

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Provide labor, materials, equipment, and other items necessary to remove the accumulation of dust, dirt, and/or foreign matter from the supply and return air systems described below. The surfaces shall be left in a clean, dry, and odorless condition.
- B. Qualification of the HVAC System Cleaning Contractor
 - 1. Membership: The HVAC system cleaning Contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA), or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.
 - 2. Certification: The HVAC system cleaning Contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full-time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.
 - 3. Supervisor Qualifications: A person certified as an ASCS by NADCA, or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.
 - 4. Experience: The HVAC system cleaning Contractor shall submit records of experience in the field of HVAC system cleaning as requested by the Owner. Bids shall only be considered from firms, which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.
 - 5. Equipment, Materials and Labor: The HVAC system cleaning Contractor shall possess and furnish all necessary equipment, materials and labor to adequately perform the specified services.
 - a. The Contractor shall assure that its 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., Contractors should comply with applicable national safety codes and standards.
 - b. The Contractor shall 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. Contractor shall submit to the Owner all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.
 - 6. Licensing: The HVAC system cleaning Contractor shall provide proof of maintaining the proper license(s), if any, as required to do the work in this state. Contractor shall comply with all Federal, state and local rules, regulations, and licensing requirements.
- C. Applicable Standards and Publications: The following current standards and publications of the issues currently in effect form a part of this specification to the extent indicated by any reference thereto and shall be the current version adopted by the Authority Having Jurisdiction:

1. National Air Duct Cleaners Association (NADCA): NADCA 1992-01, "Mechanical Cleaning of Non-Porous Air Conveyance System Components," 1992.
2. National Air Duct Cleaners Association (NADCA): "Understanding Microbial Contamination in HVAC Systems," 1996.
3. National Air Duct Cleaners Association (NADCA): "Introduction to HVAC System Cleaning Services," 1995.
4. National Air Duct Cleaners Association (NADCA): NADCA Standard 05 "Requirements for the Installation of Service Openings in HVAC Systems," 1997.
5. Underwriters' Laboratories (UL): UL Standard 181.
6. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62-89, "Ventilation for Acceptable Indoor Air Quality."
7. Environmental Protection Agency (EPA): "Building Air Quality," December, 1991.
8. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): "HVAC Duct Construction Standards – Metal and Flexible," 1985.
9. North American Insulation Manufacturers Association (NAIMA): "Cleaning Fibrous Glass Insulated Air Duct Systems," 1993.
10. NADCA Standards: The HVAC system cleaning Contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA).
 - a. All terms in this specification shall have their meaning defined as stated in the NADCA Standards.
 - b. NADCA Standards must be followed with no modifications or deviations being allowed.

D. Site Inspection and Drawings:

1. It shall be the responsibility of each prospective bidder to inspect the building and available plans.
2. The available plans are the original building construction drawings. These drawings are for reference only and do reflect the present remodeled condition of the systems. It is the bidder's responsibility, prior to bidding, to inspect the existing systems and to determine the full extent of work to be done to fulfill the requirements described herein. See NADCA specifications 2.02.

- E. Protection of Building Contents: The bidder is advised that this building is occupied 24 hours with patients, staff, delicate instruments, and materials that are sensitive to contamination and damage from dust. The selected firm shall exercise extreme care to prevent the escape of dust from the duct system into the occupied space during this contract. This includes providing temporary filter media at all air outlets until dislodged particles are no longer present in the system.
- F. Hot Work: Use of torches, welders, and other equipment that produce high temperatures is not permitted without the permission of the Owner and in accordance with codes and regulations, including the Seattle Fire Department permits as required.
- G. Time of Work: All work shall be performed at times that are agreeable to the Owner and normal operations of the system shall not be interrupted except with written permission from the Owner. The majority of work can be scheduled between the hours of 8 p.m. and 6 a.m. daily. At the end of each shift, the building shall be left in the same condition for use as it was prior to that shift's start of work.

