

ASME AG-1–2012
(Revision of ASME AG-1–2009)

Code on Nuclear Air and Gas Treatment

AN AMERICAN NATIONAL STANDARD



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**The American Society of
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CONTENTS

Foreword		xii
Committee Roster		xiii
Organization of ASME AG-1		xv
Summary of Changes		xvii
Division I	General Requirements	1
Section AA	Common Articles	2
AA-1000	Introduction	2
AA-2000	Referenced Documents	7
AA-3000	Materials	9
AA-4000	Structural Design	15
AA-5000	Inspection and Testing	29
AA-6000	Fabrication, Joining, Welding, Brazing, Protective Coating, and Installation	31
AA-7000	Packaging, Shipping, Receiving, Storage, and Handling	43
AA-8000	Quality Assurance	45
AA-9000	Nameplates and Stamping	47
AA-10000	Repair and Replacement of Components	48
Figures		
AA-4355.3	Sine Beat Frequency and Amplitude	23
AA-4355.4	Sine Amplitude Decay Rate	24
AA-4356.4-1	Response Spectrum of Composite Excitation	25
AA-4356.4-2	Oscillations Per Beat	26
AA-6324.2	Acceptable and Unacceptable Weld Profiles	35
AA-8130	Hierarchy of Responsibility	46
Tables		
AA-3100	Allowable Materials	10
AA-4212	Load Conditions	16
AA-4231	Deflection Limits	17
AA-4321	Plate- and Shell-Type Components: Primary Stress Allowables	19
AA-4323	Linear-Type Systems: Primary Stress Allowables	20
AA-10530	Lifetime Repair and Replacement Records	50
AA-10540	Nonpermanent Repair and Replacement Records	50
Nonmandatory Appendices		
AA-A	Design and Qualification by Analysis	51
AA-B	Qualification by Testing	68
AA-C	Qualification by a Combination of Analysis and Testing	73
Division II	Ventilation Air Cleaning and Ventilation Air Conditioning	77
Section BA	Fans and Blowers	78
BA-1000	Introduction	78
BA-2000	Referenced Documents	80
BA-3000	Materials	81



BA-4000	Design	82
BA-5000	Inspection and Testing	88
BA-6000	Fabrication and Installation of Centrifugal and Axial Fans	90
BA-7000	Packaging, Shipping, Receiving, Storage, and Handling	91
BA-8000	Quality Assurance	92
BA-9000	Nameplates and Operating and Maintenance Manuals	93
Table		
BA-4162	Maximum Allowable Displacement	84
Nonmandatory Appendices		
BA-A	Fan System Considerations	94
BA-B	Division of Responsibility	96
Section DA		
Dampers and Louvers		
DA-1000	Introduction	98
DA-2000	Referenced Documents	101
DA-3000	Materials	102
DA-4000	Design	104
DA-5000	Inspection and Testing	111
DA-6000	Fabrication, Finishing, and Installation	113
DA-7000	Packaging, Shipping, and Storage	114
DA-8000	Quality Assurance	115
DA-9000	Nameplates, Stampings, and Manuals	116
Mandatory Appendices		
DA-I	Frame Leakage	117
DA-II	Damper and Louver Configurations	118
Nonmandatory Appendix		
DA-A	Division of Responsibility	124
Section SA		
Ductwork		
SA-1000	Introduction	126
SA-2000	Referenced Documents	129
SA-3000	Materials	130
SA-4000	Design	131
SA-5000	Inspection and Testing	137
SA-6000	Fabrication and Installation	140
SA-7000	Packaging, Shipping, Receiving, Storage, and Handling	145
SA-8000	Quality Assurance	147
SA-9000	Nameplates and Stamping	148
Figure		
SA-1120	Ductwork and Ductwork Support — Interface Boundary	128
Tables		
SA-6410-1	Rectangular Ducts: Maximum Allowable Tolerances	142
SA-6410-2	Circular Ducts: Maximum Allowable Tolerances	143
SA-6410-3	Flatness of Surface: Maximum Allowable Waviness Tolerance	144
Nonmandatory Appendices		
SA-A	Division of Responsibility	149
SA-B	Procedures to Determine Allowable Leakage for Ductwork	151
SA-C	Additional Guidelines for Duct Design and Construction	167
Section HA		
Housings		
HA-1000	Introduction	169
HA-2000	Referenced Documents	172
HA-3000	Materials	173
HA-4000	Design	175
HA-5000	Inspection and Testing	182
HA-6000	Fabrication	185



