## COMPOSITE INDEX ASHRAE HANDBOOK SERIES

indoor air cleaning, A45.5

This index covers the current Handbook series published by ASHRAE. The four volumes in the series are identified as follows:

S = 2004 HVAC Systems and Equipment

F = 2005 Fundamentals

R = 2006 Refrigeration

Abbreviations, F37

A = 2007 HVAC Applications

Alphabetization of the index is letter by letter; for example, Heaters precedes Heat exchangers, and Floors precedes Floor slabs.

The page reference for an index entry includes the book letter and the chapter number, which may be followed by a decimal point and the beginning page in the chapter. For example, the page number S31.4 means the information may be found in the 2004 HVAC Systems and Equipment volume, Chapter 31, beginning on page 4. Each Handbook volume is revised and updated on a four-year

Each Handbook volume is revised and updated on a four-year cycle. Because technology and the interests of ASHRAE members change, some topics are not included in the current Handbook series but may be found in the earlier Handbook editions cited in the index.

media filters, S24.5

idiquit, F.1.14; P.22.3	Absorbents	industrial exhaust gas cleaning, S25.24	Air conditioners. (See also Central air
Arborytion ammonia/water, F20.1, 69 hydrogen cycle, R41.8 technology, R41.7 bands, amospheric gases, F31.15 chillers, S4.2 coefficient of performance (COP), F1.13 concepts coupling, F1.16 double-effect calculations, F1.18 cycle characteristics, F1.15 dehumidification, S22.10 equipment, R41.1 equipment, R41.1 ammonia/water, F20.1, 69 types, F1.16 modeling analysis and performance simulation, F1.17 phase constraints, F1.14 representations, F1.16 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide tethnology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide tethnology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide tethnology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide tethnology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide tethnology components, R41.2 single-effect chillers, R41.3 terminology, R45.5 Appl. See Air diffusion performance index (APDF)  Assorbents impreprised, S25.24 solid, A45.5; F22.4  Affixty base for centrifugal pumps, S39.7 AffUE. See Air and let utilization efficiency (AFUE)  Affixty base for centrifugal pumps, S39.7 AfUE. See Air and let utilization efficiency (AFUE)  Affixty base for centrifugal pumps, S39.7 AfUE. See Air and let utilization efficiency (AFUE)  Affixty base for centrifugal pumps, S39.7  Altr. General control, F27.4 changes per hour (ach), F27.3 chumburs, F19.4; F20.62 separation, F28.5 promition, F	liquid, F1.14; F22.3	moisture, F22.1	conditioning)
ammonia/water, F20.1, 69 hydrogen cycle, R41.8 technology, R41.7 bands, amospheric gases, F31.15 chillers, S4.2 coefficient of performance (COP), F1.13 concepts coupling, F1.16 double-effect calculations, F1.18 cascaded, F1.16 cycle characteristics, F1.15 dehumidification, S22.10 equipment, R41.1 evolving technologies, R41.00 ideal thermal, F1.33 industrial exhaust gas cleaning, S25.17 refrigeration cycles, F1.14 ammonia/water, F20.1, 69 lithium bromide/water, F20.1, 69 lypes, F1.16 modeling analysis and performance simulation, F1.17 phase constrains, F1.14 representations, F1.16 solar cooling, A33.18, E2, S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 double-effect chillers, R41.3 maintenance, R41.7 operation, R41.1 vorking fluids, F1.15 Acousties, See Sound Activated carbon adsorption, A45.5 ADP1.See Air diffusion performance index (APUE)  Adsorbents impregrated, S52.2  Affility laws for centrifugal pumps, S39.7 AFUE. See Annual feel utilization efficiency (AFUE)  ABU. See Air handlers  AHU. See Air handlers  AHU. See Air handlers  All. wethilation, F2.7, changes per hour (ach), F27.3  drying, S22.11 question, R38.17  Arc cleaners, 16.19, F19.94; F20.62 separation, R38.17  Air cleaners, 16.29, F19.19; F19.4; F20.62 separation, R38.17  Arc cleaners, 16.29, F19.19; F19.4; F20.62 separation, R38.17  Air c	refrigerant pairs, F1.15	Aeration, of farm crops, A23.4; F11.11	faults, A38.5
hydrogen cycle, R41.8 technology, R41.7 bands, atmospheric gases, F31.15 chillers, 84.2 Arr sand ventilation, F27.4 coefficient of performance (COP), F1.13 concepts coupling, F1.16 double-effect double-effect childration, F27.4 changes per hour (ach), F27.3 through-the-wall room units, A1.6 units, A1.1 cascaded, F1.16 cycle characteristics, F1.15 dehumidification, S22.10 equipment, R41.1 equipment, R41.1 gase of and ventilation, F27.4 changes per hour (ach), F27.3 through-the-wall room units, A1.6 units, A1.1 cascaded, F1.16 cycle characteristics, F1.15 dehumidification, S22.10 equipment, R41.1 gaseous (indoor air) dehumidification, S22.10 adovers, A45.5 filters, a46.3 filters, S46.3 filters, S46.3 industrial exhaust gas cleaning, S25.17 refrigeration cycles, F1.14 energy consumption, A45.13 environmental effects on, A45.13 performance simulation, F1.17 phase constraints, F1.14 sizing, A45.10 operation and maintenance, A45.14 split systems, S45.1 representations, F1.16 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 single-effect chillers, R41.2 sizing, A45.15 testing exhaust systems, A45.5 circuit components, S45.5 circuit components, R41.1 control, R41.6 single-effect chillers, R41.2 sizing, A45.15 control, R41.6 single-effect chillers, R41.2 periodical collection mechanisms, S24.1 industrial ventilation, S24.2 particle collection mechanisms, S24.2 particle collection mechanisms, S24.2 installation, R45.5 circuit components, S45.5 (electrical design, S45.7 multiputation, S24.5 periodically split s	Absorption	Aerosols, S24.1	packaged terminal (PTAC), S46.5
technology, R41.7 bands, atmospheric gases, F31.15 chillers, S4.2 coefficient of performance (COP), F1.13 concepts coupting, F1.16 double-effect calculations, F1.18 cascaded, F1.16 cycle characteristics, F1.15 dehumidification, S22.10 equipment, R41.1 evolving technologies, R41.10 ideal thermal, F1.13 industrial exhaust gas cleaning, S25.17 refrigeration cycles, F1.14 ammonia/water, F20.1, 69 lybps, F1.16 modeling analysis and performance simulation, F1.17 phase constraints, F1.14 representations, F1.16 solar cooling, A33.18, 26; 333.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 double-effect chillers, R41.3 manntenance, R41.7 operation, R41.6 solar cooling, A31.8, 26; 333.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 double-effect chillers, R41.2 single-effect chillers, R41.3 terminology, R41.1 working fluids, F1.15 Acoustics. See Sound Activated carbon adsorption, A45.5 ApP1. See Air diffusion performance index (ADP1)  Adsorbents imperented, S25.24 combination, S24.3 eterminology, R45.5 certification, S24.3 intropersonation performance index (ADP1)  Adsorbents imperented, S25.24 combination, S24.6 combination, S24.6 combination, S24.6 combination, S24.7 intropersonation, R41.6 industrial ventilation, S24.3 industrial ventilation, S24.3 industrial ventilation, S24.5 industrial ventilation, S24.6 industrial ventilation, S24.7 industrial ventilation, S24.8 industrial ventilation, S24.9 industrial ventilation, S24.9 industrial ventilation, S24.9 industrial ventilation, S24.8 industrial ventilation, S24.8 industrial ventilation, S24.9 industrial ventilation, S24.9 industrial ventilation, S24.8	ammonia/water, F20.1, 69	Affinity laws for centrifugal pumps, S39.7	design, S46.5, 6
bands, atmospheric gases, F31.15 chillers, S4.2 coefficient of performance (COP), F1.13 concepts coupling, F1.16 double-effect double-effect calculations, F1.18 coseaded, F1.16 cycle characteristics, F1.15 dehumidification, S22.10 equipment, R41.1 evolving technologies, R41.10 ideal thermal, F1.13 adsorbers, A45.5 ideal transl, F1.14 ammonia/water, F20.1, 69 ithium bromide/water, F20.1, 69 ithium bromide/evater, F20.1, 69 ithium bromide technology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 doublle-effect chillers, R41.2 single-effect chillers, R41.3 selection, S24.3 terminology, R45.5  Acoustics. See Sound Activated carbon adsorption, A45.5 ApP1. See Air diffusion performance index (ADP1)  Adsorberts impregnated, S25.24 solid, A45.5; F22.4  Air combination, S24.6 combinat	hydrogen cycle, R41.8	AFUE. See Annual fuel utilization efficiency	heavy-duty commercial grade, S5.2
coefficient of performance (COP), F1.13 concepts coupling, F1.16 double-effect calculations, F1.18 coscaded, F1.16 coscaded, F1.16 covele characteristics, F1.15 dehunidification, S22.10 equirment, R41.1 evolving technologies, R41.10 ideal thermal, F1.13 industrial exhaust gas cleaning, S25.17 refrigeration cycles, F1.14 ammonia/water, F20.1, 69 ithrium bromide/water, F20.1, 69 ithrium bromide technology components, R41.1 control, R41.6 double-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 double-effect chillers	technology, R41.7	(AFUE)	sizes and classifications, S46.5
coefficient of performance (COP), F1.13 concepts coupling, F1.16 double-effect calculations, F1.18 cascaded, F1.16 cascaded, F1.16 cascaded, F1.16 cascaded, F1.16 dehumidification, S22.10 equipment, R41.1 endeath technologies, R41.10 ideal thermal, F1.13 industrial exhaust gas cleaning, S25.17 refrigeration cycles, F1.14 energy consumption, A45.13 enuminalwater, F20.1, 69 ilibitium bromide/water, F20.1, 69 ilibitium bromide technology components, R41.1 phase constraints, F1.14 safety, A45.14 safety, A45.16 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 double-effect chillers, R41.2 single-effect ethillers, R41.2 single-effect chillers, R41.2 single-effect chillers, R41.2 single-effect chillers, R41.3 reminology, R41.1 working fluids, F1.15 Ar tetaitore, R38.8 transformers, R41.3 retail stores, A2.1 re	bands, atmospheric gases, F31.15	AHU. See Air handlers	testing, S46.7
concepts coupling, F1.16 double-effect calculations, F1.18 cascaded, F1.16 cycle characteristics, F1.15 dehunidification, S22.10 equipment, R41.1 evolving technologies, R41.10 ideal thermal, F1.13 industrial exhaust gas cleaning, S25.17 refrigeration cycles, F1.14 ammonia/water, F20.1, 69 itithium bromide/water, F20.1, 69 itithium bromide/water, F20.1, 69 itithium bromide/water, F20.1, 69 cyper, F1.16 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 single-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.3 terminology, R45.1 residential and industrial ventilation, S24.2 single-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.3 terminology, R45.5 terminology, R45.5 test methods, S24.2 penetration, S24.2 penetration, S24.3 penetration, S24.3 terminology, R45.5 test methods, S24.2 penetration, S24.3 terminology, R45.5 ceconditioning/water heating, S45.6 refrigerant circuit control, S45.6 refrigerant circuit control, S45.6 refrigerant circuit control, S45.5 refrigerant circuit control, S45.6 refrigerant circuit control, S45.5 refrigerant circuit control, S45.6 refrigerant circuit control, S45.5 refrigerant circuit control, S45.5 refrigerant circuit contr	chillers, S4.2	Air	residential, AI
coupling, F1.16 double-effect calculations, F1.18 cascaded, F1.16 cycle characteristics, F1.15 dehumidification, S22.10 equipment, R41.1 evolving technologies, R41.10 ideal thermal, F1.13 industrial exhaust gas cleaning, S25.17 refrigeration cycles, F1.14 ammonia/water, F20.1, 69 lithium bromide water, F20.1, 69 lithium bromide water, F20.1, 69 simulation, F1.17 phase constraints, F1.14 safety, A45.10 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 solar cooling, A35.1 control, R41.6 single-effect chillers, R41.2 single-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.3 maintenance, R41.7 voperation, R41.6 single-effect chillers, R41.3 safety, R45.4 safety, R45.4 safety, R45.4 sparticulate contaminants, S24.1 contaminants, S24.2 single-effect chillers, R41.3 particulate contaminants, S24.3 safety requirements, S24.2 single-effect chillers, R41.2 single-effect deat transformers, R41.3 residential, S24.9 selection, S24.3 standards, S24.9 sparticulate contaminants, S24.1 solid, A45.5; F22.4 dorum contaminants, S24.2 single-effect deat transformers, R41.3 residential, S24.9 sparticulate contaminants, S24.1 sparticulate contaminants, S24.2 sparticulate collection mechanisms, S24.2 sparticulate collection, S24.3	coefficient of performance (COP), F1.13	age of, and ventilation, F27.4	split systems, S5.5
double-effect calculations, F1.18 cascaded, F1.16 cycle characteristics, F1.15 cheminification, S22.10 equipment, R41.1 evolving technologies, R41.10 ideal thermal, F1.13 cheminification, S22.10 equipment, R41.1 evolving technologies, R41.10 ideal thermal, F1.13 cheminification, S22.17 refrigeration cycles, F1.14 ammonia/water, F2.01, 69 lithium bromide/water, F2.01, 69 lyps, F1.16 modeling analysis and performance simulation, F1.17 phase constraints, F1.14 representations, F1.16 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 solar cooling, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.2 single-effect chillers, R41.1 representations, F1.15 safety requirements, S24.2 single-effect chillers, R41.2 single-effect chillers, R41.1 representations, R41.5 single-effect chillers, R41.2 single-effect chillers, R41.1 representations, R41.6 single-effect chillers, R41.2 single-effect chillers, R41.2 single-effect chillers, R41.2 single-effect chillers, R41.3 residential, S24.9 terminology, R41.1 representations, F1.15 safety requirements, S24.1 residential, S24.9 terminology, R41.1 representations, F3.5 safety requirements, S24.2 single-effect chillers, R41.2 single-effect chillers, R41.2 single-effect chillers, R41.2 single-effect chillers, R41.3 residential, S24.9 safety requirements, S24.1 residential, S24.9 safety requirements, S24.2 single-effect chillers, R41.3 residential, S24.9 safety requirements, S24.1 single-effect chillers, R41.3 residential, S24.9 safety requirements, S24.1 single-effect chillers, R41.3 residential, S24.9 safety requirements, S24.1 single-effect chillers, R41.3 representation, S24.5 standards, S24.3, 5 terminology, R41.1 representation, S24.2 single-effect chillers, R41.3 representation, S24.5 safety requirements, S24.1 single-effect chillers, R41.3 representation, S24.5 safety requirements, S24.1 representation, S24.5 safety requirements, S24.2 repre	concepts	changes per hour (ach), F27.3	through-the-wall room units, A1.6
calculations, F1.18	coupling, F1.16	drying, S22.11	unitary, A1.4
cascaded, F1.16         separation, R38.17         room           cycle characteristics, F1.15         Air cleaners. (See also Filters, air; Industrial debumidification, S22.10         exhaust gas cleaning)         design, S46.1           equipment, R41.1         gaseous (indoor air)         features, S46.3           ideal thermal, F1.13         chemisorbers, A45.5         filters, S46.4           industrial exhaust gas cleaning, S25.17         economics, A45.13         noise, S46.4           refrigeration cycles, F1.14         energy consumption, A45.13         performance, S46.2           ammonia/water, F20.1, 69         installation, A45.14         split systems, S45.1           lithium bromide/water, F20.1, 69         installation, A45.10         sizes and classifications, S46.1           modeling analysis and performance simulation, F1.17         operation and maintenance, A45.14         split systems, S45.1           phase constraints, F1.14         safety, A45.14         air handlers, S45.7           representations, F1.16         sizing, A45.10         application, S45.1           solar cooling, A33.18, 26; S33.3, 7         terminology, A45.5         capacity control, S45.6           econtrol, R41.6         double-effect chillers, R41.3         industrial exhaust systems, A30.7         codes and standards, S45.6           operation, R41.6         industrial exhaust systems, A30.7	double-effect	liquefaction, R38.8	retail stores, A2.1
cycle characteristics, F1.15 dehumidification, S22.10 edumment, R41.1 evolving technologies, R41.10 ideal thermal, F1.13 industrial exhaust gas cleaning, S25.17 refrigeration cycles, F1.14 ammonia/water, F20.1, 69 lithium bromide/water, F20.1, 69 installation, A45.19 representations, F1.17 phase constraints, F1.14 representations, F1.16 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 solar cooling, R41.6 industrial exhaust gas cleaning, S25.17 refrigeration cycles, F1.14 ammonia/water, F20.1, 69 lithium bromide/water, F20.1, 69 installation, A45.19 coil placement, S45.8 modeling analysis and performance simulation, F1.17 phase constraints, F1.14 representations, F1.16 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 double-effect chillers, R41.3 maintenance, R41.7 operation and maintenance, S45.1 control, R41.6 single-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.3 terminology, R41.1 working fluids, F1.15  Acoustics. See Sound Activated carbon adsorption, A45.5 Appl. See Air diffusion performance index (ADP1) See Air diffusion performance index (ADP1, See Air diffusion, See See Sound Activated carbon adsorption, A45.5 electronic, S91, S24.5, 8; S28.	calculations, F1.18	properties, F6.19; F19.4; F20.62	rooftop units, S5.7
dehumidification, S22.10 equipment, R41.1 equipment, R41.1 ideal thermal, F1.13 industrial exhaust gas cleaning, S25.17 economics, A45.5 industrial exhaust gas cleaning, S25.17 economics, A45.13 economics, A45.13 economics, A45.13 energy consumption, A45.15 industrial exhaust gas cleaning, S25.17 erfrigeration cycles, F1.14 emergy consumption, A45.15 industrial exhaust gas cleaning, S25.17 energy consumption, A45.15 installation and service, S46.4 enrisorbers, A45.6 enonomics, A45.13 enory consumption, A45.15 installation, A45.14 epit systems, S46.2 environmental effects on, A45.15 installation, A45.14 epit systems, S45.1 environmental effects on, A45.15 installation, A45.14 epit systems, S45.16 endeling analysis and performance simulation, F1.17 phase constraints, F1.14 epresentations, F1.16 solar cooling, A33.18, 26; S33.3, 7 eterminology, A45.10 eoling, A33.18, 26; S33.3, 7 eterminology, A45.10 eoling, A33.18, 26; S33.3, 7 eterminology, A45.5 components, R41.1 eontrol, R41.6 double-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 industrial exhaust systems, A30.7 periculate control, R41.6 industrial exhaust systems, A30.7 periculate edesuperheaters, S45.5 edestine, S45.5 edestine, S45.5 electrical design, S45.7 electrical design, S45.7 epiping, S45.5  electrical design, S45.7 maintenance, R41.7 operation, R41.6 industrial ventilation, S24.2 insigle-effect chillers, R41.3 penetration, S24.3 terminology, R41.1 residential, S24.9 enertation, S24.3 penetration, S24.3 terminology, R41.1 residential, S24.9 enertation, S24.3 penetration, S24.3 piping, S45.6  Acoustics. See Sound Activated carbon adsorption, A45.5 Appl. See Air diffusion performance index (ADPI) Adsorbents interpolated, S25.24 electronic, S91.524.5, 8; S28.2  Altronditioning, (See also Central air	cascaded, F1.16	separation, R38.17	room
equipment, R41.1 evolving technologies, R41.10 adsorbers, A45.5 ideal thermal, F1.13 industrial exhaust gas cleaning, S25.17 refrigeration cycles, F1.14 ammonia/water, F20.1, 69 ilithium bromide/water, F20.1, 69 ilithium bromide/water, F20.1, 69 ilithium bromide/water, F20.1, 69 installation, A45.14 performance, S46.1 split systems, S45.1 representations, F1.16 modeling analysis and performance simulation, F1.17 phase constraints, F1.14 representations, F1.16 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 double-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect heat transformers, R41.3 terminology, R41.1 working fluids, F1.15 safety requirements, S24.2 single-effect chalters, R41.3 terminology, R41.1 working fluids, F1.15 safety requirements, S24.2 single-effect and and sorption, A45.5 safety requirements, S24.12 safety requirements, S24.2 single-effect and and sorption, A45.5 safety requirements, S24.12 single-effect and and sorption, A45.5 safety requirements, S24.12 single-effect and and preformance index (ADPI) Adsorbents indexing technology of testing, R41.6 single, A45.5 indexing fluids, F1.15 safety requirements, S24.2 combination, S24.3 single-effect diffusion performance index (ADPI) see Air diffusion performance index (ADPI) see Air diffusion performance index (ADPI) see Air diffusion performance index ideal merity and sorption, R45.5 solid, A45.5; F22.4 s	cycle characteristics, F1.15	Air cleaners. (See also Filters, air; Industrial	codes and standards, S46.4
evolving technologies, R41.10 ideal thermal, F1.13 chemisorbers, A45.5 inidustrial exhaust gas cleaning, S25.17 refrigeration cycles, F1.14 ammonia/water, F20.1, 69 lithium bromide/water, F20.1, 69 vypes, F1.16 modeling analysis and performance simulation, F1.17 phase constraints, F1.14 representations, F1.16 solar cooling, A33.18, 26; S33.3, 7 terminology, A45.10 solar cooling, A33.18, 26; S33.3, 7 terminology, A45.5 components, R41.1 control, R41.6 double-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.2 single-effect chillers, R41.2 single-effect chillers, R41.3 terminology, R41.1 residential, S24.1 residential, S24.2 single-effect chillers, R41.3 terminology, R41.1 residential, S24.3 terminology, R41.1 residential, S24.3 terminology, R41.5 safety, A45.15 safety requirements, S24.2 single-effect chillers, R41.3 terminology, R41.5 safety, R45.3 safety requirements, S24.12 safety requirements, S24.3 safety requirements, S24.12 safety requirements, S24.3 safety requirements, S24.3 safety requirements, S24.2 safety requirements, S24.2 safety requirements, S24.2 safety requirements, S24.3 safety requirements, S24.2 spart circuit control, S45.6 refrigerant circuit control, S45.6 refrigerant circuit control, S45.3 spin, S45.2 spin, S45.2 spin, S45.2 spin, S45.2 spin, S45.2 spin, S45.2 spin, S45.3 spi	dehumidification, S22.10	exhaust gas cleaning)	design, S46.1
ideal thermal, F1.13 chemisorbers, A45.6 installation and service, S46.4 industrial exhaust gas cleaning, S25.17 economics, A45.13 noise, S46.4 noise, S46.4 ammonia/water, F20.1, 69 environmental effects on, A45.15 sizes and classifications, S46.1 lithium bromide/water, F20.1, 69 installation, A45.14 split systems, S45.1 coil placement, S45.8 modeling analysis and performance simulation, F1.17 operation and maintenance, A45.14 air handlers, S45.7 residential and light-commercial, S5.5 unitary phase constraints, F1.14 safety, A45.19 application, S45.1 air handlers, S45.7 application, S45.1 solar cooling, A33.18, 26; S33.3, 7 terminology, A45.5 capacity control, S45.6 certification, S45.5 components, R41.1 types, A45.15 certification, S45.5 corponents, R41.1 control, R41.6 industrial exhaust systems, A30.7 codes and standards, S45.5, 6 double-effect chillers, R41.3 particulate desuperation, R41.6 industrial ventilation, S24.2 efficiency, S45.5 efficiency, S45.5 single-effect heat transformers, R41.3 penticulate ventilation, S24.2 installation, S45.2 maintenance, R41.7 contaminants, S24.1 efficiency, S45.5 efficiency, S45.5 engage-effect heat transformers, R41.3 penticulate ventilation, S24.2 installation, S45.2 maintenance, S45.2 terminology, R41.1 residential, S24.9 mechanical design, S45.7 multizone, S45.3 terminology, R41.1 safety requirements, S24.12 maintenance, S45.2 maintenance, S45.2 mechanical design, S45.7 multizone, S45.3 Acoustics. See Sound selection, S24.8 piping, S45.6 Activated carbon adsorption, A45.5 standards, S24.3, 5 refigerant circuit control, S45.6 ADPI, See Air diffusion performance index (ADPI) types Air washers, S19.7 combination, S24.6 electrical decombination, S24.2 space conditioning/water heating, S45.3 imprepated, S25.24 electronic, S91; S24.5, S, S28.2 Air conditioning, (See also Central air impregnated, S25.24 electronic, S91; S24.5, S, S28.2 Air conditioning, (See also Central air	equipment, R41.1	gaseous (indoor air)	features, S46.3
industrial exhaust gas cleaning, \$25.17 refrigeration cycles, F1.14 energy consumption, A45.13 performance, \$46.2 ammonia/water, F20.1, 69 lithium bromide/water, F20.1, 69 location, A45.9 modeling analysis and performance simulation, F1.17 phase constraints, F1.14 safety, A45.10 solar cooling, A3.18, 26, \$33.3, 7 terminology, A45.5 solar cooling, A3.18, 26, \$33.3, 7 terminology, A45.5 components, R41.1 types, A45.15 control, R41.6 double-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.2 single-effect chillers, R41.2 single-effect chillers, R41.1 residential, S24.2 single-effect heat transformers, R41.3 terminology, R41.1 working fluids, F1.15 safety requirements, S24.12 morking fluids, F1.15 safety requirements, S24.12 single-effect dat transformers, R45.5 standards, S24.3, 5 standards, S24.3, 5 standards, S24.3, 5 standards, S24.2 single-effect diffusion performance index (ADPI) Adsorbents impregnated, S25.24 solid, A45.5; F22.4	evolving technologies, R41.10	adsorbers, A45.5	filters, \$46.4
refrigeration cycles, F1.14 energy consumption, A45.13 performance, S46.2 ammonial/water, F20.1, 69 installation, A45.14 split systems, S45.1 coil placement, S45.8 modeling analysis and performance media selection, A45.10 residential and light-commercial, S5.5 simulation, F1.17 operation and maintenance, A45.14 unitary phase constraints, F1.14 safety, A45.14 unitary phase constraints, F1.16 sizing, A45.10 application, S45.7 application, S45.1 soil placement, S45.8 residential and light-commercial, S5.5 water/lithium bromide technology testing, A45.10 application, S45.1 soil placement, S45.8 residential and light-commercial, S5.5 water/lithium bromide technology testing, A45.10 application, S45.1 soil representations, F1.16 sizing, A45.10 application, S45.1 soil representations, F1.16 sizing, A45.15 capacity control, S45.6 control, R41.6 industrial exhaust systems, A30.7 codes and standards, S45.5 corruit components, S45.5 operation, R41.6 industrial exhaust systems, A30.7 codes and standards, S45.5 efficiency, S45.5 efficiency, S45.5 efficiency, S45.5 efficiency, S45.5 single-effect chillers, R41.2 particle collection mechanisms, S24.1 efficiency, S45.2 efficiency, S45.2 single-effect heat transformers, R41.3 penetration, S24.2 installation, S45.2 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.2 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.3 piping, S45.6 Activated carbon adsorption, A45.5 slandards, S24.3, 5 refrigerant circuit control, S45.6 Appl. See Air diffusion performance index (ADPI) types sirve with diffusion performance index (ADPI) types sirve with diffusion performance index (ADPI) sirve with own-own-owned, S5.2 slandards, S25.2 solid, A45.5; F22.4 electronic, S9.1; S24.5, 8; S28.2 Air conditioning, (See also Central air	ideal thermal, F1.13	chemisorbers, A45.6	installation and service, \$46.4
ammonia/water, F20.1, 69 environmental effects on, A45.15 sizes and classifications, S46.1 lithium bromide/water, F20.1, 69 installation, A45.14 split systems, S45.1 coil placement, S45.8 modeling analysis and performance media selection, A45.10 residential and light-commercial, S5.5 simulation, F1.17 operation and maintenance, A45.14 unitary phase constraints, F1.14 safety, A45.14 air handlers, S45.7 applications, S45.1 cooling, A33.18, 26; S33.3, 7 terminology, A45.15 capacity control, S45.6 corponents, R41.1 types, A45.7 circuit components, S45.6 control, R41.6 industrial exhaust systems, A30.7 codes and standards, S45.5, 6 double-effect chillers, R41.3 particulate desuperheaters, S45.2 efficiency, S45.5 capation, R41.6 single-effect chillers, R41.2 particle collection mechanisms, S24.1 efficiency, S45.5 capacity control, S45.6 control, R41.6 single-effect chillers, R41.2 particle collection mechanisms, S24.2 electrical design, S45.7 working fluids, F1.15 safety requirements, S24.3 maintenance, R41.7 contaminants, S24.3 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.3 mechanical design, S45.7 multizone, S45.3 Acoustics. See Sound selection, S24.3 refrigerant circuit control, S45.6 ADPI. See Air diffusion performance index (ADPI) types Air diffusion performance index (ADPI) air washers, S19.7 combination, S24.6 electronic, S9.1; S24.5, 8; S28.2 Air conditioning, (See also Central air	industrial exhaust gas cleaning, S25.17	economics, A45.13	noise, S46.4
lithium bromide/water, F20.1, 69 types, F1.16 modeling analysis and performance simulation, F1.17 phase constraints, F1.14 representations, F1.16 solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology components, R41.1 control, R41.6 double-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.2 single-effect chillers, R41.2 single-effect tech transformers, R41.1 vorking fluids, F1.15 safety requirements, S24.1 terminology, R41.1 vorking fluids, F1.15 safety requirements, S24.12 single-effect dat transformers, R41.3 vorking fluids, F1.15 safety requirements, S24.12 single-effect dat transformers, R45.5 standards, S24.3, 5 standards, S24.3, 5 standards, S24.3, 5 sping, S45.6 refrigerant circuit control, S45.6 refrigerant circuit control, S45.6 space conditioning/water heating, S45.3 sping, S45.6 space conditioning/water heating, S45.3 sping, S45.6 space conditioning/water heating, S45.3 sping, S45.2 spingle-effect dation performance index (ADPI) Adsorbents impregnated, S25.24 solid, A45.5; F22.4 solid, A45.5; F22.4 spingle-effect, S25.24 spingle-effect, S2	refrigeration cycles, F1.14	energy consumption, A45.13	performance, S46.2
types, F1.16 modeling analysis and performance media selection, A45.10 residential and light-commercial, S5.5 simulation, F1.17 phase constraints, F1.14 safety, A45.14 representations, F1.16 solar cooling, A33.18, 26; S33.3, 7 terminology, A45.5 water/lithium bromide technology components, R41.1 control, R41.6 double-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.2 single-effect chillers, R41.2 single-effect chillers, R41.3 particulate operation, S24.3 terminology, R41.1 residential, S24.9 terminology, R41.1 working fluids, F1.15 safety requirements, S24.12 single-effect chard transformers, R41.3 terminology, R41.1 residential, S24.9 safety requirements, S24.12 safety requirements, S24.12 sterminology, R41.5 standards, S24.3, 5 standards, S24.3, 5 refrigerant circuit control, S45.6 ADPI. See Air diffusion performance index (ADPI) Adsorbents impregnated, S25.24 solid, A45.5; F22.4  location, A45.5, S28.2 location, A45.10 residential, A45.10 residential, A45.10 residential, S45.10 residential, S45.10 residential, S45.2 single-effect chillers, R41.3 refrigerant circuit control, S45.6 standards, S24.3, 5 refrigerant circuit control, S45.6 standards, S24.2 space conditioning/water heating, S45.3 types, S45.2, 3 unit ventilators, S31.1 window-mounted, S5.2 solid, A45.5; F22.4 solid, A45.5; F22.4 Air conditioning. (See also Central air	ammonia/water, F20.1, 69	environmental effects on, A45.15	sizes and classifications, \$46.1
modeling analysis and performance simulation, F1.17 operation and maintenance, A45.14 unitary phase constraints, F1.14 safety, A45.14 air handlers, S45.7 representations, F1.16 sizing, A45.10 application, S45.1 solar cooling, A33.18, 26; S33.3, 7 terminology, A45.5 capacity control, S45.6 water/lithium bromide technology testing, A45.15 certification, S45.5 components, R41.1 types, A45.7 circuit components, S45.6 control, R41.6 industrial exhaust systems, A30.7 codes and standards, S45.5, 6 double-effect chillers, R41.3 particulate desuperheaters, S45.2 maintenance, R41.7 contaminants, S24.1 efficiency, S45.5 operation, R41.6 industrial ventilation, S24.2 electrical design, S45.7 single-effect chillers, R41.2 particle collection mechanisms, S24.2 installation, S45.2 single-effect theat transformers, R41.3 penetration, S24.3 maintenance, S45.2 terminology, R41.1 residential, S24.9 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.3 Acoustics. See Sound selection, S24.8 piping, S45.6 Activated carbon adsorption, A45.5 standards, S24.3, 5 refrigerant circuit control, S45.6 ADP1, See Air diffusion performance index (ADP1) impregnated, S25.24 solid, A45.5; F22.4 electronic, S9.1; S24.5, 8; S28.2 Air conditioning. (See also Central air	lithium bromide/water, F20.1, 69	installation, A45.14	split systems, \$45.1
simulation, F1.17 phase constraints, F1.14 safety, A45.14 representations, F1.16 sizing, A45.10 solar cooling, A33.18, 26; S33.3, 7 terminology, A45.5 water/lithium bromide technology testing, A45.15 components, R41.1 types, A45.7 control, R41.6 double-effect chillers, R41.3 particulate contaminants, S24.1 operation, R41.6 sindustrial ventilation, S24.2 single-effect chillers, R41.2 single-effect heat transformers, R41.3 penetration, S24.3 terminology, R41.1 residential, S24.9 solid, A45.5  Acoustics. See Sound Activated carbon adsorption, A45.5  Adsorbents impregnated, S25.24 solid, A45.5; F22.4 single-effect special see such as a size of control air size operation, R45.2 simple-effect chillers, R41.3 safety requirements, S24.12 single-effect special seign, S45.7 single-effect special seign, S45.7 single-effect special special special seign, S45.7 solid, A45.5; F22.4  Activated carbon adsorption, A45.5 simpregnated, S25.24 solid, A45.5; F22.4 solid, A45.5; F22.4 solid, A45.5; F22.4 size air air maintenance, A45.0 size air air maintenance, A45.0 size air washers, S19.7 unit ventilators, S31.1 window-mounted, S5.2 solid, A45.5; F22.4 solid, A45.5; F22.4 size air ventilation, S24.5, Size, S28.2 size air conditioning, (See also Central air	types, F1.16	location, A45.9	coil placement, S45.8
phase constraints, F1.14 safety, A45.14 air handlers, S45.7 representations, F1.16 sizing, A45.10 application, S45.1 solar cooling, A33.18, 26; S33.3, 7 terminology, A45.5 capacity control, S45.6 water/lithium bromide technology testing, A45.15 certification, S45.5 components, R41.1 types, A45.7 circuit components, S45.6 control, R41.6 industrial exhaust systems, A30.7 codes and standards, S45.5, 6 double-effect chillers, R41.3 particulate desuperheaters, S45.2 maintenance, R41.7 contaminants, S24.1 efficiency, S45.5 electrical design, S45.7 single-effect chillers, R41.2 particle collection mechanisms, S24.2 installation, S45.2 single-effect heat transformers, R41.3 penetration, S24.3 maintenance, S45.2 maintenance, S45.2 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.3 Acoustics. See Sound selection, S24.8 piping, S45.6 refrigerant circuit control, S45.6 ADP1. See Air diffusion performance index (ADP1) types Adsorbents air washers, S19.7 unit ventilators, S31.1 impregnated, S25.24 electronic, S9.1; S24.5, 8; S28.2 Air conditioning. (See also Central air	modeling analysis and performance	media selection, A45.10	residential and light-commercial, S5.5
representations, F1.16 solar cooling, A33.18, 26; S33.3, 7 terminology, A45.5 water/lithium bromide technology testing, A45.15 components, R41.1 types, A45.7 control, R41.6 double-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.2 single-effect chillers, R41.3 particulate single-effect chillers, R41.2 single-effect heat transformers, R41.3 terminology, R41.1 residential, S24.9 working fluids, F1.15 safety requirements, S24.12 morking fluids, F1.15 safety requirements, S24.8 Activated carbon adsorption, A45.5 ACTIVATED ACTIVATED ACTIVATED ATTIVATED ACTIVATED ACTI	simulation, F1.17	operation and maintenance, A45.14	unitary
solar cooling, A33.18, 26; S33.3, 7 water/lithium bromide technology testing, A45.15 components, R41.1 types, A45.7 control, R41.6 double-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 single-effect chillers, R41.2 single-effect chillers, R41.3 particulate particle collection mechanisms, S24.2 single-effect heat transformers, R41.3 penetration, S24.3 terminology, R41.1 residential, S24.9 solid, A45.5  Acoustics, See Sound Activated carbon adsorption, A45.5  ADP1, See Air diffusion performance index (ADP1) Adsorbents impregnated, S25.24 solid, A45.5; F22.4 terminology, A45.5 terminology, R41.6 single-effect chillers, R41.2 particle collection mechanisms, S24.2 particle design, S45.7 p	phase constraints, F1.14	safety, A45.14	air handlers, S45.7
water/lithium bromide technology components, R41.1 types, A45.7 components, R41.6 control, R41.6 double-effect chillers, R41.3 maintenance, R41.7 operation, R41.6 industrial exhaust systems, A30.7 operation, R41.6 industrial exhaust systems, A30.7 operation, R41.6 operation, R41.6 industrial ventilation, S24.1 operation, R41.6 single-effect chillers, R41.2 single-effect chillers, R41.2 particle collection mechanisms, S24.2 installation, S45.2 single-effect heat transformers, R41.3 penetration, S24.3 penetration, S24.3 maintenance, S45.2 terminology, R41.1 residential, S24.9 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.3 Acoustics. See Sound selection, S24.8 Activated carbon adsorption, A45.5 standards, S24.3, 5 refrigerant circuit control, S45.6 ADP1. See Air diffusion performance index (ADP1) types types types, S45.2, 3  Adsorbents impregnated, S25.24 solid, A45.5; F22.4 electronic, S91; S24.5, 8; S28.2 Air conditioning. (See also Central air	representations, F1.16	sizing, A45.10	application, \$45.1
components, R41.1 types, A45.7 circuit components, S45.6 industrial exhaust systems, A30.7 codes and standards, S45.5, 6 double-effect chillers, R41.3 particulate desuperheaters, S45.2 efficiency, S45.5 operation, R41.6 industrial ventilation, S24.1 efficiency, S45.5 operation, R41.6 industrial ventilation, S24.2 electrical design, S45.7 single-effect chillers, R41.2 particle collection mechanisms, S24.2 installation, S45.2 single-effect heat transformers, R41.3 penetration, S24.3 maintenance, S45.2 terminology, R41.1 residential, S24.9 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.3 Acoustics. See Sound selection, S24.8 piping, S45.6 refrigerant circuit control, S45.6 ADP1. See Air diffusion performance index (ADP1) types types, S45.2, 3 unit ventilators, S31.1 impregnated, S25.24 combination, S24.5, 8; S28.2 Air conditioning. (See also Central air	solar cooling, A33.18, 26; S33.3, 7	terminology, A45.5	capacity control, \$45.6
control, R41.6 industrial exhaust systems, A30.7 codes and standards, S45.5, 6 double-effect chillers, R41.3 particulate desuperheaters, S45.2 efficiency, S45.5 operation, R41.6 industrial ventilation, S24.1 efficiency, S45.5 operation, R41.6 industrial ventilation, S24.2 electrical design, S45.7 single-effect chillers, R41.2 particle collection mechanisms, S24.2 installation, S45.2 single-effect heat transformers, R41.3 penetration, S24.3 maintenance, S45.2 terminology, R41.1 residential, S24.9 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.3 Acoustics. See Sound selection, S24.8 piping, S45.6 Activated carbon adsorption, A45.5 standards, S24.3, 5 refrigerant circuit control, S45.6 ADP1. See Air diffusion performance index (ADP1) types types, S45.2, 3 unit ventilators, S31.1 impregnated, S25.24 combination, S24.6 electronic, S9.1; S24.5, 8; S28.2 Air conditioning. (See also Central air	water/lithium bromide technology	testing, A45.15	certification, S45.5
double-effect chillers, R41.3 particulate desuperheaters, S45.2 efficiency, S45.5 operation, R41.6 industrial ventilation, S24.2 electrical design, S45.7 single-effect chillers, R41.2 particle collection mechanisms, S24.2 installation, S45.2 single-effect heat transformers, R41.3 penetration, S24.3 maintenance, S45.2 terminology, R41.1 residential, S24.9 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.3 Acoustics. See Sound selection, S24.8 piping, S45.6 Activated carbon adsorption, A45.5 standards, S24.2, 5 refrigerant circuit control, S45.6 ADP1. See Air diffusion performance index (ADP1) types types, S45.2, 3 unit ventilators, S31.1 impregnated, S25.24 electronic, S9.1; S24.5, 8; S28.2 Air conditioning. (See also Central air	components, R41.1	types, A45.7	circuit components, \$45.6
maintenance, R41.7 contaminants, S24.1 efficiency, S45.5 operation, R41.6 industrial ventilation, S24.2 electrical design, S45.7 single-effect chillers, R41.2 particle collection mechanisms, S24.2 installation, S45.2 single-effect heat transformers, R41.3 penetration, S24.3 maintenance, S45.2 terminology, R41.1 residential, S24.9 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.3 Acoustics. See Sound selection, S24.8 piping, S45.6 refrigerant circuit control, S45.6 ADP1. See Air diffusion performance index (ADP1) types types types, S45.2, 3 unit ventilators, S31.1 impregnated, S25.24 electronic, S9.1; S24.5, 8; S28.2 Air conditioning. (See also Central air	control, R41.6	industrial exhaust systems, A30.7	codes and standards, S45.5, 6
operation, R41.6 industrial ventilation, S24.2 electrical design, S45.7 single-effect chillers, R41.2 particle collection mechanisms, S24.2 installation, S45.2 single-effect heat transformers, R41.3 penetration, S24.3 maintenance, S45.2 terminology, R41.1 residential, S24.9 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.3 Acoustics. See Sound selection, S24.8 piping, S45.6 refrigerant circuit control, S45.6 ADPI. See Air diffusion performance index (ADPI) types types, S45.2, 3 unit ventilators, S31.1 impregnated, S25.24 combination, S24.5 electronic, S9.1; S24.5, 8; S28.2 Air conditioning. (See also Central air	double-effect chillers, R41.3	particulate	desuperheaters, S45.2
single-effect chillers, R41.2 particle collection mechanisms, S24.2 installation, S45.2 single-effect heat transformers, R41.3 penetration, S24.3 maintenance, S45.2 terminology, R41.1 residential, S24.9 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.3 piping, S45.6 Activated carbon adsorption, A45.5 standards, S24.3, 5 refrigerant circuit control, S45.6 ADPI. See Air diffusion performance index (ADPI) types types, S45.2, 3 unit ventilators, S31.1 impregnated, S25.24 combination, S24.5 electronic, S9.1; S24.5, 8; S28.2 Air conditioning. (See also Central air	maintenance, R41.7	contaminants, S24.1	efficiency, \$45.5
single-effect heat transformers, R41.3 penetration, S24.3 maintenance, S45.2 terminology, R41.1 residential, S24.9 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.3 piping, S45.6 selection, S24.8 piping, S45.6 piping, S45.6 refrigerant circuit control, S45.6 piping, S45.6 refrigerant circuit control, S45.6 piping, S45.6 refrigerant circuit control, S45.6 refrigerant circuit control, S45.6 piping, S45.6 refrigerant circuit control, S45.6 piping, S45.6 refrigerant circuit control, S45.6 piping, S45.6 refrigerant circuit control, S45.6 refrigerant circuit control, S45.6 piping, S45.3 piping, S45.3 refrigerant circuit control, S45.6 refrigerant circuit control, S45.6 piping, S45.3 refrigerant circuit control, S45.3 refrigerant circuit control, S45.6 piping, S45.3 refrigerant circuit control, S45.6 refrigerant circuit control, S45.6 refrigerant circuit control, S45.6 piping, S45.3 refrigerant circuit control, S45.6 piping, S45.3 refrigerant circuit control, S45.6 piping, S45.3 refrigerant circuit control, S45.6 re	operation, R41.6	industrial ventilation, \$24.2	electrical design, S45.7
terminology, R41.1 residential, S24.9 mechanical design, S45.7 working fluids, F1.15 safety requirements, S24.12 multizone, S45.3  Acoustics. See Sound selection, S24.8 piping, S45.6  Activated carbon adsorption, A45.5 standards, S24.3, 5 refrigerant circuit control, S45.6  ADP1. See Air diffusion performance index test methods, S24.2 space conditioning/water heating, S45.3  (ADP1) types types, S45.2, 3  Adsorbents air washers, S19.7 unit ventilators, S31.1 impregnated, S25.24 combination, S24.6 window-mounted, S5.2 solid, A45.5; F22.4 electronic, S9.1; S24.5, 8; S28.2 Air conditioning. (See also Central air	single-effect chillers, R41.2	particle collection mechanisms, \$24.2	installation, S45.2
working fluids, F1.15  Acoustics. See Sound  Activated carbon adsorption, A45.5  ADP1. See Air diffusion performance index (ADP1)  Adsorbents  impregnated, S25.24  solid, A45.5; F22.4   safety requirements, S24.12  safety requirements, S24.12  standards, S24.3, 5  refrigerant circuit control, S45.6  refrigerant circu	single-effect heat transformers, R41.3	penetration, S24.3	maintenance, S45.2
Acoustics, See Sound  Activated carbon adsorption, A45.5  ADPI. See Air diffusion performance index (ADPI)  types  types  Adsorbents  impregnated, S25.24 solid, A45.5; F22.4  selection, S24.8  selection, S24.8  standards, S24.3, 5 refrigerant circuit control, S45.6 refrigerant circuit control, S	terminology, R41.1	residential, S24.9	mechanical design, S45.7
Activated carbon adsorption, A45.5 standards, S24.3, 5 refrigerant circuit control, S45.6  ADPI. See Air diffusion performance index (ADPI) types types, S45.2, 3  Adsorbents air washers, S19.7 unit ventilators, S31.1 impregnated, S25.24 combination, S24.6 window-mounted, S5.2 solid, A45.5; F22.4 electronic, S9.1; S24.5, 8; S28.2 Air conditioning. (See also Central air	working fluids, F1.15	safety requirements, S24.12	multizone, S45.3
ADPI. See Air diffusion performance index (ADPI) types types, S45.2, 3  Adsorbents impregnated, S25.24 solid, A45.5; F22.4 test methods, S24.2 space conditioning/water heating, S45.3 types types, S45.2, 3 unit ventilators, S31.1 window-mounted, S5.2 electronic, S9.1; S24.5, 8; S28.2 Air conditioning. (See also Central air	Acoustics. See Sound	selection, S24.8	piping, S45.6
(ADPI)typestypes, S45.2, 3Adsorbentsair washers, S19.7unit ventilators, S31.1impregnated, S25.24combination, S24.6window-mounted, S5.2solid, A45.5; F22.4electronic, S9.1; S24.5, 8; S28.2Air conditioning. (See also Central air	Activated carbon adsorption, A45.5	standards, S24.3, 5	refrigerant circuit control, \$45.6
(ADPI)typestypes, S45.2, 3Adsorbentsair washers, S19.7unit ventilators, S31.1impregnated, S25.24combination, S24.6window-mounted, S5.2solid, A45.5; F22.4electronic, S9.1; S24.5, 8; S28.2Air conditioning. (See also Central air	ADPI. See Air diffusion performance index	test methods, S24.2	space conditioning/water heating, \$45.3
impregnated, S25.24 combination, S24.6 window-mounted, S5.2 solid, A45.5; F22.4 electronic, S9.1; S24.5, 8; S28.2 Air conditioning. (See also Central air	(ADPI)	types	
impregnated, S25.24 combination, S24.6 window-mounted, S5.2 solid, A45.5; F22.4 electronic, S9.1; S24.5, 8; S28.2 Air conditioning. (See also Central air	Adsorbents	air washers, S19.7	* =
	impregnated, S25.24	combination, S24.6	
	solid, A45.5; F22.4	electronic, S9.1; S24.5, 8; S28.2	Air conditioning. (See also Central air
orapotative coloids, 017.7 conditioning)	Adsorption	evaporative coolers, \$19.7	conditioning)
dehumidification, S22.1, 10 maintenance, S24.8 airports, A3.9	dehumidification, S22.1, 10	maintenance, S24.8	airports, A3.9

