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**Twin City Fan & Blower Guide Specification  
Backward Inclined Centrifugal Induced Flow Exhaust Fans: Model BCIFE, Direct or Belt Driven**

**Twin City Fan & Blower Model BCIFE** is designed with a backward inclined flat blade, making the BCIFE an ideal choice for exhausting contaminated laboratory air.

The BCIFE fans consist of a single-wide centrifugal unit, a choice of one of four different nozzles and a specially designed windband to maximize dilution ratio (overall outlet volume/lab outlet volume) and plume height.

The BCIFE is a non-overloading centrifugal induced flow exhaust fan available in five (5) arrangements, both belt and direct drive. The BCIFE is capable of generating an induced flow to meet stringent roof exhaust requirements.

Model BCIFE is available with UL/cUL 705 listing.

**Application**

The BCIFE Induced Flow Exhaust Fans are intended for use in exhausting laboratory fumes and hazardous chemicals in such a manner that diminishes the likelihood of concentrated, contaminant-laden air from being re-entrained into the building's intake or makeup air. This unit is commonly used in exhaust systems for universities, schools, hospitals, research facilities, laboratories, restaurants and waste water treatment plants.

Induced flow exhaust fans dilute contaminated air at the outlet as well as increase the outlet volume of the fan. This accelerates the discharge air, increasing plume height without a tall stack.

Sizes (wheel diameters): 12.25 to 66 inches (315 mm to 1,680 mm)

Airflow: Up to 132,000 CFM (224,300 m3/hour)

Static Pressure: Up to 15 inches wg (3,730 Pa)

Twin City Fan & Blower (TCF) is an industry leading designer and manufacturer of high quality commercial and industrial fans and is a division of Twin City Fan Companies, Ltd. Our extensive product line includes centrifugal fans and blowers, axial fans, and power roof ventilators. For the commercial market, TCF supplies ventilation fans for retail and office buildings, restaurants, schools, hospitals, and government buildings. TCF’s industrial fans are used in a wide variety of process applications for numerous industries including Petrochemical, Nuclear, Cement, Steel, and Air Pollution Control. Special materials, construction, coatings, and accessories are available to fit any application requirements.

TCF has completed thousands of successful installations across the globe and has a proven track record for tackling the most technically complex applications within the fan industry. TCF is also known for its technical design capabilities, comprehensive testing services, and responsive sales team. Due to the company’s extensive expertise and long-standing reputation for proven quality, TCF products continue to be specified around the globe.

TCF occupies over 1,000,000 sq. ft. of manufacturing space across ten facilities in the U.S, with expanded manufacturing and service operations located in South America, Europe, India, China, and Singapore. 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 Twin City Fan & Blower Sales Representative, who can be contacted through: Twin City Fan & Blower, Minneapolis MN; (763) 551-7600; email: [tcf\_sales@tcf.com](mailto:tcf_sales@tcf.com); [www.tcf.com](http://www.tcf.com).

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SECTION 23 34 23.02 CENTRIFUGAL ROOF VENTILATORS

1. GENERAL
   * + 1. SUMMARY

Specifier: Select fan drive style in following paragraph.

* + - * 1. Section includes Backward Inclined Flat Blade Centrifugal Fans, [belt] [direct] driven.
      1. REFERENCE STANDARDS
         1. American Bearing Manufacturers Association (ABMA): [www.americanbearings.org:](http://www.americanbearings.org:%20)

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:%20)

AMCA Standard 204 - Balance Quality and Vibration Levels for Fans

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

AMCA Publication 211 - Certified Ratings Program - Product Rating Manual for Fan Air Performance

AMCA Standard 260 - Laboratory Methods of Testing Induced Flow Fans for Rating

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

AMCA Publication 311 - Certified Ratings Program - Product Rating Manual For Fan Sound Performance

* + - * 1. American National Standards Institute (ANSI): [www.ansi.org](http://www.ansi.org):

ANSI Z9.5 – Laboratory Ventilation

* + - * 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

Specifier: When optional UL/cUL 705 compliance is required, retain the following subparagraph.

