

# ASME PTC 11-2008

(Revision of ASME PTC 11-1984)

# Fans

---

## Performance Test Codes

AN AMERICAN NATIONAL STANDARD



The American Society of  
Mechanical Engineers



Date of Issuance: December 8, 2008

This Code will be revised when the Society approves the issuance of a new edition. There will be no addenda issued to PTC 11-2008.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this document. Periodically certain actions of the ASME PTC Committee may be published as Code Cases. Code Cases and interpretations are published on the ASME Web site under the Committee Pages at <http://cstools.asme.org> as they are issued.

ASME is the registered trademark of The American Society of Mechanical Engineers.

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME does not "approve," "rate," or "endorse" any item, construction, proprietary device, or activity.

ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable letters patent, nor assumes any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

ASME accepts responsibility for only those interpretations of this document issued in accordance with the established ASME procedures and policies, which precludes the issuance of interpretations by individuals.

No part of this document may be reproduced in any form,  
in an electronic retrieval system or otherwise,  
without the prior written permission of the publisher.

The American Society of Mechanical Engineers  
Three Park Avenue, New York, NY 10016-5990

Copyright © 2008 by  
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS  
All rights reserved  
Printed in U.S.A.

## CONTENTS

Notice .....	vi
Foreword .....	vii
Committee Roster .....	ix
Correspondence With the PTC 11 Committee .....	xi
<b>1      Object and Scope .....</b>	<b>1</b>
1-1    Object.....	1
1-2    Scope.....	1
1-3    Applicability.....	2
1-4    Uncertainty.....	2
<b>2      Definitions of Terms, Symbols, and Their Descriptions .....</b>	<b>3</b>
2-1    Symbols .....	3
2-2    Definitions.....	8
<b>3      Guiding Principles .....</b>	<b>15</b>
3-1    Introduction .....	15
3-2    Prior Agreements .....	15
3-3    Code Philosophy.....	15
3-4    System Design Considerations .....	18
3-5    Internal Inspection and Measurement of Cross Section.....	18
3-6    Test Personnel .....	19
3-7    Point of Operation .....	19
3-8    Method of Operation During Test .....	19
3-9    Inspection, Alterations, and Adjustments .....	19
3-10    Inconsistencies.....	20
3-11    Multiple Inlets or Ducts .....	20
3-12    Preliminary Test .....	20
3-13    Reference Measurements .....	20
<b>4      Instruments and Methods of Measurement .....</b>	<b>22</b>
4-1    General Considerations .....	22
4-2    Traverse Specifications .....	22
4-3    Barometric Pressure.....	29
4-4    Temperature .....	30
4-5    Moisture .....	30
4-6    Gas Composition .....	31
4-7    Pressure Sensing.....	31
4-8    Pressure Indicating .....	40
4-9    Yaw and Pitch .....	41
4-10    Rotational Speed.....	44
4-11    Input Power .....	44
<b>5      Computation of Results .....</b>	<b>47</b>
5-1    General Considerations .....	47
5-2    Correction of Traverse Data.....	47
5-3    Gas Composition .....	49
5-4    Density .....	52

5-5	Fluid Velocity .....	52
5-6	Mass Flow Rate.....	53
5-7	Flow-Weighted Averages .....	54
5-8	Fan Input Power .....	55
5-9	Fan Speed (Slip Method) .....	55
5-10	Mass Flow Rate: Specific Energy Approach .....	55
5-11	Volume Flow Rate: Pressure Approach .....	57
5-12	Inlet Flow Distortion .....	59
5-13	Uncertainties .....	62
<b>6</b>	<b>Report of Results .....</b>	<b>68</b>
6-1	General Requirements .....	68
6-2	Executive Summary .....	68
6-3	Introduction.....	68
6-4	Calculations and Results.....	68
6-5	Instrumentation .....	69
6-6	Conclusions.....	69
6-7	Appendices .....	69
<b>7</b>	<b>Uncertainty Analysis .....</b>	<b>70</b>
7-1	Introduction.....	70
7-2	Uncertainty Propagation Equations .....	70
7-3	Assigning Values to Primary Uncertainties .....	71
7-4	Fan Mass Flow and Uncertainty for Multiple Traverse Planes.....	74
<b>Figures</b>		
2-2.4-1	Typical Input and Outlet Boundaries .....	10
2-2.4-2	Typical Input Power Boundaries .....	11
4-2.2-1	Fan Room Pressure.....	24
4-2.4-1	Sampling Point Details (Rectangular Duct).....	25
4-2.4-2	Sampling Point Details (Circular Duct).....	26
4-2.4-3	Number of Traverse Points .....	27
4-2.5-1	Probe Orientation: Centrifugal Fans.....	28
4-2.5-2	Probe Orientation: Axial Fans.....	29
4-7-1	Fechheimer Probe.....	32
4-7-2	Five-Hole Probe .....	33
4-7-3	Yaw and Pitch Planes .....	34
4-7-4	Yaw and Pitch Convention .....	34
4-7.1-1	Five-Hole Probe Photos .....	35
4-7.1-2	Prism Probe Cut-Away.....	36
4-7.3-1	Free Stream Nozzle Jet.....	37
4-7.3-2	Wind Tunnel .....	37
4-7.3-3	Free Stream .....	38
4-9.3-1	Pitch Angle, $\phi$ , Versus Pitch Coefficient, $C_\phi$ .....	42
4-9.3-2	Velocity Pressure Coefficient, $K_v$ , Versus Pitch Pressure Coefficient, $C_\phi$ .....	43
4-9.3-3	Total Pressure Coefficient, $K_t$ , Versus Pitch Pressure Coefficient, $C_\phi$ .....	43
5-12.7-1	Traverse Point Geometry .....	61

**Tables**

4-11.5-1 Summary of Instrumentation Requirements.....	46
7-3.2.2-1 Typical Values for Primary Systematic Uncertainty .....	73

**Mandatory Appendix.....**

I Reduced Load Fan Input Power Determination .....	75
--	----

**Nonmandatory Appendices .....**

A Data Sheets.....	77
B Sample Calculations .....	82
C Method of Approaching a Specified Point of Operation.....	124
D Derivations of Uncertainties Equations .....	128
E References and Further Reading.....	163