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**Aerovent Guide Specification  
Industrial Fans: Model MHO/MHR, Direct or Belt Driven**

**Aerovent Model MHO/MHR** is an industrial grade centrifugal fan. The Model MHO/MHR is designed with a material handling, radial bladed, wheel with overloading characteristic type brake horsepower curve.

The Model MHO/MHR Industrial Fans are well suited for installations involving exhaust, material conveying, pollution control, air circulation, and a variety of other industrial applications.

The Model MHO/MHR radial paddle wheel design is extremely rugged using heavy-gauge steel components. All wheels are welded with care to ensure the maximum in strength and reliability. MHO wheels are suitable for general handling of coarse, sticky, heavy, and/or abrasive materials.

**Application**

The MHO/MHR Radial Bladed Fan is designed for industrial process applications such as fume exhaust, air pollution control, pneumatic conveying, grinding and buffing exhaust, and woodchip handling. The MHO/MHR provides maximum strength and rigidity to resist the wear and tear of heavy industrial use.

Sizes (wheel diameter): 8.75 to 104.25 inches (225 mm to 2,650 mm)

Airflow to 141,800 CFM (240,900 m3/hour)

Static pressure to 46 inches wg (11,460 Pa)

Aerovent is a leading designer and manufacturer of high quality industrial air moving equipment. Aerovent has extensive industry experience and years of active research, offering customers flexibility in fan design and construction along with superior service and state-of-the-art technology. With an unmatched variety of axial impellers and centrifugal fan wheels, every fan is built to the customer’s specific needs. This comprehensive selection of products and materials makes Aerovent the ideal choice for a diverse range of industry applications, including: Pulp & Paper, Automotive, Metal & Minerals, Mining, Power Generation, Agricultural, Marine and Water Treatment.

Aerovent occupies over 1,000,000 sq. ft. of manufacturing space in the U.S. Headquarters are located in Minneapolis, Minnesota, which houses the management, sales and marketing, accounting, human resources, material management, engineering personnel, as well as a state-of-the-art AMCA accredited testing lab.

We recommend you consult with your Aerovent Sales Representative, who can be contacted through: Aerovent, Minneapolis MN; (763) 551-7500; email: [aerovent\_sales@aerovent.com](mailto:tcf_sales@tcf.com); [www.aerovent.com](http://www.tcf.com).

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SECTION 23 34 16 – INDUSTRIAL FANS

1. GENERAL
   * + 1. SUMMARY

Specifier: Select fan drive style in following paragraph.

* + - * 1. Section includes radial blade Industrial fans, [belt] [direct] driven.
      1. REFERENCE STANDARDS
         1. American Bearing Manufacturers Association (ABMA): [www.americanbearings.org](http://www.americanbearings.org/):

ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings

ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings

* + - * 1. Air Movement and Control Association International, Inc. (AMCA): [www.amca.org](http://www.amca.org):

AMCA Standard 204 - Balance Quality and Vibration Levels for Fans

AMCA Standard 205 - Energy Efficiency Classification for Fans

AMCA Standard 210 - ASHRAE 51 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating

AMCA Standard 300 - Reverberant Room Method for Sound Testing of Fans

* + - * 1. National Electrical Manufacturers Association (NEMA): [www.nema.org](http://www.nema.org):

NEMA MG  1 – Motors and Generators

* + - * 1. National Fire Protection Association (NFPA): [www.nfpa.org](http://www.nfpa.org):

NFPA 70 - National Electric Code

* + - 1. ACTION SUBMITTALS
         1. Product Data: Include the following:

Rated capacities and operating characteristics.

Fan Performance Data: Fan performance curves with flow, static pressure and horsepower.

Sound Performance Data: Fan sound power levels in eight octave bands and, A-weighted overall sound power level or sone values.

Motor ratings and electrical characteristics.

Furnished specialty components.

Specified accessories.

Dimensioned standard drawings indicating dimensions, weights, and attachments to other work.

