

## SECTION 233516 - ENGINE EXHAUST SYSTEMS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Exhaust fans.
- B. Ductwork and duct fittings.
- C. Inlet fittings.
- D. Accessories.
- E. Carbon monoxide detectors.

## 1.2 RELATED REQUIREMENTS

- A. Section 230513 - Common Motor Requirements for HVAC Equipment: Fan motors.
- B. Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment: Vibration isolators.

## 1.3 REFERENCE STANDARDS

- A. ACGIH (IV) - Industrial Ventilation, A Manual of Recommended Practice; American Council of Governmental Industrial Hygienists; 2007, 26th edition.
- B. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2003.
- C. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).
- D. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; <http://www.amca.org/licenses/search.aspx>.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2006.
- G. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a.

- H. AWS D9.1M/D9.1 - Sheet Metal Welding Code; American Welding Society; 2006.
- I. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.
- J. SMACNA (RIDC) - Rectangular Industrial Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2004.
- K. SMACNA (ROUND) - Round Industrial Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 1999.

#### 1.4 SUBMITTALS

- A. See Section 013300 - Submittal Procedures, for submittal procedures.
- B. Product Data: Provide manufacturers literature and data sheets indicating rated capacities, dimensions, weights and point loadings, accessories, electrical characteristics and connection requirements, wiring diagrams, and location and sizes of field connections.
  - 1. Provide fan curves with specified operating point clearly plotted.
  - 2. Submit sound power levels for both fan inlet and outlet at rated capacity.
- C. Shop Drawings: Indicate dimensions, sizes, weights and point loadings, and locations and sizes of field connections.
- D. Manufacturer's Installation Instructions: Include assembly and installation instructions.
- E. Operation and Maintenance Data: Include instructions for fan lubrication, motor and drive replacement, spare parts list, and wiring diagrams.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Exhaust Hose: One, 10 foot (3 mm) length.

#### 1.5 QUALITY ASSURANCE

- A. Fan Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- B. Fan Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
- C. Fan Fabrication: Conform to AMCA 99.
- D. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

- E. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## 1.6 FIELD CONDITIONS

- A. Permanent exhaust system may not be used for ventilation during construction.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Car-Mon Products: [www.car-mon.com](http://www.car-mon.com).
- B. Monoxivent.
- C. Substitutions: See Section 016000 - Product Requirements.

### 2.2 CENTRIFUGAL FANS

- A. Manufacturers:
  - 1. Monoxivent.
  - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Base performance on sea level conditions.
- C. Performance:
  - 1. Refer to Fan Schedule.
- D. Wheel and Inlet: Steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.
- E. Housing: Heavy gage steel, spot welded with inlet bell and shaped cut-off, factory finished with enamel or prime coat.
- F. Motors and Drives:
  - 1. Motors: As indicated, in compliance with Section 230513.
  - 2. Bearings: Heavy duty pillow block type, self aligning, grease-lubricated ball bearings or roller bearings.

3. Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil.
4. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed, variable and adjustable pitch, matched belts, and rated minimum 1.5 times nameplate rating of motor.
5. Belt Guard: Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible; of 12 gage (2.8 mm), 3/4 inch (20 mm) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated.

### 2.3 DUCTWORK AND DUCT ACCESSORIES

#### A. Materials:

1. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

#### B. Ductwork:

1. Fabricate and support in accordance with:
  - a. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible.
  - b. SMACNA (ROUND) - Round Industrial Duct Construction Standard and SMACNA (RIDC) - Rectangular Industrial Duct Construction Standard.
  - c. ACGIH (IV) - Industrial Ventilation Manual.
2. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.
3. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
4. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard.
5. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow, with liquid adhesive plus sheet metal screws.
6. Joints: Minimum 4 inch (100 mm) cemented slip type, brazed or electric welded to AWS D9.1M/D9.1. Prime coat welded joints.
7. Provide standard 45 degree lateral wye branch fittings unless otherwise indicated.
8. Use double nuts and lock washers on threaded rod supports.

- #### C. Flexible Connectors:
- UL listed, fire-retardant polyethylene impregnated fabric, minimum density 20 oz per sq yd (0.68 kg/sq m), approximately 2 inches (50 mm) wide, crimped into metal edging strip.

## 2.4 EXHAUST SYSTEM ACCESSORIES

- A. Tail Pipe Adapters: Rubber formed to tapered cone with spring clip attachment, adapter size 6 inch (150 mm), for connection to 2-1/2 inch (65 mm) diameter hose.
- B. Flexible Exhaust Hose: Heat resistant neoprene coated fabric spring steel wire reinforced, rated for duty to 260 degrees F (125 degrees C) and 20 inches WG (5 kPa) positive or negative.
- C. Overhead Suspension System: System to support overhead hose consisting of 5/16 inch (8 mm) diameter nylon cable, 2 inch (50 mm) diameter cadmium plated cast steel swivel pulleys, 6 inch (150 mm) cadmium plated cast steel cleats.
- D. Exhaust Hose Reel: Spring operated, manually controlled reel consisting of metal cylinder with internal aluminum flexible pipe, zinc plated steel stand, two steel springs, brake mechanism, hose stop, hose guide and 16 feet (5 meters) of 2-1/2 inch (65 mm) diameter hose.
- E. Gas Detection System: Vulcain, or approved equal. System shall be fully functional, stand-alone, and shall consist of the following minimum requirements: Controller with visual and audible alarms, 120V to 17-27 vac step-down transformer, Analog / Digital Input Converter, Carbon Monoxide Gas Detection Transmitter (with a range of 0-500 ppm, installed at 3'-0" above finished floor), Nitrogen Dioxide Gas Detection Transmitter (with a range of 0-10 ppm, installed at 3'-0" below ceiling), Hydrogen Gas Detection Transmitter, Power Relays for ventilation equipment, and strobe / horn alarm.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install equipment in accordance with manufacturers instructions.
- B. Install flexible connections at fan inlet and discharge. Ensure metal bands of connectors are parallel with minimum 1 inch (25 mm) flex between ductwork and fan while running.
- C. Provide pitot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage.
- D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

END OF SECTION