
USACE / NAVFAC / AFCEA / NASA UFGS-23 01 30.41 (August 2010)

Preparing Activity: NASA New

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in Agreement with UMRL dated July 2010

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08/10

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SECTION 23 01 30.41

HVAC SYSTEM CLEANING 08/10

NOTE: This guide specification covers the requirements for cleaning of HVAC systems, including applicable industry standards, qualifications of cleaning contractor, cleaning methodology, and performance verification.

Do not use this specification for Army projects. Coordinate Indoor Air Quality related issues with the HVAC Directory of Expertise at the Huntsville Engineering and Support Center prior to engaging in remediation efforts.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 62.1 (2007; Errata 2007; Errata 2008; Addenda a, b, e, f, h 2008; Errata 2009; Errata 2010) Ventilation for Acceptable Indoor Air Quality

NATIONAL AIR DUCT CLEANERS ASSOCIATION (NADCA)

ACR (2006) Standard for Assessment, Cleaning, and Restoration of HVAC Systems

NADCA HVAC Inspection Manual (2005) Procedures for Assessing the Cleanliness of Commercial HVAC Systems

NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION (NAIMA)

NAIMA AH112 (1993) Cleaning Fibrous Glass or Lined Sheet Metal Ducts

NAIMA AH122 (2006) Cleaning Fibrous Insulated Duct Systems - Recommended Practices

NAIMA AH127 (1999) Impact of Duct Cleaning on Internal Duct Insulation

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1966 (2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2008) Safety and Health Requirements Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 402-C-01-001 (2001) IAQ Building Education and

Assessment Tool (I-BEAM)

EPA 402-F-91-102

(1991) Building Air Quality: A Guide for
Building Owners and Facility Managers

UNDERWRITERS LABORATORIES (UL)

UL 181

(2005; R 2008) Factory-Made Air Ducts and
Air Connectors

UL 181A

(2008e5) Standard for Closure Systems for
Use with Rigid Air Ducts and Air Connectors

UL 181B

(2008e5) Standard for Closure Systems for
Use with Flexible Air Ducts and Air
Connectors

1.2 DEFINITIONS

1.2.1 NADCA Standards

Perform the services specified here in accordance with the current
published standards of the National Air Duct Cleaners Association (ACR and
NADCA HVAC Inspection Manual).

- a. All terms in this specification are defined as stated in the NADCA
Standards.
- b. Follow NADCA Standards without modification or deviation.

1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions
in Section 01 33 00 SUBMITTAL PROCEDURES and edit
the following list to reflect only the submittals
required for the project. Submittals should be kept
to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the
submittal requires Government approval. Some
submittals are already marked with a "G". Only
delete an existing "G" if the submittal item is not
complex and can be reviewed through the Contractor's
Quality Control system. Only add a "G" if the
submittal is sufficiently important or complex in
context of the project.

For submittals requiring Government approval on Army
projects, a code of up to three characters within
the submittal tags may be used following the "G"
designation to indicate the approving authority.
Codes for Army projects using the Resident
Management System (RMS) are: "AE" for
Architect-Engineer; "DO" for District Office
(Engineering Division or other organization in the
District Office); "AO" for Area Office; "RO" for
Resident Office; and "PO" for Project Office. Codes
following the "G" typically are not used for Navy,

Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force
and NASA projects, or choose the second bracketed
item for Army projects.

Government approval is required for submittals with a "G" designation;
submittals not having a "G" designation are [for Contractor Quality Control
approval.][for information only. When used, a designation following the
"G" designation identifies the office that will review the submittal for
the Government.] Submit the following in accordance with Section 01 33 00
SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Record of Existing Conditions[; G][; G, [_____]]

Coordination Plan[; G][; G, [_____]]

NADCA Firm[; G][; G, [_____]]

Designation of NADCA Team Assistants[; G][; G, [_____]]

Designation of NADCA Air System Cleaning Specialist (ASCS)[; G][;
G, [_____]]

Designation of NADCA Supervisor Qualifications[; G][; G, [_____]]

Records of Experience in the Field of HVAC System Cleaning[; G][;
G, [_____]]

NADCA Work Execution Schedule[; G][; G, [_____]]

SD-06 Test Reports

Testing Procedures Summary[; G][; G, [_____]]

Gravimetric Analysis[; G][; G, [_____]]

Post-Project Report[; G][; G, [_____]]

1.4 QUALITY ASSURANCE

1.4.1 NADCA Firm

To secure approval for the proposed agency, submit information certifying
that the NADCA firm is a first tier subcontractor who is not affiliated
with any other company participating in work on this contract, including
furnishing equipment. Further, submit the following, for the firm, to
Contracting Officer for approval:

a. Independent NADCA firm:

NADCA Firm: NADCA registration number and expiration date of current
certification;

NADCA Supervisor Qualifications: Name and copy of NADCA supervisor
certificate and expiration date of current certification.