animal buildings, A22.4	features, S1.4	nonisothermal, F33.6
archives, A21	space requirements, \$1.5	surface (wall and ceiling), F33.6
arenas, A4.4	floor-by-floor, S5.6	throw, F33.5
atriums, A4.8	forced-air, small, S9.1	ceiling-mounted diffusers, F33.17
auditoriums, A4.3	packaged	equipment, S17
automobile, A9.1	outdoor equipment, S5.7	evaluation, F33.12
bakeries, R28	rooftop, S5.7	air velocity, F33.13
bars, A3.5	radiant panel S6.1	exhaust inlets, F33.15
bowling centers, A3.8	room-by-room, S5.3	methods
buses, A9.13	selection, S1.1	displacement ventilation, F33.10
bus terminals, A3.10	self-contained, S5.6	mixing systems, F33.7
casinos, A3.6	space requirements, S1.5	unidirectional ventilation, F33.12
changeover temperature, S3.7, 9	split, S5.5	outlets
clean spaces, A16	television studios, A3.8	groups, F33.8, 16
commercial buildings, A3.1; S5.6	temporary exhibits, A4.8	location, F33.15
computer rooms, A17	textile processing plants, A19.4	performance, F33.9
concert halls, A4.4	theaters, A4.3	selection, F33.15
convention centers, A4.5	transportation centers, A3.9	performance index, F33.13, 17
data processing areas, A17	warehouses, A3.11	return air design, F33.17
desiccant dehumidification and, S22.10	warm/humid climates, F24.8	return inlets, F33.15
dormitories, A5.1, 8	wood products facilities, A24.1	space, F33.1
educational facilities, A6.1	Air contaminants. See Contaminants	standards, F33.12
engine test facilities, A15.1	Aircraft, A10	system design, F33.14
equipment	air conditioning, A10.5	
• •	· ·	temperature gradient, F33.9
outdoor, \$5.7	air distribution, A10.7	terminology, F33.1
refrigeration, S4.2	air filters, A10.4, 9	Air diffusion performance index (ADPI),
exhibition centers, A4.5	air quality, A10.8	F33.13, 17
fairs, A4.8	cabin pressurization	Air distribution
fixed-guideway vehicles, A9.18	control, A10.6, 8	aircraft cabins, A10.7
galleries, A21	performance, A10.2, 4	air terminals, A56.1
gymnasiums, A4.5	carbon dioxide concentration, A10.9	animal environments, A22.3, 5
health care facilities, A7	environmental control system (ECS), A10.2,	bowling centers, A3.8
hospitals, A7.2	4, 6, 8	buildings, S2.1
nursing facilities, A7.14	air-conditioning packs, A10.4	central system, A41.2
outpatient, A7.13	air-cycle machine, A10.5	communications centers, A3.9
hotels and motels, A5	cabin pressure control, A10.2, 4, 6, 8	control, A46.17; S2.12
houses of worship, A4.3	design conditions	ductwork, S1.6; S2.7
ice rinks, A4.5	considerations, A10.2	equipment, S17.7
industrial environments, A12; A29	ventilation, A10.4	fixed-guideway vehicles, A9.19
kitchens, A3.5, 6; A31	engine bleed air system, A10.4	forced-air systems, small, S9.7
laboratories, A14.1	load determination, A10.3	industrial environments, A29.2
libraries, A21	outside air, A10.4	in-room terminal systems, S3.6
mass transit, A9.13	pneumatic system, A10.4	isovels, A56.5
mines, A27	regulations, A10.1	kitchen makeup air, A31.15
museums, A21	heating, A10.4	laboratories, A14.9
natatoriums, A4.6	humidity, A10.9	mapping, A56.5
nightclubs, A3.6	multiple factors, A10.10	occupied zone, A56.1
nuclear facilities, A26	oxygen levels, A10.1, 9	places of assembly, A4.2
office buildings, A3.6	ozone concentration, A10.1, 7, 8	rail cars, A9.17
paper products facilities, A24.2	ventilation, A10.1, 4	retail stores, A2.1
photographic processing and storage areas,	Air curtains	room terminals, S2.7
A20.1	application, S17.9	ships, A11.3, 4
places of assembly, A4	display cases, R46.5	sound control, A47.2, 30
plant growth chambers, A22.17*	Air diffusers	static pressure control, S17.8
power plants, A25.10	sound control, A47.9	systems, A56.1
printing plants, A1&	testing, A37.2	design considerations, A56.1
public buildings, A3.1	Air diffusion	fully stratified, A56.6
radio stations, A3.8	air jets	mixed A56.2
rail cars, A9.15	angle of divergence, F33.2	partially mixed, A56.8
restaurants, A3.5	Archimedes number, F33.6	rooms A56.1
retrofitting, contaminant control, R6.9	behavior, F33.1	terminal boxes, A46.14, 17
ship docks, A3.10	centerline velocity, F33.2	testing, adjusting, balancing, A37.3
solar energy systems, A33.16, 18, 26	classification, F33.1	textile processing plants, A19.6
subway stations, A13.13	Coanda effect, F33.6	zone control, A46.10, 19
swimming areas, A4.6	entrainment ratios, F33.5	Air distribution performance index (ADPI)
systems	isothermal, F33.2	A56.5
air-and-water, S3.1	radial flow, F33.6	Air exchange rate
decentralized, S1.4; S5.1	multiple, F33.6	air changes per hour (ach), F27.3
300011110111000, D1.1, D0.1		are enumber bet most (sout), 1 21.2

modeling, F27.20	mixing plenum, S2.5	Algae, control, A48.5
multizone measurement, F27.27	outside air, \$2.6	All-air systems
time constants, F27.3	psychrometrics, S2.3	advantages, S2.1
tracer gas measurement method, F27.26	reheat, S2.6	air distribution, S2.7
Air filters. See Filters, air	sequencing, A41.26	air handlers, S2.3
Airflow	set point reset, A41.27	buildings, S2.1
air-to-transmission ratio, S3.8	sound levels, A47.3	constant-volume, S2.8, 9
around buildings, F16	strategies, A41.26	control, S2.12
air intake contamination estimation	unitary, air conditioners, \$45.7	cooling, S2.3, 6
minimum dilution, F16.10	vibration isolation, S2.7	costs, S2.2
coefficients wind pressure, F16.3	Air intakes	dehumidification, S2.4, 6
internal pressure, F16.9	design, A44.1	disadvantages, S2.1
modeling and testing, F16.10	hospitals, A7.2	dual-duct, S2.8
patterns, A44.3; F16.1	location to avoid contamination, A44.2	economizers, S2.6
wind	outdoor, S2.5	heating, S2.2, 3
data, F16.3, 6, 7	vehicular facilities, enclosed, A13.35	humidification, S2.4, 6
effects on system operation	Air jets. See Air diffusion	mult <del>l</del> zone, S2.10
intakes and exhausts, F16.7	Air leakage. (See also Infiltration)	primary equipment, S2.3
system volume, F16.9	area, F27.12	single-duct, S2.8
ventilation, F16.7	building distribution, F27.13	variable-air-volume (VAV), S2.8, 9
velocity pressure (Bernoulli equation),	commercial buildings, F27.23	zoning, S2.1
F16.3	controlling, air-vapor retarder, F27.14	Ammonia
through building components, F23.5	leakage function, F27.12	absorption
clean spaces, A16.3	measurement, F27.12, 13	ammonia/water, F1.18; R41.7
computational fluid dynamics, A39.10	Air outlets	ammonia/water/hydrogen, R41.8
computer-aided modeling, A16.4	accessories, S17.3, 4, 5	in animal environments, A22.2, 9
condensers, evaporative, S35.16	dampers, S17.3, 4, 5	properties, ammonia/water, F20.1, 69
control, F23	location, S9.4	system practices, R3
and convection, F23.16	selection, S17.2	Anchor bolts, seismic restraint, A54.14
displacement flow, F27.2	smudging, S17.2	Anemometers
entrainment flow, F27.2	sound level, \$17.2	air devices, A37.2
exhaust hoods, A30.3	supply, S17.1	types, F14.16
furnaces, S28.2	surface effects, S17.2	Animal environments
and heat flow, F23.8, 16	temperature differential, S17.2	air contaminants, F10.4
laminar, A16.4	types, S17.3	ammonia, A22.2, 9
measurement of, A37.2	Airports, air conditioning, A3.9	carbon dioxide, A22.2
modeling, hygrothermal, F23.8	Air quality. (See also Indoor air quality)	air distribution, A22.3, 5
modeling, in buildings, F34	aircraft cabins, A10.8	air inlets, A22.6
and moisture flow, F23.8, 8	animal buildings, A22.2	air quality control, A22.2
nonunidirectional, A16.3	bus terminals, A13.23	air transport, R32.2
perfect mixing, F27.3	diesel locomotive facilities, A13.26	cattle, beef and dairy, A22.7; F10.7
smoke management, A52.5	parking garages, A13.17	chickens, F10.12
solar energy systems, A33.25	road tunnels, A13.7	cooling, A22.4
terminology, F23.2	tollbooths, A13.25	design, A22.1
	Airtightness, F14.22	disease control, A22.3
tracking, A46.9 unidirectional, A16.4, 11, 13	,	evaporative cooling, A22.4; A51.14
Airflow retarders, F23.5, 17	Air-to-air energy recovery, S44 Air-to-transmission ratio, S3.8	fans, A22.6
climates	Air transport, R32	heating, A22.4
	animals, R32.2	hydrogen sulfide, A22.2
heating; F24.5	commodity requirements, R32.2	insulation, A22.4
mixed; F24.7 warm/humid; F24.8	design considerations, R32.2	laboratory conditions, A14.14; A22.9; F10.14
walls, A43.4		
Air flux, (See also Airflow)	galley refrigeration, R32.4 ground handling, R32.4	lighting, F10.3 moisture control, A22.2
,	perishable cargo, R32.1	particulate matter (PM), A22.2
Air handlers	refrigeration, R32.3	physiological control
all-air systems, S2.3	shipping containers, R32.2	heat production
control, A46.17	Air washers	•
cooling, S2.3	air cleaning, S19.7	data, F10.2
dampers, S2.4	<u>.</u>	genetics affecting, F10.7
dehumidification, S2.4, 6	coolers, S19.5	liquid wastes, F10.7
distribution systems, A41.2	dehumidification performance factor,	heat transfer, F10.3
draw-through, \$2.3	S19.7	systems, F10.2
economizers, \$2.5	heat and mass simultaneous transfer, F5.11	poultry, A22.8
fans, S2.3, 4, 6	high-velocity spray type, S19.6	shades, A22.3
faults, A38.6	humidification, S19.6	sheep, F10.9
filter, \$2.5	maintenance, \$19.7	swine, A22.7; F10.10
heating, \$2.3	spray type, \$19.5	temperature control, A22.1; F10.3
humidification, S2.4, 6	textile processing plants, A19.4	turkeys, F10.12
location, S2.3	water treatment, A48.9; S19.8	ventilation, A22.5

Annual fuel utilization efficiency (AFUE),	slicing, R28.5	particles, F9.4
S28.5; S29.2	wrapping, R28.5	Biocides, control, A48.5
Antifreeze	Balance point, heat pumps, \$45.8	Biodiesel, F18.5
	• • • •	Biological safety cabinets, A14.6
coolants, secondary, F21.4	Balancing. (See also Testing, adjusting, and	•
ethylene glycol, F21.4	balancing)	Biomanufacturing cleanrooms, A16.6
hydronic systems, S12.16	air distribution systems, A37.3	Bioterrorism. See Chemical, biological,
propylene glycol, F21.4	dual-duct systems, A37.4	radiological, and explosive (CBRE) incidents
Antisweat heaters (ASH), R46.5	HVAC systems, A37.1	Boilers, S27
Apartment buildings	hydronic systems, A37.6	air supply, S30.22
service water heating, A49.13, 16	induction systems, A37.5	aluminum, S27.3
ventilation, A1.6	kitchen ventilation systems, A31.18	burners, S26.1
Aquifers, thermal storage, A34.6	refrigeration systems, R43.1	carbonic acid, S10.2
Archimedes number, F33.6	steam distribution systems, A37.15	cast iron, S27.1
Archives. See Museums, galleries, archives,	temperature controls, A37.16	central
and libraries	variable-air-volume (VAV) systems, A37.4	multifamily, A1.5
Arenas	Barley, F11.13	plants, S11.3
air conditioning, A4.4	Bars, A3.4, 5	classifications, S27.1
	BAS. See Building automation system	
smoke management, A52.12		codes, S27.5
Argon	(BAS)	combination, S27.4
properties, F19.2, 4; F20.66; F39.1	Baseboard units	condensing, S27.3
recovery, R38.17	application, S32.5	construction materials, S27.1
Asbestos, F9.5	design effects, S32.3	control, A46.1; S27.6
ASH. See Antisweat heaters (ASH)	finned-tube, S32.1	optimization, A41.3
Atriums	heating equipment, \$32.1	copper, \$27.3
air conditioning, A4.8	nonstandard condition corrections, S32.3	draft types, S27.3
smoke management, A52.12	radiant, S32.1	efficiency, S27.5
Attics	rating, S32.3	electric, S27.4
moisture control climates	Basements	equipment, S4.3
heating, F24.5	conditioned, A43.1	gas-fired, S26.1
•		
mixed, F24.7	heat loss, F29.11, F29.13	venting, S30.19
warm/humid, F24.8	moisture control, A43.2	integrated, S27.4
Auditoriums, A4.3	unconditioned, A43.1	modeling, F32.14
Automobiles	Beer's law, F3.12	noncondensing, S27.3
air conditioners	Bernoulli equation, F35.1	oil-fired venting, \$30.20
compressors, A9.8	generalized, F2.2, 6	piping, S10.3
condensers, A9.9	kinetic energy factor, F2.2	rating, S27.5
controls, A9.8	steady flow, F2.12	residential, A1.3
design factors, A9.1	wind velocity pressure, F16.3	selection, S27.4
evaporators, A9.6, 11	Best efficiency point (BEP), \$39.7	service water heating, A49.25
- · · · · · · · · · · · · · · · · · · ·	Beverages, R26	sizing, S27.5
lubricants, A9.11	<u> </u>	
receiver/drier/filter assembly, A9.10	beer, R26.1	stainless steel, S27.3
refrigerants	storage requirements, R11.11	standards, \$27.5
flow control, A9.8	carbonated, R26.10	steam, S27.1
vehicles, A9.11	coolers, R26.11	systems, S10.3
engine test facilities, A15.1	fruit juice, R25.1	steel, S27.2
environmental control, A9.1	liquid carbon dioxide storage, R26.12	stokers, S26.9
heaters	refrigeration systems, R26.11	storing, A48.11
controls, A9.8	refrigerators for, R47.2	venting, S30.19, 20
design factors, A9.1	thermal properties, R9.1	wall-hung, S27.4
heater cores, A9.5	time calculations	waste heat, S10.3
ventilation, A9.8	cooling, R10.1	water, S27.1
•		
Autopsy rooms, A8.5, 6	freezing, R10.7	water treatment, A48.10
Avogadro's law, and fuel combustion,	wine	working pressure, S27.1
F18.8	production, R26.8	Boiling
Backflow-prevention devices, \$42.13	storage temperature, R26.10	critical heat flux, F4.4
<b>BACnet®</b> , A39.15; F1 <b>6</b> .16	BIM. See Building information modeling	evaporators
Bacteria	(BIM)	flow mechanics, F4.4
control, A48.5	Bioaerosols	heat transfer, F4.5
food, growth in, R12.1	airborne	film, F4.2
humidifiers, growth in, S20.1	bacteria, F12.2, 5	heat transfer equations, F4.3
Bakery products, R28	control, F12.7	natural convection systems, F4.1
		· ·
air conditioning, R28.1	fungus spores, F12.2	nucleate, F4.1, 2
bread, R28	microbiological particulate, F12.5	pool, F4.1
cooling, R28.4	mold, F12.6	Bowling centers, A3.8
dough production, R28.2	pollen, F12.2	Brayton cycle
freezing, R28.5	sampling, F12.7	cryogenics, R38.11
ingredient storage, R28.1	viruses, F12.2	gas turbine, S7.9
refrigeration, R28.1; R47.2	origins, F12.1	Bread, R28