H. Special Requirements: The University of Washington Medical Center has these additional special requirements:

1. Do not block fire doors with hoses or equipment.
2. [] has a non-smoking policy.
3. Maintain a clean environment.
4. Install micro-mat media in supply diffusers before opening supply dampers, after cleaning.
5. Remove micro-mat media 24 hours later.
6. [] is responsible for asbestos issues. Vendor is to report any suspected asbestos issues to []. Work areas will be checked for asbestos prior to work and abated if required.
7. Do both exhaust and supply ductwork.
8. Keep noise to a minimum.
9. At []'s option, some work may need to be done in evening hours.
10. [] may require two or three areas cleaned during the same work period.

1.2 DESCRIPTION OF WORK

A. Perform cleaning of heating, ventilating and air-conditioning (HVAC) systems and ductwork and provide all required accessories, blank-offs, ladders, and protective materials required to perform the work. 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. Cleaning of HVAC systems shall include the following:

1. Removal and disposal of visible dirt and debris from duct systems, fans, and air-handling units using air-pressure washers, water-pressure washers, vacuuming, and sanitation of all surfaces.
2. Coordination of all activities.
3. Ceiling removal, reinstallation, and clean-up.
4. Testing, reporting, and product submittals.

1.3 HVAC SYSTEM INSPECTIONS AND SITE PREPARATIONS

A. HVAC System Evaluation: Prior to the commencement of any cleaning work, the HVAC system cleaning Contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project.

1. Damaged system components found during the inspection shall be documented and brought to the attention of the Owner.

B. Site Evaluation and Preparations: Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.

1.4 OWNER'S USE OF SPACE

- A. All work shall be accomplished with a minimum of interruption to Owner's operation within the building. All work by the cleaning contractor shall be coordinated with the Owner's representatives.
- B. In the event HVAC systems provide space heating/cooling, the duration of system shut-downs must be limited.

1.5 COORDINATION OF WORK

- A. Cleaning contractor shall submit a cleaning work schedule for each HVAC unit/duct system to the Owner's Designated Representative a minimum of four weeks prior to beginning work. The schedule shall indicate dates, times and activities for each phase or portion of the work. In addition, this schedule shall describe in detail what systems, fans, and HVAC equipment will be affected (no air flow) and what rooms, spaces or areas will require access. Also, include all procedures proposed for the project.
- B. All work activities shall be coordinated with all other trades and contractors.
- C. Cleaning activities shall not occur until all other construction activities are complete, except for testing and balancing (TAB) activities, in which case TAB activities shall be performed after acceptance of cleaning activities.
- D. The switching off and on of any HVAC unit must be prearranged and prescheduled with the Owner's Designated Representative.
- E. After cleaning a section of duct, air-handling system, and equipment has been completed, the cleaning contractor shall contact the Owner's Designated Representative, who shall perform a visual inspection of the completed work and approve the completed work before the cleaning contractor proceeds to the next phase of the cleaning project. The cleaning contractor shall provide all ladders, lighting, and fiber-optic baroscope required to permit the Owner's representative to inspect all portions of the project.

1.6 QUALITY ASSURANCE

- A. All work in this section shall be performed by an independent specialty HVAC duct-cleaning contractor. Submit information indicating qualifications and experience.
- B. A project closing report shall be submitted upon completion of the entire cleaning project. This report shall include a dated summary of the duct systems and HVAC unit inspections and approvals by the Owner's Designated Representative. Project closing report shall be bound, neatly presented, and organized according to HVAC unit, duct system or fan. Also include photographic documentation (minimum 3" x 5", 35 mm, color prints) of before and after conditions of each system component and duct section.
- C. All work activities shall be performed in accordance with local, state and federal codes, including OSHA confined space entry regulations.
- D. All proposed cleaning agents, including biocides, sanitizing fluids, detergents, and degreasers, shall be approved in writing by the Owner's representative prior to delivery of materials on-site.

1.7 SUBMITTALS

- A. Qualifications, Schedules and Reports to be Submitted:
 - 1. Qualification and experience documentation
 - 2. Project schedule and procedures
 - 3. Final report (3 copies)
- B. Product Data: Submit manufacturers' data sheets, including Material Safety Data Sheets (MSDS), if applicable, for the following:
 - 1. Air-tight plastic closure plugs
 - 2. Vacuum cleaning machines, air compressors, pressure washers, and/or cleaning-related equipment and accessories
 - 3. Biocide sanitizing fluid, coil-cleaning solutions, degreasers, encapsulants
 - 4. Duct access doors/access panels
 - 5. Labels
- C. As-Built Drawings: Upon completion of the project, submit one set of red-marked duct layout drawings showing the location of all new access holes and openings installed in the duct systems to accommodate the cleaning process.