Specifier: If Contractor will be required to provide engineering drawings and calculations for vibration, seismic, or high wind design, insert requirements here.

* + - 1. INFORMATIONAL SUBMITTALS
         1. Source quality-control reports.
         2. Field quality-control reports.
         3. ISO - 9001 certificate.
      2. CLOSEOUT SUBMITTALS
         1. Operation and Maintenance Data: Include routine maintenance, adjustment requirements, safety information, and troubleshooting guide.
      3. QUALITY ASSURANCE
         1. Manufacturer Qualifications: Approved ISO 9001-compliant manufacturer listed in this Section with minimum 10 years' experience in manufacture of similar products in successful use in similar applications, and with an ASME NQA-1 compliant Program.

Specifier: Retain paragraph below if Owner allows substitutions but requires strict control over qualifying of substitutions.

Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:

Product data, including certified independent test data indicating compliance with requirements.

Project references: Minimum of 5 installations not less than 5 years old, with Owner contact information.

Sample warranty.

Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.

Approved manufacturers must meet separate requirements of Submittals Article.

* + - * 1. AMCA Compliance:

Provide fan units tested in accordance with AMCA Standard 210 (air performance) and AMCA Standard 300 (sound performance) in an AMCA-accredited laboratory.

Provide fan units rated according to AMCA Standard 211 (air performance).

Provide fan units rated according to AMCA Standard 205 (fan efficiency grade).

* + - 1. COORDINATION
         1. Coordinate sizes and locations of supports required for fan units.
         2. Coordinate sizes and locations of equipment supports, roof curbs, and roof penetrations.
      2. FIELD CONDITIONS
         1. Handling and Storage: Handle and store fan units in accordance with manufacturer's published instructions. Examine units upon delivery for damage. Store units protected from weather.
      3. WARRANTY

Specifier: Consult Aerovent for available special Project-specific warranties.

* + - * 1. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to furnish replacement components for fan units that demonstrate defects in workmanship or materials under normal use within warranty period specified.

Warranty Period: 12 months from startup or 18 months from shipment by manufacturer, whichever first occurs.

1. PRODUCTS
   * + 1. MANUFACTURER
          1. Basis-of-Design Manufacturer: Provide fan units manufactured by **Aerovent**, Minneapolis MN; (763) 551-7500; email: [aerovent\_sales@aerovent.com](mailto:tcf_sales@tcf.com); website: [www.aerovent.com](http://www.tcf.com).
          2. Source Limitations: Obtain centrifugal radial fans from a single manufacturer.
       2. PERFORMANCE REQUIREMENTS
          1. Fan Performance Ratings: [Project site elevation-based] [Sea level-based].
          2. AMCA Compliance: Provide units that bear the AMCA-Certified Ratings Seal.
          3. Compliance: Classified under AMCA Standard 205.

Specifier: Select fan drive style in following paragraph.

* + - 1. CENTRIFUGAL INDUSTRIAL FANS
         1. Description: [Belt] [Direct] - Driven Centrifugal Industrial Fans.

Basis of Design Product: **Aerovent, Model MHO/MHR**.

Specifier: Coordinate fan orientation with notations on drawings.

* + - * 1. Fan Capacities, Characteristics, and Configuration: Refer to Drawings schedule.

Specifier: Standard material is steel. Select aluminum option in the following paragraph when spark resistant construction is required. Select options for abrasion-resistant steel when it is required.

* + - * 1. Fan Wheels: Provide continuously welded [steel] [aluminum] [[AR 250] [AR 400] abrasion resistant steel], with radial paddle blades welded to hub. Hub to be keyed to shaft.

Materials of Construction: Manufacturer’s standard, based on wheel size and pressure class.

Statically and dynamically balance wheel.

Minimum Balance Quality Grade: G6.3, in accordance with AMCA Standard 204.

* + - * 1. Fan Shaft:

AISI C1045 hot-rolled steel.

Turn, grind, and polish shaft.

