



**US Army Corps  
of Engineers®**

# ENGINEERING AND CONSTRUCTION BULLETIN

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**SUBJECT:** UFC 3-410-01 HVAC Systems Change 6 and Variable Refrigerant Flow Criteria Changes

**CATEGORY:** For Information

## 1. References:

- a. Unified Facilities Criteria (UFC) 1-200-02 High Performance and Sustainable Building Requirements
- b. UFC 3-401-01 Mechanical Engineering, with Change 1
- c. UFC 3-410-01, Heating, Ventilating and Air Conditioning Systems, with Change 6
- d. UFC 3-410-02, Lonworks ® Direct Digital Control for HVAC and other Local Building Systems, with Change 1
- e. UFC 4-010-06 Cybersecurity of Facility-Related Control Systems, with Change 1
- f. Unified Facilities Guide Specifications (UFGS) 23 09 00 Instrumentation and Control for HVAC
- g. UFGS 23 09 23.01 Lonworks Direct Digital Control for HVAC and Other Building Control Systems
- h. UFGS 23 09 23.02 BACNet Direct Digital Control for HVAC and Other Building Control Systems

2. **Purpose.** This ECB highlights changes associated with Change 6 of UFC 3-410-01 HVAC Systems and HVAC Controls changes in UFC 3-410-2 Lonworks ® Direct Digital Control for HVAC and other Local Building Systems, with Change 1 and associated specifications, noted below in part 5 of this ECB, for changes related to Variable Refrigerant Flow (VRF).

3. These criteria changes were a result of addressing Criteria Change Requests (CCR), improving direction for the user, and new/updated information applicable to the criteria. All changes applying to all Services, (Army, Navy and Air Force) were approved by the Tri-Service Mechanical Discipline Working Group (DWG).

4. The following points associated with UFC 3-410-01 Change 6 were posted on 2 March 2020. This ECB details the major changes of Change 6. Change 6 involves over forty changes. All of the changes are indicated with the \6\6/ symbol and can be viewed on the Whole Building Design Guide (WBDG) website at the link directly below.

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<https://www.wbdg.org>

a. **Paragraph 1-3 GENERAL BUILDING REQUIREMENTS** has been modified adding the words, “physical security” and “cybersecurity.”

b. **New Paragraph 1-4 CYBERSECURITY** has been added:

“All control systems (including systems separate from a utility monitoring and control system) must be planned, designed, acquired, executed, and maintained in accordance with UFC 4-010-06 and as required by individual Service Implementation Policy.

Cybersecurity is implemented to mitigate vulnerabilities to all DoD real property facility-related control systems to a level that is acceptable to the System Owner and Authorizing Official. UFC 4-010-06 provides requirements for integrating cybersecurity into the design and construction of control systems.”

c. **Paragraph 3-1 HVAC SYSTEM SELECTION AND LIFE CYCLE COST ANALYSIS CONSIDERATIONS** has the following change:

(1) “The designer must develop three energy efficient solutions for each individual energy system and prepare a LCCA to determine the heating and cooling systems, fuel sources and major system components. Designers should follow Appendix E - HVAC Systems Selection Flow Chart for this selection process. \6\ The analysis must conform to the life cycle cost and energy criteria specified in UFC 1-200-02 and 3-401-01 paragraph 2-1.1 Life Cycle Considerations.” /6/

(2) Note associated Appendix E has been modified as well.

d. **New paragraph 3-4 (FOR ARMY PROJECTS ONLY) VENTILATION AIR AND USE OF DOAS**

(1) The Army paragraphs addressing zone sensible cooling remain. Additional paragraphs have been added to have the designer include DOAS as an option according to the outside air humidity conditions and the ventilation rate as stated below. The reason for adding this new wording is to provide another means of humidity control in more humid climates and another method of ventilation design in buildings with higher ventilation requirements. DOAS may be a more life cycle cost effective option; however, in the current Army paragraphs on DOAS the designer does not even have to consider DOAS unless sensible cooling systems are to be used. As such a more life cycle cost effective option may never be realized. In addition some past designs in more humid climate zones were deficient in addressing the latent load. Having DOAS as an option further stresses the need for completely addressing the entire latent load. DOAS also offers possibly an improved way to distribute the ventilation air depending on the space configurations.

(2) “When the 1% occurrence humidity ratio (as documented in the official engineering weather data, or EWD) for the outside air (OA) is greater than the inside cooling load design set-point (78°F, 57.9°F dew-point) humidity ratio, dehumidification of outdoor air is necessary and a

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Dedicated Outdoor Air System (DOAS) must be one of the three solutions included by the designer as described in the Appendix E - HVAC System Selection Flow Chart to address the humidity. Conditioning more humid air to design set points or lower and the associated reheat can result in a DOAS being more Life Cycle Cost Effective (LCCE).