1.8 DOCUMENTS

- A. Mechanical Drawings: The Owner shall provide the HVAC system cleaning Contractor with one copy of the following documents:
 - 1. Project drawings and specifications
 - 2. Approved construction revisions pertaining to the HVAC system
 - 3. Any existing indoor air quality (IAQ) assessments or environmental reports prepared for the facility.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Vacuum Collection Machine:
 - 1. Portable vacuum-cleaning machine designed for duct cleaning mounted on wheels
 - 2. Filter section with filter bags and final HEPA exhaust filtration
 - 3. Anti-spark construction, made of all non-ferrous material
 - 4. Fan shall have a minimum of 4,000 CFM at 1.5" static pressure
 - 5. Unit shall maintain a minimum 1-inch S.P. on duct at all times
- B. Air Compressor:
 - 1. Portable-air compressor unit consisting of compressors, tanks, and controls ASME rated.
 - 2. Minimum capacity: 17 CFM free air at 175 psi.
 - 3. Accessories: hoses and velocity nozzles
- C. Water-Pressure Washer:

1. Portable hot-water pressure washer consisting of electric pumps, heaters, detergent metering device, and pressure-relief valve.
2. Minimum capacity: 2 GPM at 700 psig
3. Accessories: temperature-, chemical- and oil-resistant hoses, trigger control gun
4. Connect to hot-water source, verify source temperature, pressure and flow

PART 3 – EXECUTION

3.1 GENERAL

- A. The specific air or water pressure selected by the contractor for air or water washing of various HVAC system components shall be appropriate to the system and component being washed. Water pressure utilized shall not exceed 1000 psig.
- B. Contractor shall repair or replace any system component damaged as a result of using excessive air or water pressure.
- C. The fin elements of all reheat, heating, and cooling coils shall be combed to restore the fin elements to their original alignment prior to cleaning.
- D. The contractor shall repair or replace any building component, including, but not limited to, ceiling grids/tiles, light fixtures, walls, and flooring damaged or soiled as a result of activities associated with cleaning.
- E. Contractor shall be responsible for providing and connecting to appropriate electrical and water/waste sources and wiring for vacuum cleaning, air compressor pressure wash units, and all other equipment.
- F. Adequately protect or disable all duct- or AHU-mounted sensing devices, actuators, and detectors as required for cleaning and return to original condition when completed.

3.2 GENERAL CEILING ACCESS DIRECTIVES

- A. Spray top of ceiling panels to be removed, and surrounding affected panels, with fine water mist to settle dust prior to removal.
- B. Inform Head Nurse or department manager so that patient room doors near ceiling work will be kept closed while the work is in progress.
- C. Owner's representative shall be contacted for all ceiling access problems.

3.3 DUCT SYSTEMS

- A. Work Area Preparation:
 1. Each work area shall be protected with fire retardant polyethylene plastic sheet. Protective sheet shall cover all furniture in each room of the work area. "Furniture," in the case of laboratory rooms, shall include all laboratory benches, fume hoods, desks, and related laboratory equipment. Upon completion of the duct system cleaning in each work area, protective sheeting shall be carefully removed with collected dirt and debris disposed of in an approved manner. Vacuum-clean floors and other areas in each room, restoring each room to its original clean condition.

2. Suitably support and brace all ductwork that will be entered by personnel for cleaning, if deemed necessary by cleaning contractor and Owner's designated representative.