HA-7000	Packaging, Shipping, Receiving, Storage, and Handling	187
HA-8000	Quality Assurance	188
HA-9000	Nameplates and Stamping	189
Figures		
HA-1120-1	Housing, Air Cleaning Unit: Walk-In Type	170
HA-1120-2	Housing, Air Cleaning Unit: Side-Access Type	170
HA-1120-3	Housing, Air Conditioning Unit: Walk-In Type	171
Table		
HA-4212	Load Combinations	176
Nonmandatory Appendices		
HA-A	Division of Responsibility	190
HA-B	Additional Guidelines for Housing Design and Construction	191
HA-C	Manifold Design Guidelines	193
HA-D	Performance Test for Qualification of Sampling Manifolds	202
Section RA Refrigeration Equipment		
RA-1000	Introduction	205
RA-2000	Referenced Documents	206
RA-3000	Materials	207
RA-4000	Design Requirements	209
RA-5000	Inspection, Rating, and Testing	213
RA-6000	Fabrication and Installation	216
RA-7000	Packaging, Shipping, Storage, and Handling	218
RA-8000	Quality Assurance	220
RA-9000	Nameplates, Stamping, and Records	221
Forms		
RA-1	Manufacturer's Data Report for Section RA Non-ASME Nuclear Vessels (Customary)	222
RA-M1	Manufacturer's Data Report for Section RA Non-ASME Nuclear Vessels (SI) ..	224
RA-2	Centrifugal Compressor Test Record	226
RA-2a	Centrifugal Compressor Oil Pump Pressure Test	227
RA-2b	Centrifugal Compressor Pressure Test Record	228
RA-3	Reciprocating Scroll/Screw Compressor Test Record	229
RA-3a	Reciprocating Scroll/Screw Compressor Pressure Test Record	230
RA-4	Electrical Test Record — Controls and Control Panels	231
RA-5	Performance Test Record (Customary)	232
RA-M5	Performance Test Record (SI)	234
Mandatory Appendices		
RA-I	Performance Testing of Chilled Water Refrigeration Unit (Customary)	236
RA-MI	Performance Testing of Chilled Water Refrigeration Unit (SI)	240
RA-II	Mandatory List of Instrumentation Functions and Control Functions	244
Nonmandatory Appendices		
RA-A	Division of Responsibility	245
RA-B	Typical External Interface Diagrams	248
Section CA Conditioning Equipment		
CA-1000	Introduction	249
CA-2000	Referenced Documents	251
CA-3000	Materials	252
CA-4000	Design	254
CA-5000	Inspection and Testing	264
CA-6000	Fabrication and Installation	267
CA-7000	Packaging, Shipping, Storage, and Handling	269
CA-8000	Quality Assurance	270
CA-9000	Nameplates and Records	272



Tables		
CA-4122	Maximum Water Velocities in Water Coils	255
CA-8120-1	Lifetime Quality Assurance Records	271
CA-8120-2	Nonpermanent Quality Assurance Records	271
Mandatory Appendices		
CA-I	Manufacturer's Data Reports	274
CA-II	Factory Testing of Evaporative Coolers and Air Washers	278
Nonmandatory Appendices		
CA-A	Division of Responsibility	284
CA-B	Design Recommendations	286
Section FA		
	Moisture Separators	289
FA-1000	Introduction	289
FA-2000	Referenced Documents	290
FA-3000	Materials	291
FA-4000	Design	292
FA-5000	Inspection and Testing	295
FA-6000	Fabrication	297
FA-7000	Packaging, Shipping, and Storage	298
FA-8000	Quality Assurance	299
FA-9000	Nameplates	300
Figure		
FA-4100-1	Typical Moisture Separation Configuration	293
Table		
FA-4200-1	Moisture Separator Performance Specifications	294
Nonmandatory Appendix		
FA-A	Division of Responsibility	301
Section FB		
	Medium Efficiency Filters	302
FB-1000	Introduction	302
FB-2000	Referenced Documents	303
FB-3000	Materials	304
FB-4000	Design	305
FB-5000	Inspection and Testing	306
FB-6000	Fabrication	307
FB-7000	Packaging, Shipping, Receiving, Storage, and Handling	308
FB-8000	Quality Assurance	309
FB-9000	Labels and Marking	310
Nonmandatory Appendix		
FB-A	Division of Responsibility	311
Section FC		
	HEPA Filters	312
FC-1000	Introduction	312
FC-2000	Referenced Documents	313
FC-3000	Materials	314
FC-4000	Design	316
FC-5000	Inspection	322
FC-6000	Fabrication	325
FC-7000	Packaging, Shipping, and Storage	326
FC-8000	Quality Assurance	327
FC-9000	Nameplates	328
Figures		
FC-4100-1	Type A Metal Case Separator Filter	317
FC-4100-2	Type A Wood Case Separator Filter	317
FC-4100-3	Type B Minipleat (Glue Separator) Filter	318



