

TABLE OF CONTENTS

CHAPTER 1	ADMINISTRATION 1		
101.0	General 1	107.0	Board of Appeals 6
101.1	Title 1	107.1	General 6
101.2	Scope 1	107.2	Limitations of Authority 6
101.3	Purpose 1	Table 104.5	Mechanical Permit Fees 7
101.4	Unconstitutional 1	CHAPTER 2	DEFINITIONS 9
101.5	Validity 1	201.0	General 9
102.0	Applicability 1	201.1	Applicability 9
102.1	Conflicts Between Codes 1	202.0	Definition of Terms 9
102.2	Existing Installations 1	202.1	General 9
102.3	Maintenance 1	CHAPTER 3	GENERAL REGULATIONS 23
102.4	Additions, Alterations, Renovations, or Repairs 1	301.0	General 23
102.5	Health and Safety 1	301.1	Applicability 23
102.6	Changes in Building Occupancy 1	301.2	Approval 23
102.7	Moved Structures 1	301.3	Design of Equipment 23
102.8	Appendices 2	301.4	Electrical Connections 23
103.0	Duties and Powers of the Authority Having Jurisdiction 2	301.5	Oil-Burning Appliances 23
103.1	General 2	301.6	Personnel Protection 23
103.2	Liability 2	302.0	Materials – Standards and Alternates 23
103.3	Applications and Permits 2	302.1	Minimum Standards 23
103.4	Right of Entry 2	302.2	Alternate Materials and Methods of Construction Equivalency 23
104.0	Permits 2	302.3	Alternative Engineered Design. 24
104.1	Permits Required 2	303.0	Installation 24
104.2	Exempt Work 2	303.1	Listed Appliances 24
104.3	Application for Permit 2	303.2	Closet or Alcove Installations 24
104.4	Permit Issuance 3	303.3	Unlisted Appliances 24
104.5	Fees 4	303.4	Anchorage of Appliances 24
105.0	Inspections and Testing 4	303.5	Movement 24
105.1	General 4	303.6	Identification of Equipment 24
105.2	Required Inspections 4	303.7	Liquefied Petroleum Gas Facilities 24
105.3	Testing of Systems 5	303.8	Equipment and Appliances on Roofs 25
105.4	Connection to Service Utilities 5	303.9	Avoiding Strain on Gas Piping 25
106.0	Violations and Penalties 5	303.10	Clearances 25
106.1	General 5	304.0	Accessibility for Service 25
106.2	Notices of Correction or Violation 5	304.1	General 25
106.3	Penalties 5	304.2	Sloped Roof 25
106.4	Stop Orders 5		
106.5	Authority to Disconnect Utilities in Emergencies 6		
106.6	Authority to Condemn 6		

304.3	Access to Equipment and Appliances on Roofs	25	313.3	Suspended Piping	29
304.4	Appliances in Attics and Under-Floor Spaces	26	313.4	Alignment	30
305.0	Location	26	313.5	Underground Installation	30
305.1	Installation in Garages	26	313.6	Hanger Rod Sizes	30
305.2	Flood Hazard Areas	26	Table 313.6	Hanger Rod Sizes	30
305.3	Elevator Shaft	26	313.7	Gas Piping	30
305.4	Drainage Pan	26	314.0	Balancing	30
306.0	Automatic Control Devices	27	314.1	General	30
306.1	General	27	315.0	Louvers in Hurricane Prone Regions	30
307.0	Labeling	27	315.1	General	30
307.1	Fuel-Burning Appliances	27	316.0	Protection of Piping, Tubing, Materials, and Structures	30
307.2	Electric Heating Appliances	27	316.1	General	30
307.3	Heat Pump and Electric Cooling Appliances	27	316.2	Installation	30
307.4	Absorption Units	27	316.3	Corrosion, Erosion, and Mechanical Damage	30
308.0	Improper Location	28	316.4	Protectively Coated Pipe	30
308.1	General	28	316.5	Fire-Resistant Construction	30
309.0	Workmanship	28	316.6	Steel Nail Plates	30
309.1	Engineering Practices	28	316.7	Sleeves	30
309.2	Concealing Imperfections	28	316.8	Firewalls	30
309.3	Installation Practices	28	316.9	Structural Members	31
310.0	Condensate Wastes and Control	28	316.10	Rodentproofing	31
310.1	Condensate Disposal	28	316.11	Metal Collars	31
310.2	Condensate Control	28	317.0	Trenching, Excavation, and Backfill	31
310.3	Condensate Waste Pipe Material and Sizing	28	317.1	Trenches	31
Table 310.3	Minimum Condensate Pipe Size	28	317.2	Tunneling and Driving	31
310.4	Appliance Condensate Drains	29	317.3	Open Trenches	31
310.5	Point of Discharge	29	317.4	Excavations	31
310.6	Condensate Waste From Air-Conditioning Coils	29	Table 303.10.1	Reduction of Clearances with Specified Forms or Protection	32
310.7	Plastic Fittings	29	Table 313.3	Hangers and Supports	34
311.0	Heating or Cooling Air System	29	CHAPTER 4	VENTILATION AIR	35
311.1	Source	29	401.0	General	35
311.2	Air Filters	29	401.1	Applicability	35
311.3	Prohibited Source	29	402.0	Ventilation Air	35
311.4	Return-Air Limitations	29	402.1	Occupiable Spaces	35
312.0	Plumbing Connections	29	402.2	Natural Ventilation	35
312.1	General	29	402.3	Mechanical Ventilation	35
313.0	Hangers and Supports	29	402.4	Outdoor Air Intake Protection	36
313.1	General	29	403.0	Ventilation Rates	36
313.2	Material	29	403.1	General	36
			403.2	Zone Calculations	36