B. Cleaning Operation:

1. Isolate duct section to be worked upon, by using protective seal barriers within the ductwork, to prevent loose dirt and debris from migrating to cleaned sections of the duct system.
 - a. Fiberglass filter media or equivalent media such as cheesecloth may be temporarily fitted over each register, grille and diffuser in the duct system to intercept any migrating loose dirt and debris.
 - b. Grilles or diffusers near, or which can in any way affect, areas housing "at-risk" patients with suppressed immune systems shall be temporarily fitted with HEPA filters.
2. Provide round cleaning access holes (1-1/4-inches diameter or less) and rectangular access/inspection openings (22 inches x 22 inches maximum size) at predetermined and selected locations in each duct system as required to accomplish the cleaning operation.
 - a. The location of each access hole or opening shall be shown and identified in a red-marked blueline print set of the duct system layout drawings.
 - 1) Location of access holes and openings shall be approved by the owner's designated representative.
 - 2) Existing duct access panels shall be used wherever possible.
 - b. Upon completion of the cleaning operation, the round access openings shall be plugged air-tight with plastic caps designed for this purpose.
 - c. The rectangular access openings shall be closed using an overlapping galvanized sheet-metal (or material to match existing ductwork) cover (cross broken) of the same gauge thickness as existing duct. Rectangular cover shall be fastened using self-tapping sheet-metal screws with a silicone bead sealing gasket; or 3M No. 1202-T sealant tape used as a sealing gasket, at perimeter of cover. Seal all joints air-tight.
 - d. Where ducts are provided with exterior insulation, neatly cut and remove insulation as required to accommodate required duct access holes and openings. When complete, reinsulate all ducts at access points and install new vapor barriers to match existing.
3. Visually inspect the duct interior prior to cleaning each duct section. Use a fiber-optic baroscope to accomplish the inspection. Ask for all smaller ducts not otherwise accessible. Include this data in the Project Closing Report.
4. Wash and vacuum-clean each duct section:
 - a. Lined Ducts: Air-pressure wash and vacuum or rotary brush and vacuum in accordance with NAIMA-recommended practice 1993.
 - b. Unlined Ducts: Air-pressure wash and vacuum or rotary brush and vacuum or water pressure wash and vacuum.
5. Visually inspect each duct section, using a baroscope where necessary, to ensure the duct section is vacuumed clean.

6. Upon completion of the cleaning of each duct section, treat the interior surfaces of the duct section with a fine mist EPA-approved broad-spectrum biocide sanitizing fluid. The biocide sanitizing fluid shall be perfumed to conceal the basic medicinal phenolic odor of the fluid.
 - a. Copper 8 Quinolinolate fungicide shall be used to treat ductwork that supplies areas inhabited by "at-risk" patients with suppressed immune systems.
 - b. Touch Coat encapsulating sealant shall be applied to lined ductwork that supplies areas inhabited by "at-risk" patients with suppressed immune systems.
7. All registers, grilles and diffusers shall be removed, vacuum-cleaned, washed and then remounted.
8. Terminal Reheat Coils Cleaning:
 - a. Attach a temporary water-collection pan below the coil and duct.
 - b. Access openings shall be made upstream and downstream of each reheat coil as deemed necessary by the cleaning contractor.
 - c. Where deemed necessary by the cleaning contractor, isolate the reheat coil from the duct system by installing temporary protective barriers upstream and downstream from the coil to prevent migration of wash water into the duct system.
 - d. Pressure-wash upstream and downstream faces of each reheat coil, using an EPA-approved cleansing agent. Rinse thoroughly to remove any residual dirt and cleansing agent.
 - e. Vacuum water from all surfaces of coil and adjacent ductwork.
9. After duct section and reheat coils have been completely cleaned and sanitized, a final visual inspection, using a fiber-optic baroscope as required, shall be accomplished with the owner's designated representative. Include this data in the Project Closing Report.
10. Repeat the cleaning process described above for succeeding duct sections until the entire duct system is completely clean.

3.4 HVAC UNITS (Existing)

A. Work Area Preparation:

1. Isolate HVAC unit housing from adjacent equipment and building room surfaces with polyethylene sheet.
2. Protect all motors, bearing assemblies, and belt drive assemblies within the HVAC unit housing with taped-on polyethylene sheet to prevent intrusion of potentially damaging wash water.
3. Carefully remove filters/filter media from holding frames and/or spools in an approved manner and store filters and protect from damage. Reinstall filters and filter media after cleaning operation is complete in accordance with filter manufacturers' instructions to insure a leak-free installation. Do not restart fans until all filters have been reinstalled and inspected by owner representative.

B. Cleaning Operation:

1. Vacuum-clean entire internal space of HVAC unit, including each component, component supports, frames, mounts, etc. contained therein, to remove loose dirt and debris.

