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USACE / NAVFAC / AFCEC / NASA	**UFGS-23 34 23.00 40 (February 2017)**

Preparing Activity: NASA	**Superseding**
	UFGS-23 34 23.00 40 (May 2014)
	UFGS-23 34 23 (February 2011)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021

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DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION 23 34 23.00 40

HVAC POWER VENTILATORS

02/17

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SECTION 23 34 23.00 40

HVAC POWER VENTILATORS
02/17

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NOTE: This guide specification covers the requirements for power roof ventilators designed to exhaust air from a building by means of a motor-driven fan.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. 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, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

****

PART 1 GENERAL

****

NOTE: Provide drawings that indicate and schedule the following:

Unit number

Location

Cubic meter feet per minute air

Static pressure kilopascal inches of water

Fan revolutions per minute

Type of fan

Type of wheel

Housing style

Maximum tip speed

Noise level in sones

Fan motor power

Drive type

Controls

Type of damper(s)

Type of screens

****

Provide a power roof ventilator[s] [system] complete with all components and accessory equipment as specified in this section.

****

NOTE: If Section 23 30 00 HVAC AIR DISTRIBUTIONis not included in the project specification, insert applicable requirements therefrom and delete the first paragraph. If Section 26 60 13.00 40 LOW-VOLTAGE MOTORS is not included in the project specification, insert applicable requirements therefrom and delete the second paragraph.

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[Section 23 30 00 HVAC AIR DISTRIBUTION applies to work specified in this section.

][Section 26 60 13.00 40 LOW-VOLTAGE MOTORS applies to this section.

]1.1 REFERENCES

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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 Reference Identifier (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 are automatically 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 CIVIL ENGINEERS (ASCE)

ASCE 7-16	(2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B37	(2018) Standard Specification for Aluminum for Use in Iron and Steel Manufacture
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B209M	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

RCBEA GUIDE	(2004) NASA Reliability Centered Building and Equipment Acceptance Guide

UNDERWRITERS LABORATORIES (UL)

UL 705	(2017; Reprint Oct 2018) UL Standard for Safety Power Ventilators

1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings; G[, [____]]

Installation Drawings; G[, [____]]

SD-03 Product Data

Housing; G[, [____]]

Fan; G[, [____]]

Motor; G[, [____]]

Bases; G[, [____]]

Roof Curbs; G[, [____]]

Dampers; G[, [____]]

Screens; G[, [____]]

Sound Baffles; G[, [____]]

SD-06 Test Reports

Final Test Reports; G[, [____]]

SD-11 Closeout Submittals

Record Drawings; G[, [____]]

1.3 QUALITY CONTROL

Rate and label ventilators in accordance with the applicable standards of the Air Movement Control Association (AMCA), and indicate if the license bears the AMCA seal for both air and sound.

1.3.1 Predictive Testing and Inspection Technology Requirements

****
NOTE: The Predictive Testing and Inspection (PT&I) tests prescribed in Section 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS are MANDATORY for all [NASA] [_____] assets and systems identified as Critical, Configured, or Mission Essential. If the system is non-critical, non-configured, and is not mission essential, use sound engineering discretion to assess the value of adding these additional test and acceptance requirements. See Section 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS for additional information regarding cost feasibility of PT&I.
****

This section contains systems or equipment components regulated by NASA's Reliability Centered Building and Equipment Acceptance Program (RCBEA). This program requires the use of Predictive Testing and Inspection (PT&I) technologies in conformance with the RCBEA GUIDE to ensure that building equipment and systems have been installed properly and contain no identifiable defects that shorten the design life of a system or its components. Satisfactory completion of all acceptance requirements is required to obtain Government approval and acceptance of the Contractor's work.

Perform PT&I tests and provide submittals as specified in Section 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Design Requirements

Submit the manufacturer's catalog data, including equipment and performance data, for power roof ventilator(s). As a minimum, include the following data:

****
NOTE: Insert the appropriate agency in items "d" and "f" below if applicable, i.e. Army, Navy, etc.
****

a. Fan Type

b. Fan Specifications, including:

(1) Number of rotating fan blades/vanes

(2) Number of stationary fan blades/vanes

(3) Rotating speed(s)

(4) Number of belts (if belt-driven)

(5) Belt lengths- measured at the pitch line (if belt-driven)

(6) Diameter of the drive sheave at the drive pitch line (if belt-driven)

(7) Diameter of the driven sheave at the drive pitch line (if belt-driven)

c. Location of Installation

d. [_____] Identification Number

e. Date of Installation (Required or Actual Acceptance Date)

f. Applicable [_____] reference drawing number(s)

Submit detailed shop drawings for power roof ventilator systems.