403.3	Single-Zone Systems	36	505.4	Minimum Velocities and Circulation	45
403.4	One Hundred Percent Outdoor Air Systems	36	Table 505.4	Minimum Duct Design Velocities	46
403.5	Multiple-Zone Recirculating Systems	36	505.5	Makeup Air	46
403.6	Design for Varying Operating Conditions	37	505.6	Hoods and Enclosures	46
403.7	Exhaust Ventilation	37	506.0	Product-Conveying Ducts	46
403.8	Dynamic Reset	37	506.1	Materials	46
403.9	Air Classification and Recirculation	37	506.2	Construction	47
404.0	Multiple-Zone Systems	38	506.3	Fittings	47
404.1	General	38	506.4	Explosion Venting	47
404.2	Average Outdoor Air Fraction	38	506.5	Supports	47
404.3	Zone Ventilation Efficiency	38	506.6	Fire Protection	47
Table 402.1	Minimum Ventilation Rates in Breathing Zone	39	506.7	Duct Clearances	47
Table 403.2.2	Zone Air Distribution Effectiveness	41	Table 506.2(1)	Minimum Sheet Metal Thickness for Round Ducts	48
Table 403.5.2	System Ventilation Efficiency	41	Table 506.2(2)	Minimum Sheet Metal Thickness for Rectangular Ducts	50
Table 403.7	Minimum Exhaust Rates	42	506.8	Protection from Physical Damage	50
CHAPTER 5	EXHAUST SYSTEMS	43	Part II	Commercial Hoods and Kitchen Ventilation	51
501.0	General	43	507.0	General Requirements	51
501.1	Applicability	43	507.1	Exhaust System	51
502.0	Termination	43	507.2	Listed Devices	51
502.1	Exhaust Opening Protection	43	507.3	Clearance	51
502.2	Termination of Exhaust Ducts	43	507.4	Drawings	52
Part I	Environmental Air Ducts and Product-Conveying Systems	43	507.5	Notification of Change	52
503.0	Motors, Fans, and Filters	43	508.0	Hoods	52
503.1	General	43	508.1	Where Required	52
503.2	Fans	43	508.2	Listed Type I Hood Assemblies	53
504.0	Environmental Air Ducts	43	508.3	Construction of Type I Hoods	53
504.1	General	43	508.4	Construction of Type II Hoods	53
504.2	Independent Exhaust Systems	44	508.5	Supports	53
504.3	Domestic Range	44	508.6	Grease Vapor	53
504.4	Clothes Dryers	44	508.7	Seams, Joints, and Penetrations	53
504.5	Heat (Energy) Recovery Ventilators	45	508.8	Eyebrow-Type Hoods	53
504.6	Gypsum Wallboard Ducts	45	508.9	Insulation	53
505.0	Product-Conveying Systems	45	508.10	Hood Size	53
505.1	General	45	Table 508.10.1.2	Extra-Heavy-Duty Cooking Appliance Airflow	54
505.2	Penetrations	45	Table 508.10.1.3	Heavy-Duty Cooking Appliance Airflow	54
505.3	Product-Conveying Ducts Classification	45	Table 508.10.1.4	Medium-Duty Cooking Appliance Airflow	54

Table 508.10.1.5	Light-Duty Cooking Appliance Airflow	55	513.5	Manual Activation	66
508.11	Exhaust Hood Assemblies with Integrated Supply-Air Plenums	55	513.6	System Annunciation	66
508.12	Solid-Fuel Hood Assemblies	55	513.7	System Supervision	66
508.13	Exhaust Outlets	55	513.8	Special Design and Application	67
509.0	Grease Removal Devices in Hoods	55	513.9	Review and Certification	67
509.1	Grease Removal Devices	55	513.10	Installation Requirements	67
509.2	Installation	55	513.11	Portable Fire Extinguishers	67
509.3	Solid-Fuel Grease Removal Devices	56	513.12	Maintenance	67
510.0	Exhaust Duct Systems	56	513.13	Solid-Fuel Fire-Extinguishing Equipment	67
510.1	General	56	514.0	Procedures for the Use, Inspection, Testing, and Maintenance of Equipment	67
510.2	Clearance	57	514.1	Operating Procedures	67
510.3	Openings	57	514.2	Inspection, Testing and Maintenance	67
510.4	Listed Grease Ducts	57	514.3	Inspection for Grease Buildup	68
510.5	Other Grease Ducts	57	Table 514.3	Schedule of Inspection for Grease Buildup	68
510.6	Exterior Installations	58	514.4	Cleaning of Exhaust Systems	68
510.7	Interior Installations	58	514.5	Cooking Equipment Maintenance	68
510.8	Underground Installations	60	515.0	Minimum Safety Requirements for Cooking Equipment	69
510.9	Termination of Type I Hood Exhaust System	60	515.1	Cooking Equipment	69
510.10	Termination of Type II Hood Exhaust System	61	515.2	Operating Controls	69
510.11	Solid-Fuel Duct Systems	62	516.0	Recirculating Systems	69
511.0	Air Movement	62	516.1	General Requirements	69
511.1	Exhaust Fans for Commercial Cooking Operations	62	516.2	Design Restrictions	69
511.2	Airflow	62	516.3	Interlocks	70
511.3	Makeup Air	63	516.4	Location and Application Restrictions	70
511.4	Common Duct (Manifold) Systems	64	516.5	Additional Fire Safety Requirements	70
511.5	Solid-Fuel Air Movement Requirements	64	516.6	Use and Maintenance	70
512.0	Auxiliary Equipment	64	517.0	Solid-Fuel Cooking Operations	70
512.1	Dampers	64	517.1	Venting Application	70
512.2	Electrical Equipment	64	517.2	Location of Appliances	71
512.3	Other Equipment	64	517.3	Hoods for Solid-Fuel Cooking	71
512.4	Solid-Fuel Auxiliary Equipment	65	517.4	Exhaust Systems for Solid-Fuel Cooking	71
513.0	Fire-Extinguishing Equipment	65	517.5	Grease Removal Devices for Solid-Fuel Cooking	72
513.1	General	65	517.6	Air Movement for Solid-Fuel Cooking	72
513.2	Types of Equipment	65			
513.3	Simultaneous Operation	66			
513.4	Fuel and Electric Power Shutoff	66			