Breweries	air conditioning, A3.10	insulation barrier, R30.1
carbon dioxide production, R26.6	physical configuration, A13.22	load calculations, R30.8
refrigeration	ventilation	maintenance, R30.10
fermenting cellar, R26.4	equipment, A13.31	mechanical cooling and heating, R30.3
Kraeusen cellar, R26.5	operation areas, A13.23	operations, R30.9
stock cellar, R26.5	control, A13.24	qualification testing, R30.7
systems, R26.7	effects of alternative fuel use, A13.24	safety, R30.7
wort cooler, R26.3	platforms, A13.22	sanitation, R30.3
storage tanks, R26.6	Butane, commercial, F18.4	shock and vibration, R30.5
vinegar production, R26.8	CAD. See Computer-aided design (CAD)	space considerations, R30.10
Brines. See Coolants, secondary	Cafeterias	storage effect cooling, R30.4
Building automation systems (BAS), A39.15;	air conditioning, A3.4	system application, R30.8
F15.13	service water heating, A49.13, 19	temperature-controlled transport, R30.1
Building energy monitoring, A40. (See also	Calcium chloride brines, F21.1	temperature settings, R30.10
Energy monitoring)	Candy	use, <b>₹30.9</b>
Building envelopes	chocolate, R29.1	vapor barrier, R30.1
ceilings, A43.5	manufacture	ventilation, R30.5, 10
condensation, S20.2	chilling, R29.3	Carnot refrigeration cycle, F1.6
energy conservation, A43.1	coating, R29.4	Casinos, A3.4, 6
fenestration, A43.6	cooling, R29.4	Cattle, beef and dairy, A22.7
foundations, A43.1	dipping, R29.2	(See also Animal environments)
heat flow through	drying, R29.3	growth, F10.7
effect of moisture on, F23.5	enrobing, R29.2	heat and moisture production, F10.8
interface, A43.6	plants, R29.1	lactation, F10.8
museums, galleries, archives, and libraries,	refrigeration plant, R29.4	reproduction, F10.8
A21.12	storage	CAV. See Constant air volume (CAV)
roofs, A43.5	humidity, R29.7	Cavitation, F2.13
structural failure, from moisture, F23.5	temperature, R29.6	pumps, centrifugal, S39.9
thermal bridges	Capillary action, and moisture flow, F23.8	valves, S42.2
design recommendations, A43.10	Capillary tubes	CBRE. See Chemical, biological, radiological,
heat transfer, A43.8	capacity balance, R44.24	and explosive (CBRE) incidents
mitigation of, A43.9	characteristic curve, R44.24	Ceiling effect. See Coanda effect
thermal bridges, F23.4	pressure-reducing device, R44.23	Ceilings
thermal mass, A43.11	restrictor orifice, S21.2	air movement, A43.6 cathedral, F24
thermal transmission data, F25.1	selection, R44.26  Carbon dioxide	•
walls, residential, A43.3  Building information modeling (BIM),	in aircraft cabins, A10.9	moisture control, F24.5 insulation, A43.5
A39.11	in animal environments, A22.2	moisture control, A43.6
Building thermal mass	combustion, F18.1, 10	R-values, F25.14
charging and discharging, A34.15	greenhouse enrichment, A22.14	sound correction, A47.25
effects of, A34.14	liquefaction, R26.7	sound transmission, A47.30
precooling, A41.28	measurement, F14.23	Central air conditioning, A41. (See also Air
Burners	refrigerant, R3.26	conditioning)
air supply, S30.22	storage, R26.12	Central plants
controls, S26.12	Carbon emissions, F17.9	boiler, S11.3
conversion, S26.1, 2	Carbon monoxide	chiller, S11.1, 3
dual-fuel gas/oil, S26.7	analyzers, A13.9, 10	distribution design, S11.4
gas-fired, S26.1	parking garages, A13.17, 18	district heating and cooling, S11.2
altitude compensation, S26.3	road tunnels, A13.7	emission control, S11.4
combustion and adjustments, \$26.3	tollbooths, A13.25	heating medium, S11.3
commercial, S26.2	Cargo containers, R30	hotels and motels, A5.7
industrial, S26.2	airborne sound, R30.7	thermal storage, S11.3
residential, S26.1	air circulation, R30.3	Central systems
venting, S30.19	ambient design factors, R30.6	cooling and heating, S4.1
oil-fired, S26.4	commodity precooling, R30.9	features, S1.3
commercial, S26.5	control, R30.5, 10	furnaces, S28.1
fuel	controlled atmosphere, R30.5	humidifiers, S20.5
handling system, S26.8	costs, owning and operating, R30.9	residential forced air, S9.1
preparation system, S26.9	design, R30.1	space requirements, S1.5
storage, S26.7	equipment	CERs. See Controlled-environment rooms
industrial, S26.5	attachment provisions, R30.3	(CERs)
residential, S26.4	design and selection factors, R30.5, 8	Cetane number, engine fuels, F18.7
venting, S30.20	operating economy, R30.6	CFD. See Computational fluid dynamics
venting, S30.19, 20	qualification testing, R30.7	(CFD)
Buses	selection, R30.8	Charging, refrigeration systems, R45.4
air conditioning, A9.13	system application factors, R30.8	Chemical, biological, radiological, and
garage ventilation, A13.20	types, R30.3	explosive (CBRE) incidents, A58
Bus terminals	heating only, R30.5	biological events, A58.4

chemical agent types, A58.1	rating, S38.10	resistance coefficients, S30.10
gases and vapors, A58.3	refrigerant	standards, S30.24, 29
incapacitating, A58.2	selection, S38.8	terminations, S30.27
irritants, A58.2	transfer units, S38.11	wind effects, S30.3, 27
toxic, A58.2	selection methods, S38.10	Chlorinated polyvinyl chloride (CPVC), A32.6
chemical events, A58.1	control, A46.4	Chocolate, R29.1 (See also Candy)
explosive events, A58.5	capacity, S38.4, 14	Choking, F2.13
design considerations, A58.6	considerations, S38.10	CHP systems. See Cogeneration
loading description, A58.5	regulating, S38.4	Cinemas, A4.3
general guidelines, A58.1	safety, S38.5	Claude cycle, R38.8
HVAC system design, A58.7	costs, S38.4	Cleanrooms. See Clean spaces
radiological events, A58.4	direct expansion, R2.27; S38.1	Clean spaces, A16
risk evaluation, A58.7	economizing, S38.1	aerospace, A16.13
Chemical plants	expansion turbines, \$38.1	air filters, A16.3, 8, 11
automation, R37.3	faults, A38.5	airflow, A16.3, 4, 11, 13
energy recovery, R37.4	flash, S38.1	applications, A16.2
flow sheets, R37.1	heat recovery, S38.3	biomanufacturing cleanrooms, A16.6
instrumentation and controls, R37.8	injection, S38.1	construction, A16.17
outdoor construction, R37.4	liquid-chilling systems, S38	contaminant control, A16.3, 8
piping, R37.8	load distribution, A41.21	cooling, A16.14
pumps, R37.8	maintenance, S38.5, 12, 15	energy conservation, A16.16
refrigeration	multiple, S38.2	fire safety, A16.14
compressors, R37.6	noise generation, A47.10, S38.10	high-bay, A16.13
condensers, R37.6	optimization, A46.5	humidity control, A16.14
cooling towers, R37.8	reciprocating	makeup air, A16.14, 16
equipment, R37.3, 6	components, S38.6	noise control, A16.17
evaporators, R37.7	control, S38.7	operation, A16.17
load, R37.2	equipment, S38.6	particle sources, A16.3
safety requirements, R37.2	performance, S38.6	pharmaceutical
spray ponds, R37.8	refrigerant selection, \$38.6	aseptic, A16.7
systems, R37.1, 5	selection methods, \$38.7	start-up, A16.9
safety requirements, R37.2	refrigeration cycle, S38.1	biomanufacturing, A16.6
specifications, R37.1	screw	contaminant control, A16.8
tanks, R37.8	applications, S38.15	control and monitoring, A16.9
Chemisorption, A45.6	capacity control, \$38.14	design, A16.7
Chickens, F10. (See also Animal environments;	components, S38.12	isolators, A16.9
Poultry)	maintenance, S38.15	nonaseptic, A16.9
Chilled water	performance, \$38.13	unidirectional hoods, A16.8
cogeneration distribution, \$7.31	selection methods, S38.3, 7, 10	pressurization, A16.15
district heating and cooling, S11.3, 19, 31	sequencing, A41.6, 20, 23	process exhaust, A16.14, 16
optimal temperature, A41.17	standards, \$38.5	semiconductor, A16.11
pumping system, A41.2, 6, 17	subcooling, S38.1	system sizing and redundancy, A16.15
pump sequencing, A41.16, 20	vapor compression model, F32.15	temperature control, A16.14
reset, A41.16, 17	vibration control, A47.12, S38.10	terminology, A16.1
systems, \$12.1, 11	Chilton-Colburn j-factor analogy, F5.6	testing, A16.6
central plant, A37.14	Chimneys, S30	vibration control, A16.17
heat transfer versus flow, A37.7	accessories, S30.25	Climate design information, F28
one-pipe, \$12.12	capacity calculation examples, S30.13	Clothing
testing, adjusting, balancing, A37.8	caps, \$30.27	insulation, clo units, F8.8
two-pipe, S12.12	codes, S30.29	moisture permeability, F8.8
thermal storage, A34.4	design equations, S30.3	CLTD/CLF. See Cooling load temperature
water treatment, A48.10	draft, \$30.1	differential method with solar cooling load
Chillers	altitude correction, \$30.8	factors (CLTD/CLF)
absorption, S4.2	available, S30.1, 4, 8	Coal
ammonia/water, R41.7 heat-activated, S7.27	theoretical, S30.1, 3, 8	classification, F18.7
•	fireplace, S30.1, 21	handling facilities, A25.6, 9
water/lithium bromide, R41.2	flow losses, S30.9	heating value, F18.8
blast, R47.3	flue gas, S30.1	stokers, S26.9
central plants, A46.4; S11.1, 3	friction loss, \$30.10	types, F18.7
centrifugal	functions, \$30.1	Coanda effect, A31.2; F33.6; S17.2
air-cooled, \$38.12	gas	Codes, A59. (See also Standards)
controls, \$38.10	appliance venting, \$30.19	air conditioners, room, \$46.4
equipment, S38.8	temperature, \$30.6	air distribution, A56.1
fouling, S38.10	velocity, \$30.9	boilers, S27.5
free cooling, S38.11	heat transfer, \$30.6	building codes, \$16.1
heat recovery, \$38.11	masonry, S30.19, 21	chimneys, fireplaces, and gas vents,
maintenance, S38.12	mass flow, S30.5	S30.29
purge units, S38.11	materials, S30.23	cogeneration, S7.50

condensers, S35	Coils	classification, F18.7
evaporative, S35.19	air-cooling, S2.6	heating value, F18.8
water-cooled, S35.7	airflow resistance, S21.6	types, F18.7
coolers, liquid, S37.4	applications, S21.1, 4	condensation in, F18.15
data processing, A17.15	aqueous glycol coils, S21.2	continuous, F18.2
dehumidifiers, room, S47.3	construction and arrangement, S21.1	corrosion in, F18.15
duct construction, \$16.1	control, A46.7; S21.3	diesel fuel, F18.6
electrical, A55.15	direct-expansion coils, S21.2	efficiency, F18.12
engines, \$7.50	fluid flow arrangement, S21.3	engine fuels, cetane number, F18.7
furnaces, S28.10	heat transfer, S21.7	excess air, F18.9
makeup air units, S31.9	load determination, S21.15	flammability limits F18.1
motors, \$40.1, 13	maintenance, S21.15	fuel oils, F18.5
nuclear facilities, A26.10	performance	gaseous fuels
piping, S41.6	cooling and dehumidifying, S21.9	illuminants, F18.9
turbines, S7.50	cooling-only, S21.7	liquefied petroleum gas, F18.4
Coefficient of performance (COP)	rating, \$21.6	natyral gas, F18.4
absorption, F1.13	refrigerant coils, \$21.2	types and properties, F18.4
compressors, \$34.1	selection, S21.5	gas turbine fuel, F18.6
economic (ECOP), cogeneration, S7.35	on ships, A11.4	heating value, F18.3
•	water coils, S21.2	ignition temperature, F18.2
refrigeration, F1.3, 13	·	
room air conditioners, S46.2	air-heating, \$23.1	illuminants, F18.9
Cogeneration, S7	applications, S23.4	liquid fuels, F18.5
codes, \$7.50	aqueous glycol, \$23.2	engines, F18.6
combined-cycle power plants, \$7.35	construction, S23.1	noise, F18.16
controls and instruments, \$7.41	design, S23.1	oscillation, F18.16
economic feasibility, S7.46	electric, A46.3; S23.3	pollution, F18.13
estimate, \$7.47	maintenance, \$23.5	principles, F18.1
load duration curve, \$7.47	rating, S23.4	pulse, F18.2
two-dimensional, S7.49	refrigerant, S23.3	reactions, F18.1
simulation, \$7.50	selection, \$23.3	resonance, F18.16
electrical systems, S7.28	shipboard, A11.4	solid fuels, F18.7
engines	steam, A46.2; S23.2	soot, F18.16
design and installation, \$7.38	water, A46.2; S14.8; S23.2	sound, F18.16
sizing, S7.42	condensers, S35	stoichiometric, F18.1
expansion engines/turbines, S7.38	evaporative, S35.16	types, F18.1
heat-activated chillers, S7.27	dehumidifying, S21.1	Combustion air systems, S7.6
heat recovery	desuperheating, S35.18	air required, S7.6; S30.22
engines, S7.19, 21	energy recovery loops, S44.11	analysis, F14.32
turbines, S7.25	halocarbon refrigeration systems, R2.27	burners
load profiling, S7.34	heat and mass simultaneous transfer,	gas, S26.3
maintenance, \$7.42	F5.12	oil, S26.4
noise and vibration control, \$7.41	heat reclaim, \$23.3	control, S26.14
packaged systems, S7.34	preheat, \$2.5	efficiency boilers, S27.5
peak shaving, \$7.34	reheat, S2.6; S23.2	industrial exhaust gas cleaning, S25.27
performance, S7.34	Colburn's analogy, F3.14	venting, S30.1
prime movers	Colebrook equation	Combustion turbine inlet air cooling (CTIAC).
engines, S7.2	friction factor, F35.6	\$7.10
fuel cells, S7.36	pressure drop, F36.1	thermal storage, A34.17
selection, S7.34	Collectors, solar, A33.6, 11, 23, 25; S33.3	Comfort. (See also Physiological principles,
thermal output, S7.19, 20	(See also Solar energy)	humans)
turbines	Colleges and universities, A6.10	environmental indices, F8.20
combustion, S7.8, 45	Combined heating and power (CHP) systems.	environmental parameters
steam, \$7.13, 45	See Cogeneration	air velocity, F14.29
regulatory issues, S7.30	Combustion, F18	asymmetric thermal radiation, F8.13
standards, S7.50	air pollution, F18.13	draft, F8.13
terminology, S7.46	air required for, F18.8	floor temperature, F8.15
thermal energy storage, S7.35	altitude compensation, F18.3	radiant temperature, F8.11
trigeneration, S7.1	calculations	vertical air temperature difference, F8.14
unconventional systems, \$7.36	air required for, F18.8	humidity, F14.30; S20.1
		local discomfort, F8.13
utilization systems	carbon dioxide, theoretical, F18.10	•
air, \$7.32	efficiency, F18.12	nonuniform conditions, F8.13
desiccant systems, \$7.33	flue gas	predicted mean vote (PMV), F8.17; F14.30
district heating and cooling, \$7.33	dew point, F18.10	predicted percent dissatisfied (PPD), F8.17
HVAC, \$7.33	loss, F18.12	radiant heating, A53.3
hydronic, S7.33	quantity produced, F18.10	special environments
requirements, \$7.32	water vapor in, F18.10	extreme cold, F8.25
service hot water, \$7.33	coals	hot and humid environments, F8.24
vibration control, foundations, S7.42	characteristics, F18.7	infrared heating, F8.22

radiant heating, comfort equations, F8.23	design, S34.33, 34	surfaces, F34.7
steady-state energy balance, F8.16	drivers, S34.33	symmetry, F34.8
two-node model, F8.17	efficiency, S34.30	walls, F34.7
thermal sensation scale, F8.11	isentropic analysis, S34.27	considerations, F34.9
zones, F8.12, 19; F9.11	lubrication, S34.34	grids, F34.4
Commercial and public buildings	Mach number, S34.29	mathematical approaches, F34.1
air leakage, F27.23	noise, S34.32	meshing, F34.4
airports, A3.9	paralleling, S34.33	reporting, F34.9, 13
bars, A3.4, 5	polytropic analysis, S34.27	steps, F34.9
bowling centers, A3.8	refrigeration cycle, S34.25	turbulence modeling, F34.3
burners	surging, S34.30	validation, F34.9, 10
gas, \$26.2	testing, \$34.30	verification, F34.9
oil, S26.5	turbocompressors, \$34.25	viscosity modeling, F34.10
bus terminals, A3.10	vibration, S34.32	Computer-aided design (CAD), A16.4; A39.11
cafeterias, A3.4	chemical industry refrigeration, R37.6	Computers, A39
casinos, A3.4, 6	drives, R3.2	abbreviations for programming, F37.1
central cooling systems, A41.1	dynamic, S34.1	BACnet®, A39.15; F15.16
communications centers, A3.8	engine-driven, \$7.43, 44	building automation systems (BAS), A39.15
ducts	halocarbon refrigeration systems, R2.24	computational fluid dynamics, A13.2;
construction, S16.2	heat pump systems, S8.6	A39.10; A52.14
design, small applications, \$9.10	motors, \$40.4	computer-aided design (CAD), A16.4;
furnaces, \$28.8	noise generation, A47.10	A39.11
garages, A3.10	operation and maintenance, S34.34	for control, F15.4, 9, 18
general criteria, A3.1	orbital, S34.21	design tools
humidifiers, \$20.6	positive-displacement, \$34.4	acoustic calculations, A39.8
ice rinks, R35	performance, S34.1	building information modeling (BIM),
indoor air quality (IAQ), F27.9	reciprocating, S7.43; S34.4	A39.11
kitchen ventilation, A31.1	application, \$34.9	cogeneration, S7.50
load characteristics, A3.1	capacity control, \$34.8	computational fluid dynamics, A39.10
malls, A2.6	crankcase, R2.34	computer-aided design (CAD), A39.11
nightclubs, A3.4, 6	features, S34.7	duct design, A39.6
office buildings, A3.6	Jubrication, S34.8	equipment selection and simulation, A39.8
restaurants, A3.4, 5 retail facilities, A2.1	parallel, R3.10 performance, S34.5	load calculations, A39.5
service water heating, A49.11	special devices, \$34.8	piping design, A39.7
ship docks, A3.10	types, S34.4	refrigerant properties, A39.12
transportation centers, A3.9	valves, S34.7	smoke control analysis, A52.12, 14
warehouses, A3.11	rotary, R3.12; S34.9, 11	ventilation, A39.12
Commissioning, A42. (See also Building	screw, S7.44	road tunnel, A13.2
commissioning)	lubricant cooling, R3.12	equipment, A39.8
acceptance, A42.7	single, S34.11	graphics, A39.11
construction, A42.6	capacity control, S34.14	hardware, A39.1
control systems, F15.16	compression process, S34.11	HVAC simulation, A39.9
costs, A42.10	economizers, S34.13, 14	Internet, A39.16
desiccant dehumidifiers, S22.7	lubrication, S34.12	modeling, F15.18
design, A42.5; A46.23	noise and vibration, \$34.16	monitoring and control, A39.14
existing buildings, A42.1, 11	oil-injected, S34.12	networking components, A39.13
in integrated building design, A57.8	performance, S34.16	peripherals, A39.5
laboratories, A14.19	volume ratio, S34.14	smoke control analysis, A52.12, 14
makeup air units, S31.10	twin, S34.17	software, A39.2
new construction, A42.1	capacity control, S34.18	antispyware, A39.2
objectives, A42.2	compression process, S34.17	custom programming, A39.4
occupancy and operations, A42.10	economizers, S34.20	development tools, A39.4
owner's project requirements (OPR), A42.2	hermetic, \$34.21	energy analysis, F32.3
predesign, A42.4	lubrication, S34.20	firewall, A39.2
pumps, centrifugar, \$39.14	volume ratio, S34.18	graphics, A39.3
recommissioning, A42.1, 10	scroll, S34.21	HVAC, A39.5
retrocommissioning, A42.1, 11	capacity control, S34.23	readymade, A39.4
team, A42.3	efficiency, \$34.23	road tunnel, A13.2
test procedures, A42.8	noise and vibration, S34.24	terminology, A39.2
Communications centers, A3.8	trochoidal (Wankel), \$34.25	utilities, A39.2, 12
Compressors, S34	Computational fluid dynamics (CFD), F34.1	supervisory control, A39.14
air conditioners, room, S46.2	assessing predictions, F34.11	World Wide Web, A39.17
ammonia refrigeration systems, R3.2	boundary conditions for	Concert halls, A4.4
centrifugal, S7.44	inlet, F34.6	Concrete
angular momentum, S34.26	outlet, F34.7	cooling, R36.1
capacity control, S34.31	reporting, F34.13	pozzolanic admixtures, R36.1
critical speed, S34.32	sources/sinks, F34.8	selection, R36.1