FC-4100-4	Type C Separatorless Filter	318
FC-4100-5	Type D Thread Separator Filter	319
FC-4100-6	Gel Seal Filter Corner—Isometric.....	320
Tables		
FC-4110	Nominal Sizes and Ratings.....	316
FC-5100-1	Test Groups and Sequence.....	323
FC-5120-1	Acceptable Test.....	323
FC-5140-1	Test Conditions and Requirements	323
Mandatory Appendix		
FC-I	Filter Media: Fire-Resistant, High Efficiency	329
Nonmandatory Appendix		
FC-A	Division of Responsibility.....	338
Section FD		
	Type II Adsorber Cells	339
FD-1000	Introduction.....	339
FD-2000	Referenced Documents.....	340
FD-3000	Materials	341
FD-4000	Design	343
FD-5000	Inspection and Testing.....	345
FD-6000	Fabrication	347
FD-7000	Packaging and Shipping	348
FD-8000	Quality Assurance.....	349
FD-9000	Nameplates and Certification	350
Figure		
FD-4100	Type II Adsorber Cell.....	344
Tables		
FD-5332	Detector Sensitivity for Leak Test	346
FD-6100	Cell Dimensions and Tolerances	347
Mandatory Appendix		
FD-I	Calculation of Residence Time of Adsorber Cells	351
Nonmandatory Appendix		
FD-A	Division of Responsibility.....	352
Section FE		
	Type III Adsorbers	353
FE-1000	Introduction.....	353
FE-2000	Referenced Documents.....	355
FE-3000	Materials	356
FE-4000	Design	357
FE-5000	Inspection and Testing.....	362
FE-6000	Fabrication and Installation.....	364
FE-7000	Packaging and Shipping	365
FE-8000	Quality Assurance.....	366
FE-9000	Nameplates	367
Figure		
FE-4110	Horizontal Section of Type III Adsorber Bed	358
Mandatory Appendices		
FE-I	Residence Time Calculation	368
FE-II	Screen Waviness Inspection Test.....	369
FE-III	Adsorber Filling Qualification Test Procedure	372
FE-IV	Type III Adsorber Qualification Test Procedure	378
Nonmandatory Appendices		
FE-A	Visual Inspection Recommendations for Type III Adsorbers	385
FE-B	Division of Responsibility.....	386

Section FF	Adsorbent Media	387
FF-1000	Introduction.....	387
FF-2000	Referenced Documents.....	388
FF-3000	Materials	389
FF-4000	Design	390
FF-5000	Inspection and Testing.....	391
FF-6000	Fabrication	393
FF-7000	Packaging and Shipping	394
FF-8000	Quality Assurance.....	395
FF-9000	Nameplate and Certification	396
Nonmandatory Appendix		
FF-A	Division of Responsibility.....	397
Section FG	Mounting Frames for Air-Cleaning Equipment	398
FG-1000	Introduction.....	398
FG-2000	Referenced Documents.....	399
FG-3000	Materials	400
FG-4000	Design	401
FG-5000	Inspection and Testing.....	407
FG-6000	Fabrication	409
FG-7000	Packaging and Shipping	410
FG-8000	Quality Assurance.....	411
FG-9000	Nameplates	412
Figures		
FG-4110-1	Typical Filter Mounting Frame	402
FG-4120-1	Typical Type II Adsorber Mounting Frame	403
FG-4140-1	Typical Moisture Separator Mounting Frame	404
Nonmandatory Appendix		
FG-A	Division of Responsibility.....	413
Section FH	Other Adsorbers	416
FH-1000	Introduction.....	416
FH-2000	Referenced Documents.....	417
FH-3000	Materials	418
FH-4000	Design	420
FH-5000	Inspection and Testing.....	425
FH-6000	Fabrication	427
FH-7000	Packaging and Shipping	428
FH-8000	Quality Assurance.....	429
FH-9000	Nameplates and Certification	430
Figures		
FH-4000-1	Type IV “V” Adsorbers Model (Fluid Seal Version).....	421
FH-4000-1A	Type IV “V” Bed Adsorbers Model (Gasketed Version)	422
FH-4000-2	Type IV “V” Adsorbers Model, Exploded View.....	423
FH-4000-3	Type IV “U” Bed Adsorbers Model (Gasketed Version)	424
Table		
FH-6100	Dimensional Requirements	427
Nonmandatory Appendix		
FH-A	Division of Responsibility.....	431
Section FI	Metal Media Filters (In The Course of Preparation)	432
Section FJ	Low Efficiency Filters	433
FJ-1000	Introduction.....	433
FJ-2000	Referenced Documents.....	434
FJ-3000	Materials	435
FJ-4000	Design	436