517.7	Fire-Extinguishing Equipment for Solid-Fuel Cooking	72	605.2	Fire Dampers	77
517.8	Other Safety Requirements	73	605.3	Ceiling Radiation Dampers	77
518.0	Downdraft Appliances	73	605.4	Multiple Arrangements	78
518.1	General	73	605.5	Access and Identification	78
518.2	Ventilation System	73	605.6	Freedom from Interference	78
518.3	Fire-Extinguishing Equipment	73	605.7	Temperature Classification of Operating Elements	78
518.4	Airflow Switch or Transducer	73	606.0	Ventilating Ceilings	78
518.5	Surface Materials	73	606.1	General	78
			606.2	Requirements	78
			607.0	Use of Under-Floor Space as Supply Plenum for Dwelling Units	78
CHAPTER 6	DUCT SYSTEMS	75	607.1	General	78
601.0	General	75	607.2	Dwelling Units	78
601.1	Applicability	75	607.3	Enclosed	78
601.2	Sizing Requirements	75	607.4	Flammable Materials	78
602.0	Material	75	607.5	Access	78
602.1	General	75	607.6	Automatic Control	78
602.2	Combustibles Within Ducts or Plenums	75	607.7	Temperature Limit	78
602.3	Metal	75	607.8	Noncombustible Receptacle	78
602.4	Existing Metal Ducts	75	607.9	Floor Registers	78
602.5	Gypsum	75	607.10	Exterior Wall and Interior Stud Partitions	78
602.6	Factory-Made Air Ducts	76	607.11	Wall Register	78
602.7	Vibration Isolators	76	607.12	Distance from Combustible	78
602.8	Corridors	76	607.13	Vapor Barrier	78
603.0	Installation of Ducts	76	607.14	Prohibited	79
603.1	General	76	608.0	Automatic Shutoffs	79
603.2	Under Floor or Crawl Space	76	608.1	Air-Moving Systems and Smoke Detectors	79
603.3	Metal Ducts	76			
603.4	Factory-Made Air Ducts and Connectors	76	CHAPTER 7	COMBUSTION AIR	81
603.5	Flexible Air Ducts and Connectors	76	701.0	General	81
603.6	Plastic Ducts	76	701.1	Applicability	81
603.7	Protection of Ducts	76	701.2	Pressure Difference	81
603.8	Support of Ducts	76	701.3	Makeup Air	81
603.9	Protection Against Flood Damage	76	701.4	Indoor Combustion Air	81
603.10	Joints and Seams of Ducts	77	701.5	Indoor Opening Size and Location	81
603.11	Cross Contamination	77	701.6	Outdoor Combustion Air	81
603.12	Underground Installation	77	701.7	Combination Indoor and Outdoor Combustion Air	82
604.0	Insulation of Ducts	77	701.8	Engineered Installations	83
604.1	General	77	701.9	Mechanical Combustion Air Supply	83
605.0	Smoke Dampers, Fire Dampers, and Ceiling Dampers	77	701.10	Louvers, Grilles, and Screens	83
605.1	Smoke Dampers	77			

701.11	Combustion Air Ducts	84
701.12	Dampers Prohibited	84
702.0	Process Air	84
702.1	General	84
703.0	Extra Device or Attachment	84
703.1	General	84
704.0	Bleed Lines for Diaphragm-Type Valves	84
704.1	General	84
CHAPTER 8	CHIMNEYS AND VENTS	85
801.0	General	85
801.1	Applicability	85
801.2	Venting of Gas Appliances	85
801.3	Appliances Fueled by Other Fuels	85
802.0	Venting of Appliances	85
802.1	Listing	85
802.2	Connection to Venting Systems	85
802.3	Design and Construction	85
802.4	Type of Venting System to be Used	86
Table 802.4	Type of Venting System to be Used	86
802.5	Masonry, Metal, and Factory-Built Chimneys	86
802.6	Gas Vents	89
Table 802.6.2	Roof Pitch Height	89
802.7	Single-Wall Metal Pipe	91
Table 802.7.3.4	Clearance for Connectors	91
802.8	Through-the-Wall Vent Termination	92
802.9	Condensation Drain	93
802.10	Vent Connectors for Category I Appliances	93
Table 802.10.1.3	Minimum Thickness for Galvanized Steel Vent Connectors for Low- Heat Appliances	93
Table 802.10.1.4	Minimum Thickness for Steel Vent Connectors for Medium-Heat Appliances and Commercial and Industrial Incinerators	94
802.11	Vent Connectors for Category II, Category III, and Category IV Appliances	95
802.12	Draft Hoods and Draft Controls	95

802.13	Manually Operated Dampers	96
802.14	Obstructions	96
802.15	Automatically Operated Vent Dampers	96
803.0	Sizing of Category I Venting Systems	96
803.1	Single Appliance Vent Table 803.1.2(1) through Table 803.1.2(6)	96
803.2	Multiple Appliance Vent Table 803.2(1) through Table 803.2(9)	97
Table 803.2.1	Vent Connector Maximum Length	98
Table 803.1.2(1)	Type B Double-Wall Gas Vent	102
Table 803.1.2(2)	Type B Double-Wall Gas Vent	105
Table 803.1.2(3)	Masonry Chimney	107
Table 803.1.2(4)	Masonry Chimney	109
Table 803.1.2(5)	Single-Wall Metal Pipe or Type B Asbestos-Cement Vent	111
Table 803.1.2(6)	Exterior Masonry Chimney	112
Table 803.2(1)	Type B Double-Wall Vent	113
Table 803.2(2)	Type B Double-Wall Vent	117
Table 803.2(3)	Masonry Chimney	119
Table 803.2(4)	Masonry Chimney	121
Table 803.2(5)	Single-Wall Metal Pipe or Type B Asbestos – Cement Vent	123
Table 803.2(6)	Exterior Masonry Chimney	123
Table 803.2(7)	Exterior Masonry Chimney	124
Table 803.2(8)	Exterior Masonry Chimney	125
Table 803.2(9)	Exterior Masonry Chimney	126

CHAPTER 9	INSTALLATION OF SPECIFIC APPLIANCES	127
901.0	General	127
901.1	Applicability	127
902.0	General	127
902.1	Nonindustrial Appliance	127
902.2	Combustion Air from Bedroom or Bathroom	127
902.3	Added or Converted Equipment or Appliances	127
902.4	Type of Gas(es)	127
902.5	Fuel Input Rate	127
902.6	Building Structural Members	127