water bearing for, A49.23 conceding stem systems, 78.16, 15; 10.6, 511.7, 18 stem systems, 78.16, 16 stem systems, 78.16, 18 stem systems, 78.16, 18 stem systems, 78.10, 18 stem systems,	thermal design, R36.4	pressure control, R2.32	measurement, A45.4; F12.9; F14.32
astema systems, F36 15; 8106; 811.7, 18 water resoluter, A84.11 Condensation in building components, F23.9 concealed, S29.2 control, with insulation, F26.2 dew-point analysis, F23.10 droposise, F48 energy recovery equipment, \$44.7 inin, F48	water heating for, A49.23		
water (seatment, A48,11		g ,	
Condensation in building components, F23-9 concealed, S20.2 dew-point analysis, F23.10 dropowice, F44 sensery recovery equipment, S44-7 flouring factor, S35.4 concendensative systems, F34.5 noncondensative gases, F4.10 with viii, F4.11 oii-fierd appliances, S30.20 prevention, F24-4 dehumidification for, S22.10 standards, S35.5 conductance, thermal, F3.1, E F23.1 orderection, F24-4 dehumidification for, S22.10 standards, S35.5 arised, S35.2 concendensable gases, F4.10 with viii, F4.11 oii-fierd appliances, S30.20 prevention, F24-4 dehumidification for, S22.10 standards, S35.5 conductance, thermal, F3.1, E F23.1 orderection, F24.5 delay-state, F3.2 thermal, F3.1, 2 control, S35.1 arised, S35.5 a	•	•	
in building components, P23-9 conteol, with insulation, P23-9 conteol, with insulation, P26-2 deve-point analysis, P23-10 dropwise, F4.8 bat removal, S35.1 cooling tower, S35.4 bat removal, S35.1 cooling tower, S35.4 bat removal, S35.1 cooling tower, S35.2 liquid subcooling, S35.5 moneondersable gases, P4.10 with oil, P4.11 oil-fired appliances, S30.20 problems of the problems of		<u> </u>	
conceled, \$20.2 dew-point analysis, F23.10 deuropeint anal			*
control, with insulation, P20-2 deve-point analysis, P23-10 dropwize, F4.8 energy recovery equipment, S44.7 film, F4.8 heat transfer S55.2 liquid subcooling, S35.5 moneondensable gases, F4.10 with oil, F4.11 oil-fired appliances, S30.20 prevention, P24.4 dethumodification for, S22.10 strake, P2.10 in tubes, F4.10 visible, S20.2 Condensers, S35.3 aris-dic, S35.12 control, S35.3 aris-dic, S35.12 rompoonder, S35.3 aris-dic, S35.13 rompoonder, S35.3 aris-dic, S35.14 rompoonder, S35.15 rompoonders arise fragment on systems, R3.2 bort-normal shell-and-daube, R3.15 parallel tor-to-control, S35.15 rompoonders or refrigeration systems, R3.2 bort-normal shell-and-daube, R3.15 parallel tor-to-control, S35.15 rompoonders or refrigeration systems, R3.2 bort-normal shell-and-daube, R3.15 capacity control, S35.16 rompoonders in shell suddender, S2.20 rompoonders or refrigeration, R35.6 graphing, R3.14 rompoonders or ristlations, S35.15 rompoonders or ristlations, S35.16 rompoonders or ristlations, S35.16 rompoonders in shell-and-daube, R3.15 pooles, S35.16 rompoonders or ristlations, S35.17 rompoonders or ristlations, S35.18 rompoonders or ristlations, S35.19 rompoonders or ristlations, S35.10 rompoonders or ristlations, S35.16 rompoonders or ristlations, S35.19 rompoonders or ristlations, S35.10 rompoond			
dew.point analysis, F23.10 drop-wise, F4.8 energy recovery equipment, S44.7 fifting, F4.8 heat transfer coefficients, F4.9 in combustion systems, F18.15 interstitial, and drying, F23.10 moncondensable gases, F4.10 with oil, F4.11 oil-fired applainness, S30.20 prevention, F24.4 debundification for, S22.10 surface, F23.10 in tubes, F4.10 visible, S20.2 Condensers, S35.5 air conditioners, room, S46.2 air-ocoled, R4.61, F3.51.1 control, S35.5 air-ocoled, R4.61, F3.51.1 control, S35.1 air-ocoled, R4.61, F3.51.1 remote from compressor, F4.6.17 maintenance, S35.13 moise, R4.6.17 samonia refrigeration systems, R3.2 horizontal shell-und-tube, R3.15 painle horizontal shell-und-tube, R3.15 piping, R3.14 cascade, R4.31. piping, R3.14 cascade, R4.31.7 specific granting, S35.18 wetting, S35.18 wetting, S35.18 codes, S35.19 codes, S35.19 codes, S35.19 codes, S35.16 maintenance, S35.18 location, R3.15, S35.16 maintenance, S35.18 location, R3.15, S35.16 maintenance, S35.18 wetting, R3.64 case shell-und-tube, R3.15 piping, R3.14 cascade, R4.31.1 minutericuting with liquid colorers, S35.18 location, R3.15, S35.16 maintenance, S35.18 location, R3.15, S35.16 maintenance, S35.18 location, R3.15, S35.16 maintenance, S35.18 wetting, R3.51.8 wetting method, S35.10 codes, S35.16 maintenance, S35.19 rocodes, S35.16 maintenance, S35.19 rocodes, S35.18 location, R3.15, S35.16 maintenance, S35.19 rocodes, S35.16 maintenance, S35.19 rocodes, S35.18 location, R3.15, S35.16 maintenance, S35.19 rocodes, S35.10 rocodes condusers rocodes condusers rocoded condusers, S35.10 rocodes condusers rocodes rocodes			
dropsvie, F4.8 energy recovery equipment, S44.7 film, F4.8 heat transfer coefficients, F4.9 in combustion systems, F18.15 interstitial, and drying, F23.10 noncondensable gases, F4.10 with oil, F4.11 oil-filed appliances, 530.20 prevention, F2.4.4 dehumdification for, S22.10 surface, F23.10 in tubes, F4.10 visible, S20.2 Condensers, S35 arr-ade, S35.12 refrigermat-side, S35.12 rootnet, S35.12 rootnet, S35.12 rootnet, S35.12 rootnet, S35.12 rootnet, S35.13 machine room, R46.17 maintenance, S35.13 machine room, R46.17 maintenance, S35.13 none, R46.18 systill, F2.13 none, R46.17 systill, F2.15 systill, F2.13 none, R46.17 systill, F2.15 systill, F2.13 none, R46.17 systill, F2.15 systill, F2.13		·	
film. F4.8 heat transfer coefficients, F4.9 in combustion systems, F18.15 interstitial, and drying, F23.10 noncondensable gases, F4.10 with oif, F4.11 oid-fined appliances, S30.20 prevention, F24.4 dehumidification for, S22.10 strate, F24.4 dehumidification for, S22.10 strate, F24.4 dehumidification for, S22.10 strate, F3.12 conduction with providing factors, F3.5 for S2.10 strate, F3.5 for S2.10 strate, F3.5 for S2.10 strate, F3.5 for S2.12 control, S3.5 for S3.5 fo	- · · · · · · · · · · · · · · · · · · ·		
heat transfer coefficients, F4-9 in combustion systems, F18.15 interstitial, and drying, F23.10 noncondensable gases, F3-10 with oil, F4.11 owith oil, F4.12 owith oil, F4.14 owith oil, F4.15 owith oil, F4.14 owith oil, F4.14 owith oil, F4.15 ow	energy recovery equipment, S44.7	heat transfer, S35.2	• • • • • • • • • • • • • • • • • • • •
in combustion systems, F18.15 increatibila, and drying, F23.10 noncondensable gases, F4.10 with oif, F4.11 oif-fired appliances, \$30.20 prevention, F24.4 dehumidification for, \$32.10 strake, F3.2 dehumidification for, \$22.10 strake, F3.2 thermal, F3.1.8; F23.1 oin blubs, F4.10 visible, \$20.2 Condenser, \$35.2 inconditioners, room, \$46.2 sir-cooled, R46.16; \$35.12 control, S35.1 control, S35.1 nuckine coorner, \$35.12 nuckine coorner, \$35.12 nuckine coorner, \$35.13 noise, F46.18 nuine, F3.1.2 control, S35.12 nuckine coorner, \$46.17 numinions rofrigeration systems, R4.2 phorizontal shell-and-tube, R3.15 pring, R3.14 custack, R43.11 custack, R43.11 custack, R43.19 pring, R3.8.14 custack, R43.19 code, \$35.10 capacity control, \$35.10 capacity		· •	, ,
interstitial, and daying. P23-10 moneondemshelp gases, P4.10 with oil, P4.11 with oil, P4.11 surface, P23.10 s		,	
noncondensable gases, F4.10 with oil, F4.11 oil-lifted appliances, S30.20 prevention, F24.4 debumsdification for, S22.10 surface, F23.10 deplay cases, R46.4 stady-state, F3.2 thermal, F3.18; F23.1 conduction in tubes, F4.10 display cases, R46.4 stady-state, F3.2 thermal, F3.18; F23.1 of thermal, F3.18; F23.1 of thermal, F3.18; F23.1 of thermal, F3.14 foods, R9.9 soils, F25.13 of thermal insulation, F23.14 of thermal insulation, F23.14 of thermal, F3.14 conductions, S35.12 characteristics, S35.12 machine room, R46.17 maintenance, S35.13 machine room, R46.17 maintenance, S35.13 moise, R46.18 rating, S35.11 contour in the stady of the stady-state reset, A41.27 versus variable-air-volume (CAV) control, A41.2 construction, E46.18 rating, S35.11 contour in the stady of the stady o		<u> </u>	The state of the s
with oil, F4.11 bypes, \$35.5 conductance, thermal, F3.18; F23.1 conductance, thermal, F3.18; F23.1 conductance, thermal, F3.18; F23.1 conductance, F3.2 thermal, F3.17; F23.1 apparent, F23.1	· • •	* * * * * * * * * * * * * * * * * * *	* *
oil-fired appliances, \$30.20 prevention, \$724.4 dehumidification for, \$22.10 surface, \$723.10 in tubes, \$74.10 visible, \$70.20 conduction display cases, \$76.4 steady-state, \$73.2 thermal, \$73.1, \$2.1 conduction, \$75.20 conduction, \$75.20 conductive, thermal, \$73.1, \$2.1 conductive, \$75.20 control, \$35.3 air conditioners, \$75.31.1 control, \$35.3 air conditioners, \$75.31.2 control, \$35.12 control, \$35.12 control, \$35.13 control, \$35.14 control, \$35.15 control, \$35.15 control, \$35.16 con			_ ·
prevention, F24.4 dehumidification for, \$22.10 surface, F23.10 display cases, R46.4 stady-state, F3.2 thormul, F3.1.2 control, S23.10 sin mbes, F4.10 visible, \$20.2 Condensers, \$35.12 air-cooled, R46.16, \$35.12 control, \$33.3 air-side, \$35.12 low-pressure-drop, \$35.12 refrigerant-side, \$35.12 control, \$35.13 machine room, R46.17 maintenance, \$35.13 noise, R46.18 rating, \$35.11 remote from compressor, R46.17 ammoina refrigeration systems, R3.2 horizontal shell-and-tube, R3.15 parallel horizontal shell-and-tube, R3.15 parallel horizontal shell-and-tube, R3.15 piping, R3.14 cascade, R43.1 remote from compressor, R46.17 control, S25.10 single-duct, \$2.9 terminal units, \$2.11 control, S25.15 evaporative, R46.17, \$35.14 air/low, \$35.16 despectation, \$35.16 despectation, \$35.16 maintenance, \$35.18 meltiple-condenser installations, \$35.18 multiple-condenser installations, \$35.19 numiticroituting with liquid coolers, \$35.18 multiple-condenser installations, \$35.19 numiticroituting with liquid coolers, \$35.18 multiple-condenser installations, \$35.19 numiticroituting with liquid coolers, \$35.18 multiple-condenser installations, \$35.19 avaporative, R4,	•		
dehumidification for, \$22.10     in tubes, F4.10     in tubes, F4.11     in tubes, F4.12     in tubes, F4.	* - · · · · · · · · · · · · · · · · · ·		•
surface, P23.10 in tubes, P4.10 visible, S20.2 Condensers, S35 air conditioners, room, S46.2 air-cooled, R46.16, S35.11 control, S35 air-side, S35.12 low-pressure-drop, S35.12 refrigerant-side, S35.12 installation, S35.13 machine room, R46.17 maintenance, S35.13 noise, R46.18 rating, S35.11 remote from compressor, R46.17 ammonia refrigeration systems, R3.2 horizontal shell-and-tube, R3.15 parallel horizontal shell-and-tube, R3.15 papallel horizontal shell-and-tube, R3.15 paping, R3.14 cascade, R43.1, cascade, R43.2, cascade, R43.1, cascade, R43.1, cascade, R43.1, casc	* *		
visible, S20.2 Condesters, S35 air conditioners, room, S46.2 air-cooled, R46.16, S35.11 control, S35 air-side, S35.1.2 low-pressure-drop, S35.12 refrigerant-side, S35.1.2 installation, S35.13 machine room, R46.17 maintenance, S35.13 noise, R46.18 rating, S35.11 remote from compressor, R46.17 ammonia refrigeration systems, R3.2, behavior of hermial insulation, F23.14 chemical industry refrigeration, R37.6 in chillers, S38.6, 8, 13 circuiting, S35.16 capacity control, S35.19 codes, S35.19 codes, S35.19 codes, S35.19 codes, S35.19 codes, S35.19 codes, S35.19 combination of the main insulation, R45.5 location, R3.15; S35.16 heat transfer, S35.18 multiple-condenser installations, S35.18 multiple-condenser installations, S35.19 standards, S35.19 mutericulting with liquid coolers, S35.18 multiple-condenser installations, S35.19 standards, S35.19 varee, R46.37 standards, S35.19 varee, R46.47 standards, S35.19 rating, S35.17 standards, S35.19 varee, R46.47 standards, S35.19 varee, R46.47 standards, S35.19 varee, R46.57 standards, S35.19 varee, R46		± *	
Condensers, S35         apparent, F23.1         combustion, F18.13           air conditioners, room, 846.2         air conditioners, room, 846.2         dust, S25.12           control, 835         air-side, S35.12         soils, F25.13         control, S35           in-side, S35.12         control, S35         control, S35         control, S35         figure, F25.13         figure, F12.18           control, S35         control, S35.13         control, A41.2         figure, F12.13         figure, F12.13           mainter room, R46.17         control, A41.2         control, A41.2         figure, F12.1         figure, F12.1           mainter acce, S35.13         moise, R46.18         rating, S35.11         remote from compressor, R46.17         control, A41.2         control, A41.2         measurement, F14.32           ammonia refrigeration systems, R3.2         birchinela industry refrigeration, R37.6         birchillers, S36.6, R3.1         control, A31.5         bigas block wall, F31.2         containers, (See also Cargo containers)         size transport, R31.2         containers, F35.1         smokes, F12.1         special system, R6.8         figure, division, F18.3         store, F12.1         smokes, F12.1         smokes, F12.1         smokes, F12.1         smo	in tubes, F4.10	thermal, F3.1, 2	classification, F12.1
air-cooled, R46.16; S35.12 control, S35 air-side, S35.12 low-pressure-drop, S35.12 refrigerant-side, S35.12 refrigerant-side, S35.13 machine room, R46.17 maintenance, S35.13 moise, R46.18 rating, S35.13 remote from compressor, R46.17 ammonia refrigeration systems, R3.2, bernical industry refrigeration, R37.6 inchillers, S38.6, 8, 13 circuiting, S35.16 capacity control, S35.18 wetting method, S35.16 capacity control, S35.18 wetting method, S35.16 desuperheating, S35.18 wetting method, S35.16 heat transfer, S35.16 location, R3.15; S35.16 multicle-cuiting with liquid coolers, S35.18 multiple-condenser installations, S35.19 multiclic-tuiting with liquid coolers, S35.18 multiple-condenser installations, S35.19 syare, S35.19 vare, S35.19 vare	visible, S20.2	Conductivity, thermal, F23.1	collection mechanisms, S24.2; S25.10, 1
air-cooled, R46.16; S35.11 control, S35 air-side, S35.12 low-pressure-drop, S35.12 refrigerant-side, S35.12 installation, S35.13 machine room, R46.17 maintenance, S35.13 noise, R46.18 rating, S35.11 remote from compressor, R46.17 ammonia refrigeration systems, R3.2 horizontal shell-and-tube, R3.15 piping, R3.14 cascade, R43.1 cascade,		**	*
control, S35     air-side, S35.12     low-pressure-drop, S35.12     refrigerant-side, S35.12     refrigerant-side, S35.13     machine room, R46.17     maintenance, S35.13     machine room, R46.17     maintenance, S35.13     moise, R46.18     rating, S35.13     remote from compressor, R46.17     ammonia refrigeration systems, R3.2     chorizontal shell-and-tube, R3.15     parallel horizontal shell-and-tube, R3.15     parallel horizontal shell-and-tube, R3.15     parallel horizontal shell-and-tube, R3.15     propring, R3.14     classede, R43.1     chemical industry refrigeration, R37.6     in chillers, S36.6, 8, 13     circuiting, S35.5     evaporative, R46.17     airflow, S35.16     capacity control, S35.19     codes, S35.19     codes, S35.19     codes, S35.19     multicircuiting with liquid coolers, S35.18     location, R3.15; S33.16     freeze prevention, S35.16     freeze prevention, S35.16     freeze prevention, S35.17     purging, S35.19     rating, S35.17     sandards, S35.19     multicircuiting with liquid coolers, S35.18     multiple-condenser installations, S35.19     rating, S35.19     sandards, S35.19     wett-packed scrubbers, S25.18     sandards, S35.19     wett-packed scrubbers, S25.18     sandards, S35.19     sanda		· · · · · · · · · · · · · · · · · · ·	
air-side, \$35.12   Constant air volume (CAV)   F12.2     low-pressure-drop, \$35.12   control, \$41.2   supply air temperature reset, \$41.27     installation, \$35.13   supply air temperature reset, \$41.27     maintenance, \$35.13   supply air temperature reset, \$41.27     measurement, \$14.32   mists, \$F12.1, 3     pollen, \$F12.4   supply air temperature reset, \$41.27     measurement, \$F14.32   mists, \$F12.1, 3     pollen, \$F12.4   supply air temperature reset, \$41.27     measurement, \$F14.32   mists, \$F12.1, 3     pollen, \$F12.4   supply air temperature reset, \$41.27     measurement, \$F14.32   mists, \$F12.1, 3     pollen, \$F12.4   supply air temperature reset, \$41.27     measurement, \$F14.32   mists, \$F12.1, 3     pollen, \$F12.4   supply air temperature reset, \$41.27     measurement, \$F14.32   mists, \$F12.1, 3     pollen, \$F12.4   supply air temperature reset, \$41.27     measurement, \$F14.32   mists, \$F12.1, 3     pollen, \$F12.4   supply air temperature reset, \$41.27     measurement, \$F14.32   mists, \$F12.1, 3     pollen, \$F12.4   supply air temperature reset, \$41.27     measurement, \$F14.32   mists, \$F12.1, 3     pollen, \$F12.4   supply air temperature reset, \$41.27     measurement, \$F14.32   mists, \$F12.1, 3     pollen, \$F12.4   supply air temperature reset, \$41.27     pollen, \$F12.5   supply air temperature reset, \$41.27     pollen, \$F12.5   supply air temperature reset, \$41.20   supply air systems, \$41.20     pollen, \$F12.5   supply air systems, \$41.20   supply air systems, \$41.20     pollen, \$F12.5   supply air systems, \$41.20			•
low-pressure-drop, \$35.12 control, \$41.2 supply air temperature reset, \$41.27 installation, \$35.13 cressure reset, \$41.27 cressus variable-air-volume (VAV), \$41.12 measurement, \$14.32 miss, \$12.1 measurement, \$14.32 miss, \$12.1 moise, \$46.18 strong, \$35.11 termote from compressor, \$46.17 ammonia refrigeration systems, \$8.2 horizontal shell-and-tube, \$8.15 parallel horizontal shell-and-tube, \$8.15 piping, \$8.1.4 caseade, \$8.43.1 cressurement, \$8.55 cressurement,			* ***
refrigerant-side, S35.12 installation, S35.13 machine room, R46.17 maintenance, S35.13 moise, R46.18 rating, S35.11 remote from compressor, R46.17 ammonia refrigeration systems, R3.2 horizontal shell-and-tube, R3.15 piping, R3.14 cascade, R43.1 chemical industry refrigeration, R37.6 in chillers, S38.6, 8, 13 circuiting, S35.16 capacity control, S35.19 codes, S35.19 codes, S35.19 colls, S35.16 desuperheating, S35.18 wetting method, S35.16 ffeeze prevention, S35.16 maintenance, S35.19 multicircuiting with liquid coolers, S35.18 multiple-condenser installations, S35.16 maintenance, S35.19 multicircuiting with liquid coolers, S35.18 multiple-condenser installations, S35.19 multicircuiting with liquid coolers, S35.19 multiple-condenser installations, S35.19 multicircuiting with liquid coolers, S35.18 halocarbon refrigeration systems air-cooled, R2.33 evaporative, R46.17; S35.19 multicircuiting with liquid coolers, S35.18 halocarbon refrigeration systems air-cooled, R2.33 evaporative, R46.23 inclusted building design, A57.7, 8 builded building design, A57.7, 8 builded building design, A57.7, 8 builded building design, A57.7, 8 building envelopes) contains wall, F31.5 glass bluck wall, F31.6 glass bluel building design, A57.7, 8 building envelopes) contains wall, F31.5 glass bluel building design, A57.7, 8 building envelopes) contains wall, F31.6 glass bluel building design, A57.7, 8 building envelopes) contains w	-		
installation, S35.13 machine room, R46.17 maintenance, S35.13 noise, R46.18 rating, S35.11 remote from compressor, R46.17 ammonia refrigeration systems, R3.2 horizontal shell-and-tube, R3.15 parallel horizontal shell-and-tube, R3.15 piping, R3.14 cascade, R43.1 chemical industry refrigeration, R37.6 in chillers, S38.6, 8, 13 circuiting, S35.5 evaporative, R46.17, S35.14 airflow, S35.16 capacity control, S35.19 coils, S35.19 coils, S35.16 ffeeze prevention, S35.16 heat transfer, S35.14 hocation, R3.15; S35.16 maintenance, S35.19 multicircuiting with liquid coolers, S35.18 hocation, R3.15; S35.16 multiple-condenser installations, S35.16, 17 purping, S35.17 standards, S35.19 rating, S35.17 standards, S35.19 water, S35.18 halocarbon refrigeration systems air-cooled, R2.33 evaporative, R2.33  evaporative, R2.17  Construction. (See also Building envelopes) curtain wall, F31.5  single-duct, S2.10 police, R2.17  construction. (See also Building envelopes) curtain wall, F31.5  pingle-duct, S2.10 polycycle aromatic compounds (PAC), P5.6  radioactive, F2.18 smits, F12.13 pollen, F12.45 smists, F12.13 pollen, F12.45 smists, F12.14 smists, F12.4 smost, F12.4 smost, F12.4 smost, F12.4 sm	• • •		• · · · · · · · · · · · · · · · · · · ·
machine room, R46.17 maintenance, S35.13 noise, R46.18 rating, S35.11 remote from compressor, R46.17 ammonia refrigeration systems, R3.2 horizontal shell-and-tube, R3.15 parallel horizontal shell-and-tube, R3.15 piping, R3.14 cascade, R43.1 chemical industry refrigeration, R37.6 in chillers, S38.6, 8, 13 circuiting, S35.16 capacity control, S35.19 codes, S35.19 codes, S35.10 desuperheating, S35.18 wetting method, S35.16 heat transfer, S35.14 leat transfer, S35.14 leat transfer, S35.14 multicircuiting with liquid coolers, S35.18 multiple-condenser installations, S35.16 maintenance, S35.19 multicircuiting with liquid coolers, S35.18 multiple-condenser installations, S35.16 maintenance, S35.19 maintenance, S35.19 pring, R35.17 standards, S35.17 standards, S35.17 standards, S35.17 standards, S35.19 water, S35.18 halocarbon refrigeration systems air dual-duct, S2.9 terminal units, S2.10 contentration, 25.20 terminal units, S2.11 continuity, R3.15 spoke wall, F31.40 single-duct, S2.9 terminal units, S2.11 continuity wall, F31.5 glass block wall, F31.40 size also Cargo containers) curtain wall, F31.5 glass block wall, F31.40 size also Cargo containers) air transport, R31.2 Contamnants clean spaces, A16.3, 8 food, R12.1 gaseous, F12.1 gaseous, F12.1 adsorption, A45.4 combustion, F18.13; S25.27 concentration, indoor, measurement, A45.4 control, A45.5; F12.14 adsorption, A45.5; F12.14 adsorption, A45.5 control, A45.5; F12.14 adsorption, A45.5 desicant dehumidification, S22.10 desicant dehumidification, S22.10 desicant dehumidification, S22.10 desicant dehumidification, S22.10 deliution ventilation, A45.5 incineration, 25.2.7 special system characteristics, R6.9 textile processing, A19.7 Control, (See also Controls, automatic and Supervisory control) absorption units, R41.6, 9 air-cooled, R2.33 evaporative, R2.33 indoorair, F12.15 authority, F15.6 automobile air conditioning, A9.8	- · · · · · · · · · · · · · · · · · · ·		•
maintenance, \$35.13 noise, R46.18 rating, \$35.11 remote from compressor, R46.17 ammonia refrigeration systems, R3.2 horizontal shell-and-tube, R3.15 parallel horizontal shell-and-tube, R3.15 piping, R3.14 cascade, R43.1 chemical industry refrigeration, R37.6 in chillers, \$38.6, 8, 13 circuiting, \$35.5 evaporative, R46.17; \$35.14 airflow, \$35.16 capacity control, \$35.19 coids, \$35.19 coids, \$35.19 coids, \$35.16 desuperheating, \$35.18 wetting method, \$35.16 heat transfer, \$35.14 liquid subcoolers, \$35.18 multiple-condenser installations, \$35.16, 17 purping, \$35.19 rating, \$35.19 rating, \$35.19 rating, \$35.19 rating, \$35.19 rating, \$35.16 maintenance, \$35.19 rating, \$35.19 ra			