Provide roof ventilators that comply with UL 705 and are furnished complete with bases, curbs, flashing flanges, noise baffles, dampers, damper controls, louvers, and screens, as indicated.

Provide ventilators that are designed for windloads in accordance with ASCE 7-16 with the installed design not less than 210[_____] kilometer per hour 130[_____] miles per hour windload. Ensure that the structural bracing is properly spaced to accommodate this loading and meets the design requirements of the covering material. Ensure that ventilators are adequately reinforced and well-braced with the joints properly formed. Ensure that the edges are wired or beaded where necessary to ensure rigidity. Prevent galvanic action between different metals in direct contact by providing nonconductive separators. Make all soldering even and smooth.

****

NOTE: Retain the following paragraph only when protected metal is required.

****

Provide corrosion-resistant steel bolts, rivets, and other fastenings used in connection with protected metal.

2.2 COMPONENTS

2.2.1 Housing Style

Provide [round-mushroom style] [louvered-penthouse style] [low-contour style] [vertical-discharge style] power roof ventilator as indicated.

2.2.2 Fan Type

****

NOTE: When possible use sealed bearings. One of the major causes of bearing failures is over-lubrication and lubrication contamination.

Using sealed bearings helps to eliminate this failure mode.

****

Provide fans of the following types:

2.2.2.1 Type C-PRV Centrifugal, Direct Drive

For Type C-PRV ventilators, provide a centrifugal roof ventilator with direct drive, nonoverloading, backward-inclined wheel. Provide a vibration-isolated drive with an elastomer. Provide drive components that are mounted in a compartment isolated from the airstream.

2.2.2.2 Type CB-PRV Centrifugal, V-Belt Drive

For Type CB-PRV ventilators provide a centrifugal roof ventilator with V-belt drive, nonoverloading, backward-inclined wheel. Provide a vibration-isolated drive with an elastomer. Provide drive components that are mounted in a compartment isolated from the airstream.

2.2.2.3 Type P-PRV Propeller, Direct Drive

For Type P-PRV ventilators, provide a propeller roof ventilator with direct drive that is vibration-isolated with an elastomer. Provide drive components that are mounted in a compartment isolated from the airstream.

2.2.2.4 Type PB-PRV Propeller, V-Belt Drive

For Type PB-PRV ventilators, provide a propeller roof ventilator with V-belt drive that is vibration-isolated with an elastomer. Provide drive components that are mounted in a compartment isolated from the airstream.

2.2.2.5 Type VA-PRV Vane Axial, Direct Drive

For Type VA-PRV ventilators, provide a vane axial roof ventilator with direct drive that is vibration-isolated with an elastomer.

2.2.2.6 Type VAB-PRV Vane Axial, V-Belt Drive

For Type VAB-PRV ventilators, provide a vane axial roof ventilator with V-belt drive that is vibration-isolated with an elastomer.

2.2.2.7 Type TA-PRV Tube Axial, Direct Drive

For Type TA-PRV ventilators, provide a tube axial roof ventilator with direct drive that is vibration-isolated with an elastomer.

2.2.2.8 Type TAV-PRV Tube Axial, V-Belt Drive

For Type TAV-PRV ventilators, provide a tube axial roof ventilator with V-belt drive that is vibration-isolated with an elastomer.

2.2.3 Fan Motor

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NOTE: Modify voltage as required and select a motor power based on air flow and static pressure in millimeter inches of water.

****

****
NOTE: When possible, use sealed bearings. One of the major causes of bearing failures is over lubrication and lubrication contamination. Using sealed bearings helps to eliminate this failure mode.
****

Provide single-phase, 120 V, 60 Hz, split-phase, belt-driven motors less than 375 watt 1/2 horsepower, with permanently lubricated ball bearings.

Provide three-phase [_____], 460 [_____] V, 60 Hz motors 375 watt 1/2 horsepower and larger.

Provide motors with local disconnects to allow for fan and motor maintenance. Provide all motors with thermal-overload protection. For motors located in airstreams, use a totally enclosed type.

Use energy efficient permanent split capacitor motors, single phase, 60 Hz direct-drive motors 375 watt 1/2 horsepower or less.

2.2.4 Bases

When bases are provided with the ventilators, use factory-formed bases of the type indicated, constructed of the same material as the hoods, and of the thickness necessary to meet the design requirement for connection to the roof. Provide bases that are suitable for raised-curb mounting where indicated. Form curb flanges of the base as cap flashing, extending at least 50 millimeter 2 inches over the roofing base. Where indicated or required, extend the shafts of ventilators a sufficient distance through the supporting construction to permit attachment of vent ducts.

2.2.5 Roof Curbs

Provide factory-formed metal ventilator curbs of the type and design required for the ventilator and suitable for the roof configuration and flashing.