* + - * 1. Underwriters Laboratories, Inc. / Underwriters Laboratories of Canada (UL/cUL): [www.ul.com](http://www.ul.com):

UL/cUL 705 - Standard for Power Ventilators

* + - 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.

Fan volumetric flow rate, fan nozzle outlet velocity, induced flow rate, total volumetric flow rate, windband outlet velocity, and discharge plume height at indicated wind speed.

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 types tested in accordance with AMCA Standard 210 (air performance), AMCA Standard 260 (Induced Flow Fans) and AMCA Standard 300 (sound performance) in an AMCA-accredited laboratory.

Provide fan units rated according to AMCA Standard 211 (air performance) and AMCA Standard 311 (sound performance)

Provide fan units tested according to AMCA Standard 260.

* + - 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 TCF 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: 36 months from shipment by manufacturer.

1. PRODUCTS
   * + 1. MANUFACTURER
          1. Basis-of-Design Manufacturer: Provide fan units manufactured by **Twin City Fan & Blower**, Minneapolis MN; (763) 551-7600; email: [tcf\_sales@tcf.com](mailto:tcf_sales@tcf.com); website: [www.tcf.com](http://www.tcf.com).
          2. Source Limitations: Obtain fans from a single manufacturer.
       2. PERFORMANCE REQUIREMENTS
          1. Fan Performance Ratings: [Project site elevation- based] [Sea level elevation-based].
          2. AMCA Compliance: Provide units that bear the AMCA-Certified Rating Seal.
          3. Compliance:

Classified under UL 705.

* + - * 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70.
      1. BACKWARD INCLINED FLAT BLADE CENTRIFUGAL INDUCED FLOW FANS
         1. Description: [Direct] [Belt]- Driven, Backward Inclined Flat Blade Centrifugal Fans: Single width, single inlet, centrifugal fan.

Basis of Design Product: **Twin City Fan & Blower, Model BCIFE**.

Permanently attach nameplate displaying serial number and unit information.

Fan assemblies: Provide unit suitable for maintaining structural integrity and operation in 125 mile per hour (55.9 meter/second) wind without external guy - wires or supplemental supports.

* + - * 1. Fan Capacities, Characteristics, and Configuration: Refer to Drawing schedule.
        2. Fan Wheel: Provide fabricated wheel with flat, single thickness blades, continuously welded to backplate and wheel outer rim. 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: Where required, select option in the following paragraph to include extended grease lines.

* + - * 1. Bearings: Manufacturer's standard field-lubricated, self-aligning ball or spherical roller bearings with pillow block mounts, based on fan size and mounting orientation [, with grease lines extended to outside fan housing].

Minimum L-10 Bearing Life: 200,000 hours at maximum operating speed, in accordance with ABMA 9 for ball type, or ABMA 11 for roller type bearings.

* + - * 1. Housing: Continuously welded [steel] [aluminum] [304 stainless steel] [316 stainless steel], reinforced with rigid bracing. Includes aerodynamically spun inlet cone.

Specifier: In following subparagraph, a bolted access door is standard. A quick open latched access door is optional.

Housings with lock seams or partially welded construction are not acceptable.

Include threaded drain connection [with threaded plug] at lowest point of housing scroll.

Specifier: In following subparagraph, a shaft seal is standard. The standard shaft seal is not gas-tight. Gas-tight shaft seals are available options.

Provide [standard] [gas-tight] shaft seal to reduce leakage and protect the bearings from contaminated airstreams.

Specifier: Where external access to fan wheel is required, select from the access door options in the following paragraph.

Provide [bolted] [quick open latched] access door.

Specifier: Where required, retain option in following paragraph to include pre-punched duct flanges on inlet and outlet connections.

Provide housing with [pre-punched] flanges for making connections to ductwork.