rating, S35.11 remote from compressor, R46.17 ammonia refrigeration systems, R3.2 horizontal shell-and-tube, R3.15 parallel horizontal shell-and-tube, R3.15 piping, R3.14 cascade, R43.1 cascade, R44.1 cascade, R43.1 cascade, R44.1	•	· · · · · · · · · · · · · · · · · · ·	
remote from compressor, R46.17 ammonia refrigeration systems, R3.2 horizontal shell-and-tube, R3.15 parallel horizontal shell-and-tube, R3.15 piping, R3.14 cascade, R43.1 chemical industry refrigeration, R37.6 in chillers, S38.6, 8, 13 circuiting, S35.16 capacity control, S35.19 codes, S35.10 codes, S35.10 desuperheating, S35.16 host transfer, S35.14 horizontal shell-and-tube, R3.15 piping, R3.14 combination and transport, R31.2  Containers, Gee also Cargo containers) air transport, R31.2  Contaminants clean spaces, A16.3, 8 food, R1.2.1 gaseous, F12.1 gaseous, F12.1 gaseous, F12.1 animal environments, F10.4 combustion, F18.13; S25.27 concentration, indoor, measurement, wetting method, S35.16 heat transfer, S35.14 location, R3.15; S35.16 maintenance, S35.19 multicircuiting with liquid coolers, S35.18 multiple-condenser installations, S35.16, 17 purging, S35.19 radioactive, F12.18 size distribution, F12.4 smogs, F12.1, 3 smokes, F12.1 suspended particles, counters, F12.5 synthetic vireous fibers, F9.5 refrigerant systems, R6.1 dirt, R6.6 filed assembly, R6.8 filter-driers, R6.6 generation by high temperature, R5.8 lubricants, R6.7 metallic, R6.6 moisture, R6.1 motor burnout, R6.8, 8 noncondensable gases, R6.7 residual cleaning agents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.9 solvents, R6.7 solvents, R6.9 solvents, R6.7 solvents, R6.9 solvents, R6.7 special system characteristics, R6.9 textile processing, A19.7 Continuity, fluid dynamics, F2.2 Control, (See also Controls, automatic and Supervisory control) absorption units, R41.6, 9 air-handling systems, S2.12 air-handling systems, S2.12 authority, F15.6 automobile air conditioning, A9.8	noise, R46.18	single-duct, S2.9	polycyclic aromatic compounds (PAC),
ammonia refrigeration systems, R3.2 horizontal shell-and-tube, R3.15 glass block wall, F31.5 glass block wall, F31.40 smogs, F12.1, 3 smokes, F12.1 piping, R3.14 cascade, R43.1 cohemical industry refrigeration, R37.6 in chillers, S38.6, 8, 13 circuiting, S35.5 evaporative, R46.17; S35.14 cascade, R47.1 cohemical industry refrigeration, R37.6 in chillers, S38.6, 8, 13 circuiting, S35.5 evaporative, R46.17; S35.14 change of the cohemical industry refrigeration, R37.6 in chillers, S35.16 change of the cohemical industry refrigeration, R37.6 in chillers, S35.16 change of the cohemical industry refrigeration, R37.6 in chillers, S35.19 change of the cohemical industry refrigeration, R37.6 in chillers, S35.19 change of the cohemical industry refrigeration, R37.6 in chillers, S35.18 change of the cohemical industry refrigeration, R37.6 in chillers, S35.18 change of the cohemical industry refrigeration, R37.6 in chillers, S35.18 change of the cohemical industry refrigeration, R37.6 in chillers, S35.18 change of the cohemical industry refrigeration, R37.6 in chillers, S35.18 change of the cohemical industry refrigeration, R37.6 in chillers, S35.18 change of the cohemical industry refrigeration, R37.6 in chillers, S35.18 change of the cohemical industry refrigeration, R37.6 in chillers, S35.18 change of the cohemical industry refrigeration, R37.6 in industry refrigeration, R37.5 in industry refrigeration, R			
horizontal shell-and-tube, R3.15 parallel horizontal shell-and-tube, R3.15 parallel horizontal shell-and-tube, R3.15 piping, R3.14 cascade, R43.1 chemical industry refrigeration, R37.6 in chillers, S38.6, 8, 13 circuiting, S35.5 evaporative, R46.17; S35.14 airflow, S35.16 capacity control, S35.19 coils, S35.19 coils, S35.16 desuperheating, S35.18 wetting method, S35.16 heat transfer, S35.14 liquid subcoolers, S35.18 location, R3.15; S35.16 maintenance, S35.19 multicircuiting with liquid coolers, S35.18 multiple-condenser installations, S35.19 rating, S35.19 rating, S35.19 rating, S35.19 water, S35.19 water, S35.19 water, S35.19 rating, S35.19 rating, S35.19 water, S35.19 air look wall, F31.40 in integrated building design, A57.7, 8 wood frame, F24.1 suspended particles, counters, F12.5 synthetic vitreous fibers, F9.5 refrigerant systems, R6.1 dir, R6.6 field assembly, R6.8 filter-driers, R6.6 generation by high temperature, R5.8 lubricants, R6.7 metallic, R6.6 moisture, R6.1 motor burnout, R6.8, 8 noncondensable gases, R6.7 control, A45.5; F12.14 residual cleaning agents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.9 textile disassembly, R6.8 filter-driers, R6.6 moisture, R5.8 lubricants, R6.7 metallic, R6.6 moisture, R6.1 motor burnout, R6.8, 8 noncondensable gases, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.9 textile disassembly, R6.8 filter-driers, R6.6 filed assembly, R6.8 filter-driers, R6.6 metall assembly, R6.8 filter-driers, R6.6 moisture, R5.1 motor burnout, R6.8, 8 noncondensable gases, R6.7 solvents, R6.1 motor burnout, R6.8, 8 noncondensable gases, R6.7 solvents, R6.1 motor burnout, R6.8, 8 noncondensable gases, R6.7 solvents, R6.1 motor burnout, R6.8, 8 noncondensable gases, R6.7 solvents, R6.1 motor burnout, R6.8, 8 noncondensable gases, R6.7 solvents, R6.1 motor burnout, R6.8,		, , ,	•
parallel horizontal shell-and-tube, R3.15 piping, R3.14 cascade, R43.1 chemical industry refrigeration, R37.6 in chillers, S38.6, 8, 13 circuiting, S35.5 capacity, R46.17; S35.14 airflow, S35.16 capacity control, S35.19 coils, S35.16 desuperheating, S35.16 desuperheating, S35.16 heat transfer, S35.14 liquid subcoolers, S35.18 multiple-condenser installations, S35.19 multicircuiting with liquid coolers, S35.19 multicircuiting with liquid coolers, S35.19 multiple-condenser installations, S35.19 rating, S35.17 purging, S35.19 rating, S35.18 water, S35.18 halocarbon refrigeration systems air-cooled, R2.33 evaporative, R2.33 in integrated building design, A57.7, 8 wood frame, F24.1 suspended particles, counters, F12.5 suspended particles, counters, F12.5 suspended particles, counters, F12.5 suppended particles, counters, F12.5 suspended particles, counters, F12.5 suspended particles, counters, F12.5 suppended particles, counters, F12.5 suptended particles, counters, F12.5 suppended particles, counters, F12.5 suptended particles, counters, F12.5 firiter-driers, R6.6 dir, R6.6 fild assembly, R6.8 filter-driers, R6.7 metallic, R6.6 moisture, R5.1 motor burnout, R6.8, 8 noncondensable gases, R6.7 residual cleaning agents,	· · · · · · · · · · · · · · · · · · ·		
piping, R3.14 cascade, R43.1 chemical industry efrigeration, R37.6 in chillers, S38.6, 8, 13 circuiting, S35.5 evaporative, R46.17; S35.14 airflow, S35.16 capacity control, S35.19 codes, S35.19 codes, S35.19 codes, S35.16 desuperheating, S35.16 desuperheating, S35.16 capacity control, S35.16 desuperheating, S35.16 desuperheating, S35.16 heat transfer, S35.14 liquid subcoolers, S35.18 liquid subcoolers, S35.18 multicircuiting with liquid coolers, S35.18 multiple-condenser installations, S35.16, 17 purging, S35.17 standards, S35.19 refrigerant systems air cooled, R2.3 evaporative, R46.17; S35.14 slubricants, R6.6 filled assembly, R6.8 filter-driers, R6.6 field assembly, R6.8 filter-driers, R6.6 food, R12.1 gaseous, F12.1 animal environments, F10.4 combustion, F18.13; S25.27 moisture, R6.1 moistrure, R6.1 moistrure, R6.1 moistrure, R6.1 moistrure, R6.1 moistrure, R6.7 residual cleaning agents, R6.7 sludge, tars, and wax, R6.7 solvents, R6.7 special system characteristics, R6.9 textile processing, A19.7 Continuity, fluid dynamics, F2.2 Control. (See also Controls, automatic and Supervisory control) absorption units, R41.6, 9 air-cooled condensers, S35.12 air-cooled condensers, S35.12 air-cooled condensers, S35.12 air-cooled, R2.33 evaporative, R2.33 indostrial, F12.15 authority, F15.6 automobile air conditioning, A9.8		,	<u> </u>
cascade, R43.1 chemical industry refrigeration, R37.6 in chillers, S38.6, 8, 13 circuiting, S35.5 evaporative, R46.17; S35.14 airflow, S35.16 capacity control, S35.19 coils, S35.16 desuperheating, S35.18 wetting method, S35.16 heat transfer, S35.14 liquid subcoolers, S35.16 heat transfer, S35.16 coation, R3.15; S35.16 maintenance, S35.19 multicircuiting with liquid coolers, S35.18 multiple-condenser installations, S35.16 multiple-condenser installations, S35.17 rating, S35.19 water, S35.18 halocarbon refrigeration systems air-cooled, R2.33 evaporative, R2.33 indoor air, F12.15 air tandards, S35.18 evaporative, R42.33 indostrial, F12.15 air tandards, R35.18 evaporative, R42.33 air transport, R31.2 containers, R31.2 containers, R31.2 dir, R6.6 circtifierant systems, R6.1 dir, R6.6 control, R31.2 dir, R6.6 control, R31.2 dir, R6.6 control, R31.2 dir, R6.6 field assembly, R6.8 filter-driers, R6.6	•		•
chemical industry refrigeration, R37.6 in chillers, S38.6, 8, 13 circuiting, S35.5 carpacity, R46.17; S35.14 capacity control, S35.19 colls, S35.16 desuperheating, S35.16 desuperheating, S35.16 freeze prevention, S35.16 heat transfer, S35.14 liquid subcoolers, S35.18 maintenance, S35.19 multiple-condenser installations, S35.16 multiple-condenser installations, S35.17 standards, S35.19 vater, S35.19 vater, S35.19 subcoarbon refrigeration systems air-cooled, R2.33 evaporative, R2.33 industrial, F12.15 incinetation, R31.2  contaminants clean spaces, R31.2 dirt, R6.6 field assembly, R6.8 filter-driers, R6.6 generation by high temperature, R5.8 lubricants, R6.7 metallic, R6.6 moisture, R6.1 moisture, R6.2 moisture, R6.1 moisture, R6.1 moisture, R6.2 moisture, R6.3 moisture, R6.7 solvens,			
in chillers, S38.6, 8, 13 circuiting, S35.5 evaporative, R46.17; S35.14     airflow, S35.16     capacity control, S35.19     codes, S35.19     codes, S35.19     codes, S35.16     desuperheating, S35.18     wetting method, S35.16     heat transfer, S35.14     liquid subcoolers, S35.18     location, R3.15; S35.16     maintenance, S35.19     multiple-condenser installations,     S35.16, 17     purging, S35.19     rating, S35.19     rating, S35.19     sair-cooled, R2.33     evaporative, R2.33 evaporative, R2.33 evaporative, R2.33 evaporative, R35.3 evaporative, R35.14     clean spaces, A16.3, 8     filter-driers, R6.6     field assembly, R6.8     field assembly, R6.8     field assembly, R6.8     filter-driers, R6.6     generation by high temperature, R5.8     lubricants, R6.7     metallic, R6.6     moisture, R6.1     motor burnout, R6.8, 8     noncondensable gases, R6.7     residual cleaning agents, R6.7     solvents, R6.9     textile processing, A19.7     Continuity, fluid dynamics, F2.2     Control. (See also Controls, automatic and Supervisory control)     absorption units, R41.6, 9     air-cooled condensers, S35.12     aircaft cabin pressure, A10.6, 8     air-handling systems, A41.26, A46.9     all-air systems, S2.12     authority, F15.6     automobile air conditioning, A9.8			•
circuiting, S35.5 evaporative, R46.17; S35.14 clean spaces, A16.3, 8 airflow, S35.16 capacity control, S35.19 codes, S35.19 codes, S35.19 coles, S35.16 desuperheating, S35.18 wetting method, S35.16 cat transfer, S35.14 liquid subcoolers, S35.18 location, R3.15; S35.16 multiple-condenser installations, S35.16 multiple-condenser installations, S35.17 purging, S35.19 rating, S35.17 standards, S35.19 water, S35.18 halocarbon refrigeration systems air-cooled, R2.33 evaporative, R2.33 evaporative, R2.33 evaporative, R46.17; S35.14 clean spaces, A16.3, 8 filter-driers, R6.6 generation by high temperature, R5.8 filter-driers, R6.6 moisture, R6.1 motor burnout, R6.8, 8 noncondensable gases, R6.7 residual cleaning agents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.6 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.6 solvents, R6.7 solvents, R6.6 solvents, R6.7 solvents, R6.9 textile processing, A19.7 Continuity, fluid dynamics, F2.2 Control. (See also Con		• •	- · · · · · · · · · · · · · · · · · · ·
evaporative, R46.17; S35.14     airflow, S35.16     capacity control, S35.19     codes, S35.19     coils, S35.16     desuperheating, S35.18     wetting method, S35.16     context ransfer, S35.14     iliquid subcoolers, S35.18     location, R3.15; S35.16     maintenance, S35.19     multicircuiting with liquid coolers, S35.18     multiple-condenser installations, S35.19     multiple-condenser installations, S35.19     rating, S35.19     water, S35.18     halocarbon refrigeration systems     aiir-cooled, R2.33     evaporative, R2.33     industrial, F12.15		• •	
capacity control, S35.19 codes, S35.19 codes, S35.19 coils, S35.16 desuperheating, S35.18 wetting method, S35.16 control, A45.4 liquid subcoolers, S35.18 location, R3.15; S35.16 multiple-condenser installations, S35.19 purging, S35.19 rating, S35.19 water, S35.18 balocarbon refrigeration systems air-cooled, R2.33 evaporative, R2.33  gaseous, F12.1 animal environments, F10.4 combustion, F18.13; S25.27 moisture, R6.6 metallic, R6.6 moisture, R6.6 moisture, R6.8 moncondensable gases, R6.7 residual cleaning agents, R6.7 residual cleaning agents, R6.7 solvents, R6.7 solvents		clean spaces, A16.3, 8	
codes, S35.19 coils, S35.16 coils, S35.16 desuperheating, S35.18 wetting method, S35.16 A45.4 freeze prevention, S35.16 heat transfer, S35.14 liquid subcoolers, S35.18 cotation, R3.15; S35.16 multiple-condenser installations, S35.16 multiple-condenser installations, S35.16 S35.16 rating, S35.17 standards, S35.18 halocarbon refrigeration systems air-cooled, R2.33 evaporative, R2.33  animal environments, F10.4 combustion, F18.13; S25.27 moisture, R6.1 motor burnout, R6.8, 8 monocondensable gases, R6.7 residual cleaning agents, R6.7 solvents,		food, R12.1	generation by high temperature, R5.8
coils, S35.16 desuperheating, S35.18 wetting method, S35.16 A45.4 freeze prevention, S35.16 heat transfer, S35.14 liquid subcoolers, S35.18 location, R3.15; S35.16 multicircuiting with liquid coolers, S35.18 multiple-condenser installations, S35.16 S35.16 Ty purging, S35.17 standards, S35.18 water, S35.18 halocarbon refrigeration systems air-cooled, R2.33 evaporative, R2.33 evaporative, R2.33  method, S35.18 concentration, indoor, measurement, motor burnout, R6.8, 8 noncondensable gases, R6.7 residual cleaning agents, R6.7 residual cleaning agents, R6.7 solvents, R6.7 residual cleaning agents, R6.7 solvents, R6.9 textile processing, A19.7 Continuity, fluid dynamics, F2.2 Control. (See also Controls, automatic and Supervisory control) absorption units, R41.6, 9 air-cooled condensers, S35.12 air-cabin pressure, A10.6, 8 air-handling systems, A41.26, A46.9 ail-air systems, S2.12 authority, F15.6 automobile air conditioning, A9.8			
desuperheating, S35.18 wetting method, S35.16 A45.4 freeze prevention, S35.16 control, A45.5; F12.14 heat transfer, S35.14 liquid subcoolers, S35.18 location, R3.15; S35.16 maintenance, S35.19 multicircuiting with liquid coolers, S35.18 multiple-condenser installations, S35.16, 17 purging, S35.19 rating, S35.17 standards, S35.19 water, S35.18 halocarbon refrigeration systems air-cooled, R2.33 evaporative, R2.33  desircant dehumidification, Mat.5 control, A45.5; S25.24 sludge, tars, and wax, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 special system characteristics, R6.9 textile processing, A19.7 Continuity, fluid dynamics, F2.2 Control, (See also Controls, automatic and Supervisory control) air-cooled condensers, S35.12 air-cooled, R2.33 indoor air, F12.15 indoor air, F12.15 indoor air, F12.15 automobile air conditioning, A9.8		•	
wetting method, S35.16 freeze prevention, S35.16 control, A45.5; F12.14 heat transfer, S35.14 liquid subcoolers, S35.18 location, R3.15; S35.16 maintenance, S35.19 multicircuiting with liquid coolers, S35.18 multiple-condenser installations, S35.16, 17 purging, S35.19 rating, S35.17 standards, S35.19 water, S35.18 halocarbon refrigeration systems air-cooled, R2.33 evaporative, R2.33  wethous desired and safery file adsorption, A45.4  A45.5; F12.14 residual cleaning agents, R6.7 residual cleaning agents, R6.7 residual cleaning agents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 special system characteristics, R6.9 textile processing, A19.7  Continuity, fluid dynamics, F2.2 Control. (See also Controls, automatic and Supervisory control) air-cooled condensers, S35.12 air-cooled condensers, S35.12 air-cooled, R2.33 indoor air, F12.15 authority, F15.6 automobile air conditioning, A9.8	*		
freeze prevention, S35.16 control, A45.5; F12.14 residual cleaning agents, R6.7 adsorption, A45.5; S25.24 sludge, tars, and wax, R6.7 solvents, R6.9 maintenance, S35.19 desiccant dehumidification, S22.10 multicircuiting with liquid coolers, S35.18 dilution ventilation, A45.5 continuity, fluid dynamics, F2.2 multiple-condenser installations, hoods and local exhaust, A45.5 control. (See also Controls, automatic and S35.16, 17 source elimination, A45.5 supervisory control) absorption units, R41.6, 9 air-cooled condensers, S35.12 standards, S35.19 wet-packed scrubbers, S25.18 environmental tobacco smoke (ETS); water, S35.18 f12.2 sindoor air, F12.15 authority, F15.6 automobile air conditioning, A9.8	<u> </u>		
heat transfer, S35.14 adsorption, A45.5; S25.24 sludge, tars, and wax, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.7 solvents, R6.9 maintenance, S35.19 desiccant dehumidification, S22.10 textile processing, A19.7 Continuity, fluid dynamics, F2.2 multiple-condenser installations, hoods and local exhaust, A45.5 continuity, fluid dynamics, F2.2 Control. (See also Controls, automatic and S35.16, 17 solvents, R6.9 source elimination, A45.5 solvents, R6.9 supervisory control) absorption units, R41.6, 9 air-cooled condensers, S35.12 standards, S35.19 environmental tobacco smoke (ETS); water, S35.18 F12.2 sir-cooled, R2.33 indoor air, F12.15 automobile air conditioning, A9.8	<del>-</del>		<del>-</del>
liquid subcoolers, \$35.18 location, R3.15; \$35.16 maintenance, \$35.19 multicircuiting with liquid coolers, \$35.18 multiple-condenser installations, \$35.16, 17 purging, \$35.19 rating, \$35.17 standards, \$35.18 materia, \$35.18 halocarbon refrigeration systems air-cooled, R2.33 evaporative, R2.33  location, R3.15; \$35.18 chemisorption, A45.6 chemisorption, A45.6 chemisorption, A45.6 special system characteristics, R6.9 textile processing, A19.7 Continuity, fluid dynamics, F2.2 Control. (See also Controls, automatic and Supervisory control) absorption units, R41.6, 9 air-cooled condensers, \$35.12 aircraft cabin pressure, A10.6, 8 air-handling systems, A41.26, A46.9 all-air systems, \$2.12 authority, F15.6 automobile air conditioning, A9.8	• ′		
location, R3.15; S35.16 chemisorption, A45.6 special system characteristics, R6.9 maintenance, S35.19 desiccant dehumidification, S22.10 textile processing, A19.7 Continuity, fluid dynamics, F2.2 multiple-condenser installations, hoods and local exhaust, A45.5 continuity, fluid dynamics, F2.2 Control. (See also Controls, automatic and S35.16, 17 incineration, S25.27 supervisory control) absorption units, R41.6, 9 air-cooled condensers, S35.12 standards, S35.19 environmental tobacco smoke (ETS); water, S35.18 F12.2 air-cooled, R2.33 indoor air, F12.15 automobile air conditioning, A9.8	· · · · · · · · · · · · · · · · · · ·		
maintenance, S35.19 desiccant dehumidification, S22.10 multicircuiting with liquid coolers, S35.18 dilution ventilation, A45.5 Continuity, fluid dynamics, F2.2 multiple-condenser installations, hoods and local exhaust, A45.5 Control. (See also Controls, automatic and S35.16, 17 incineration, S25.27 Supervisory control) absorption units, R41.6, 9 air-cooled condensers, S35.12 standards, S35.19 environmental tobacco smoke (ETS); water, S35.18 F12.2 air-capted serubles, F12.17, 17 all-air systems, A41.26, A46.9 all-air systems, S2.12 authority, F15.6 automobile air conditioning, A9.8	. ,	· · · · · · · · · · · · · · · · · · ·	
multiple-condenser installations, S35.16, 17 incineration, S25.27 purging, S35.19 rating, S35.17 standards, S35.19 water, S35.18 halocarbon refrigeration systems air-cooled, R2.33 evaporative, R2.33  moderation, S25.27 sindoor air, F12.15 incineration, S25.27 supervisory control) absorption units, R41.6, 9 air-cooled condensers, S35.12 air-cooled condensers, S35.12 air-handling systems, A41.26, A46.9 all-air systems, S2.12 authority, F15.6 automobile air conditioning, A9.8	· · · · · · · · · · · · · · · · · · ·	•	
S35.16, 17 incineration, S25.27 Supervisory control)  purging, S35.19 source elimination, A45.5 absorption units, R41.6, 9  rating, S35.17 wet-packed scrubbers, S25.18 air-cooled condensers, S35.12  standards, S35.19 environmental tobacco smoke (ETS); aircraft cabin pressure, A10.6, 8  water, S35.18 F12.2 air-handling systems, A41.26, A46.9  halocarbon refrigeration systems flammable, F12.17, 17 all-air systems, S2.12  air-cooled, R2.33 indoor air, F12.15 authority, F15.6  evaporative, R2.33 industrial, F12.15 automobile air conditioning, A9.8	multicircuiting with liquid coolers, S35.18	dilution ventilation, A45.5	Continuity, fluid dynamics, F2.2
purging, S35.19 source elimination, A45.5 absorption units, R41.6, 9 rating, S35.17 wet-packed scrubbers, S25.18 air-cooled condensers, S35.12 standards, S35.19 environmental tobacco smoke (ETS); aircraft cabin pressure, A10.6, 8 water, S35.18 F12.2 air-handling systems, A41.26, A46.9 halocarbon refrigeration systems flammable, F12.17, 17 all-air systems, S2.12 air-cooled, R2.33 indoor air, F12.15 authority, F15.6 evaporative, R2.33 industrial, F12.15 automobile air conditioning, A9.8	•	•	•
rating, S35.17 wet-packed scrubbers, S25.18 air-cooled condensers, S35.12 standards, S35.19 environmental tobacco smoke (ETS); aircraft cabin pressure, A10.6, 8 water, S35.18 F12.2 air-handling systems, A41.26, A46.9 halocarbon refrigeration systems flammable, F12.17, 17 all-air systems, S2.12 air-cooled, R2.33 indoor air, F12.15 authority, F15.6 evaporative, R2.33 industrial, F12.15 automobile air conditioning, A9.8	•	·	
standards, S35.19 environmental tobacco smoke (ETS); aircraft cabin pressure, A10.6, 8 water, S35.18 F12.2 air-handling systems, A41.26, A46.9 halocarbon refrigeration systems flammable, F12.17, 17 all-air systems, S2.12 air-cooled, R2.33 indoor air, F12.15 authority, F15.6 evaporative, R2.33 industrial, F12.15 automobile air conditioning, A9.8		,	•
water, S35.18 F12.2 air-handling systems, A41.26, A46.9 halocarbon refrigeration systems flammable, F12.17, 17 all-air systems, S2.12 air-cooled, R2.33 indoor air, F12.15 authority, F15.6 evaporative, R2.33 industrial, F12.15 automobile air conditioning, A9.8	<u> </u>	•	
halocarbon refrigeration systems flammable, F12.17, 17 all-air systems, S2.12 air-cooled, R2.33 indoor air, F12.15 authority, F15.6 evaporative, R2.33 industrial, F12.15 automobile air conditioning, A9.8		* **	•
air-cooled, R2.33 indoor air, F12.15 authority, F15.6 evaporative, R2.33 industrial, F12.15 automobile air conditioning, A9.8			
evaporative, R2.33 industrial, F12.15 automobile air conditioning, A9.8			•
1 ,			
		· · · · · · · · · · · · · · · · · · ·	<u> </u>