FJ-5000	Inspection and Testing.....	437
FJ-6000	Fabrication	438
FJ-7000	Packaging, Shipping, Receiving, Storage, and Handling	439
FJ-8000	Quality Assurance.....	440
FJ-9000	Labels and Markings	441
Nonmandatory Appendix		
FJ-A	Division of Responsibility.....	442
Section FK		
Special HEPA Filters.....		
FK-1000	Introduction.....	443
FK-2000	Referenced Documents.....	445
FK-3000	Materials	446
FK-4000	Design	448
FK-5000	Qualification, Inspection, and Production Testing	458
FK-6000	Fabrication	465
FK-7000	Packaging, Shipping, and Storage.....	466
FK-8000	Quality Assurance.....	467
FK-9000	Nameplates	468
Figures		
FK-4100-1	Type 1 Radial Flow HEPA Filter (Internal Gasket), Mid-Section View	449
FK-4100-2	Type 1 Radial Flow HEPA Filter (Gelatinous Seal), Mid-Section View.....	450
FK-4100-3	Type 1 Radial Flow HEPA Filter (External Gasket), Mid-Section View	451
FK-4100-4	Type 1 Radial Flow HEPA Filter (Gelatinous Seal), Mid-Section View.....	452
FK-4100-5	Type 2 Axial Flow Circular HEPA Filter.....	453
FK-4100-6	Type 2 Axial Flow Circular HEPA Filter.....	454
Tables		
FK-4000-1	Type 1 Radial Flow HEPA Filter — Nominal Rating	448
FK-4000-2	Type 2 Axial Flow Circular HEPA Filter — Nominal Rating	453
FK-4000-3	Performance Requirements	457
FK-5000-1	Test Groups and Sequence — Type 1 Radial Flow HEPA Filters.....	459
FK-5000-2	Test Groups and Sequence — Type 2 Axial Flow Circular HEPA Filters.....	460
FK-5000-3	Test Groups and Sequence — Type 4 Axial Flow Rectangular HEPA Filters ..	463
FK-5000-4	Test Conditions and Requirements	464
Nonmandatory Appendix		
FK-A	Determination of HEPA Filter Service Life	469
FK-B	Division of Responsibility.....	470
Section FL		
Deep Bed Sand Filters		
FL-1000	Introduction.....	471
FL-2000	Referenced Documents.....	472
FL-3000	Materials	473
FL-4000	Design	475
FL-5000	Inspection and Testing.....	478
FL-6000	Fabrication/Field Construction	482
FL-7000	Packaging, Shipping, Receiving, Storage, and Handling	484
FL-8000	Quality Assurance.....	485
FL-9000	Labels and Markings	486
Figure		
FL-4120-1	Typical DBS Filter Cross Section, DOE-HDBK-1169-2003	476
Mandatory Appendices		
FL-I	Air-Aerosol Mixing Test Procedural Guidelines.....	487
FL-II	Deep Bed Sand Filter In-Place Leak Test Procedural Guidelines.....	491
Nonmandatory Appendices		
FL-A	Division of Responsibility.....	494
FL-B	Guidelines for Deep Bed Sand Filters.....	495

Section FM	High Strength HEPA Filters (In the Course of Preparation)	504
Section IA	Instrumentation and Controls	505
IA-1000	Introduction.....	505
IA-2000	Referenced Documents.....	506
IA-3000	Materials.....	507
IA-4000	Design Requirements.....	509
IA-5000	Inspection and Testing.....	515
IA-6000	Panel Fabrication and Assembly.....	517
IA-7000	Packaging, Shipping, Receiving, Storage, and Handling.....	519
IA-8000	Quality Assurance Requirements.....	520
IA-9000	Nameplates.....	521
Table		
IA-3100	Allowable Materials.....	508
Nonmandatory Appendices		
IA-A	Division of Responsibility.....	522
IA-B	Sample Checklist for Visual Examination of Control Panels/Enclosures, Instruments, and Control Devices.....	524
IA-C	Instrumentation for Nuclear Air and Gas Treatment Systems.....	525
Division III	Process Gas Treatment (All Sections in the Course of Preparation)	527
Section GA	Pressure Vessels, Piping, Heat Exchangers, and Valves.....	528
Section GB	Noble Gas Hold-Up Equipment.....	528
Section GC	Compressors.....	528
Section GD	Other Radionuclide Equipment.....	528
Section GE	Hydrogen Recombiners.....	528
Section GF	Gas Sampling.....	528
Section GG	Scrubbers.....	529
Section GH	Cyclones.....	529
Section GI	Membranes.....	529
Section GJ	Filters.....	529
Section GK	Mist Eliminators.....	529
Section GL	Electrostatic Precipitators.....	530
Section GM	Adsorbent Media.....	530
Division IV	Testing Procedures	531
Section TA	Field Testing of Air Treatment Systems	532
TA-1000	Introduction.....	532
TA-2000	Referenced Documents.....	534
TA-3000	General Inspection and Test Requirements.....	535
TA-4000	Field Acceptance Tests.....	539
TA-5000	Corrective Action Requirements.....	551
TA-6000	Quality Assurance.....	552
Tables		
TA-3200	Instrument Accuracy Requirements.....	536
TA-4110	Fan Acceptance Tests.....	540
TA-4210	Damper Acceptance Tests.....	541
TA-4310	Duct, Housing, and Frame Acceptance Tests.....	542
TA-4410	Refrigeration Equipment Acceptance Tests.....	543
TA-4510	Conditioning Equipment Acceptance Tests.....	545
TA-4610	Moisture Separator, Prefilter, and HEPA Filter Acceptance Tests.....	547
TA-4710	Types II, III, and IV Adsorber Bank Acceptance Tests.....	548
Mandatory Appendices		
TA-I	Visual Inspection Checklist.....	553
TA-II	Structural Capability Test Procedural Guidelines.....	555
TA-III	Duct and Housing Leak Test Procedural Guidelines.....	560
TA-IV	Airflow Distribution Test Procedural Guidelines.....	565