The DOAS must also be one of the three solutions included when the ventilation air for the building is 1000 CFM or greater. When larger volumes of ventilation air are required the DOAS may be more LCCE.

The required DOAS solution must apply to new and renovation projects.

Life cycle cost analyses (LCCA) must be performed to include a DOAS. The calculations must show the Energy Use Index (EUI) for the DOAS as well as the other solutions.

For buildings that may be unoccupied for extended periods of time, a DOAS may be necessary to maintain humidity conditions in the building to avoid mold growth or moisture damage during such time periods. An example building would be a barracks for which the assigned unit deploys. Coordinate with the installation Directorate of Public Works or component equivalent to determine when this is necessary. When this is required, ensure that the DOAS is designed, including capacity and controls, to properly dehumidify the building.

The DOAS coils must be designed to condition OA, occupant and space loads.

An alarm must be included with the HVAC controls that would indicate if the outside air damper failed to open during occupied period.”

(3) A DOAS is required whether or not life cycle cost effective per the following paragraphs (New wording) “A DOAS is required whether or not life cycle cost effective per the following paragraphs” (Existing wording): “When zone sensible cooling systems (e.g. fan coil units, chilled beams, heat pumps, etc.) are employed.....”

(4) Each Service now has its own separate paragraphs on Dedicated Outdoor Air Systems (DOAS).

**e. New paragraph 3-6 SPECIFIC FACILITY-TYPE HVAC REQUIREMENTS, and subparagraph 3-6.1 Facility Air Conditioning Eligibility**

Comfort cooling is not allowed for Army and Air Force for the following facilities unless approved by the AHJ remains unchanged. The Navy has a different view. There is a special stipulation for Army projects that require special cooling for manufacturing or maintenance processes as indicated.

**f. New subparagraph 3-6.11 Fitness Centers**

Now has its own unified UFC, UFC-4-740-02 Fitness Centers.

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**g. New subparagraph 3-6.12 General Purpose Aircraft Hangars**

Existing wording has been deleted and replaced by the direction to follow UFC 4-211-01 Aircraft Maintenance Hangars with Change 1.

**h. New subparagraph 3-6.14 Telecommunications Rooms**

HVAC designs for telecommunications rooms must be in accordance with UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design, with Change 1.

**i. New subparagraph 3-6.17.2 Open Control System Requirements and VRF Systems**

Revised paragraph now reads, “All HVAC control systems, including VRF systems, must meet the requirements of UFGS 23 09 00 and either UFGS 23 09 23.01 or UFGS 23 09 23.02. These specifications require the installation of non-proprietary control networks down to the level of each individual device in the system. As of the publication date for this UFC, all known commercially-available VRF systems rely on a proprietary network with a gateway to provide open protocol interface; this arrangement does not comply with the UFGS requirements for open protocols. UFC 3-410-02 includes a process by which specific systems can be excepted from some of the open protocol requirements and permitted to use proprietary communications between system components with a gateway or interface meeting the open protocol requirements. /6/”

**j. New subparagraph 3-6.17.3 1. Design Requirements for VRF Systems**

Subparagraph now reads, “VRF systems must meet the control system specifications, or the system must be identified for an exception in accordance with UFC 3-410-02.” /6/

**k. New paragraph 3-7.3 ECONOMIZER**

For Army and Air Force the revised wording now reads, “For Army and Air Force projects, water economizer must be used in lieu of air economizers where practicable. The prohibition of air side economizers as stated in this UFC must be followed. /6/” The intent remains the same. The revised wording enables clearer direction for the designer.

**l. New subparagraph 3-7.6.3 Non-Occupied Spaces**

Revised paragraph now reads, “Electric resistance heating is permitted in the following non-occupied spaces where life cycle cost effective:

- In non-occupied spaces in facilities without hot water heating systems.
- Electrical rooms”

**m. New subparagraph 3-7.9 Ground Coupled Heat Pumps, subparagraph Piping**

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(1) New wording added to the second paragraph, “Use reverse return circuits and headers in large well fields. No more than 20 wells may be allowed on a single branch circuit with a maximum of 20% of the total number of wells for an entire system on a single branch circuit.”

(2) The sentence, “No more than 10 wells may be allowed on each header” has been deleted.

**n. New subparagraph 3-7.14.5 Variable Speed Drives**

Revised paragraph now reads, “Variable speed drives on pumps or fans must not be manually or automatically adjusted to achieve system balance. Balance systems to deliver design flows with variable speed drives operating at between 55 and 60 Hz so that maximum operational flexibility is maintained. Design conditions for variable speed drives to exceed 60 Hz is prohibited. Replace or adjust fan drive sheaves and throttle pump discharges to achieve system balance. Consider trimming pump impellers on larger systems. Verify pump performance at minimum and maximum operating points.”