NADCA Air System Cleaning Specialist (ASCS): Name and documented evidence that the team field leader has satisfactorily performed full-time supervision of HVAC cleaning work in the field for not less than 3 years immediately preceding this contract's bid opening date.

NADCA Team Assistants: Names and documented evidence that each field technician has satisfactorily assisted a NADCA team field leader in performance of HVAC cleaning work in the field for not less than one year immediately preceding this contract's bid opening date.

Current Certificates: Registrations and certifications are current, and valid for the duration of this contract. Renew Certifications which expire prior to completion of the HVAC cleaning work, in a timely manner so that there is no lapse in registration or certification. NADCA agency or NADCA team personnel without a current registration or current certification are not to perform HVAC cleaning work on this contract.

- b. **TAB Team Members:** NADCA team approved to accomplish work on this contract are full-time employees of the NADCA firm. No other personnel is allowed to do HVAC cleaning work on this contract.
- c. **Replacement of NADCA Team Members:** Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Contracting Officer.

1.4.2 Experience

Submit **records of experience in the field of HVAC system cleaning**. Bids will only be considered from firms which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.

1.4.3 Equipment, Materials and Labor

Possess and furnish all necessary equipment, materials and labor to adequately perform the specified services and comply with the applicable provisions of NADCA General Specifications for the Cleaning of Commercial HVAC Systems and **ASHRAE 62.1**.

- a. Assure that all employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and Material Safety Data Sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A., comply with applicable national safety codes and standards.
- b. Maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification.
- c. Submit all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process, including all VOC ratings.

[1.4.4 Licensing

NOTE: If specific state or territorial licensing requirements are specified in Division 00, delete the following paragraph.

Provide proof of maintaining the proper license(s), if any, as required to do work in [____][the state of[____]]. Comply with all Federal, state and local rules, regulations, and licensing requirements.

]1.5 STANDARDS

1.5.1 NADCA Standards

Perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (ACR and NADCA HVAC Inspection Manual).

- a. All terms in this specification have their meaning defined as stated in the NADCA Standards.
- b. Follow NADCA Standards with no modifications or deviations being allowed.

1.6 DOCUMENTS

1.6.1 Mechanical Drawings

Obtain one copy of the following documents:

- a. Project drawings and specifications
- b. Approved construction revisions pertaining to the HVAC system
- c. Any existing indoor air quality (IAQ) assessments or environmental reports prepared for the facility.

Submit a NADCA Work Execution Schedule to the Contracting Officer within [10] [____] working days of the contract award.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 SCOPE OF WORK

3.1.1 Scope

This section defines the **minimum** requirements necessary to render HVAC components clean, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards. Conform all inspection work to NADCA HVAC Inspection Manual.

Remove visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.

The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. The return air grilles, return air ducts (except ceiling plenums and mechanical room) to the air handling unit (AHU), the interior surfaces of the AHU, mixing box, coil compartment, condensate drain pans, humidifiers and dehumidifiers, supply air ducts, fans, fan housing, fan blades, air wash systems, spray eliminators, turning vanes, filters, filter housings, reheat coils, and supply diffusers are all considered part of the HVAC system. The HVAC system may also include other components such as dedicated exhaust and ventilation components and make-up air systems.

Note: Modify the above paragraph to succinctly and specifically define those systems and components requiring cleaning.

3.2 HVAC SYSTEM INSPECTIONS AND SITE PREPARATIONS

3.2.1 HVAC System Evaluation

Prior to the commencement of any cleaning work, perform a visual inspection of the HVAC system in the presence of the Contracting Officer to determine appropriate methods, tools, and equipment required to satisfactorily complete this project. Notify the Contracting Officer [____][10] days prior to the planned inspection.

Document damaged system components found during the inspection and submit to the Contracting Officer, clearly labeled "[Record of Existing Conditions](#)."