2. Pressure-wash or hand-wash, using an approved cleansing agent, each HVAC unit. This shall include all the internal surfaces except interior lining and sound attenuator units of the HVAC unit housing and all the internal components of the HVAC unit, including fans, cooling and heating coil banks, filter back support frames, and control damper assemblies.
 - a. Where deemed necessary by the cleaning contractor, cleansing agent solution may be separately applied prior to pressure wash.
 - b. Hand-scrub where required to remove all residual dirt.
 - c. Rinse thoroughly with clear water to remove any residual dirt and cleansing agent.
3. Pressure-washing of the heating and cooling coil banks shall be accomplished at both the upstream and downstream faces of the coils.
4. Fan casings and impeller wheels shall be cleaned on all surfaces, inside and outside.
5. Vacuum-clean all washed surfaces. Remove all standing water. Vacuum-collected wash water shall be disposed of outside of the HVAC unit.
6. After all cleaned surfaces have dried, treat all surfaces within the HVAC unit housing with a fine mist EPA-approved broad-spectrum biocide sanitizing fluid. The biocide sanitizing fluid shall be perfumed to conceal the basic medicinal phenolic odor of the fluid.
7. A visual inspection of the HVAC unit, including all of its internal components, shall be performed by the owner's designated representative together with the cleaning contractor.

3.5 FINAL PURGE

A. Work Area Preparation:

1. Cover all terminal air outlets (diffusers, registers, grilles, etc.) with cheesecloth, as needed. Tape cloth to terminal device frame to eliminate air leakage.
2. Terminal outlets near, or that can affect, areas housing "at-risk" patients with suppressed immune systems shall be covered with HEPA filters.

B. Purge Procedure:

1. Inform Owner's designated representative that outlets have been covered with cheesecloth or HEPA filters where required.
2. Insure all filters have been properly installed.

C. Start switch units and, in the event of variable speed/volume systems, operate unit up and down between low and high speed to dislodge dirt and debris. Perform purge operation continuously for a minimum of 30 minutes.

D. Cleanup:

1. Remove cheesecloth or other temporary filter from air terminal outlets, and wash and dry outlet frame with approved cleaning solution to remove adhesive residue.
2. Vacuum and clean all areas and restore to original condition.

3.6 HEALTH AND SAFETY

- A. **Safety Standards:** Cleaning Contractors shall comply with all applicable federal, state, and local requirements for protecting the safety of the Contractor's employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.
- B. **Occupant Safety:** No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.
- C. **Disposal of Debris:** All Debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state and local requirements.

3.7 CLEANLINESS VERIFICATION

- A. **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 biocidal agents and coatings.
- B. **Visual Inspection:** The HVAC system shall be inspected visually to ensure that no visible contaminants are present.
 - 1. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the Owner reserves the right to further verify system cleanliness through gravimetric or wipe testing analysis testing as specified herein.
 - 2. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
- C. **Gravimetric Analysis:** At the discretion and expense of the Owner, sections of the HVAC system may be tested for cleanliness using the NADCA Vacuum Test (gravimetric analysis) as specified in applicable NADCA Standards. Levels of debris collected shall be equal to or less than acceptable levels defined in applicable NADCA Standards.
 - 1. If gravimetric analysis determines that levels of debris are equal to or lower than those levels specified in applicable NADCA standards, the system shall be considered clean and shall have passed cleanliness verification.
 - 2. If gravimetric analysis determines that levels of debris exceed those specified in applicable NADCA standards, the system shall not be considered clean and those sections of the system which failed cleanliness verification shall be re-cleaned at the expense of the HVAC system cleaning Contractor.
 - 3. Gravimetric analysis shall be performed by a qualified third party experienced in testing of this nature.
 - 4. Cleanliness verification shall be performed immediately after mechanical cleaning and before the HVAC system is restored to normal operation.
- D. **Verification of Coil Cleaning**
 - 1. Cleaning must 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 Standards).

3.8 PRE-EXISTING SYSTEM DAMAGE

- A. Contractor is not responsible for problems resulting from prior inappropriate or careless cleaning techniques of others.

3.9 POST-PROJECT REPORT

- A. At the conclusion of the project, the Contractor shall provide a report to the Owner indicating the following:
 - 1. Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.
 - 2. Areas of the system found to be damaged and/or in need of repair.

END OF SECTION