Induced Flow Exhaust Fans
Suggested Specification Section 15500 (Master Format™ 1996)
Suggested Specification Section 23 38 16 (Master Format™ 2004)

PART 1 GENERAL

1.01 WORK INCLUDED

Induced Flow Exhaust Fans - Centrifugal

1.02 RELATED WORK

All sections, drawings plans, specifications and contract documents.

1.03 REFERENCES

A. AMCA Publication 99, “Standards Handbook” (2003 Edition)
B. AMCA Standard 210-99, “Laboratory Methods of Testing Fans for Aerodynamic Performance Rating”
C. AMCA Standard 211-05, “Certified Ratings Program- Product Rating Manual for Fan Air Performance”
D. AMCA Standard 300-96, “Reverberant Room Method for Sound Testing of Fans”
E. AMCA Publication 311-05, “Certified Ratings Program – Product Rating Manual for Fan Sound Performance”
F. AMCA 204-96, “Balance Quality and Vibration Levels for Fans”
G. AMCA 500-D-98, “Laboratory Methods of Testing Dampers for Rating”
H. AMCA 500-L-99, “Laboratory Methods of Testing Louvers for Rating”
I. SMACNA “HVAC Duct Construction Standards - Metal and Flexible”, Medium Pressure Plenum Construction
J. ANSI/AIHA Z9.5-2003, “Laboratory Ventilation”
K. ANSI/ABMA 11-1990 (R1999), “Load Ratings and Fatigue Life for Roller Bearings”
L. ASHRAE, “Laboratory Design Guide” (2002 Edition)
M. ASTM B117-03, “Standard Practice for Operating Salt Spray (Fog) Apparatus”
N. ASTM D2247-02, “Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity”
O. ASTM D2794-93(2004), “Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)”

1.04 QUALITY ASSURANCE

A. Performance ratings: Fans shall be licensed to bear the AMCA Certified Ratings Seal for Sound and Air Performance. Acceptable manufacturers whose equipment is not licensed to bear the AMCA Certified Ratings Seal for Sound and Air Performance shall submit sound and air performance data obtained and calculated in accordance with AMCA Standards 210, 211, 300, and 311. These tests shall be performed by a laboratory that is accredited by AMCA.

B. Fans shall be manufactured at an ISO 9001 Certified facility.

C. Units specified as Spark Resistant Construction shall conform to AMCA Standard 99-0401-86, “Classifications for Spark Resistant Construction.”

D. Fan impeller shall be statically and dynamically balanced in accordance with AMCA Standard 204-96, “Balance Quality and Vibration Levels for Fans.” Vibration tests shall be conducted and recorded on each assembled fan before shipment at the specified fan RPM. These readings shall conform to the AMCA 204-96 Standard.

E. Fan entrainment design shall have been verified by computational fluid dynamics (CFD). Computational fluid dynamics (CFD) evaluation of fan discharge and entrainment airflow may also be provided as requested by the owner and/or engineer.

F. Fan manufacturer shall provide at the owner and/or engineer’s expense and option, witness testing of the fan in an AMCA Accredited Laboratory during the submittal stage of the project. These tests shall be performed in accordance with AMCA Standard 210-99, “Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

1.05 SUBMITTALS

A. Provide dimensional drawings, product data and performance on each induced flow exhaust fan unit.

B. Provide fan curves for each fan at the specified point of operation. Airflow, static pressure and brake horsepower shall be clearly shown on the submittal. For multiple fan assemblies, fan curves shall be adjusted to show assembly operation.

C. Primary airflow from laboratory exhaust system, optional bypass airflow through mixing box, overall airflow through fan, and discharge nozzle airflow shall be provided. Outlet nozzle velocity and plume rise calculated per ASHRAE Applications Handbook shall also be provided for the specified fan performance and wind velocity.

PART 2 PRODUCTS

2.01 GENERAL

A. Fan performance data shall follow AMCA Standard Conditions of 0 Ft elevation and 70 Deg F. (Air Density shall be 0.075 lb/ft)

B. Fans selected shall allow for +/- 15% variation of scheduled static pressure and airflow.

C. **Option 1:** Fan shall be AMCA Arrangement 10, Belt Drive Upblast Centrifugal Airfoil Blower as dictated on the plans and specifications.

Option 2: Fan shall be AMCA Arrangement 9, Belt Drive Upblast Centrifugal Airfoil Blower as dictated on the plans and specifications.

Option 3: Fan shall be AMCA Arrangement 4, Direct Drive Upblast

Centrifugal Airfoil Blower as dictated on the plans and specifications.

Option 4: Fan shall be AMCA Arrangement 8, Direct Drive Upblast Centrifugal Airflow Blower as dictated on the plans and specifications.

D. Fan systems shall incorporate integral lifting lugs for ease of installation.

2.02 FAN HOUSING AND CONSTRUCTION

A. Fan housing shall be a minimum 14 gauge steel construction.

B. Adjustable motor plate, where applicable shall utilize threaded studs for positive belt tensioning.

C. Fan shall be constructed with an integral housing drain to alleviate rainwater.

D. Fan shall include a bolted and gasketed access door.

E. Belt driven fan shafts shall be AISI C-1045 hot rolled or stainless steel and accurately turned, ground, and polished. Shafting shall be sized for a critical speed of at least 125% of maximum fan RPM.

F. Unit fasteners exposed to corrosive airstream shall be of stainless steel construction.

G. **Option 1:** Unit components fabricated of steel shall be coated with an electrostatically applied, high performance, baked phenolic epoxy powder coating with an ultraviolet protective topcoat. Finish color shall be light gray. Coating thickness shall be 5.0 mils.