Provide job-built curbs that conform to the recommendations of the ventilator manufacturer, that are sized correctly for the ventilator, and that are suitable for the type of supporting roof construction.

2.2.6 Back-Draft Dampers

Provide gravity-operated back-draft dampers with adjustable counterweights constructed of the same material as fan housing.

[Provide motor-operated back-draft dampers constructed of the same material as fan housing.

][Interlock damper-actuating motor with the fan motor.

]2.2.7 Screens

Provide [bird screens] [insert screens] with frames constructed of the same material as that used in the ventilators and ensure the screens are securely attached in a manner that permits easy removal for access and cleaning.

2.2.8 Sound Baffles

Provide permanently constructed sound baffles that are impervious to moisture. Provide removable baffles.

2.3 MATERIALS

Provide manufacturers' standard materials.

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NOTE: When more than one material is required, indicate the location of various materials on the drawings.
****

2.3.1 Aluminum Alloy

Provide aluminum alloy in accordance with ASTM B209M ASTM B209 and ASTM B37.

2.3.2 Zinc-Coated Steel

Provide zinc-coated steel in accordance with ASTM A653/A653M.

2.3.3 Fibrous Glass

Provide fibrous glass ventilators that are molded from a glass-fiber-reinforced polyester resin with a pigmented polyester resin gel coat in the manufacturer's standard color, and that are between 0.51 and 1.53 millimeter 0.02 inches and 0.06 inches thick. Provide a matrix material that is not less than 30 percent, by weight, of chopped-fiber and random-strand glass fibers, and that is thoroughly saturated and impregnated with not more than 70 percent high-solids polyester resin with not less than 5 percent antimony trioxide fire-retardant additive. Provide material that is smooth and uniform in texture, and color throughout the cross section and that is shatter-resistant. Ensure that the material is free from visual defects, foreign inclusions, cracks, crazing, die lines, pinholes, and striations. Ensure that the material has no areas that are unsaturated or lacking resin, and no areas with excessive resin.

PART 3 EXECUTION

3.1 INSTALLATION

Submit installation drawings for power roof ventilators.

Install power roof ventilators in accordance with the manufacturer's installation instructions. Coordinate installation of ventilators with other work. Coordinate anchors, attachments, and other items to be built for installation as the work progresses. Rigidly install ventilators in a weathertight and watertight manner that is free from vibration. Refer to Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT for vibration isolation considerations.

[3.1.1 Lubrication

Ensure the movable parts of dampers and related operating hardware are lubricated in accordance with manufacturer's printed instructions and that they operate smoothly and quietly without binding.

]3.2 FIELD QUALITY CONTROL

3.2.1 Tests

****
NOTE: If the specified system is identified as critical, configured, or mission essential, use Section 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS to establish predictive and acceptance testing criteria. Include the first paragraph, delete the second paragraph and paragraphs VIBRATION ANALYZER, ACCEPTANCE, LUBRICATION, AND FINAL TEST REPORTS.
****

Perform PT&I tests and provide submittals as specified in Section 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS.

[After installation, test each power roof ventilator to demonstrate proper operation at indicated and specified performance requirements, including the running, balance, noise, and proper direction of fan rotation.

][3.2.1.1 Vibration Analyzer

Use an fast Fourier transform (FFT) analyzer to measure vibration levels. Ensure that the ventilator meets the following characteristics: a dynamic range greater than 70 dB; a minimum of 400 line resolution; a frequency response range of 5 Hz to 10 KHz (300 600000 cpm); the capacity to perform ensemble averaging, the capability to use a Hanning window; auto-ranging frequency amplitude; a minimum amplitude accuracy over the selected frequency range of plus or minus 20 percent or plus or minus 1.5 dB.

Use either a stud-mounted accelerometer or mount the accelerometer using a rare earth, low-mass magnet and a sound disk (or finished surface) with the FFT analyzer to collect data. Provide the accelerometer with a mass and mounting that minimally influence the frequency response of the system over the selected measurement range.

][3.2.2 Acceptance

Prior to final acceptance, use precision alignment devices to demonstrate that the fan and motor are aligned as specified by the manufacturer.

Prior to final acceptance, verify conformance to specifications with vibration analysis. Ensure vibration levels are not more than .075 in/sec at 1 times the run speed and at the fan/blade frequency, and not more than 0.04 in/sec at other multiples of the run speed.

][3.2.3 Final Test Reports

Provide final test reports to the Contracting Officer. Provide reports

with a cover letter/sheet clearly marked with the system name, date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

]3.3 CLOSEOUT ACTIVITIES

Submit detailed record drawings upon completion of the installation.

-- End of Section --