Addendum d
to ASHRAE Guideline 41-2020

Public Review Draft

Proposed Addendum d to
Guideline 41-2020, Design, Installation, and
Commissioning of Variable Refrigerant
Flow (VRF) Systems

First Public Review (August 2022)
(Draft shows Proposed Changes to Current Guideline)

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Addendum d to ASHRAE Guideline 41-2020, Design, Installation, and Commissioning of Variable Refrigerant Flow (VRF) Systems

(This foreword is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

FOREWORD

The changes to the control section of the guideline are made to update and clarify how the VRF internal system controls work both as stand-alone and when interfaced with third-party automation and controls systems and devices. Figure 5-1 was updated to show typical BAS configurations interfacing with VRF typical layout as well as Web/internet interface. A firewall is shown to put infancies on the need to secure web connected systems.

[Note to Reviewers: This addendum makes proposed changes to the current guideline. These changes are indicated in the text by underlining (for additions) and strikethrough (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current guideline are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]

Addendum d to Guideline 41-2020

6.8 System Controls. The installation of a complete system of manufacturers’ controls is required for a VRF System to work properly. VRF systems are just that, a system, not applied components like dampers, fans, or coils. That said, there are various levels of system control that can be applied by third-party control and automation vendors. The minimum manufacturers’ controls needed for a proper operating VRF System should be specified with the VRF System, not in the building automation and control specification. Only the manufacturer can determine these minimum requirements for the system operation. This includes all manufacturers’ equipment needed to interface the third-party controls to the VRF System.

Varying levels of manufacturer and third-party controls exist for VRF systems and include options for local control, central system control, and remote system monitoring and data analytics. Manufacturers’ controls and controllers are typically proprietary to each specific manufacturer; however, some third-party controls vendors are able to develop controls to integrate directly with VRF manufacturers proprietary controls at different systems (see Figure 5), locations within the manufacturers’ control system. Figure 5 shows the typical third-party building automation system interface.

Local control options include wired and wireless controllers to control the VRF terminal units with varying levels of programmability. Wireless controllers typically offer the ability to change mode, set point, and fan speed. Wire remote controllers are available as programmable or nonprogrammable. The nonprogrammable controllers provide similar control options to the wireless controller but on a larger controller interface. Programmable controllers typically include options for scheduling, setback, set-point temperature range control, and additional menus for programming and diagnostics of the equipment. Manufacturers’ all local controllers should be able to display any error codes for their connected units. A third-party option at this level can be used by installing the manufacturers’ “thermostat interface” and then installing a smart thermostat by a third-party vender. This could be a very good option for homes, apartments, and smaller offices that want a single controller for multiple units or VRF Systems. Wi-Fi enabled smart thermostats can provide the monitoring and alarming for applications that do not have any technical staff.
Central controllers provide the ability to connect multiple systems to a central point, and some manufacturers incorporate the means to integrate other building equipment, either through analog or digital interlocks or over BACnet if the central controller provides a BACnet client capability. These controllers provide the ability to control and monitor their connected units, either through a built-in interface or via a workstation or remote computer if the controller is added to the building’s IT network or web connected.

Most manufacturers have available building management system (BMS) gateways, typically for BACnet, LON, and Modbus. These gateways can be for systems integration or can be smaller communication cards that are field installed at the terminal unit level. These gateways typically include multiple points per terminal unit and usually provide all the functionality that the end user has at the local controller level.

When web connecting the VRF System, the owner has the ability to use data analytics systems in the cloud to monitor and analyze the VRF System. Advantages of cloud-based systems are their scalability to scale with the systems and buildings owned, and the data storage needed to do in-depth data analytics over a longer time period. On-site Building Automation Systems like those shown in Figure 5 can do the same functions, but the computer and storage requirements can be significant and expensive to maintain. Finding the best fit from smart thermostats to large scale system control and data analytics is important to cover early in the design so that the system meets owner expectations.

**Informative Note:** Service and maintenance personnel should receive manufacturer specific training on the VRF system controls to be qualified to operate and maintain the equipment, which may increase the cost of the maintenance.

**6.8.1 Controls Wiring Layout.** When laying out the wiring, the following should be considered:

- VRF systems typically use two-wire, low-voltage communication wiring to provide digital communication between devices. Consult the manufacturers’ literature to determine the appropriate size and style of wire (e.g., # gage, stranded, shielded).

- Take the necessary steps to protect the digital signal from electronic and/or other interference. The control wire should never be run near or in the same conduit as the electrical power supply.

- VRF systems use digital communication. Always terminate the continuous control wire at a VRF device. Splicing control wiring is strongly discouraged. Splicing communication wiring is known to interfere with the VRF digital communication signal, leading to delays in commissioning the system.

- VRF control architecture is flexible and uses a daisy-chain sequence. These sequences typically connect from upper-level controllers to ODUs, between the ODUs to IDUs, between IDUs to IDUs, and from control devices to IDUs. However, variations on this layout may be permitted. Consult the manufacturer guidelines defining the control wiring architecture.

- The installer has the responsibility to ensure that all communication wiring complies with the applicable codes.
Figure 5 Control System Architecture