Size shaft for first critical speed minimum 1.43 times maximum speed for each fan class.

Apply petroleum based rust preventative coating.

Key shaft to wheel hub.

Include OSHA compliant [shaft] [shaft and bearing] guard.

Specifier: Retain the option in the following paragraph when extended grease lines are required.

* + - * 1. Bearings: Heavy-duty, grease lubricated, spherical roller or anti-friction ball, self-aligning, pillow block type, based on fan size and mounting orientation[, with grease lines extended to outside fan housing].

Minimum Average Bearing Life: ABMA L-50 = 200,000 hours at the maximum fan RPM.

Specifier: The standard material is steel. Select options for abrasion-resistant steel when it is required.

* + - * 1. Housing: Continuously welded [steel] [[AR 250] [AR 400] abrasion resistant steel], reinforced with rigid bracing. Housings with lock seams or partially welded construction are not acceptable.

Specifier: Retain the following paragraphs as required by Drawing Schedule.

Access Door: [Bolted flush with interior] [Raised Bolted [[4 inch (102 mm)] [6 inch (152 mm)] [8 inch (203 mm)]] [Quick Open Latched].

Drain: 3/4 inch NPT [with plug].

For fan units with wheel diameters 33 inches (840 mm) or smaller, provide adjustable fan housings that can be field rotated to eight standard positions.

For fan units with wheel diameters larger than 33 inches (840 mm), provide fixed position fan housings welded in place at factory.

Specifier: When connecting flanges are required for ductwork, retain following paragraph. Select option for factory punched holes, when required.

For fan units with wheel diameters larger than 33 inches (840 mm), pre-punched outlet flanges are standard.

Provide flanged connections with pre-punched bolt holes at fan outlet [and inlet].

Specifier: When insulated housing required for sound or temperature, retain following paragraph. Select option for insulation type.

Provide [factory fabricated steel wall insulated housing] [aluminum clad insulated housing]; minimum thickness [2 inches (51 mm)] [\_\_\_\_\_]. Anchor housing insulation with weld pins].

* + - * 1. Supports: Steel angle, intermittently welded with sealant filled between welds.

Specifier: Direct drive is available only for Arrangement 8 (all sizes) fans. Delete paragraph and its subparagraphs if only belt-driven units are required.

* + - * 1. Direct Drive:

Specifier: Retain paragraph below for direct drive, Arrangement 8 fans only.

Provide coupling with service factor of 1.5 x motor HP between motor and fan shaft.

Include OSHA compliant coupling guard

Specifier: Retain the following paragraph and subparagraphs for belt-driven fans only.

* + - * 1. Belt Drives:

Specifier: In the following paragraph, select 120% option for motors up to 25 hp. Select 150% option for motors larger than 25 hp.

Specifier: In the following paragraph, select variable pitch option for motors up to 10 hp. Select fixed pitch option for motors larger than 10 hp.

Drive Components: V-belt drive, rated for minimum [120] [150] percent of motor nameplate horsepower, with machined, [variable] [fixed] - pitch cast-iron sheaves, and heat resistant, oil resistant, static-free V-belts.

* + - * 1. Motors: Comply with NEMA MG-1 for designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 section "Common Motor Requirements for HVAC Equipment."

Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

Motor Speed: Based upon performance requirements and application.

Specifier: If factory disconnect is required, select NEMA enclosure rating in following paragraph, and select one subparagraph below to specify factory or field mounting. Retain second subparagraph when NEMA 7/9 (explosion proof) option is selected.

Provide unfused disconnect switch, NEMA [1] [3R] [4] [4X] [7/9 explosion proof], selected in accordance with Division 26 section "Enclosed Switches."

Factory mount and wire disconnect switch.

Ship disconnect switch loose for field mounting and wiring.

Specifier: Select motor electrical data in following subparagraphs, or show this data on the drawing fan schedule. Do not show the data in both places.

Electrical Data:

Voltage: [115] [208] [230] [460] [575] [\_\_\_\_\_] V; [1] [3] phase; 60 Hz.