902.7	Flammable Vapors	127	905.8	Installation in Commercial Garages	131
902.8	Solid-Fuel Burning Appliances	127	905.9	Installation in Aircraft Hangers	131
902.9	Combination of Appliances and Equipment	127	905.10	Electric Duct Heaters	131
902.10	Protection of Gas Appliances from fumes or Gases other than Products of Combustion	127	906.0	Floor Furnaces	132
903.0	Air-Conditioning Appliances	128	906.1	Installation	132
903.1	Electric Air Conditioners	128	906.2	Temperature Limit Controls	132
903.2	Gas-Fired Air Conditioners and Heat Pumps	128	906.3	Combustion and Circulating Air	132
904.0	Central Heating Boilers and Furnaces	128	906.4	Placement.	132
904.1	Location	128	906.5	Bracing	132
904.2	Clearance	129	906.6	Support.	132
904.3	Assembly and Installation.	129	906.7	Clearance	132
Table 904.2	Clearances to Combustible Material for Unlisted Furnaces, Boilers, and Air Conditioners.	129	906.8	Access	132
904.4	Temperature- or Pressure-Limiting Devices	130	906.9	Seepage Pan	132
904.5	Low-Water Cutoff	130	906.10	Wind Protection	132
904.6	Steam Safety and Pressure-Relief Valves	130	906.11	Upper-Floor Installations	132
904.7	Furnace Plenums and Air Ducts	130	906.12	First Floor Installation	132
904.8	Refrigeration Coils	130	906.13	Oil-Fired Floor Furnaces.	132
904.9	Cooling Units used with Heating Boilers	130	907.0	Wall Furnaces.	133
904.10	Furnace (Upright and Horizontal)	130	907.1	Installation	133
904.11	Solid-Fuel Furnaces	130	907.2	Location	133
904.12	Oil-Fired Central Furnaces	130	907.3	Combustion and Circulating Air	133
904.13	Commercial or Industrial Gas Heaters	130	907.4	Oil-Fired Wall Furnaces	133
905.0	Duct Furnaces	131	908.0	Clothes Dryers	133
905.1	Clearances	131	908.1	Electric Clothes Dryers.	133
905.2	Installation of Duct Furnaces.	131	908.2	Gas-Fired Clothes Dryers.	133
905.3	Access Panels	131	909.0	Conversion Burners	134
905.4	Location of Draft Hoods and Controls	131	909.1	General.	134
905.5	Circulating Air	131	910.0	Burner Assemblies	134
905.6	Duct Furnaces Used with Refrigeration Systems	131	910.1	Oil Burners	134
905.7	Installation in Commercial Garages and Aircraft Hangers	131	910.2	Gas Burners	134
			911.0	Decorative Appliances for Installation in Vented Fireplaces.	134
			911.1	Prohibited Installations	134
			911.2	Installation	134
			Table 911.2	Free Opening Area of Chimney Damper for Venting Flue Gases from Unlisted Decorative Appliances for Installation in Vented Fireplaces.	134
			911.3	Fireplace Screens.	134
			912.0	Gas Fireplaces, Vented	134
			912.1	Prohibited Installations	134
			912.2	Installation	134

912.3	Combustion and Circulating Air	135	918.1	Clearance for Listed Appliances	137
913.0	Factory-Built Fireplaces and Fireplace Stoves	135	918.2	Clearance for Unlisted Appliances	137
913.1	Factory-Built Fireplaces	135	918.3	Mounting on Combustible Floors	137
913.2	Fireplace Stoves	135	918.4	Installation on Noncombustible Floors	138
913.3	Fireplace Accessories	135	918.5	Combustible Material Adjacent to Cooking Top	138
914.0	Non-Recirculating Direct Gas-Fired Industrial Air Heaters	135	918.6	Use with Casters	138
914.1	Application	135	918.7	Level Installation	138
914.2	Prohibited Installations	135	918.8	Ventilation	138
914.3	Installation	135	919.0	Food Service Appliances, Counter Appliances	138
914.4	Clearance from Combustible Materials	135	919.1	Vertical Clearance	138
914.5	Air Supply	135	919.2	Clearance for Listed Appliances	138
914.6	Atmospheric Vents, Gas Reliefs, or Bleeds	135	919.3	Clearance for Unlisted Appliances	138
914.7	Relief Openings	135	919.4	Mounting of Unlisted Appliances	138
914.8	Purging	135	919.4	Hot Plates and Laundry Stoves	138
915.0	Recirculating Direct Gas-Fired Industrial Air Heaters	135	920.0	General	138
915.1	Application	135	920.1	Household Cooking Appliances	139
915.2	Prohibited Installations	135	921.0	Electric Household Cooking Appliances	139
915.3	Installation	136	921.1	Gas-Fired Household Cooking Appliances	139
915.4	Clearance from Combustible Materials	136	921.2	Floor-Mounted Units	139
915.5	Air Supply	136	921.3	Built-In Units	139
915.6	Atmospheric Vents, Gas Reliefs, or Bleeds	136	921.4	Cooking Appliances Listing	140
915.7	Relief Openings	136	922.0	Commercial Electric Ranges	140
915.8	Purging	136	922.1	Commercial Wood-Fired Baking Ovens	140
916.0	Room Heaters	136	922.2	Oil-Burning Ranges	140
916.1	Electric Room Heaters	136	922.3	Open-Top Broiler Units	140
916.2	Gas-Fired Room Heaters	136	923.0	Listed Units	140
916.3	Solid-Fuel-Type Room Heaters	137	923.1	Unlisted Units	140
917.0	Unit Heaters	137	923.2	Protection Above Domestic Units	140
917.1	Support	137	923.3	Commercial Units	140
917.2	Clearance	137	923.4	Outdoor Cooking Appliances	140
917.3	Combustion and Circulating Air	137	924.0	Listed Units	140
917.4	Ductwork	137	924.1	Unlisted Units	140
917.5	Installation in Commercial Garages and Aircraft Hangers	137	924.2	Illuminating Appliances	140
917.6	Oil-Fired Unit Heaters	137	925.0		
918.0	Food Service Appliance, Floor Mounted	137			

