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IPC-9591

Performance Parameters (Mechanical, Electrical, Environmental and Quality/Reliability) for Air Moving Devices

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A standard developed by IPC

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Developed by the Air Moving Devices Standard Subcommittee (9-81) of
the OEM Management Council Steering Committee (9-80) of IPC

Users of this publication are encouraged to participate in the
development of future revisions.

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Acknowledgment

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Performance Parameters (Mechanical, Electrical, Environmental and Quality/Reliability) For Air Moving Devices

1 SCOPE

1.1 Statement of Scope This document will standardize the Performance Parameters for Air Moving Devices. The phrase “Air Moving Device” (or “Air Mover”) refers to equipment such as, fans, blowers and other forced air movement technologies. This specification sets requirements for design, manufacture, and test application of Air Moving Devices, and is intended for use by the industry. The term “end user” as used in this document refers to the OEM or design/materials entity responsible for specifying the function and reliability of an Air Moving Device in a final product application.

1.2 Description Air Moving Devices addressed in this document are used in the electronics industry for the cooling of heat-producing components, and range from small devices mounted directly to hot components such as micro-processor air moving devices, to larger devices used to force air through a chassis containing many heat dissipating components.

Performance Parameters are comprised of **Mechanical, Electrical, Environmental, and Quality/Reliability** requirements.

Mechanical requirements include bearing design and grease, rotor balancing, self induced vibration, general air-flow configuration, form factor (size, shape and wiring color), device orientation, air movement characteristics, acoustics, and materials used in fabrication of the device.

Electrical requirements define the electrical interface, including type of power (AC, DC, or Pulse Width Modulation), voltage, frequency and current needs, speed control and, where used, tachometer signal and any other electrical interfaces provided by the air moving device.

Environmental requirements entail both shipping and operating temperatures, humidity, shock and vibration limits.

Quality/Reliability Assurance requirements include definitions and requirements for testing the reliability of Air Moving Devices.

1.3 Purpose The purpose of this document is to create a set of consistent specifications of Air Moving Devices for the electronics industry. These specifications will apply to suppliers of air moving devices, including their design and

testing, and will provide guidelines for the end user to ensure adequate specifications for use in their products. All of the specifications and requirements defined in this document are intended to be part of suppliers’ Air Moving Devices Certifications outlined by the customers and will ship with first article and any design changes to the air moving device.

1.4 Terms and Definitions The definition of all terms used herein **shall** be as specified in IPC-T-50 and as defined below.

AABUS –

(As an Acronym): As Agreed Between User and Supplier.

(As a Term): Indicates additional or alternate requirements to be decided between the user and the supplier in the procurement documentation. Examples include contractual requirements, modifications to purchase documentation, and information on the drawing. Agreements can be used to define test methods, conditions, frequencies, categories or acceptance criteria within a test, if not already established.

2 APPLICABLE DOCUMENTS

2.1 International Organization for Standardization¹

ISO 281,12-1 Rolling Bearings – Dynamic Load Ratings and Rating Life

ISO 1940-1 Mechanical Vibration – Balance Quality Requirements for Rotors in a Constant (Rigid) State

ISO 2953 Balancing Machines – Description and Evaluation

ISO 3741 Determination of Sound Power Levels of Noise Sources – Precision Methods for Broad-Band Sources in Reverberation Rooms (Equivalent to ANSI/NAIS S12.51)

ISO 3744 Determination of Sound Power Levels Noise Sources Using Sound Pressure – Engineering Method in an Essentially Free Field Over a Reflecting Plane (Equivalent to ANSI/NAIS S12.54)

ISO 9296 Declared Noise Emission Values of Computer and Business Equipment

ISO 10302 Method for the Measurement of Airborne Noise Emitted by Small Air-Moving Devices (Equivalent to ANSI S12.11)

1. www.iso.org

2.2 ECMA International²

ECMA 275 Measurement of Structure-Borne Vibration Induced by Small Air Moving Devices (AMDs)

2.3 International Electrotechnical Commission³

IEC 60529 Degrees of Protection Provided by Enclosures (equivalent to EN60529)

IEC 60950 Information Technology Equipment – Safety

2.4 Military⁴

MIL-HDBK-217 Reliability Prediction of Electronic Equipment

2.5 Telcordia⁵

SR332 Reliability Prediction Procedure for Electronic Equipment

2.6 American Society of Heating, Refrigerating and Air-Conditioning Engineers⁶

ANSI/ASHRAE 51/AMCA Standard 210 Laboratory Methods of Testing Air Moving Devices for Aerodynamic Performance Rating

2.7 Air Movement & Control Association International, Inc.⁷

ANSI/AMCA Standard 210 Laboratory Methods of Testing Air Moving Devices for Aerodynamic Performance Rating

ANSI/AMCA Standard 610 Methods of Testing Airflow Measurement Stations for Rating

3 MECHANICAL REQUIREMENTS

This section describes how an Air Moving Device supplier documents (and in some cases, tests) mechanical design, and what the end user should specify for mechanical attributes of an Air Moving Device.