boilers, A46.1; S27.6	mlant arrayath about one A 22 17	F16.7
	plant growth chambers, A22.17	sensors, F15.7
building pressurization, A46.8	processes, A45.5	flow rate, F15.9
burners, S26.12	radiant panels, A46.4; S6.20	humidity (hygrometers), F15.8
bus terminal ventilation, A13.24	radioactivity, A26.7	indoor air quality, F15.9
central air conditioning, A41.1	rail car air conditioning, A9.17	lighting level, F15.9
chemical plants, R37.3	refrigerant flow, R44.1	location, A46.23
chilled-water pumps, A41.6, 16, 17	residential heating and cooling, A1.5	power sensing and transmission, F15.9
chillers, A41.20	road tunnel ventilation, A13.9	pressure, F15.9
clean spaces, noise and vibration, A16.17	scale, A48.4	temperature, F15.8
•	•	-
cogeneration systems, \$7.41	ship air conditioning	transducers, electronic-to-pneumatic
combustion turbines, S7.11	merchant, A11.3	(E/P), F15.12
components, F15.4	naval surface, A11.4	computers, A39.14; F15.4
condensers, S35	smoke, A52.1	control action types, F15.2, 3, 16
evaporative, S35.19	snow-melting systems, A50.10	dampers, F15.6
cooling, S6.20	solar energy, A33.13, 24, 26; S33.17	actuator mounting, F15.7
coils, A46.7; S21.3	differential temperature controller, S33.17	actuators, F15.6
tower fans, A41.12, A41.16	hot-water dump, S33.18	types, F15.6
	÷ ''	
towers, A46.5	over-temperature protection, S33.17	direct digital (DDC), A37.16; F15.4, 9, 17
corrosion, A48.2, 9	sound, A47.1, 44; F7.15	energy sources, F15.4
dehumidifying coils, S21.3	insulation, F23.17	explosive atmospheres, A46.20
design principles	static pressure	extraordinary incidents, A46.21
building and mechanical subdivision,	limit control, A46.21	feedback (closed loop), F15.1
A46.21	variable flow rates, A46.8	fuzzy logic, F15.3
controlled area size, A46.23	steam systems, S10.13	mobile applications, A46.20
energy conservation, A46.21	thermal, F23	modeling, F32.23
		· · · · · · · · · · · · · · · · · · ·
load matching, A46.23	thermal, in insulation, F24.1	modulating, F15.2
sensor location, A46.23	thermal storage systems, A34.23; A41.29	open loop, F15.1
system selection, A46.22	unit heaters, S31.7	positive positioners, F15.7
economizers, A46.2, A46.12	unit ventilators, A46.17; S31.3	proportional-integral-derivative (PID), F15.3
electric heating slabs, S6.20	variable-air-volume (VAV) systems, A41.2;	proportional-only (P), F15.2
energy recovery equipment, S44.7, 11	A46.7	proportional plus integral (P1), F15.3
engines, S7.7	vibration, A47.38	refrigerant flow, R44.1
fans, A46.7; S18.9	zone systems, A46.19	safety, A46.20
air volume, S40.7	zone valves, \$10.13	sensors, F15.7, 9; R44.4
fire, A52.1	Controlled-atmosphere (CA) storage	switches, R44.1
fixed-guideway vehicle air conditioning,	apples, R22.3	systems, F15.1
A9.18	apricots, R22.13	terminology, F15.1
forced-air systems, small, S9.3	berries, R22.13	testing, A37.16
furnaces, S28.1, 7	cherries, sweet, R22.12	transducers, pressure, R44.4
gaseous contaminants, A45.1	figs, R22.13	tuning, F15.3, 16, 17
heaters, S29.2, 4	grapes, R22.8	two-position, F15.2
infrared, S15.4	nectarines, R22.12	valves, F15.4
heating coils, A46.2	peaches, R22.12	
•		actuators, F15.5
heat pumps, A46.16; S45.10	pears, R22.6, 7	flow characteristics, F15.5
heat recovery systems, S8.18	plums, R22.11	selection and sizing, F15.5
heat timers, \$10.13	refrigerated facilities, R14.3	Convection
humidifiers, S20.8	strawberries, R22.13	and heat transfer, with insulation, F23.16
humidity, A46.13; S20.1; S22.1	vegetables, R24.6	flow, fully developed turbulent, F3.14
hydronic heating systems, A46.20; S12.9;	Controlled-environment rooms (CERs), and	forced, F3.13
S14.8	plant growth, A22.16	condensation in tubes, F4.8
justice facilities, A8.3	Controls, automatic, F15	evaporation in tubes, F4.4
hitchen ventilation A21.27	· · · · · · · · · · · · · · · · · · ·	*
kitchen ventilation, A31.27	(See also Control)	equations, F4.6, 9
laboratory systems, A14.12	authority, F15.6	laminar, F3.13
liquid chillers,	classification, F15.4	transition region, F3.14
considerations, S38.4, 7, 10, 14	closed loop (feedback), F15.1	turbulent, F3.13
low-temperature, R3.6	commissioning, F15.16	free, F3.16
makeup air units, <b>A</b> 46.18; S31.9	components	mass, F5.4
moisture, in insulation, F23; F24.1	auxiliary, F15.10	natural, F3.16; F4.1
motors, S40.4, 6	controlled devices	steam heating systems, S10.11
protection, S40.6	actuator, F15.4	thermal, F3.2
	*	
noise and vibration, \$7.7	dampers, F15.4, 6	Convectors
nuclear facilities, A26.5	operator, F15.4	application, S32.5
optimization, A41.1	positive positioners, F15.7	design effects, S32.3
outdoor air quantity, A46.10	valves, F15.4	heat-distributing unit, S32.1
paper moisture content, A18.2	controllers	nonstandard condition corrections, S32.3
parking garage ventilation, A13.18	direct digital (DDC), F15.9, 17	rating, S32.3
photographic materials processing, A20.3	static pressure, A46.8, 21	Convention centers, A4.5
pipe-tracing systems, A50.20	thermostats, F15.10	Conversion factors, F38
P-P	uioiiiiobiaio, 1 13.10	COMPARISON INCLUSES, 1 JU