925.1	Clearances for Listed Appliances	140	932.2	Installation	142
925.2	Clearances for Unlisted Appliances	140	932.3	General	142
Table 925.2.1	Clearances for Unlisted Outdoor Open-Flame Illuminating Appliances	140	323.3	Fuel-Gas Controls	142
925.3	Mounting on Buildings	140	932.4	Electrical Equipment	142
925.4	Mounting on Posts	141	932.5	Installations Inside Buildings	142
925.5	Appliance Pressure Regulators	141	932.6	Exterior Installations	143
926.0	Incinerators and Crematories	141	933.0	Outdoor Open Flame Decorative Appliances	143
926.1	Field Constructed Commercial-Industrial Incinerators	141	933.1	General	143
926.2	Factory-Built Commercial Crematories	141	934.0	Evaporative Cooling Systems	143
926.3	Residential Incinerators	141	934.1	General	143
927.0	Infrared Heaters	141	934.2	Location	143
927.1	Support	141	934.3	Access, Inspection, and Repair	143
927.2	Suspended Low-Intensity Infrared Tube Heaters	141	934.4	Installation	143
927.3	Clearance	141	935.0	Refrigeration Appliances	143
927.4	Combustion and Ventilation Air	141	935.1	Self-Contained Refrigerators and Freezers	143
927.5	Installation in Commercial Garages and Aircraft Hangars	141	935.2	Unit Coolers	143
928.0	Pool Heaters	141	935.3	Self-Contained Mechanical Refrigeration Systems	143
928.1	Location	141	936.0	Ductless Mini-Split Systems Installation	143
928.2	Clearance	141	936.1	General	143
928.3	Temperature or Pressure-Limiting Devices	141	937.0	Air Filter Appliances	143
928.4	Bypass Valves	141	937.1	Electrostatic Air Cleaners	143
928.5	Venting	142	937.2	High-Efficiency Particulate Air Filter Units	143
929.0	Refrigerators	142	938.0	Gaseous Hydrogen Systems	143
929.1	Clearance	142	938.1	General	143
929.2	Venting or Ventilating Kits Approved for Use With a Refrigerator	142	939.0	Compressed Natural Gas (CNG) Vehicular Fuel Systems	143
930.0	Gas-Fired Toilets	142	939.1	General	143
930.1	Clearance	142			
930.2	Installation on Combustible Floors	142	CHAPTER 10	BOILERS AND PRESSURE VESSELS	145
930.3	Vents	142	1001.0	General	145
931.0	Appliances for Installation in Manufactured Housing	142	1001.1	Applicability	145
932.0	Small Ceramic Kilns	142	1001.2	Boiler Rooms and Enclosures	145
932.1	General	142	1001.3	Air for Combustion and Ventilation	145
			1001.4	Drainage	145
			1001.5	Mounting	145
			1001.6	Chimneys or Vents	145
			1002.0	Standards	145
			1002.1	General	145
			1002.2	Oil-Burning Boilers	145
			1002.3	Electric Boilers	145

1002.4	Solid-Fuel Boilers	145
1003.0	Detailed Requirements	145
1003.1	Safety Requirements	145
1003.2	Controls	145
1003.3	Gauges	146
1003.4	Stack Dampers	146
1003.5	Welding	146
1004.0	Expansion Tanks	146
1004.1	General	146
1004.2	Open-Type Expansion Tanks	146
1004.3	Closed-Type Systems	146
1004.4	Minimum Capacity of Closed- Type Tank	146
Table 1004.4(1)	Expansion Tank Capacities for Gravity Hot Water Systems	146
Table 1004.4(2)	Expansion Tank Capacities for Forced Hot Water Systems	147
1005.0	Safety or Relief Valve Discharge	147
1005.1	General	147
1005.2	Discharge Piping	147
1005.3	Splash Shield	147
1005.4	Hazardous Discharge	147
1005.5	Vacuum Relief Valve	147
1006.0	Shutoff Valves	147
1006.1	General	147
1007.0	Gas-Pressure Regulators	147
1007.1	General	147
1008.0	Low-Water Cutoff	147
1008.1	General	147
1009.0	Combustion Regulators - Safety Valves	147
1009.1	General	147
1010.0	Clearance for Access	148
1010.1	General	148
1010.2	Power Boilers	148
1010.3	Steam-Heating Boilers, Hot Water Boilers, and Power Boilers	148
1010.4	Package Boilers, Steam-Heating Boilers, and Hot-Water-Heating Boilers	148
1011.0	Boilers, Stokers, and Steam Generators	148
1011.1	General	148
1012.0	Operating Adjustments and Instructions	148
1012.1	General	148

1013.0	Inspections and Tests	148
1013.1	General	148
1013.2	Operating Permit	148
1013.3	Maintenance Inspection	148
1013.4	Power and Miniature Boilers	148
1013.5	Steam- and Water-Heating Boilers	148
1013.6	Automatic Steam-Heating Boilers	149
1013.7	Unfired Pressure Vessels	149
1014.0	Operation and Maintenance of Boilers and Pressure Vessels	149
1014.1	General	149
Table 1003.2.1	Controls and Limit Devices for Automatic Boilers	150

CHAPTER 11

REFRIGERATION	153	
1101.0	General	153
1101.1	Applicability	153
1101.2	Equipment	153
Part I	Refrigeration Systems	153
1102.0	Refrigeration Systems	153
1102.1	General	153
1102.2	Refrigerants	153
1103.0	Classification	153
1103.1	Classification of Refrigerants	153
1103.2	Classification of Refrigeration Systems	153
1103.3	Higher Flammability Refrigerants	153
1104.0	Requirements for Refrigerant and Refrigeration Systems Use	153
1104.1	System Selection	153
1104.2	Refrigerant Concentration Limit	153
1104.3	Institutional Occupancies	154
1104.4	Industrial Occupancies and Refrigerated Rooms	154
1104.5	Flammable Refrigerants	154
1104.6	Applications for Human Comfort and for Nonindustrial Occupancies	154
1104.7	Refrigerant Type and Purity	154
1104.8	Changing Refrigerants	155
1105.0	General Requirements	155
1105.1	Human Comfort	155
1105.2	Supports and Anchorage	155