TA-V	Air-Aerosol Mixing Test Procedural Guidelines.....	569
TA-VI	HEPA Filter Bank In-Place Leak Test Procedural Guidelines.....	573
TA-VII	Adsorber Bank In-Place Leak Test Procedural Guidelines.....	577
TA-VIII	Refrigerant Piping and Coil System Leak Test Procedural Guidelines.....	581
Nonmandatory Appendices		
TA-A	Mounting Frame Pressure Leak Test Procedural Guidelines.....	585
TA-B	Corrective Action Guidance.....	589
TA-C	Challenge Gas and Aerosol Substitute Selection Criteria.....	590
Section TB	Field Testing of Gas-Processing Systems (In the Course of Preparation) ...	591
Mandatory Appendix		
I	Preparation of Technical Inquiries to the Committee on Nuclear Air and Gas Treatment.....	593
Nonmandatory Appendix		
A	Format Guide for Technical Inquiries.....	595

FOREWORD

In 1971, the ANSI N45.8 Committee was organized to develop standards for high reliability air cleaning equipment for nuclear facilities and corresponding tests to confirm performance of the equipment. Two standards, ASME N509 and ASME N510, were published in 1975 and 1976.

In 1976, under the accredited organization rules, the Committee was reorganized as the ASME Committee on Nuclear Air and Gas Treatment. The scope of responsibility increased to include the development of codes and standards for design, fabrication, inspection, and testing of air cleaning and conditioning components and appurtenances used in safety-related systems in nuclear facilities. ASME AG-1 is the new Code resulting from the increased scope.

This Code contains mandatory requirements, specific prohibitions, and nonmandatory guidance for construction activities. Construction, as used in this Foreword, is an all-inclusive term relating to material, design, fabrication, inspection, testing, and certification. The Code does not address all aspects of these activities and those not specifically addressed may be considered. The Code is neither a handbook nor a replacement for education, experience, and the use of engineering judgment. The phrase “engineering judgment” refers to technical judgments made by knowledgeable designers

experienced in the application of the Code. Engineering judgments must be consistent with Code philosophy and such judgments shall never be used to overrule mandatory requirements or specific prohibitions of the Code. The user is cautioned to carefully review these Code requirements for suitability to specific applications other than nuclear power and nuclear fuel cycle facilities.

The Code requirements established by the Committee shall not be interpreted as approving, recommending, or endorsing any proprietary design.

The Committee on Nuclear Air and Gas Treatment meets regularly to consider revisions of the Code requirements, new Code requirements as dictated by technological development, Code Cases, and requests for interpretations. Only the Committee on Nuclear Air and Gas Treatment has the authority to provide official interpretations of this Code. Requests for revisions, new Code requirements, Code Cases, or interpretations shall be addressed to the Secretary in writing and shall give full particulars in order to receive consideration and action. (See Mandatory Appendix covering preparation of technical inquiries.)

The first edition of this Code was approved by the American National Standards Institute (ANSI) on April 30, 1985, and issued on February 28, 1986. This eighth edition was approved by ANSI on November 16, 2012.