Coolants, secondary	vacuum cooling, R15.9	shutdown, A48.9
brines	geothermal energy systems, A32.9	siting, S36.8
corrosion inhibition, A48.10; F21.4	greenhouses, A22.12	sound, attenuators, S36.11
properties, F21.1	radiant panel systems, S6.1	start-up, A48.8
calcium chloride solutions, F21.1	radiative, A33.17	testing, A37.15; S36.15
d-limonene, F21.12	solar energy systems, A33.16, 18, 26	theory, \$36.15
ethylene glycol, F21.4	water systems, S12.1, 11, 12	counterflow integration, S36.15
halocarbons, F21.12	dynamometers, A15.4	cross-flow integration, S36.17
inhibited glycols	Cooling load	heat and mass transfer, S36.15
corrosion inhibition, F21.5	calculations, F29; F30	types, S4.3
ethylene, F21.4	central plant, S4.2	direct contact, \$36.5
propylene, F21.4	coil, F30.2	indirect contact, \$36.2, 6
service considerations, F21.10	nonresidential, F30.1	open systems, S13.1
low-temperature refrigeration, R39.11	heat balance, F30.2	water treatment, A48.4, 8, 9; S13.2; S36.13
nonhalocarbon nonaqueous fluids, F21.12	conduction transfer functions, F30.22	winter operation, S36.10
polydimethylsiloxane, F21.12	heat gain	inspections, S36.13
propylene glycol, F21.4	fenestration, F30.17	Cool storage, A34.1
refrigeration systems, R4.1	sol-air temperature, F30.26	COP. See Coefficient of performance (COP)
sodium chloride solutions, F21.1	heat sources, F30.3	Corn
Coolers. (See also Refrigerators)	radiant time series (RTS), F30.28	drying, A23.1; F11.12
beverage, R26.11	sol-air temperature, F30.26	fungi, F11.2
cryocoolers, R38.11	perimeter zones, S3.1	Correctional facilities. See Justice facilities
forced-circulation air, R42.1	refrigeration, S3.7	Corrosion
installation and operation, R42.6	residential calculations,	brines, F21.4
liquid (See also Evaporators)	block load, F29.8	in combustion systems, F18.15
evaporative, w/evaporative condensers,	residential heat balance (RHB) method,	concentration cell corrosion, A48.2
S35.18	F29.2	contributing factors, A48.2
Baudelot, S37.2	residential load factor (RLF) method,	control, A48.2, 3, 9
brazed (semiwelded) plate, S37.2	F29.2	in boilers, A48.10
in chillers, S38.6, 8, 12	Cooling load temperature differential method	cathodic protection, A48.4
flooded, S37.2	with solar cooling load factors (CLTD/CLF),	buried pipe, S11.23
freeze prevention, S37.5	F30.45	in cooling towers, A48.4
heat transfer, S37	Cooling towers, S36	cycles of concentration, A48.3
coefficients, S37.3	approach to wet bulb, S36.1	in geothermal energy systems, A32.6
fouling factor, S37.4	capacity control; S36.2	inhibitors, A48.3
maintenance, S37.6	airflow, A41.13	materials selection, A48.3
oil return, S37.6	fan cycling, S36.8	passivation, A48.4
pressure drop, S37.4	fan sequencing, A41.13	protective coatings, A48.3
refrigerant flow control, S37.5	flow modulation, A41.8	in steam and condensate systems, A48.11
residential, A1.4	two-speed fans, S36.8	energy recovery equipment, S44.7
shell-and-tube, S37.1	variable-frequency fan drives, \$36.9	inhibited glycols, F21.5
tube-in-tube, S37.1	variable- vs. fixed-speed fans, A41.8	under insulation, F26.5
vessel design requirements, S37.4	construction materials, S36.7	microorganism influence, A48.2, 5
piping, R2.25, 26	design conditions, S36.2	oil-fired appliances, \$30.21
retail food store, R46.1	drift, S36.11	oxygen corrosion, A48.2, 11
walk-in, R46.12; R47.3	eliminators, S36.11, 12	secondary coolant systems, R4.5
water, R26.11	economics, S36.7	service water systems, A49.8
Cooling. (See also Air conditioning)	fill, S36.3	types, A48.2
absorption equipment, R41.1	fogging, S36.11	white rust, A48.4
animal environments, A22.4	free cooling, S36.10	Costs. (See also Economics)
bakery products, R28.4	freeze protection, S13.3; S36.10	all-air systems, S2.2
concrete	heat and mass simultaneous transfer, F5.12	analysis period, A36.2
active systems, R36.5	indirect evaporative coolers, \$13.3; \$19.4	economic analysis techniques
air blast, R36.2	inspections, \$36.11	computer analysis, A36.11
chilled water, R36.1	Legionella pneumophila, S36.12, 13	life-cycle cost analyses, A36.9
embedded coils, R36.1	maintenance, S36.11	present value (worth), A36.9
inundation, R36.2	model, F32.17	simple payback, A36.9
passive, R36.4	number of transfer units (NTU), S36.16	energy, A36.4, 9
controls, S6.20	performance	financing alternatives, A36.8
ebullient, S7.22, 39	curves, S36.13	inflation, A36.10
foods and beverages, time calculations,	monitoring, S36.11	interest and discount rate, A36.3
R10.1	thermal, S36.15	laboratory systems, A14.19
fruits and vegetables	tower coefficients, \$36.19	life-cycle, A36.11
evaporative, R15.8	piping, \$13.2; \$36.8	energy recovery equipment, S44.12, 16,
forced-air, R15.6	plumes, S36.11	23
hydrocooling, R15.3	principle of operation, S36.1	operation and maintenance, A38.2
load calculation, R15.1	recommissioning, A48.8	piping insulation, S11.16
package icing, R15.8	selection, S36.7	maintenance, A36.6