**o. 4-2.2 IMC CHAPTER 2 “DEFINITIONS” SUPPLEMENTS, Section 309 HVAC Control**

(1) **309.4 Minimum Control Points Revised wording:** Provide a control system with at least the minimum points as indicated in Appendix D. Develop point schedules and required naming conventions in accordance with UFC 3-410-02. For Navy projects, provide DDC BACnet® system in accordance with UFC 3-410-02.

(2) Note prior wording, “Users of the ASHRAE's BACnet® protocol should provide” and “Minimum control points for Lonworks® protocol systems are provided in UFC 3-410-02” are now deleted.

(3) **309.5 DDC Accreditation Revised wording:** Provide hardware equipment utilizing the latest technology which will accomplish the desired control and will meet the Risk Management Framework (RMF) plan developed to comply with UFC 4-010-06.

(4) The following wording has been removed, “DoD Information Assurance Certification and Accreditation Process (DIACAP) requirements as described in DoD Instruction 8510.01, DoD Information Assurance Certification and Accreditation Process (DIACAP).”

**p. Revised subparagraph 4-2.4.6 Addition – Section D408 “Equipment Rooms”**

The following wording has replaced all of the existing wording in this paragraph, “D4087.1 Equipment Spaces. All equipment rooms must have exterior access sized to accommodate all maintenance and equipment replacement throughout the life of the building. Incorporate provisions for future equipment removal and replacement. Provide fall protection as required. Hand rails must be removable. Equipment rooms on grade must be provided with door(s) on the building exterior. Equipment rooms above grade must be provided with exterior access that will allow crane or mobile lift access to equipment. Provide fall protection as appropriate. Hand rails must be removable. Coordinate with the Architect on this requirement since it may have

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historical preservation impacts. Equipment rooms below grade must be provided with pit access with floor drains, stairs and exterior double door(s) at a minimum. Provide fall protection as required. Hand rails must be removable. For supplemental mechanical spaces with equipment weighing 125 lbs or less, verify if exterior access is required by the Installation Commander.”

5. UFC 3-410-02 Direct Digital Control for HVAC and Other Building Control Systems requires the use of Open protocols for HVAC systems. Change 1 to UFC 3-410-02, published on 2 March 2020, adds new requirements in Paragraph 2.4 which permit the use of proprietary protocols for specific applications under specific circumstances. These are summarized in this ECB, and fully defined in the UFC. It’s critical to note that use of proprietary protocols remains prohibited except as specifically allowed by the UFC.

**a. Revised paragraph 2.4 Use of Proprietary Networks**

(1) Proprietary networks are now permitted between the two components of a simple split system which consists of a single indoor unit and a single outdoor unit from the same manufacturer.

(2) Proprietary networks are now permitted for multi-split (including variable refrigerant flow) systems under specific conditions defined in the UFC. Of note, these conditions include lower life-cycle cost than at least two (2) alternate solutions not using proprietary networks and the approval of the system as an acceptable option by the receiving system owner. For USACE projects, a UMCS MCX review is also required.

(3) Proprietary networks are now permitted for multiple boilers or multiple chillers operating together. Of note, the units must be co-located in the same room, from the same manufacturer and must operate using a common "plant" sequence of operation which stages the units in a manner that requires operational parameters be shared between them and which cannot be accomplished with a single lead-lag command from a third-party controller.

(4) The specific exceptions defined in this UFC were determined as warranted based on implementation and maintenance considerations, and on industry capabilities to provide solutions meeting open systems requirements and apply only to the indicated systems. For all other systems, the use of multiple devices communicating on a proprietary networks requires a waiver from UFC requirements.

(5) To suggest additional systems for consideration for establishing exception procedures, submit a Criteria Change Request (CCR) to this UFC.

6. UFGS 23 09 00 Instrumentation and Control for HVAC, UFGS 23 09 23.01 Lonworks Direct Digital Control for HVAC and Other Building Control Systems and UFGS 23 09 23.02 BACnet Direct Digital Control for HVAC and Other Building Control Systems have been revised to accommodate these new exceptions and requirements.

**a. UFGS 23 09 00: A new subpart (1.1.2)** has been added which defines installation requirement for the three situations where proprietary networks are permitted, and which includes a table where the designer can indicate any systems which have been permitted to use

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proprietary networks in accordance with the UFC. A new submittal has been added for delivery of the engineering tool software associated with the proprietary network.

b. **UFGS 23 09 23.01 and UFGS 23 09 23.02: Gateway requirements in (subpart 3.1.5)** have been revised and a note has been added to clarify that the intent is to only allow the use of gateways to packaged equipment controllers which were not procured under the scope of the same project the specification is used for and not to allow the installation of a proprietary network.

7. **Point of Contact.** HQUSACE point of contact for this ECB is Timothy Gordon, CECW-EC, 202-761-4125.

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CHRISTINE T. ALTENDORF, P.E., PHD, SES  
Chief, Engineering and Construction  
U.S. Army Corps of Engineers