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ORGANIZATION OF ASME AG-1

1. GENERAL

The ASME Code on Nuclear Air and Gas Treatment consists of Divisions I through IV. All Divisions are broken down into Sections designated by two capital letters. Each Division is made up as follows:

Division I: General Requirements
Section AA: Common Articles

Division II: Ventilation Air Cleaning and Ventilation
Air Conditioning

Section BA: Fans and Blowers
Section DA: Dampers and Louvers
Section SA: Ductwork
Section HA: Housings
Section RA: Refrigeration Equipment
Section CA: Conditioning Equipment
Section FA: Moisture Separators
Section FB: Medium Efficiency Filters
Section FC: HEPA Filters
Section FD: Type II Adsorber Cells
Section FE: Type III Adsorbers
Section FF: Adsorbent Media
Section FG: Mounting Frames for Air-Cleaning
Equipment
Section FH: Other Adsorbers
Section FI: Metal Media Filters
Section FJ: Low Efficiency Filters
Section FK: Special HEPA Filters
Section FL: Deep Bed Sand Filters
Section FM: High Strength HEPA Filters
Section IA: Instrumentation and Controls

Division III: Process Gas Treatment

Section GA: Pressure Vessels, Piping, Heat Ex-
changers, and Valves
Section GB: Noble Gas Hold-Up Equipment
Section GC: Compressors
Section GD: Other Radionuclide Equipment
Section GE: Hydrogen Recombiners
Section GF: Gas Sampling
Section GG: Scrubbers
Section GH: Cyclones

Section GI: Membranes
Section GJ: Filters
Section GK: Mist Eliminators
Section GL: Elastomeric Precipitators
Section GM: Adsorbent Media

Division IV: Testing Procedures

Section TA: Field Testing of Air Treatment Systems
Section TB: Field Testing of Gas-Processing Systems

2. SECTIONS

Sections are divided into articles, subarticles, paragraphs, and, where necessary, subparagraphs and sub-subparagraphs.

3. ARTICLES

Articles are designated by the application letters indicated above for the sections, followed by Arabic numbers in units of 1000, such as BA-1000 or RA-2000. Where possible, articles dealing with the same topics are given the same number in each section in accordance with the following:

Article Number	Title
1000	Introduction
2000	Referenced Documents
3000	Materials
4000	Structural Design
5000	Inspection and Testing
6000	Fabrication, Joining, Weld- ing, Brazing, Protective Coating, and Installation
7000	Packaging, Shipping, Re- ceiving, Storage, and Handling
8000	Quality Assurance
9000	Nameplates and Stamping

The numbering of articles and the material contained in the articles may not, however, be consecutive. Because the complete outline may cover phases not applicable to a particular section or article, the rules have been prepared with some gaps in the numbering.



4. SUBARTICLES

Subarticles are numbered in units of 100, such as BA-1100 or RA-1200.

5. SUBSUBARTICLES

Subsubarticles are numbered in units of 10, such as BA-2130, and generally have no text. When a number such as BA-1110 is followed by text, it is considered a paragraph.

6. PARAGRAPHS

Paragraphs are numbered in units of 1, such as BA-2131 or RA-2132.

7. SUBPARAGRAPHS

Subparagraphs, when they are major subdivisions of a paragraph, are designated by adding a decimal followed by one or more digits to the paragraph number, such as BA-1111.1 or RA-1111.2. When they are minor subdivisions of a paragraph, subparagraphs may be designated

by lowercase letters in parentheses, such as BA-1111(a) or RA-1111(b).

8. SUBSUBPARAGRAPHS

Subsubparagraphs are designated by adding lowercase letters in parentheses to major subparagraph numbers, such as BA-1111.1(a) or RA-1111(b). When further subdivisions of minor subparagraphs are necessary, subsubparagraphs are designated by adding Arabic numerals in parentheses to the subparagraph designation, such as BA-1111(a)(1) or RA-1111(a)(2).

9. APPENDICES

Appendices pertaining to each section appear at the end of each section and are designated with the section prefix. Nonmandatory appendices are designated by letters of the alphabet, and mandatory appendices are designated by Roman numerals. Metric appendices carry the same designators as customary appendices, with the prefix “M.”



ASME AG-1-2012

SUMMARY OF CHANGES

Following approval by the ASME Committee on Nuclear Air and Gas Treatment (CONAGT), and after public review, ASME AG-1-2012 was approved by the American National Standards Institute on November 16, 2012.

ASME AG-1-2012 consists of AG-1-2009, ASME AG-1a-2009, and ASME AG-1b-2011; editorial changes, revisions, and corrections; as well as the following changes identified by a margin note, **(12)**.