Voltage: [190] [380] [\_\_\_\_\_] V; [1] [3] phase; 50 Hz.

Specifier: Select motor enclosure type in first following subparagraph.

Enclosure Type: [Open, Drip Proof (ODP)] [Totally Enclosed Fan Cooled (TEFC)]

Specifier: For motors located in hazardous locations, select one or the other of the following. If motor is not located in hazardous location, delete subparagraph. Consult Aerovent for hazardous location classification availability.

[Explosion Proof] [ATEX].

Provide motors that comply with the Energy Independence and Security Act of 2007 (EISA).

Specifier: For motors controlled by VFDs, retain the following subparagraph.

When controlled with a Variable Frequency Drive (VFD), provide premium efficiency motors suitable for inverter duty use.

Specifier: Retain the following paragraph for belt-driven fans only.

* + - * 1. Motor Mounting Platform: Heavy-duty motor mounting platform that allows adjustment of drive belt tension. Motor location per drawing schedule.

Specifier: Retain paragraph and subparagraph below when isolation is required, and coordinate options with project design.

* + - * 1. Vibration Isolation:

Specifier: Retain paragraph and subparagraph below, and coordinate options with project design.

Provide isolation of fan from connected piping, duct work and foundation in accordance with fan manufacturer's requirements, and Division 23, Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

Specifier: Retain the following paragraphs for smaller sized Arrangement 9 and 10 fans only (Sizes 919 and smaller). Select options as required. Consult Aerovent for assistance.

For fans mounted directly to foundation, provide [spring] [neoprene-in-shear] vibration isolators, [and seismic restraints].

Spring Isolators: Select for [1 inch (25.4 mm)] [2 inch (51 mm)] deflection.

Specifier: Retain the following paragraphs if fan is to be mounted on a separate base.

Isolation Type Base:

Spring isolation base: Provide spring isolators [and seismic restraints] with [1 inch (25.4 mm)] [2 inch (51 mm)] deflection.

Inertia type base: Provide spring isolators [and seismic restraints] with [1 inch (25.4 mm)] [2 inch (51 mm)] deflection.

Specifier: Retain the following paragraphs for smaller sized Arrangement 10 fans only (Sizes 919 and smaller).

Spring Isolator Rail

Equipment isolation rails with integral spring assemblies.

* + - * 1. Interior Access:

Specifier: Paragraphs 1 represents construction features for all fans. Paragraph 2 represents optional access method that might be applied for fans requiring frequent inspection or cleaning.

Retain Paragraph 1 below for all fans.

Design fan to allow for wheel removal through fan inlet opening.

Specifier: Paragraph 2 below is available on sizes 921 and larger. Delete for sizes 919 and smaller fans.

Split Housing: Provide two mating sections that lift apart to allow total access to interior of fan wheel. Include bolts, hardware, and full gasketing.

* + - * 1. Accessories:

Specifier: Accessories listed in subparagraphs below are optional Aerovent features for this unit. Consult Aerovent representative for recommended options based upon Project requirements.

Specifier: Retain following paragraph only for Arrangement 10 outdoor fans, when required.

Weather Cover: Provide steel weather cover to shield motor and belt-drive from weather. Fabricate with rainproof ventilation slots.

Specifier: Paragraph below requires punched inlet and outlet flanges.

Companion Flanges: Steel flanges with pre-punched bolt holes, shipped loose for field installation.

Specifier: When required, provide optional split housing to allow easier access to wheel and inside of scroll.

Provide Split Housing: [Horizontal] [Pie-shaped] [3-way].

Specifier: When required, edit the following paragraph and subparagraphs to require an inlet box and inlet box options. Inlet box damper, if required, is specified above with other dampers.

Inlet Box: Match housing construction, with [bolt-on] [free-standing] [integral] configuration with fan housing.