1105.3	Access	155	1109.1	Materials	158
1105.4	Illumination and Service		1109.2	Joints	158
	Receptacles	155	1109.3	Penetration of Piping	158
1105.5	Ventilation of Rooms		1109.4	Location of Refrigeration Piping . .	159
	Containing Condensing Units	155	1109.5	Underground Piping	159
1105.6	Prohibited Locations	156	1109.6	Support	159
1105.7	Condensate	156	1109.7	Pipe Enclosure	159
1105.8	Defrost	156	1109.8	Visual Inspection	159
1105.9	Overflows	156	1109.9	Condensation	159
1105.10	Condensate, Defrost, and		1109.10	Identification	159
	Overflow Disposal	156	1110.0	Valves	159
1105.11	Refrigerant Port Protection	156	1110.1	More than 6.6 Pounds	
1105.12	Storage	156		of Refrigerant	159
1106.0	Refrigeration Machinery Rooms . .	156	1110.2	More than 110 Pounds	
1106.1	Where Required	156		of Refrigerant	159
1106.2	Dimensions	156	1110.3	Support	159
1106.3	Exits	156	1110.4	Access	160
1106.4	Refrigerant-Vapor Alarms	156	1110.5	Identification	160
1106.5	Separation	157	1111.0	Pressure-Limiting Devices	160
1106.6	Combustion Air	157	1111.1	Where Required	160
1106.7	Airflow	157	1111.2	Setting	160
1106.8	Special Requirements	157	1111.3	Connection	160
1107.0	Refrigeration Machinery		1111.4	Operation	160
	Room Ventilation	157	1112.0	Pressure-Relief Devices	160
1107.1	General	157	1112.1	General	160
1107.2	Refrigeration Machinery		1112.2	Positive Displacement	
	Rooms	157		Compressor	160
1107.3	Natural Ventilation	157	1112.3	Liquid-Containing Portions	
1107.4	Distribution of Ventilation	157		of Systems	160
1107.5	Use of Ventilation Systems		1112.4	Evaporators	160
	for Other Purposes	157	1112.5	Actuation	161
1107.6	Emergency Control of the		1112.6	Stop Valves Prohibited	161
	Ventilation Systems	157	1112.7	Location	161
1107.7	Ventilation Discharge	158	1112.8	Materials	161
1107.8	Fans	158	1112.9	Pressure-Relief	
1107.9	Ventilation Intake	158		Device Settings	161
1107.10	Maximum Temperature	158	1112.10	Discharge from	
1107.11	Refrigerant Parts in Air Duct	158		Pressure-Relief Devices	161
1108.0	Refrigeration Machinery Room		1112.11	Discharge Piping	162
	Equipment and Controls	158	Table 1112.11.3	Atmospheric Pressure at	
1108.1	General	158		Nominal Installation	
1108.2	Electrical	158		Elevation	162
1108.3	Emergency Shut-off	158	1112.12	Rating of Pressure-	
1108.4	Installation, Maintenance,			Relief Device	163
	and Testing	158	1112.13	Rating of Rupture	
1108.5	Emergency Pressure			Members and Fusible Plugs	163
	Control System	158	1113.0	Overpressure Protection	163
1109.0	Refrigeration Piping, Containers,		1113.1	General	163
	and Valves	158	1113.2	Type of Protection	163

1113.3	Discharging Into Lowside of System	163
1113.4	Parallel Pressure-Relief Devices	163
1113.5	Discharge Capacity	164
1113.6	Three-Way Valve	164
Table 1113.5	Relief Devices Capacity Factor	164
1114.0	Special Discharge Requirements	164
1114.1	General	164
1114.2	Design Requirements	164
1114.3	Testing	164
1115.0	Labeling and Identification	165
1115.1	General	165
1115.2	Volume and Type	165
1115.3	Permanent Sign	165
1115.4	Marking of Pressure- Relief Devices	165
1116.0	Testing of Refrigeration Equipment	165
1116.1	Factory Tests	165
1116.2	Field Tests	165
1116.3	Test Gases	165
Table 1116.2	Field Leak Test Pressures	166
1116.4	Declaration	166
1116.5	Brine Systems	166
1117.0	Refrigerant-Containing Pressure Vessels	166
1117.1	Inside Dimensions 6 inches or Less	166
1117.2	Inside Dimensions More than 6 inches	166
1117.3	Pressure Vessels for 15 psig or Less	166
1118.0	Maintenance and Operation	166
1118.1	General	166
Part II	Cooling Towers	167
1119.0	General	167
1119.1	Applicability	167
1120.0	Support and Anchorage	167
1120.1	General	167
1121.0	Drainage	167
1121.1	General	167
1122.0	Chemical Treatment Systems	167
1122.1	General	167
1122.2	Automated Control of Cycles of Concentration	167

1123.0	Location	167
1123.1	General	167
1124.0	Electrical	167
1124.1	General	167
1125.0	Refrigerants and Hazardous Fluids	167
1125.1	General	167
1126.0	Drift Eliminators	167
1126.1	General	167
Table 1102.2	Refrigerant Groups, Properties, and Allowable Quantities	168
Table 1104.1	Permissible Refrigeration Systems	172
CHAPTER 12	HYDRONICS	173
1201.0	General	173
1201.1	Applicability	173
1201.2	Insulation	173
1201.3	Water Hammer	173
1201.4	Manifolds	173
1201.5	Heat Emitters	173
1202.0	Protection of Potable Water Supply	173
1202.1	Prohibited Sources	173
1202.2	Chemical Injection	173
1202.3	Compatibility	173
1203.0	Capacity of Heat Source	173
1203.1	Heat Source	173
1203.2	Dual Purpose Water Heater	173
Table 1203.2	Water Heaters	173
1203.3	Tankless Water Heater	173
1204.0	Identification of a Potable and Nonpotable Water System	173
1204.1	General	173
1204.2	Color and Information	173
1204.3	Potable Water	173
1204.4	Nonpotable Water	173
Table 1204.3	Minimum Length of Color Field and Size of Letters	174
1204.5	Location of Piping Identification	174
1204.6	Flow Directions	174
1205.0	Installation, Testing, and Inspection	174
1205.1	Operating Instructions	174
1205.2	Pressure Testing	174
1205.3	Flushing	174