<i>Page</i>	<i>Location</i>	<i>Change</i>
2-6	AA-1100	Revised
	AA-1110	Revised
	AA-1120	Second paragraph added
	AA-1130	(1) Definitions of <i>Engineered Safety Feature (ESF)</i> , nuclear safety function, and <i>operating basis earthquake (OBE)</i> , revised (2) Definitions of <i>nonsafety-related equipment</i> , <i>Nuclear Air Treatment Systems (NATS)</i> , <i>nuclear power plant operating modes</i> , <i>nuclear power plant process systems</i> , <i>nuclear safety related</i> , <i>safety-related equipment</i> , and <i>seismic/nonsafety-related equipment</i> deleted (3) Note deleted from definition of <i>single failure</i>
7	Article AA-2000	Listing of ASHRAE documents updated
10-14	Table AA-3100	Revised in its entirety
15	AA-4211	(1) Definition of <i>fluid momentum loads (FML)</i> revised
		(2) With definition of <i>normal loads (N)</i> , equation revised
17	AA-4244	Added
22	AA-4351.7	Last sentence revised
	AA-4351.9	Second sentence revised
28	AA-4442(k)	Revised
33	AA-6310(k)(1)(g)	Added
38	AA-6510	Third and fourth paragraphs revised
	AA-6511	Second sentence deleted
	AA-6512	Last sentence deleted
	AA-6513	Second sentence deleted
45	AA-8120	Revised
48	AA-10121	Revised
78	BA-1100	Revised
	BA-1110	Revised



<i>Page</i>	<i>Location</i>	<i>Change</i>
83	BA-4132	Last sentence revised
84	BA-4222.1	Third sentence revised
98	DA-1100	Revised
	DA-1110	Revised
	DA-1200	Title revised
105	DA-4212.2(c)	Revised
126	SA-1100	Revised
	SA-1110	Revised
131	SA-4211	Subparagraph (c) deleted, and subsequent subparas. (d) through (i) redesignated as (c) through (h), respectively
132	SA-4244	Second paragraph revised
134	SA-4452(e)	Revised
136	SA-4600(f)	Revised
140	SA-6140	First paragraph revised
159	SA-B-1234	First paragraph revised
162	SA-B-1320	First sentence revised
169	HA-1100	Revised
	HA-1110	Revised
	HA-1120	Second paragraph revised
175	HA-4211	Definition of <i>fluid momentum loads (FML)</i> deleted
177	HA-4245	Last paragraph revised
179	HA-4510	First paragraph revised
185	HA-6140	First paragraph revised
205	RA-1100	Revised
	RA-1200	Revised
	RA-1300(b)	Revised
	RA-1300(c)	Revised
206	Article RA-2000	References updated
209	RA-4100	Revised
	RA-4200	(1) First paragraph revised (2) Subparagraph (a) revised (3) Subparagraph (b) revised (4) Subparagraph (b)(10) deleted, and subsequent subparas. renumbered accordingly
210	RA-4300	First paragraph revised
211	RA-4432	Revised
	RA-4600	Revised
	RA-4610	Revised
	RA-4620	Revised



<i>Page</i>	<i>Location</i>	<i>Change</i>
212	RA-4630	(1) First paragraph revised (2) Subparagraph (c) revised
220	RA-8100	Revised in its entirety
245	Table RA-A-1000	Item RA-4200(a) revised
248	Fig. RA-B-1000	Revised
249	CA-1110	Revised
	CA-1120	Revised
	CA-1130	Revised
	CA-1220	Definition of <i>building structure</i> deleted
251	Article CA-2000	References updated
252	CA-3210	Warning statement deleted
	CA-3220	Warning statement deleted
	CA-3230	Revised
255	CA-4127	Revised
256	CA-4132(c)(3)	Revised
	CA-4134.2	Last sentence revised
260	CA-4332(b)(3)	Revised
261	CA-4423(c)	Table reference corrected
289	FA-1100	Revised
	FA-1110	Revised
302	FB-1100	Revised
	FB-1110	Revised
312	FC-1100	Revised
	FC-1110	Revised
313	Article FC-2000	References updated
314, 315	FC-3160	Subparagraphs (d) and (e) revised
316–320	FC-4100	Subparagraphs (b) and (c) revised
	FC-4130	Revised in its entirety
	Fig. FC-4100-1	Revised
	Fig. FC-4100-3	Revised
	Fig. FC-4100-5	Revised
	FC-4150	Paragraph added
323	Table FC-5100-1	Under “Requirement” column, entry revised for FC-5120
	Table FC-5120-1	Title revised
325	FC-6212	Metric equivalents corrected
330	Article FC-I-2000	Introductory paragraph revised
331	FC-I-3110	Revised
	FC-I-3120	Second sentence revised



