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Australian Standard®

SAA FAN TEST CODE

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Association of Consulting Engineers, Australia
Australasian Institute of Mining and Metallurgy
Australian Institute of Refrigeration Air Conditioning and Heating
Bureau of Steel Manufacturers of Australia
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INDUSTRIAL FANS— DETERMINATION OF PERFORMANCE CHARACTERISTICS known as the SAA FAN TEST CODE

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PREFACE

This Standard was prepared by the Association's Committee on Industrial Fans in response to a request by the Confederation of Australian Industry for standardized methods of test which can be used either to determine or to prove performance values. The Standard is limited to test procedures and it does not attempt to control manufacturing materials, procedures, or design techniques.

In the preparation of this Standard, considerable assistance has been obtained from BS 848, Fans for General Purposes, Part 1—Methods of Testing Performance, AMCA 210-74 (ASHRAE 51-75), Laboratory Methods of Testing Fans for Rating, and from a variety of drafts of ISO/TC 117, Industrial Fans. The Standard incorporates certain material in common with one or another of these documents, but is not exactly like any of them.

The Foreword explains the philosophy underlying this Standard and outlines the more significant comparisons between this and other Standards.

It should be clearly understood that the publication of this Standard does not imply an intention that it be implemented immediately and universally, or retrospectively. Neither does it require that existing data derived from other Standards be discarded.

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FOREWORD

This Standard has much in common with traditional fan testing Standards, but differs in three significant ways as follows:

(a) For the specific case of volume flow rate and fan pressure measurement by the downstream test duct method, it introduces as an alternative a technique that uses swivelling probes in the airstream which measure yaw, total pressure, and static pressure.

(b) It adopts the total pressure concept as the preferred basis for reporting the characteristics of a fan.

(c) It grades the test methods into Class A and Class B to give an indication of the accuracy of the results obtained.

The traditional measurement-duct method for determining downstream volume airflow which incorporates an airflow straightener remains, but the yawmeter method has been introduced as an alternative to counter uncertainties arising from the use of the straightener. It is usual to include in the calculations some allowance for the losses caused by the straightener itself, but these are based on an assumption of straight fully developed pipe flow and provide for skin friction losses only. As swirl in the airstream increases, straightener losses due to aerodynamic effects must obviously increase, but there is no way of judging what these losses might be or accounting for them. A further objection is that a straightener may conceal the existence of an airflow fault in one fan while doing nothing for another which is superior to it. Thus, the gap between superior and inferior fans is artificially narrowed. (A brief discussion of the influence on performance of inlet and outlet flow quality faults is given in Appendix A.)

The yawmeter test method has no device for straightening the swirling airflow, but determines the velocity in the actual direction of flow. Vectoring is applied to obtain mean axial flow velocity and hence volume flow rate. Considerable experimental work has indicated that the accuracy and the reliability of the results are excellent.

The method entails traversing the airflow at a specified test plane, measuring yaw, and static and total pressures at 24 or 30 points depending on flow quality. This measurement plane needs to be located far enough from the fan outlet to ensure that the resulting swirling flows have coalesced to such a degree that unsteadiness is reduced to an acceptable level for measurement purposes. Approximate values for the mean tangential velocity pressure can be obtained when the ‘conservation of angular momentum’ convention is applied to swirling flows in circular ducts of restricted length. Knowing the yaw angles, the component axial velocities and total pressures can be determined with a high degree of accuracy.

This Standard treats the yawmeter method as being a preferred method having a Class A accuracy grading. whereas methods using a downstream flow straightener are graded as Class B. It should be clearly understood that this grading does not indicate fan quality, only the accuracy of the test method; whether the outlet flow quality is good or bad, methods of either class can be employed.

All fluid losses are essentially losses in total pressure, hence the change in emphasis from ‘fan static pressure’ to a total pressure term. For an exhaust fan, because the dynamic pressure at discharge is dissipated, the term ‘fan inlet total pressure’, is synonymous with the commonly used one, namely ‘fan static pressure’, and may be substituted without conflicting with the traditional definition of the latter. Where the fan inlet flow complies with specifications, then the only pressure determination needed is either—

(i) fan total pressure (blower and in-line fans); or

(ii) fan inlet total pressure (exhaust and diaphragm-mounted fans).

A choice of either Class A or Class B test procedure is available. Where the fan inlet flow does not comply with the specifications, blower and diaphragm-mounted fans must be treated separately, resulting in the following four classifications:

A. Free inlet, free outlet (diaphragm-mounted fans).

B. Free inlet, ducted outlet (blower fans).

C. Ducted inlet, free outlet (exhaust fans).

D. Ducted inlet, ducted outlet (in-line fans).