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.
        2. Nozzle and Windband

Provide discharge nozzle and windband combination to induce ambient airflow from outside fan housing and increase discharge velocities to velocities that comply with ANSI Z9.5, minimum 3,000 fpm (15.2 m/s) without significantly affecting BHP requirements.

Provide windband to develop minimum 84 inch (2,134 mm) discharge height above roof surface.

Fan Nozzle Velocity: 9,500 fpm (48.3 m/s), maximum.

Induction by Windband and Nozzle Combination: Up to 278 percent of fan inlet capacity.

Specifier: Retain paragraph and subparagraphs below for belt-driven units only.

* + - * 1. Belt Drives:

Drive Components: V-belt drive, rated for minimum 200 percent of motor nameplate horsepower, with machined, cast-iron pulleys, and heat resistant, oil resistant, V-belts. Locate belts and drives outside fan housing.

Motor 10 HP and Smaller: Adjustable pitch.

Motor 15 HP and Larger: Fixed pitch.

Specifier: When belt guards are required, select among options in the following paragraph.

Belt Guard: Steel, totally [vented] [enclosed and sealed]. [OSHA compliant]. [Quick access.]. Factory paint belt guards yellow.

Specifier: The weather cover in the following paragraph is available for Arrangement 4 and Arrangement 10 fans only.

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

Specifier: Direct drive is available only for Arrangement 8 (size 402 and larger) 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.

* + - * 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: [3,600] [1,800] [1,200] [900] rpm.

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 the following paragraph.

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 TCF 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 paragraph below for belt-driven units only.

* + - * 1. Motor Mounting Platform: Heavy-duty motor mounting platform that adjusts to allow adjustment of drive belt tension.
        2. Hardware: Provide corrosion resistant stainless steel hardware and fasteners.
        3. Coatings:

Specifier: Retain subparagraph 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 gray enamel.

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

* + - * 1. Vibration Isolation:

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

Provide welded structural steel vibration isolation base and [spring] vibration isolators 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. Select options as required. Consult TCF 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:

Specifier: Delete paragraph 1 for fans in Arrangement 8. Select options as required.

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.

* + - * 1. Accessories:

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

Acoustic Windband: Provide noise attenuating windband at fan outlet.

Roof Curb: Self-flashing, 12 inches (305 mm) high [, with 1-1/2 inch (38 mm) thick insulation]. Fabricate roof curb of galvanized steel with wood nailer.

Flexible Duct Connections: Provide EPDM or PTFE elastomer round flexible connection assemblies with duct flanges matching fan inlet connections.

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

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

Shaft Guard: Provide sheet metal guards to cover exposed portions of fan shaft, while leaving bearings exposed.

Shaft Guard/Bearing Guard/Extended Lubrication Lines: Sheet metal guards to cover fan shaft and bearings, including extended lubrication lines from shaft bearings to Zerk fittings mounted safe from contact with moving parts. Paint guard assemblies yellow.

Specifier: Coupling guards in the following paragraph are available for Arrangement 8 fans only.

Coupling Guards: Sheet metal guards to cover fan shaft coupling. Paint coupling guard yellow.

Specifier: Straightening vanes in the following paragraph are available only when optional mixing plenum box is selected.

Vortex Breaker: Installed in the mixing plenum box at the fan inlet to minimize air turbulence.

Specifier: Where required, include mixing plenum box in paragraphs below

Mixing Plenum Box: Mixing plenum box features modular construction allowing for multiple configurations and retrofit installation.

Mixing Plenum Box: Mixing plenum box matching fan housing material of construction, to include integral duct flange to mate to fan inlet.

Specifier: In the following paragraph, the standard mixing plenum box configuration is bottom inlet. Side inlet is optional. For special duct adapting plates on bottom of box, contact factory prior to ordering.

Intake: [Bottom] [Side] intake mixing plenum box for attachment of building duct.

Mount mixing box on heavy duty roof curb.

Insulated mixing box with stainless steel liner.