1205.4	Oxygen Diffusion Corrosion	174	1211.11	Polyvinyl Chloride (PVC) Pipe . . .	178
1206.0	Safety Devices	174	1211.12	Steel Pipe and Tubing	179
1206.1	General	174	1211.13	Joints Between	
1206.2	Pressurized Vessels	174		Various Materials	179
1206.3	Discharge Piping	174	1212.0	Valves	179
1207.0	Heating Appliances		1212.1	General	179
	and Equipment	174	1212.2	Where Required	179
1207.1	General	174	1212.3	Heat Exchanger	179
1207.2	Boilers	174	1212.4	Pressure Vessels	179
1207.3	Dual-Purpose Water Heaters	174	1212.5	Pressure Reducing Valves	179
1207.4	Solar Heat Collector		1212.6	Equipment, Components,	
	Systems	175		and Appliances	179
1208.0	Circulators	175	1212.7	Expansion Tank	179
1208.1	General	175	1212.8	Flow Balancing Valves	179
1208.2	Mounting	175	1212.9	Mixing or Temperature	
1208.3	Sizing	175		Control Valves	179
1209.0	Expansion Tanks	175	1212.10	Thermosiphoning	179
1209.1	Where Required	175	1212.11	Air Removal Device	
1209.2	System with Closed			or Air Vents	179
	Expansion Tanks	175	1213.0	System Controls	180
1209.3	Systems with Open		1213.1	Water Temperature	
	Expansion Tanks	175		Controls	180
1210.0	Materials	175	1213.2	Radiant Floor Heating	
1210.1	Piping, Tubing, and Fittings	175		Panels	180
1210.2	Expansion and Contraction	175	1213.3	Operating Steam Controls	180
1210.3	Hangers and Supports	175	1213.4	Occupied Spaces	180
1211.0	Joints and Connections	175	1213.5	Return-Water Low-Temperature	
1211.1	General	175		Protection	180
Table 1210.1	Materials for Hydronic		1214.0	Pressure and Flow Controls	180
	Systems Piping, Tubing,		1214.1	Balancing	180
	and Fittings	176	1214.2	Low-Water Control	180
1211.2	Chlorinated Polyvinyl Chloride		1214.3	Flow-Sensing Devices	180
	(CPVC) Pipe	176	1214.4	Automatic Makeup Water	180
1211.3	Copper or Copper Alloy Pipe		1214.5	Differential Pressure	
	and Tubing	176		Regulation	180
1211.4	Cross-Linked Polyethylene		1214.6	Air-Removal Device	180
	(PEX) Pipe	177	1214.7	Air-Separation Device	180
1211.5	Cross-Linked		1214.8	Secondary Loops	180
	Polyethylene/Aluminum/Cross-Linked		1215.0	Hydronic Space Heating	180
	Polyethylene		1215.1	General	180
	(PEX-AL-PEX) Pipe	177	1215.2	Installation	180
1211.6	Ductile Iron Pipe	177	1215.3	Freeze Protection	180
1211.7	Polyethylene (PE)		1215.4	Balancing	180
	Plastic Pipe/Tubing	178	1215.5	Heat Transfer Medium	180
1211.8	Polyethylene/Aluminum/Polyethylene		1216.0	Steam Systems	181
	(PE-AL-PE)	178	1216.1	Steam Traps	181
1211.9	Polyethylene of Raised		1216.2	Sloping for Two-Pipe	
	Temperature (PE-RT)	178		System	181
1211.10	Polypropylene (PP) Pipe	178			

1216.3	Sloping for One-Pipe System	181	1302.2	Piping System Requirements	185
1216.4	Automatic Air Vents	181	1302.3	Applications	185
1216.5	Condensate Flow	181	1303.0	Inspection	185
1216.6	Steam-Distribution Piping	181	1303.1	Inspection Notification	185
1217.0	Radiant Heating and Cooling	181	1303.2	Excavation	185
1217.1	Installation	181	1303.3	Type of Inspections	185
1217.2	Radiant Under-Floor Heating	181	1303.4	Inspection Waived	186
1217.3	Chilled Water Systems	181	1304.0	Certificate of Inspection	186
1217.4	Dehumidification	181	1304.1	Issuance	186
1217.5	Tube Placement	181	1304.2	Gas Supplier	186
Table 1217.5	Maximum Length of Continuous Tubing from a Supply-and-Return Manifold Arrangement	181	1304.3	Unlawful	186
1217.6	Poured Floor Systems (Thermal Mass)	181	1305.0	Authority to Render Gas Service	186
1217.7	Radiant Heating and Cooling Panels	182	1305.1	Authorized Personnel	186
1218.0	Heat Exchangers	182	1305.2	Outlets	186
1218.1	General	182	1306.0	Authority to Disconnect	186
1219.0	Indirect-Fired Domestic Hot-Water Storage Tanks	182	1306.1	Disconnection	186
1219.1	General	182	1306.2	Notice	186
1220.0	Auxiliary Systems	182	1306.3	Capped Outlets	186
1220.1	General	182	1307.0	Temporary Use of Gas	186
1220.2	Use of Chemical Additives and Corrosive Fluids	183	1307.1	General	186
1220.3	Snow Melt	183	1308.0	Gas Piping System Design, Materials, and Components	186
Table 1220.3.1	Loop Lengths for Snow Melt Systems	183	1308.1	Installation of Piping System	186
1220.4	Hydronic Makeup Air Units	183	1308.2	Provision for Location of Point of Delivery	186
1221.0	Piping Installation	183	1308.3	Interconnections Between Gas Piping Systems	186
1221.1	General	183	1308.4	Sizing of Gas Piping Systems	187
1221.2	Embedded Piping and Joints	183	1308.5	Acceptable Piping Materials and Joining Methods	187
1221.3	Pressure Tested	183	Table 1308.4.1	Approximate Gas Input for Typical Appliances	187
1221.4	System Drainage	184	Table 1308.5.7.2	Specifications for Threading Metallic Pipe	188
1221.5	Condensate Drainage	184	1308.6	Gas Meters	190
1221.6	Clearance to Combustibles	184	1308.7	Gas Pressure Regulators	190
CHAPTER 13	FUEL GAS PIPING	185	1308.8	Backpressure Protection	191
1301.0	Scope of Gas Piping	185	1308.9	Low-Pressure Protection	191
1301.1	Applicability	185	1308.10	Shutoff Valves	191
1302.0	Coverage of Piping System	185	1308.11	Expansion and Flexibility	191
1302.1	General	185	1309.0	Excess Flow Valve	191
			1309.1	General	191
			1310.0	Venting of Gas Appliance Pressure Regulators	191
			1310.1	General	191
			1311.0	Gas Piping Installation	192