3.1 Bearing Design The supplier **shall** be responsible for providing information on bearing manufacturer, model, and other specifics as listed in Appendix A – Information Required from Air Moving Device Supplier. Appendix A is not intended to be a complete list; other similar, relevant information **shall** be provided upon request.

3.2 Lubrication System The Air Moving Device supplier **shall** provide any information the end user requests on a lubrication system (grease, oil or any other antifriction approaches), according to the requirements listed in Appendix A, Information Required from Air Moving Device Supplier.

plier. Appendix A is not intended to be a complete list; other similar, relevant information **shall** be provided upon request.

3.3 Rotor Balancing Imbalance in the rotor/impeller of an Air Moving Device can cause excessive vibration, noise, and premature wear even when adequate bearing design and proper grease have been used. The Air Moving Device supplier **shall** provide evidence of rotor balancing results for all products under consideration by the end user.

- Air Moving Device supplier **shall** provide balance quality grade information as defined by ISO 1940-1, Mechanical Vibration – Balance Quality Requirements for Rotors in a Constant (Rigid) State.
- Rotor imbalance **shall** be determined using a dynamic balance machine; the balance speed **shall** be recorded (reference ISO 2953).
- The balance requirement **shall** be met by the assembled air moving device with all the rotating components including impeller, magnets and any other rotating components. ***It is not adequate for the unassembled impeller alone*** to meet the balance requirement.

3.4 General Airflow Configuration There are three basic types of airflow configuration: axial, radial and cross flow. The end user **shall** be responsible for selecting an appropriate Air Moving Device for the intended product design.

3.5 Form The supplier **shall** specify, in a requirements document, all package dimensions and tolerances.

- The supplier **shall** assure that the Air Moving Device will conform to the package size and tolerances defined on the supplier engineering drawing.
- The device **shall** comply with all dimensional requirements listed on the supplier engineering drawing or data sheets and meet the associated tolerances.
- Measurement, quality data and a tolerance analysis of all dimensions indicated as “critical dimensions” on the supplier engineering drawing or data sheets **shall** be provided by the supplier upon request, and in the Air Moving Devices Certifications AABUS.
- The location of any sensing devices, hub strut, or wire exit positions **shall** be made consistent with the depiction on the supplier engineering drawing or data sheets.
- Air moving devices controlled by a temperature sensor housed within the air moving device assembly **shall** be documented on the supplier engineering drawing or data sheets.

2. www.ecma-international.org

3. www.iec.ch

4. www.dscc.dla.mil

5. www.telcordia.com

6. www.ashrae.org

7. www.amca.org

- Wiring location **shall** be documented and wire insulation colors defined on the supplier engineering drawings or data sheets.

3.6 Orientation Supplier **shall** specify the supported air moving device orientation:

1. Shaft vertical; inlet up.
2. Shaft vertical; inlet down.
3. Shaft horizontal.
4. Operational orientation not restricted.

3.7 Air Movement Airflow of an air moving device or blower depends on its design, the supplied voltage or Pulse Width Modulation (PWM) duty cycle, and the static pressure against which it must move the air. Typical pressure-flow curves are illustrated in Figure 3-1 and Figure 3-2.

The vertical Y-axis indicates the static pressure that the air moving device outputs while X-axis indicates the volumetric flow rate. English units of inches of water pressure should be used to indicate pressure and the volumetric flow rate should be given in cubic feet per minute. Secondary units in SI can be provided (Pa for pressure and cubic meters per hour for flow rate).

The Air Moving Device supplier **shall** provide air movement characteristics, based on testing, using the methods described below:

- The supplier-provided Static Pressure vs. Airflow curves **shall** be acquired with the air moving device operating at its nominal voltage and at its low, medium and high speeds, for example, 50%, 75% and 100% of the nominal speed, as seen in Figure 3-2. The operating curves **shall** extend from the shut-off point (zero flow rate) to free-air (zero static pressure), except when the air mover is not intended to operate over the entire range (for example, due to winding overheating).
- The “Static Pressure vs. Airflow” curve **shall** be developed per ANSI/AMCA Standard 210.
- The supplier **shall** assure test equipment is maintained according to ANSI/AMCA Standard 610.
- Standard air density **shall** be used on all pressure-flow diagrams for pressure-airflow corrections and **shall** be fixed at 1.2 kg/m³ (0.075 lb/ft³), (air at 20°C [68°F], 101.3 kPa [14.7 psia], and 50% relative humidity). The supplier **shall**, on request, supply numeric soft-copy data tables. The tables must include flow, pressure, RPM, voltage and current at each of the reported test conditions.