Option 2: Unit components fabricated of steel shall be coated with an electrostatically applied, baked epoxy powder coating with an ultraviolet protective topcoat. Finish color shall be dark gray. Coating thickness shall be 5.0 mils.

Option 3: Unit components fabricated of steel shall be coated with an electrostatically applied, baked polyester powder coating. Finish color shall be gray. Coating thickness shall be 2.0 mils.

Coating shall be salt spray tested per ASTM B117 for in excess of 1000 hours without failure, humidity resistance tested per ASTM D2247 for in excess of 1000 hours without failure, and impact resistance tested per ASTM D2794 and shall pass a minimum of 100 in-lbs.

H. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM.

I. Units specified as Spark Resistant Construction shall be constructed to the AMCA Spark Resistant Construction level as dictated on the plans and specifications.

J. Unit shall be shipped in ISTA Certified Transit Tested Packaging.

2.03 DILUTION NOZZLE

A. Fans shall incorporate a double concentric accelerator fiberglass reinforced plastic (FRP) induction nozzle selected for optimal performance per the plans and specifications. Nozzle shall be constructed and designed to avoid extreme variations in velocity flows across the outlet, even against wind loading. Where required, CFD shall be provided demonstrating this on submitted nozzle. Bifurcated designs shall not be allowed.

B. Induction nozzle shall be constructed and designed to efficiently handle up to 7000 feet per minute outlet velocity and shall have a optimally matched accelerator for the specified design conditions.

2.04 CENTRIFUGAL FAN IMPELLER

A. Fan impeller shall be steel, non-overloading, centrifugal backward inclined, airfoil type. Blades shall be continuously welded to the backplate and inlet shroud.

B. Fan impeller hub shall be keyed and securely attached to the fan shaft. Fan shaft shall be AISI C-1045 hot rolled or stainless steel and accurately turned, ground, and polished. Shafting shall be sized for a critical speed of at least 125% of maximum fan RPM.

C. Fan impeller shall be statically and dynamically balanced in accordance with AMCA Standard 204-96, “Balance Quality and Vibration Levels for Fans.”

D. Fan impeller shall be coated with finish to match the fan housing.

E. **Option 1:** Belt driven fan bearings shall be designed and tested specifically for use in air handling applications. Construction shall be heavy duty regreaseable ball or roller type in cast iron pillow block housing.

Option 2: Pillow block bearings shall utilize concentric mounting locking collars for attachment to fan shaft.

F. **Option 1:** Belt driven fan bearings shall be selected for a minimum L50 life of not less than 200,000 hours.

Option 2: Belt driven fan bearings shall be selected for a minimum L10 life of not less than 200,000 hours.

G. **Option 1:** Belt driven fan bearings shall have copper lubrication lines run to a centralized location for ease of maintenance.

Option 2: Belt driven fan bearings shall have stainless steel lubrication lines run to a centralized location for ease of maintenance.

2.05 BYPASS AIR PLENUM

A. For constant volume systems the fan and nozzle assembly shall be directly connected to the roof curb and exhaust duct.

B. For variable volume systems a bypass air plenum shall be supplied as shown on the contract drawings.
C. Bypass air plenum shall introduce outside air above the roof level and shall have rain hood(s) and bird screen protection over the bypass air damper(s).
D. Bypass air plenum shall be constructed of welded steel, minimum 14 gauge, with a finish to match the fan housing.
E. Bypass dampers shall be opposed blade design, coated to match the fan housing and plenum.
F. A fan isolation damper gravity type coated to match fan housing and plenum shall be provided as show on the project documents.

2.06 FAN MOTORS AND DRIVES

A. **Option 1:** Fan motors shall be premium efficiency, NEMA frame, nominal 1800 or 3600 RPM Totally Enclosed Fan Cooled (TEFC) with a 1.15 service factor.

Option 2: Fan motors shall be premium efficiency, NEMA frame, nominal 1800 or 3600 RPM Totally Enclosed Fan Cooled, Inverter Duty Labeled with a 1.15 service factor.

Option 3: Fan motors shall be premium efficiency, NEMA frame, nominal 1800 or 3600 RPM Mill and Chem duty with a 1.15 service factor.

Option 4: Fan motors shall be premium efficiency, NEMA frame, nominal 1800 or 3600 RPM Explosion Proof with 1.0 service factor. Class ___ and Division ___ Rating.

B. **Option 1:** Belt driven fan drive belts shall be oil and heat resistant, non-static type. Fixed drives shall be sized for a minimum 1.5 service factor (150% of the motor horsepower) and shall be readily and easily accessible for service, if required.

Option 2: Belt driven fan drive belts shall be oil and heat resistant, non-static type. Fixed drives shall be sized for a minimum 2.0 service factor (200% of the motor horsepower) and shall be readily and easily accessible for service, if required.

C. Belt driven fans shall utilize precision machined cast iron type sheaves, keyed and securely attached to the wheel and motor shafts.

PART 3 INSTALLATION

A. Install high plume dilution fan system(s) as indicated on the contract drawings and in the contract specifications.

B. Install fan system(s) in accordance with manufacturers Installation, Operation, and Maintenance Manuals. Start up procedures from the IOM manuals shall be strictly followed.

PART 4 ACCEPTABLE MANUFACTURERS

A. Loren Cook Company, Vari-Plume™ Induced Flow Exhaust Fan, Model CA-VP.