Specifier: When required, retain the following paragraph for isolation and bypass dampers. These are useful to control the building exhaust flow, affluent air dilution, fan isolation as well as allow for system expansion.

Note the selection of damper materials and coatings. Select these to suit project requirements.

Isolation dampers: When multiple fans are mounted on one common plenum box, provide isolation dampers to isolate each fan in the system for mixing plenum box.

Specifier: The standard isolation damper is galvanized steel. Epoxy coated steel, Heresite coated steel, unfinished aluminum, epoxy coated aluminum, Heresite coated aluminum, 304 stainless steel, and 316 stainless steel are optional.

Parallel blade design, constructed of [galvanized steel] [epoxy-coated steel] [Heresite-coated steel] [unfinished aluminum] [epoxy-coated aluminum] [Heresite-coated aluminum] [304 stainless steel] [316 stainless steel].

Provide [24] [115] V-powered, two-position, spring return actuator rated for NEMA [2/IP54] [4] [7/9] environment to coordinate with fan operation.

Bypass Damper: Provide modulating bypass damper to maintain fan discharge velocity as fan delivery changes.

Specifier: The standard bypass damper is galvanized steel. Epoxy coated steel, Heresite coated steel, unfinished aluminum, epoxy coated aluminum, Heresite coated aluminum, 304 stainless steel, and 316 stainless steel are optional.

Opposed blade design, constructed of [galvanized steel] [epoxy-coated steel] [Heresite-coated steel] [unfinished aluminum] [epoxy-coated aluminum] [Heresite-coated aluminum] [304 stainless steel] [316 stainless steel].

Provide [24] [115] V-powered, modulating actuator, rated for NEMA [2/IP54] [7/9] environment, to coordinate with fan operation.

Specifier: When required, retain the following paragraph to get UL/cUL 705 compliance and labeling.

UL/cUL 705 Compliant Assembly: Provide components required for UL/cUL 705 compliance. Affix UL/cUL 705 labeling and nameplate to finished unit.

Specifier: When required, for Arrangement 1, 8, 9, or 10 fans, retain the high temperature package in the following paragraph.

High Temperature Package: Suitable for temperatures from 301 to 500 deg. F (149 to 260 deg. C).

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

Specifier: Retain following paragraph when spark-resistant construction is required. The standard is Type C spark resistant construction. Type A is optional. Select applicable subparagraph.

Spark Resistant Construction:

AMCA Type A: Provide aluminum or other non-ferrous metal parts in contact with flowing airstream. Maximum operating temperature: 250 deg. F (121 deg. C).

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

Specifier: Where flow measurement is required, retain following subparagraph. This flow measurement device can be used with instrumentation provided by Twin City Fans, or instrumentation provided as the work of a separate contract.

Piezometer Ring: Provide piezometer ring type differential pressure device with connections for field-installed flow measuring instrumentation.

Pressure Transducer without Display: Provide piezometer ring and transducer to convert differential pressure readings to 4 - 20 mA DC signal proportional to flow.

Specifier: When required, retain enclosure option in following paragraph.

Pressure Transducer/Transmitter with Display [NEMA 4X Enclosure]: Provide piezometer ring and transducer with local digital display to convert differential pressure readings to 4 - 20 mA DC signal proportional to flow. Include two independently adjustable SPDT dry-contact outputs.

Jib Crane and Mounting Base: Provide manually operated jib crane suitable for unit maintenance and motor removal.

Jib Crane Mounting Base: Provide mounting base for manually operated jib crane.

* + - 1. SOURCE QUALITY CONTROL
         1. Factory Run Test: Test run assembled fan units prior to shipment at specified operating speed or maximum RPM allowed. Statically and dynamically balance each wheel in accordance with AMCA 204 "Balance Quality and Vibration Levels for Fans" to Fan Application Category BV-3, Balance Quality Grade G6.3. 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, 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.

* + - * 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.

* + - * 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 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 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