3.2.2 Site Evaluation and Preparations

Conduct a site evaluation, and establish a specific, [coordination plan](#) which details how each area of the building will be protected during the various phases of the project.

3.3 GENERAL HVAC SYSTEM CLEANING REQUIREMENTS

3.3.1 Containment

Collect debris removed during cleaning and take precautions to ensure that debris is not otherwise dispersed outside the HVAC system during the cleaning process.

3.3.2 Particulate Collection

Where the Particulate Collection Equipment (PCE) is exhausting inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or greater). When the PCE is exhausting outside the building, undertake Mechanical Cleaning operations only with PCE, including adequate filtration to contain Debris removed from the HVAC system. When the PCE is exhausting outside the building, take precautions to locate the equipment down wind and away from all air intakes and other points of entry into the building.

3.3.3 Controlling Odors

Take all reasonable measures to control offensive odors and/or mist vapors during the cleaning process.

3.3.4 Component Cleaning

Employ cleaning methods such that all HVAC system components are Visibly Clean as defined in applicable standards. Upon completion, return all components to those settings recorded just prior to cleaning operations.

3.3.5 Air-Volume Control Devices

Mark the position of dampers and any air-directional mechanical devices inside the HVAC system prior to cleaning and, upon completion, restore to their marked position.

3.3.6 Service Openings

Utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection. Utilize the existing service openings already installed in the HVAC system where possible.

Create other openings where needed, created and resealed in conformance with NADCA Standard 05. Place closures so they do not significantly hinder, restrict, alter the air-flow within the system, or compromise the structural integrity of the system. Properly insulate closures to prevent heat loss/gain or condensation on surfaces within the system. Conform construction techniques used in the creation of openings to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards. Cutting service openings into flexible duct is not permitted. Disconnect flexible duct at the ends as needed for proper cleaning and inspection.

Reseal rigid fiber glass ductboard duct systems in accordance with NAIMA recommended practices; [NAIMA AH112](#), [NAIMA AH122](#), and [NAIMA AH127](#). Only closure techniques which comply with [UL 181](#), [UL 181A](#), or [UL 181B](#) are suitable for fiber glass duct system closures.

Clearly mark all service openings, capable of being re-opened for future inspection or remediation, and report their location in project report documents.

3.3.7 Ceiling Sections (Tile)

Carefully remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process. Replace any damaged ceiling sections caused by the removal at no cost to the Government.

3.3.8 Air Distribution Devices (Registers, Grilles and Diffusers)

Clean all air distribution devices.

3.3.9 Air Handling Units, Terminal Units, Blowers and Exhaust Fans

Insure that supply, return, and exhaust fans and blowers are thoroughly cleaned. Areas to be cleaned include blowers, fan housings, plenums (except ceiling supply and return plenums), scrolls, blades, or vanes,

shafts, baffles, dampers and drive assemblies. Remove all visible surface contamination deposits in accordance with NADCA Standards.

- a. Clean all air handling unit (AHU) internal surfaces, components and condensate collectors and drains.
- b. Assure that a suitable operative drainage system is in place prior to beginning wash down procedures.
- c. Clean all coils and related components, including evaporator fins.

3.3.10 Duct Systems

- a. Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas.
- b. Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Testings NADCA Standards.

3.4 HEALTH AND SAFETY

3.4.1 Safety Standards

Comply with all applicable federal, state, and local requirements for protecting the safety of the contractors' employees, building occupants, and the environment. In particular, follow all applicable standards of the Occupational Safety and Health Administration (OSHA) when working in accordance with this specification[, and [EM 385-1-1](#)].

3.4.2 Occupant Safety

Employ no processes or materials in such a manner that they will introduce additional hazards into occupied spaces.

3.4.3 Disposal of Debris

Dispose of all debris removed from the HVAC System in accordance with applicable federal, state and local requirements.

3.5 MECHANICAL CLEANING METHODOLOGY

3.5.1 Source Removal Cleaning Methods

Clean the HVAC system using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. Select Source Removal methods which will render the HVAC System Visibly Clean and capable of passing cleaning verification methods NADCA Standards and other specified standards and tests, in accordance with all general requirements. Use no cleaning method, or combination of methods, which could potentially damage components of the HVAC system or negatively alter the integrity of the system.