1311.1	Piping Underground	192	1314.4	Detection of Leaks and Defects	199
1311.2	Installation of Piping	192	1314.5	Piping System Leak Test	200
Table 1311.2.4.1	Support of Piping	193	1314.6	Purging Requirements	200
1311.3	Concealed Piping in Buildings . . .	193	Table 1314.6.1	Size and Length of Piping.	200
1311.4	Piping in Vertical Chases	194	1315.0	Required Gas Supply	201
1311.5	Maximum Design Operating Pressure	194	1315.1	General	201
1311.6	Appliance Overpressure Protection	194	1315.2	Volume	201
1311.7	Gas Pipe Turns	194	1315.3	Gas Appliances	201
1311.8	Drips and Sediment Traps	195	1315.4	Size of Piping Outlets	201
1311.9	Outlets	195	1316.0	Required Gas Piping Size	201
1311.10	Branch Pipe Connection	195	1316.1	Pipe Sizing Methods	201
1311.11	Manual Gas Shutoff Valves	195	1316.2	Tables for Sizing Gas Piping Systems	201
1311.12	Prohibited Devices	195	1316.3	Sizing Equations	201
1311.13	Systems Containing Gas-Air Mixtures Outside the Flammable Range	195	Table 1316.3	<i>Cr</i> and <i>Y</i> for Natural Gas and Undiluted Propane at Standard Conditions	202
1311.14	Systems Containing Flammable Gas-Air Mixtures	195	1316.4	Sizing of Piping Sections	202
1312.0	Electrical Bonding and Grounding	197	1316.5	Engineering Methods	202
1312.1	Pipe and Tubing other than CSST	197	1316.6	Variable Gas Pressures	202
1312.2	Bonding of CSST Gas Piping	197	Table 1316.2(1)	Schedule 40 Metallic Pipe	204
1312.3	Grounding Conductor of Electrode	197	Table 1316.2(2)	Schedule 40 Metallic Pipe	205
1312.4	Lighting Protection System	197	Table 1316.2(3)	Schedule 40 Metallic Pipe	206
1312.5	Electrical Circuits	197	Table 1316.2(4)	Schedule 40 Metallic Pipe	207
1312.6	Electrical Connection	197	Table 1316.2(5)	Schedule 40 Metallic Pipe	208
1313.0	Appliance Connections to Building Piping	197	Table 1316.2(6)	Schedule 40 Metallic Pipe	209
1313.1	Connecting Gas Appliances	197	Table 1316.2(7)	Semi-Rigid Copper Tubing	210
1313.2	Use of Gas Hose Connectors	197	Table 1316.2(8)	Semi-Rigid Copper Tubing	211
1313.3	Connection of Portable and Mobile Industrial Appliances	198	Table 1316.2(9)	Semi-Rigid Copper Tubing	212
1313.4	Appliance Shutoff Valves and Connections	198	Table 1316.2(10)	Semi-Rigid Copper Tubing	213
1313.5	Quick-Disconnect Devices	198	Table 1316.2(11)	Semi-Rigid Copper Tubing	214
1313.6	Gas Convenience Outlets	198	Table 1316.2(12)	Semi-Rigid Copper Tubing	215
1313.7	Sediment Trap	198	Table 1316.2(13)	Semi-Rigid Copper Tubing	216
1313.8	Installation of Piping	198	Table 1316.2(14)	Corrugated Stainless Steel Tubing (CSST)	217
1313.9	Liquefied Petroleum Gas Facilities and Piping	198	Table 1316.2(15)	Corrugated Stainless Steel Tubing (CSST)	218
1314.0	Pressure Testing and Inspection	199	Table 1316.2(16)	Corrugated Stainless Steel Tubing (CSST)	219
1314.1	Piping Installations	199	Table 1316.2(17)	Corrugated Stainless Steel Tubing (CSST)	220
1314.2	Test Preparation	199	Table 1316.2(18)	Corrugated Stainless Steel Tubing (CSST)	221
1314.3	Test Pressure	199	Table 1316.2(19)	Polyethylene Plastic Pipe	222
			Table 1316.2(20)	Polyethylene Plastic Pipe	223
			Table 1316.2(21)	Polyethylene Plastic Pipe	224

Table 1316.2(22)	Polyethylene Plastic Tubing	225
Table 1316.2(23)	Polyethylene Plastic Tubing	225
Table 1316.2(24)	Schedule 40 Metallic Pipe	226
Table 1316.2(25)	Schedule 40 Metallic Pipe	227
Table 1316.2(26)	Schedule 40 Metallic Pipe	228
Table 1316.2(27)	Schedule 40 Metallic Pipe	229
Table 1316.2(28)	Semi-Rigid Copper Tubing	230
Table 1316.2(29)	Semi-Rigid Copper Tubing	231
Table 1316.2(30)	Semi-Rigid Copper Tubing	232
Table 1316.2(31)	Corrugated Stainless Steel Tubing (CSST)	233
Table 1316.2(32)	Corrugated Stainless Steel Tubing (CSST)	234
Table 1316.2(33)	Corrugated Stainless Steel Tubing (CSST)	235
Table 1316.2(34)	Polyethylene Plastic Pipe	236
Table 1316.2(35)	Polyethylene Plastic Pipe	237
Table 1316.2(36)	Polyethylene Plastic Tubing	238

CHAPTER 14 PROCESS PIPING 239

1401.0	General	239
1401.1	Applicability	239
1402.0	Permit	239
1402.1	General	239
1403.0	Plans Required	239
1403.1	General	239
1404.0	Workmanship	239
1404.1	General	239
1405.0	Inspections	239
1405.1	General	239
1405.2	Required Inspections	239
1405.3	Other Inspections	239
1406.0	Pipe, Tubing, and Fittings	239
1406.1	General	239
1406.2	Hazardous Process Piping (HPP)	239
1406.3	Special Requirements for HPP Gases	240

CHAPTER 15 SOLAR ENERGY SYSTEMS 241

1501.0	General	241
1501.1	Applicability	241

CHAPTER 16 STATIONARY POWER PLANTS 243

1601.0	Stationary Fuel Cell Power Plants	243
--------	---	-----

1601.1	General	243
1602.0	Stationary Gas Engines and Generators	243
1602.1	General	243
1602.2	Connection to the Gas Supply Piping	243
1602.3	Stationary Engine Generators	243

CHAPTER 17 REFERENCED STANDARDS 245

1701.0	General	245
1701.1	Standards	245
Table 1701.1	Referenced Standards	245

APPENDICES TABLE OF CONTENTS 261

Appendix A	Residential Plan Examiner Review Form for HVAC System Design	263
Appendix B	Procedures to be Followed to Place Gas Equipment in Operation	265
Appendix C	Installation and Testing of Oil (Liquid) Fuel-Fired Equipment	267
Appendix D	Fuel Supply: Manufactured/Mobile Home Parks and Recreational Vehicle Parks	273
Appendix E	Sustainable Practices	279
Appendix F	Sizing of Venting Systems and Outdoor Combustion and Ventilation Opening Design	383
Appendix G	Example Calculation of Outdoor Air Rate	393

INDEX 395