3.8 Acoustical Acoustical noise emission sound power levels at specified static pressure(s) and voltage(s), rpm(s) or PWM(s) **shall** be provided for the Air Moving Device. The noise levels for an Air Moving Device can vary significantly, depending on the static pressure and flow.

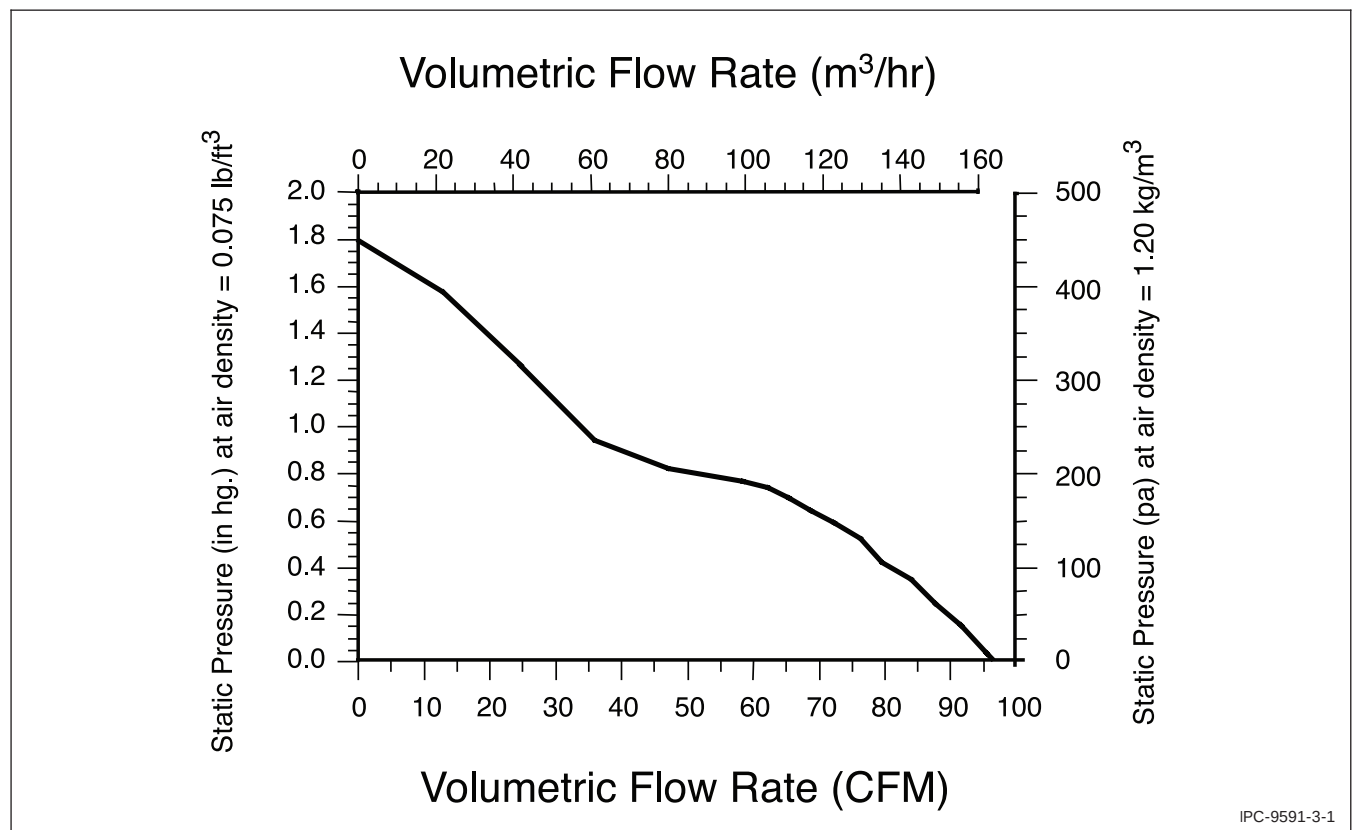


Figure 3-1 Air Moving Device Static Pressure vs. Flow Rate Single Curve (example)