Incorporate the use of vacuum collection devices that are operated continuously during cleaning for all methods used. Connect a vacuum device to the downstream end of the section being cleaned through a predetermined opening. Use a vacuum collection device of sufficient power to render all areas being cleaned under negative pressure, such that containment of

debris and the protection of the indoor environment is assured.

Equip all vacuum devices exhausting air inside the building, including hand-held vacuums and wet-vacuums, with HEPA filters (minimum efficiency).

Equip all vacuum devices exhausting air outside the facility with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system, in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors which violates any outdoor environmental standards, codes or regulations is not allowed.

All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

3.5.2 Methods of Cleaning Fibrous Glass Insulated Components

Thoroughly clean glass thermal or acoustical insulation elements present in any equipment or ductwork with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

Do not use cleaning methods which cause damage to fibrous glass components or which will render the system capable of passing Cleaning Verification Tests NADCA Standards).

3.5.3 Damaged Fibrous Glass Material

If there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, identify them for replacement.

When requested or specified, be capable of remediating exposed damaged insulation in air handlers and/or ductwork requiring replacement.

3.5.4 Replacement Material

If replacement of fiber glass materials is required, conform all materials to applicable industry codes and standards, including those of UL and [SMACNA 1966](#).

Replacement of damaged insulation is **not** covered by this specification.

3.5.5 Cleaning of Coils

Use any cleaning method which will render the Coil Visibly Clean and capable of passing Coil Cleaning Verification applicable NADCA Standards. Coil drain pans are subject to Non-Porous Surfaces Cleaning Verification. Maintain operability of the drain for the condensate at all times. Do not damage, displace, inhibit heat transfer, or cause erosion of the coil surface or fins, and conform to coil manufacturer recommendations when available. Thoroughly rinse coils with clean water to remove any latent residues.

3.5.6 Antimicrobial Agents and Coatings

Only apply antimicrobial agents if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.

Perform application of any antimicrobial agents used to control the growth of fungal or bacteriological contaminants after the removal of surface deposits and debris.

Use only antimicrobial agents registered by the U.S. Environmental Protection Agency (EPA 402-F-91-102)(EPA 402-C-01-001) specifically for use within HVAC system.

Apply antimicrobial agents in strict accordance with manufacturer's instructions.

Use only antimicrobial coating products, for both porous and non-porous surfaces, which are EPA registered, water soluble solutions with supporting efficacy data and MSDS records.

Apply antimicrobial coatings according to manufacturer's instructions. Spray coatings directly onto interior ductwork surfaces, rather than "fog" downstream onto surfaces. Achieve a continuous film on the surface to be treated by the coating application, and apply in strict accordance with manufacturer's minimum millage surface application rate standards for effectiveness.

3.6 CLEANLINESS VERIFICATION

3.6.1 General

Verification of HVAC System cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including antimicrobial agents and coatings.

3.6.2 Visual Inspection

Visually inspect the HVAC system to ensure that no visible contaminants are present.

If no contaminants are evident through visual inspection, consider the HVAC system clean; however, further verification of the system cleanliness through gravimetric or wipe testing analysis testing may be requested at the discretion of the Contracting Officer, as specified herein.

If visible contaminants are evident through visual inspection, re-clean those portions of the system where contaminants are visible, and subject to re-inspection for cleanliness.

[3.6.3 Gravimetric Analysis

At the expense of the **Contractor**, test sections of the HVAC system for cleanliness using the NADCA Vacuum Test (gravimetric analysis) as specified in applicable NADCA Standards. Levels of debris collected are to be equal to or less than acceptable levels defined in applicable NADCA Standards.

If gravimetric analysis determines that levels of debris are equal to or

lower than those levels specified, the system is considered clean and to have passed cleanliness verification.

If gravimetric analysis determines that levels of debris exceed those specified in applicable NADCA standards, the system will not be considered clean, and re-cleaning of those sections of the system which failed cleanliness verification will be required at the expense of the HVAC system cleaning contractor.

Perform cleanliness verification immediately after mechanical cleaning and before the HVAC system is restored to normal operation.

13.6.4 Verification of Coil Cleaning

Cleaning is to restore the coil pressure drop to within 10 percent of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean only if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection (see [NADCA HVAC Inspection Manual](#) Standards).

3.7 POST-PROJECT REPORT

At the conclusion of the project, provide a [Testing Procedures Summary](#) and [Post-Project Report](#) indicating the following:

- a. Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.
- b. Areas of the system found to be damaged and/or in need of repair.

-- End of Section --