

ASME PTC 34-2007

Waste Combustors With Energy Recovery

Performance Test Codes

AN AMERICAN NATIONAL STANDARD



**The American Society of
Mechanical Engineers**

Three Park Avenue • New York, NY 10016

CONTENTS

Notice	v
Foreword	vi
Committee Roster	vii
Correspondence With the PTC 34 Committee	viii
Introduction	ix
Section 1 Object and Scope	1
1-1 Object	1
1-2 Scope	1
1-3 Uncertainty	1
Section 2 Definitions and Description of Terms	2
2-1 Definitions	2
2-2 Description of Terms	4
2-3 Units and Conversions	4
2-4 Steam Generator Envelope	4
Section 3 Guiding Principles	8
3-1 Introduction	8
3-2 Planning for the Test	8
3-3 Test Personnel and Responsibilities	8
3-4 Test Preparation, Test Apparatus, and Plant Equipment	9
3-5 Conduct of Test	9
3-6 Data Evaluation and Reporting	11
3-7 Prior Agreements	12
Section 4 Instruments and Methods of Measurement	14
4-1 Introduction	14
4-2 Data Required	14
4-3 General Measurement Requirements	14
4-4 Temperature Measurement	21
4-5 Pressure Measurement	22
4-6 Flow Measurement	25
4-7 Sampling and Analysis	29
Section 5 Computation of Results	34
5-1 Introduction	34
5-2 Measurement Data Reduction	34
5-3 Output (Q_{rO}), Btu/hr (W)	35
5-4 Input	36
5-5 Energy Balance	36
5-6 Efficiency	37
5-7 Residue Properties	37
5-8 Flue Gas Products	38
5-9 Combustion Air Properties	39
5-10 Air and Flue Gas Temperature	41
5-11 Losses	42
5-12 Credits	44
5-13 Supplementary Fuel Input	45
5-14 <i>HHV</i> of Waste Fuel	45
5-15 Sorbent and Other Additives	45
5-16 Uncertainty	45

5-17	Other Operating Parameters	48
5-18	Corrections to Standard or Guarantee Conditions	48
5-19	Enthalpy of Air, Flue Gas, and Other Substances Commonly Required for Energy Balance Calculations	51
5-20	Acronyms	53
Section 6	Report of Results.....	65
6-1	Introduction	65
6-2	Contents of Report	65
Section 7	Uncertainty Analysis.....	67
7-1	Introduction	67
7-2	Fundamental Concepts	67
7-3	Pretest Uncertainty Analysis and Test Planning	74
7-4	Equations and Procedures for Determining the Standard Deviation for the Estimate of Random Error	74
7-5	Equations and Guidance for Determining Systematic Uncertainty	78
7-6	Uncertainty of Test Results	83
Figures		
2-4	Typical System Boundary	7
3-5.4	Repeatability of Runs	11
4-4.3.1-1	Sampling Grids — Rectangular Ducts	23
4-4.3.1-2	Sampling Grids — Circular Ducts	24
5-19.9-1	Mean Specific Heat of Dry Air vs. Temperature	55
5-19.9-2	Mean Specific Heat of Water Vapor vs. Temperature	56
5-19.9-3	Mean Specific Heat of Dry Flue Gas vs. Temperature	58
5-19.9-4	Mean Specific Heat of Dry Residue vs. Temperature	59
7-2.2-1	Types of Errors in Measurements	69
7-2.2-2	Time Dependence of Errors	69
7-2.3	Constant Value and Continuous Variable Models	71
7-5.2.1-1	Generic Calibration Curve	80
Tables		
2-3	Units and Conversions	5
3-5.5	Operating Parameter Deviations	11
4-2-1	Parameters Required for Input, Efficiency, and HHV Determinations	15
4-2-2	Parameters Required for Wet Flue Gas Flow Using Economizer Heat Balance	18
4-2-3	Parameters Required to Determine Corrected Flue Gas Exit Temperature	18
4-3.5	Potential Instrumentation Systematic Uncertainties	20
5-16.3	Two-Tailed Student's <i>t</i> Table for the 95% Confidence Level	47
5-20.2	List of Acronyms Used	61
Mandatory Appendix		
I	Standard Radiation and Convection Loss Chart	85
Nonmandatory Appendices		
A	Sample Calculation Procedures for Waste Combustors With Energy Recovery	87
B	Test Method for Determining Moisture, Combustible Content, and Heating Value of Residue From Municipal Solid Waste Incinerators	97
C	References	99