERV or DOAS requirements on all VRF indoor units under 54 mbh fails to recognize the efficiencies and advantages of VRF systems in their various configurations. It is our opinion that the DOAS/ERV requirements should be limited to packaged systems for which economizers are designed, and that it is inherently disadvantageous to overlay this requirement onto VRF multi-split systems. An overlay of additional stringent requirements puts these inherently more expensive systems at an even greater cost disadvantage. These rules should be applied carefully and with consideration and phased in over time to allow the industry time to adapt.

Respectfully,

Doug Tucker
Director, Industry & Government Relations
Mitsubishi Electric US,
Heating and Air Conditioning Division
1340 Satellite Blvd.
Suwanee, GA 30024
678-372-6127
dtucker@hvac.mea.com

Bruce Severance
Regulatory Compliance Engineer
Mitsubishi Electric US,
Heating and Air Conditioning Division
PO Box 1000,
Grover Beach, CA 93483
805-574-3207
bseverance@hvac.mea.com