<i>Page</i>	<i>Location</i>	<i>Change</i>
332	FC-I-3234	Last sentence revised
	FC-I-3241	Title revised
	FC-I-3242	Title and paragraph revised
	FC-I-3271	Title revised
	FC-I-3272	Title and paragraph revised
	FC-I-3280	Last sentence revised
	FC-I-3300	Revised
333	Article FC-I-4000	Title revised
	FC-I-4110	Second sentence added
	FC-I-4210	Title revised
	FC-I-4221	Revised
334	FC-I-4231	Title and paragraph revised
	FC-I-4232	Title revised
	FC-I-4240	Revised
	FC-I-4261	Title and paragraph revised
	FC-I-4262	Title revised
	FC-I-4300	(1) Redesignated as FC-I-4280 and title revised (2) New FC-I-4300 added
335	Table FC-I-4330-1	Added
339	FD-1100	Revised
	FD-1110	Revised
353	FE-1100	Revised
	FE-1110	Revised
360, 361	FE-4623.4	Penultimate sentence revised
387	FF-1100	Revised
	FF-1110	Revised
	FF-1120	First paragraph revised
398	FG-1100	Revised
	FG-1110	Revised
416	FH-1100	Revised
	FH-1110	Revised
433	FJ-1100	Revised
	FJ-1110	Revised
	FJ-1130	(1) <i>Extended medium filter</i> and <i>filter medium</i> revised to read <i>extended media filter</i> and <i>filter media</i> , respectively (2) Definitions of <i>extended filter media</i> , <i>filter media</i> , <i>flat-panel filter</i> , and <i>sealants</i> revised
435	FI-3110	Title and paragraph revised



<i>Page</i>	<i>Location</i>	<i>Change</i>
443	FK-1100	Revised
	FK-1110	Revised
471–503	Section FL	Added
505	IA-1100	Revised
	IA-1110	Revised
	IA-1120	Second and third paragraphs revised
509	IA-4120	First paragraph revised
510	IA-4200	Revised
	IA-4311	Revised
	IA-4321	Revised
	IA-4325	Revised
511	IA-4420	First and second paragraphs revised
	IA-4430	First and second paragraphs revised
	IA-4511	Revised
512	IA-4539	Revised
513	IA-4811	Subparagraphs (b) and (c) revised
514	IA-4833	Revised
	IA-4910	Revised
	IA-4920	Revised
529, 530	Section GG	Added (in course of preparation)
	Section GH	Added (in course of preparation)
	Section GI	Added (in course of preparation)
	Section GJ	Added (in course of preparation)
	Section GK	Added (in course of preparation)
	Section GL	Added (in course of preparation)
	Section GM	Added (in course of preparation)
532	TA-1100	Revised
	TA-1110	Revised
	TA-1120	Revised



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Division I General Requirements



SECTION AA

COMMON ARTICLES

AA-1000 INTRODUCTION

(12) AA-1100 SCOPE

This Code provides requirements for the performance, design, fabrication, installation, inspection, acceptance testing, and quality assurance of equipment used in air and gas treatment systems in nuclear facilities.

(12) AA-1110 PURPOSE

The purpose of this Code is to ensure that equipment used in nuclear facilities for air and gas treatment systems is acceptable in all aspects of design and operation.

(12) AA-1120 APPLICABILITY

This Code applies only to individual components in a system. This Code does not cover any functional system design requirements or sizing of complete systems, or any operating characteristics of these systems. The responsibility for meeting each requirement of this Code shall be assigned to the Owner or assigned designee.

The requirements of AG-1 for air and gas treatment components may be used for engineered safety features systems and normal systems in nuclear power generation facilities, and for air cleaning systems in other nuclear facilities. The design and procurement specifications shall delineate the design, qualification and quality assurance requirements appropriate for the application.

(12) AA-1130 DEFINITIONS AND TERMS

Each Code section shall delineate the definitions and terms unique to that section. Definitions that have common application are listed in this section.

acceptance test: a test made upon completion of fabrication, installation, repair, or modification of a unit,

component, or part to verify to the user or Owner that the item meets specified requirements.

active component: any component that must perform a mechanical motion or change of state during the course of accomplishing a nuclear safety-related function.

air density: 0.075 lb/ft³ (1.201 kg/m³) for standard air. This corresponds to air at a pressure of 29.92 in. Hg (760 mm Hg) at a temperature of 69.8°F (21°C) with a specific volume of 13.33 ft³/lb (0.832 m³/kg).

airflow (ACFM, SCFM, ACMS, SCMS): expressed in terms of CFM (cubic feet of air per minute). ACFM is a cubic foot of air with a density at actual existing conditions. SCFM (standard CFM) is a cubic foot of air with a standard density. ACMS and SCMS correspondingly apply to cubic meters per second under actual and standard conditions.

allowable deflection (d_{all}): the deflection resulting from each of the component loading conditions defined in AA-4212.

allowable stress value (S): the maximum stress limit to be used in the design.

assembly: two or more devices sharing a common mounting or supporting structure.

broadband response spectrum: a response spectrum that describes the motion indicating that multiple frequency excitation predominates.

Certificate of Compliance: a written statement attesting that the materials are in accordance with specified requirements.

Certificate of Conformance: a document signed or otherwise authenticated by an authorized individual certifying the degree to which items or services meet specified requirements.

Certified Material Test Report (CMTR): a document provided by the Material Manufacturer or Material Supplier and signed by an authorized individual that contains sufficient data and information to verify the