Access Door: [Bolted flush with interior] [Raised Bolted [[4 inch (102 mm)] [6 inch (152 mm)] [8 inch (203 mm)]] [Quick Open Latched].

Drain: 3/4 inch NPT [with plug].

Provide [factory fabricated insulated housing] [aluminum clad insulated housing; minimum thickness [2 inches (51 mm)] [\_\_\_\_\_]. Anchor housing insulation with weld pins].

Volume Control Devices

Specifier: For inlet vane dampers, external dampers are suitable for hostile environments with dirty air streams. Outlet dampers are the least expensive damper option, but do not have the best energy performance.

Specifier: In the following paragraph, select the option that conforms to the required operating air stream temperature.

Inlet Vane Dampers: Provide pre-rotational inlet vane dampers external to fan housing. Maximum Inlet Vane Damper Operating Temperature: [70 - 300 deg. F (21 - 148 deg. C)] [301 - 600 deg. F (149 - 316 deg. C)].

Specifier: When outlet dampers are required for applications with clean airstream, pressures up to 24 inches wg, and temperatures up to 300 deg. F, select dampers with single-surface blades, as described in the following paragraph.

Outlet Dampers: (Parallel-blade) (Opposed-blade) single surface dampers suitable for modulating fan delivery at discharge static pressure up to 24 inches wg –up to 300 deg. F (148 deg. C).

Specifier: When outlet dampers are required for applications with abrasive material in the airstream, pressures up to 40 in. wc, and temperatures up to 800 deg. F, select dampers with double-surface blades, as described in the following paragraph.

Outlet Dampers: [Parallel-blade] [Opposed-blade] double surface airfoil dampers suitable for modulating fan delivery at discharge static pressure up to 40 inches wg at [70 - 300 deg. F (21 - 148 deg. C)] [301 - 600 deg. F (149 - 316 deg. C)] [601 - 800 deg. F (316 - 427 deg. C)].

Inlet Box Damper: Welded construction, suitable for modulating fan delivery at [70 - 300 deg. F (21 - 148 deg. C)] [301 - 600 deg. F (149 - 316 deg. C)] [601 - 800 deg. F (316 - 427 deg. C)].

Actuators:

Specifier: Select applicable paragraph and subparagraphs when actuator is required for volume control device(s).

Actuators listed in subparagraphs below offer various construction features and options. Consult Aerovent for recommended options based upon Project requirements.

Electric actuator.

Double acting pneumatic actuator (air-to-air).

Specifier: Select applicable subparagraph and delete remaining subparagraphs

Two-position.

Modulating service with pneumatic positioner.

Modulating service with electro-pneumatic positioner.

Pneumatic actuator with spring return (air-to-spring):

Specifier: Select applicable subparagraph and delete remaining subparagraphs

Two-position.

Modulating service with pneumatic positioner.

Modulating service with electro-pneumatic positioner.

Specifier: Retain following two paragraphs if safety screens are required. Select options in second following paragraph to designate screen locations.

Safety Screens: at fan [inlet] [outlet].

Inlet Bell: Venturi mounted at fan inlet [with inlet screen].

Specifier: Retain following paragraph when spark-resistant construction is required. Select applicable subparagraph.

Spark Resistant Construction: Mount bearings outside flow airstream.

AMCA Type B: Provide non-ferrous fan wheel impeller and aluminum rub ring where shaft penetrates fan housing. Maximum operating temperature: 250 deg. F (121 deg. C).

Specifier: For Type C construction, select maximum operating temperature as required by project conditions.

AMCA Type C: Provide construction that will not permit shaft or fan wheel impeller to contact or strike ferrous metal parts. Maximum operating temperature: [500 deg. F (260 deg. C)] [800 deg. F (427 deg. C)].

Specifier: The shaft seal in the following paragraph is not air tight. For air tight, or other custom shaft seals, contact a Aerovent technical representative and revise the following paragraph.

Shaft seal, including backing plate and fabric seal, to limit airstream infiltration.

Shaft Cooler: Provide bolt-on aluminum shaft cooler sized to fit fan shaft.

High Temperature Package: Suitable for temperatures from [301 to 500 deg. F (149 to 260 deg. C)] [501 to 600 deg. F (261 to 316 deg. C)] [601 to 800 deg. F (316 to 427 deg. C)].

Provide high temperature bearings and grease, shaft seal, and bolt-on aluminum shaft cooler.

Extended Lube Lines: Provide lubrication lines with grease fittings from the fan bearings terminating on the drive side of the fan for ease of lubrication.

* + - * 1. Coatings:

Specifier: Retain Paragraph 1. or 2. based on application requirements. Delete remaining paragraph.

Standard Coating: All carbon steel components shall be cleaned and chemically treated by a phosphatizing process. Fan shall then be coated with blue enamel.

Special Coating: [\_\_\_\_\_].

* + - 1. SOURCE QUALITY CONTROL
         1. Factory Run Test: Statically and dynamically balance each wheel in accordance with AMCA Standard 204 "Balance Quality and Vibration Levels for Fans" to Fan Application Category BV-3, Balance Quality Grade G6.3. Test run assembled fan units prior to shipment at specified operating speed or maximum RPM allowed. Obtain balance readings by electronic equipment in the axial, vertical, and horizontal directions on each set of bearings.

1. EXECUTION
   * + 1. EXAMINATION
          1. Examine areas to receive fans. Notify Engineer regarding conditions that may adversely affect installation, operation, or maintenance of fans. Proceed with installation once conditions are in accordance with manufacturer's published instructions.
       2. PROTECTION
          1. Protect adjacent construction and finished surfaces during installation and testing.
          2. Except for operational testing, do not operate fan during construction.
       3. INSTALLATION
          1. Install fans in accordance with Contract documents and manufacturer's published instructions.

Specifier: Insert applicable installation requirements for vibration, seismic, and high wind design if applicable to installation.

* + - * 1. Install fan units with adequate clearances for service and maintenance.

Specifier: Coordinate duct installation and specialty arrangements with schematics on Drawings and with requirements specified in duct systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

Retain option for companion flanges when required.

* + - * 1. Duct Connections: Drawings indicate general arrangement of ducts and duct accessories. Where indicated on Drawings, [install factory-furnished companion flanges and] make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 section "Air Duct Accessories."

Install connecting ducts with adequate clearances for service and maintenance.

* + - * 1. Electrical Connections: Connect wiring in accordance with NFPA 70 and Division 26 section "Low-Voltage Electrical Power Conductors and Cables."

Ground and bond equipment according to Division 26 section "Grounding and Bonding for Electrical Systems."

* + - * 1. Equipment Identification: Label units according to Division 23 section "Identification for HVAC Piping and Equipment."
      1. FIELD QUALITY CONTROL

Specifier: Select option in paragraph below to define the party responsible for final tests and inspections to be performed.

* + - * 1. [Owner will retain] [Contractor shall retain] qualified testing agency to perform field tests and inspections.

Specifier: Retain first paragraph below to describe tests and inspections to be performed.

Specifier: When only direct drive fans are required, delete references to belts in the following paragraph and subparagraphs.

* + - * 1. Tests and Inspections:

Verify that unit is secured to supports, and that duct and electrical connections are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

Verify that cleaning and adjusting are complete.

Specifier: Retain option in the following paragraph for belt driven units. Otherwise, delete option.

[Disconnect fan belt drive from motor.] Verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

Verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation.

Verify that manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in fully open position.

Disable automatic temperature-control actuators, energize motor, adjust fan to indicated rpm, and measure and record motor voltage and amperage.

Shut unit down and reconnect automatic temperature-control actuators.

Remove and replace malfunctioning units and retest as specified above.

* + - * 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
        2. Submit test and inspection reports.
      1. ADJUSTING AND CLEANING
         1. Adjust, clean, and maintain installed fan units in accordance with manufacturer's published instructions.

END OF SECTION