	:1-4'	F 528 2 7
operating	insulation	furnaces, S28.2, 7
actual, A36.4	low-temperature, R38.23	multilouver, S17.5
electrical energy, A36.4	selection (table), R38.26	multishutter, S17.3
natural gas, A36.6	thermal conductivity (table), R38.24	opposed-blade, S2.4; S17.3, 6
other fuels, A36.6	isenthalpic expansion, R38.6	outdoor air, A46.10
snow-melting systems, A50.8, 10	isentropic expansion, R38.7	parallel-blade, S2.5
owning	Joule-Thomson cycle, R38.6	return air, S2.4
initial cost, A36.1	Kleemenko cycle, R38.13	sound control, A47.8
insurance, A36.4	Linde cycle, R38.6	splitter, S17.6
taxes, A36.4	liquefaction	vehicular facilities, enclosed, A13.32
periodic, A36.4	balanced flow condition, R38.6	vent, S30.25
refrigerant phaseout, A36.8	of gases, R38.6	Dams, concrete cooling, R36.1
<b>Cotton</b> , drying, A23.8; F11.12	liquid-level sensors, R38.27	Darcy equation, F35.6
Courthouses, A8.4	mixed refrigerant cycle, R38.8	Darcy-Weisbach equation
Courtrooms, A8.4	natural gas processing, R38.18	ductwork sectional losses, F35.8
CPVC. See Chlorinated polyvinyl chloride	properties	pressure drop, F2.7; F36.1
(CPVC)	electrical, R38.5	water-cooled condensers, S35.4
Crawlspaces	magnetic, R38.5	water systems, S39.4
heat loss, F29.13	mechanical, R38.6	Data-driven modeling
insulation, A43.1	thermal, R38.3	black-box, F32.24
moisture control, F24.10	purification of gases, R38.19	calibrated simulation, F32.25
vented vs. unvented, A43.1	recovery of gases, R38.17, 18	empirical, F32.24
wall insulation, A43.2	separation of gases, Gibbs phase rule, R38.16	examples, F32.30
Critical spaces	staging, R38.15	gray-box, F32.25
forensic labs, A8.6	Stirling cycle, R38.14	neural network, F32.30
justice facilities, A8.3	storage systems, R38.26	steady-state, F32.25
Crops. See Farm crops	transfer systems, R38.27	Data processing areas
Cryogenics, R38	CTIAC. See Combustion turbine inlet air	air-conditioning systems, A17.1
biomedical applications	cooling (CTIAC)	humidification; S20.1
* -	Curtain walls, F31.5	· ·
cryomicroscopy, R40.6		codes, standards, and guidelines, A17.15
cryopreservation, R40.1	Cycloparaffins, R7.2	design criteria, A17.1
cryoprotective agents, R40.2	Dairy products, R20	Daylighting
cryosurgery, R40.7	aseptic packaging, R20.20	interior building illumination, F31.56
induced hypothermia, R40.7	butter	light transmittance, F31.57
refrigeration, R40.1	manufacture, R20.6	solar radiation, F31.1
specimen preparation, R40.6	refrigeration load, R20.9	Defrosting
Brayton cycle, R38.11	buttermilk, R20.5	air coolers, forced-circulation, R42.4
cascade cycle, R38.8	cheese	air-source heat pump coils, S8.7, 8; S45.9
Claude cycle, R38.8	cheese room refrigeration, R20.13	ammonia liquid recirculation systems, R3.22
cryobiological, R40.8	manufacture, R20.10	household refrigerators and freezers, R48.6
cryocoolers	cream, R20.5	meat coolers, R17.2
recuperative	display refrigerators, R46.6	retail food store refrigerators, R46.19
Brayton, R38.12	ice cream	Degree-day method, F32.17
Joule-Thomson, R38.11	freezing, R20.16	variable-base, F32.19
Kleemenko, R38.13	hardening, R20.17	Dehumidification, A46.13; S22
regenerative	milkfat content, R20.13	absorption, S22.10
Gifford-McMahon, R38.16	mix preparation, R20.15	adsorption, S22.10
orifice pulse tube, R38.14	refrigeration	air washers, S19.7
Stirling, R38.14	equipment, R20.19	all-air systems, S2.4
cryopumping, R38.1	requirements, R20.16	desiccant, S22.1
equipment	milk	applications, S22.1, 8
coiled-tube exchanger, R38.21	dry, R20.22	capacity, S22.2
compressors, R38.20	evaporated, R20.21	equipment, S22.3
expansion devices, R3820	fresh	high-pressure, S22.10
heat exchangers, R38.21	processing, R20.2	liquid, F22.3
regenerators, R38,22	production, R20.1	solid, F22.4
systems, R38.20	storage, R20.4	evaporative cooling, A51.2; S19.7
turboalternators, R38.21	sweetened condensed, R20.22	performance factor, S19.7
turboexpanders, R38.21	thermal properties, R9.1	residential, A1.5
fluids	UHT sterilization, R20.19	Dehumidifiers
cold burns, R38.28	yogurt, R20.5	desiccant, S22
flammability, R38.29	Dampers	capacity, S22.2
storage vessels, R38.26	air outlet, S17.3, 4, 5	commissioning, S22.8
transfer, R38.2726	balancing	high-pressure, \$22.10
freezers, industrial, R16.5	in constant-volume systems, F35.15	• •
·	· · · · · · · · · · · · · · · · · · ·	liquid, S22.3
hazards, R38.28	in VAV systems, F35.15	operation, S22.7
Heylandt cycle, R38.8	controls, automatic, F15.6, 6	rotary solid, S22.4
instrumentation, R38.27	fire and smoke control, A52.8	solid, S22.4

heat pipes, S47.5	Dirty bombs. See Chemical, biological,	design criteria, A5.1
ice rinks, S47.4	radiological, and explosive (CBRE) incidents	energy systems, A5.1
indoor swimming pool, S47.4	Discharge coefficients, in fluid flow, F2.9	load characteristics, A5.1
makeup air treatment, \$47.3	Dispersive infrared (DIR), F15.8	service water heating, A49.12, 15, 19
mechanical, S47.1	Display cases, R46.1, 4	Draft
components, S47.2	District heating and cooling, S11	burners, S26.14
psychrometrics, S47.1	applicability, S11.1	chimney, S30.1
types, S47.2	central plants	altitude correction, S30.8
Dehydration	boiler, S11.3	available, S30.1, 4, 8
farm crops, A23.1; F11.1	chiller, A46.4; S11.1, 3	theoretical, S30.1, 3, 8
industrial systems for, A28.1	distribution design, S11.4	comfort affected by, F8.13
of eggs, R21.11	emission control, S11.4	cooling towers, \$36.3, 5
refrigeration systems, R45.1	equipment, S11.2	Drag, in fluid flow, F2.5
Density	heating medium, S11.3	Driers, R6.6. (See also Dryers)
fluids, F2.1	thermal storage, S11.3	Drip station steam systems, S11.7
modeling, R9.6	cogeneration, S7.33	Dryers. (See also Driers)
Dental facilities, A7.14	components, S11.1	commercial and industrial
Desiccants, F22.1; S22.1	consumer interconnections	adsorption, S22.10, 11
		- · · · · · · · · · · · · · · · · · · ·
adsorption, S22.1	chilled water, S11.3, 19, 31	agitated-bed, A28.6
cosorption of water vapor and air	components, S11.27	calculations, A28.2
contaminants, F22.5	direct connection, S11.26	conduction, A28.3
dehumidification, \$22.1	flow control, S11.28	constant-moisture solvent, A28.6
cogeneration, S7.33	hot water, S11.29	convection, A28.4
glycols, S22.2	indirect connection	dielectric, A28.4
isotherms, F22.5	heat exchangers, S11.27	drying time determination, A28.1
life, F22.5	steam, S11.18, 29	flash, A28.6
liquid, S22.2, 3	temperature differential control, S11.31	fluidized-bed, A28.6
lithium chloride, S22.2	costs, A36.9	freeze drying, A28.6
materials, F22.1	distribution system	mechanism, A28.1
refrigerant systems, R6.5	aboveground systems, S11.18, 19	microwave, A28.4
equilibrium curves, R6.4	condensate drainage and return, S11.7, 18	psychrometrics, A28.1
moisture, R6.3	conduits, S11.21, 23	radiant infrared, A28.3
types	constant-flow, S11.4	selection, A28.3
liquid absorbents, F22.3	construction, S11.18	superheated vapor, A28.6
solid adsorbents, F22.4	entry pits, S11.24	tunnel, A28.5
wheel, S22.4	hydraulic design, S11.6	ultraviolet (UV), A28.3
Desuperheaters	insulation	vacuum drying, A28.6
air conditioners, unitary, S45.2	economical thickness, S11.16	desiccant, high-pressure, S22.10
in ammonia refrigeration, R3.3	pipe, S11.7, 16, 20	farm crops, A23.1
condensers, evaporative, S35.18	pipe, S11.6	Drying
heat pumps, unitary, \$45.2	thermal design conditions, S11.7	air, S22.11
Dew-point analysis, F23.12	underground systems, S11.19	desiccant, high-pressure, S22.10, 11
Diamagnetism, and superconductivity,	valve vaults, S11.24	dew point control, S22.11
R38.5	variable-flow, S11.5	farm crops, A23.1, F11.1
Diesel fuel, F18.6	water hammer, S11.6	gases, S22.11
Diffusers, air	economics, S11.2	DTW. See Dual-temperature water (DTW)
sound control, A47.8	geothermal heating systems, A32.8	system
Diffusion	heating conversion to, \$11.31	Dual-duct systems
coefficient, F5.2	heat transfer analysis, S11.9	all-air systems, S2.8
eddy, F5.6	ground to air, S11.10	control, A46.19
moisture flow, F23.7	pipes in	terminal boxes, A46.16
molecular, F5.1	air, S11.16	testing, adjusting, balancing, A37.4
space air, F33.1	buried trenches or tunnels, S11.14	Dual-temperature water (DTW) system, S12.1
Diffusivity	shallow trenches, \$11.15	DuBois equation, F8.3
thermal, F23.1	single buried pipe, S11.10	Duct design
of foods, R9.17	soil temperature calculation, S11.9	all-air systems, S2.7
water vapor, F23.2	two pipes buried, S11.12	Bernoulli equation, F35.1
Dilution	metering, S11.32	commercial, small applications, S9.10
exhaust, F16.10	pressure losses, S11.6	computer analysis, A39.6
smoke, A52.4	thermal storage, A34.7, 17; S11.3	Darcy equation, F35.6
ventilation, A29.2; A45.5	water systems, S11.1	Darcy-Weisbach equation, F35.8
Dimensionless variables, F3.14	d-limonene, F21.12	design considerations
Dining halls	DNS. See Direct numerical simulation (DNS)	space pressure relationships, F35.10
justice facilities, A8.4	Docks, ship, A3.10	velocities for HVAC components, F35.12
DIR. See Dispersive infrared (DIR)	Doors	duct fitting database, F35.8
Direct digital control (DDC), F15.4, 9	U-factors, F25.14; F31.11	dynamic losses
Direct numerical simulation (DNS), turbulence	Dormitories	duct fitting database, F35.8
modeling, F34.4	air conditioning, A5.8	local loss coefficients, F35.7
11100011115, 1 0 1.1	an conditioning, 713.0	1000 1000 000111010110, 1 33.7

fan-system interface, F35.8	security concerns, A58.6	heat pumps, unitary, S45.5
fire safety, F35.11	ships, A11.3	industrial exhaust gas cleaning, S25.3
•		
fitting loss coefficients	sound	infrared heaters, S15.4
duct fitting database, F35.8	attenuation, A47.12	motors, S40.2
flexible ducts, F35.8	control, F7.13	pumps, centrifugal, S39.7
tables, F35.20-60	transmission, A47.20	refrigerating, F1.3
friction losses, F35.4	velocity measurement in, F14.17	Eggs, R21
head, F35.2	vibration control, A47.46	composition, R21.1
industrial exhaust systems, F35.17; S25.28	Dust mites, F23.5	dehydration, R21.11
insulation, F35.11	Dusts, S24.1	processing plant sanitation, R21.12
leakage, F35.11	indoor environmental health, F9.4	products, R21.9
methods, F35.13	synthetic, S24.2	shell eggs
noise, F35.13	•	packaging, R21.8
	Dynamometers, A15.1	
pressure, F35.2	Earth, stabilization, R36.3, 4	processing, R21.5
residential, \$9.8	Earthquakes, seismic restraint design, A54.1	refrigeration, R21.5
roughness factors, F35.6	Economic analysis, A36	spoilage prevention, R21.4
smoke management, F35.11	computer analysis, A36.11	storage, R21.8
stack effect, F35.2	life-cycle cost analyses, A36.9	structure, R21.1
testing, adjusting, and balancing,	present value (worth), A36.10	transportation, R21.8
F35.13	simple payback, A36.9	storage, R21.1
Ducts	Economic coefficient of performance (ECOP),	thermal properties, R9.1
acoustical lining, A47.15; S16.4	\$7.35	EIFS. See Exterior insulation finishing system
in hospitals, A7.13	Economics. (See also Costs)	(EIFS)
airflow measurement in, A37.2	cogeneration, S7.46	Electricity
antimicrobial, \$16.5	•	•
· · · · · · · · · · · · · · · · · · ·	district heating and cooling, \$11.2	billing rates, A55.12
classifications, S16.1	energy management planning, A35.2	codes, A55.15
cleaning, S16.2	energy recovery equipment, \$44.23	costs, A36.4, 9
construction	evaporative cooling, A51.15, 17	generation, on-site, A36.9
codes, S16.1	indoor gaseous contaminant control, A45.13	imbalance, S40.1
commercial, S16.2	insulation thickness, pipe, S11.16	motor starting, A55.5; S40.7
acoustical treatment, S16.4	laboratory systems, A14.19	performance, A55.1
hangers, S16.4	owning and operating costs, A36.1	power quality variations, A55.7
materials, S16.2	steam turbines, S7.19	principles, A55.2
plenums and apparatus casings, S16.4	Economizers,	safety, A55.1
industrial, S16.4	air-side, S5.9	voltage, A55.1
hangers, S16.5	compressors	Electric thermal storage (ETS), A34.12
materials, \$16.4	single-screw, S34.13, 14	Electrostatic precipitators, S24.8; S25.7
·		
kitchen exhaust, S16.5	twin-screw, \$34.20	Elevators, smoke control, A52.11
master specifications, \$16.6	control, A41.26	Emissions, pollution, F18.6
outdoor ducts, \$16.6	humidification load calculation, \$20.3	Emissivity, F3.2, 8
residential, \$16.2	kitchen ventilation, A31.21	Emittance, thermal, F23.2
seismic qualification, S16.6	water-side, S5.2, 9	Enclosed vehicular facilities, A13
sheet metal welding, \$16.6	ECOP. See Economic coefficient of	Energy
standards, S16.1	performance (ECOP)	audit, A35.9
commercial, S16.2	ECS. See Environmental control system (ECS)	costs, A36.4
industrial, S16.4	Eddy diffusivity, F5.6	emergency use reduction, A35.17
residential, S16.2	Educational facilities, A6	field survey audit, A37.17
thermal insulation, S16.6	air conditioning, A6.1	forecasting building needs, A41.31
underground, S16.6	service water heating, A49.21	savings verification, A40.2
desiccant dehumidifiers, S22.7	EER. See Energy efficiency ratio (EER)	wheels, S44.10
efficiency testing, S9.11	Effectiveness, heat transfer, F3.28	Energy balance
	· · · · · · · · · · · · · · · · · · ·	comfort, F8.2, 16
fabric, \$16.6	Effective radiant flux (ERF), A53.2	• •
fibrous glass, \$16.3	Efficiency	refrigeration systems, R43.3
nat oval, 1 33.7, 510.3	air conditioners	Energy conservation, F17.2
flexible, S16.4	room, S46.2	air conditioners, room, S46.3
fluid flow, F2.1	unitary, S45.5	building envelopes, A43.1
forced-air systems, small, S9.2, 8	boilers, S27.5	building supervisory control, A41.1
friction chart, F35.6	combustion, F18.12	clean spaces, A16.16
industrial exhaust systems, A30.5	compressors	educational facilities, A6.1, 2
insulation, F24.15; F26.11; F35.11	centrifugal, S34.30	farm crop drying, A23.3
leakage, F35.11; S16.2	positive-displacement, S34.2	greenhouses, A22.15
noise in, A47.7	reciprocating, S34.6	hospitals, A7.13
noncircular, F35.6	rotary, S34.10	industrial environments, A29.6
plastic, S16.5	scroll, S34.23	infrared heaters, S15.1
rectangular, F35.7; S16.2, 5	single-screw, S34.16	kitchen ventilation, A31.21
	<u> </u>	
road tunnels, A13.8	fins, F3.24	pumps, centrifugal, S39.13
roughness factors, F35.6	forced-air systems, small, S9.12	refrigerators, commercial, R47.7
round, S16.2, 5	furnaces, S9.12; S28.5, 7	temperature and ventilation control, A46.21

textile processing, A19.7	analysis, A40.6, 9	ebullient cooling, S7.22, 39
thermal insulation, F26.1	measurement uncertainty, A40.12	exhaust systems, S7.6, 39
Energy consumption	reporting, A40.6, 14	gas, \$7.6
benchmarking, A35.7	requirements, A40.7	expansion engines, S7.38
building HVAC, control effect on, A41.7	verification, A40.5, 14	fuels, F18.6
in buildings, F17.3	design and implementation methodology,	cetane number, F18.7
emergency reduction, A35.17	A40.6	heating values; S7.5
gaseous contaminant control, A45.13	documentation, A40.7, 14	selection, S7.4
humidifiers, S20.3	planning, A40.5, 14	heat recovery
United States	quality assurance, A40.5, 14	exhaust gas, S7.23
per capita end-use, F17.10	Energy production, world, F17.7	jacket water, S7.21▶
projections, F17.10	Energy recovery. (See also Heat recovery)	lubricant, S7.23
world, F17.8	air-to-air	reciprocating, S7.21
Energy efficiency, F17.2	applications, S44.1	turbocharger, S7.23
in commercial and food service refrigerators,	design	heat release, A15.1
R47.7	condensation, S44.7	heat removal, S7.40
design, F17.2	controls, S44.7, 11	jacket water system, S7.6, 38
Energy efficiency ratio (EER), S46.2	corrosion, S44.7	lubrication, S7.6
Energy estimating, F32	cross-contamination, S44.11	maintenance, S7.7
analysis, F32.3	filters, air, S44.7	noise control, S7.7
application to cooling and dehumidifying	fouling, S44.7	performance, S7.3
coils, F32.11	freeze prevention, S44.7	reciprocating, S7.2
degree-day and bin methods, F32.17	maintenance, S44.7, 11	sizing, S7.42
annual degree-day, F32.18	performance, S44.9	standards, S7.50
variable base, F32.19	pressure drop, S44.7	superchargers, turbochargers, \$7.6
balance point temperature, F32.18	economic considerations, S44.23	vibration control, S7.7
correlation, F32.22	effectiveness, S44.8	water-cooled, S7.38
degree-day, F32.20	energy transfer, S44.4	Engine test facilities, A15
forecasting, A41.31	equipment	air conditioning, A15.1
general considerations, F32.1	coil energy recovery loops, S44.11	dynamometers, A15.1
integration of systems, F32.23	devices, S44.1	exhaust, A15.2
models, F32.1	heat pipe heat exchangers, S44.13	noise levels, A15.4
monthly degree-day, F32.20	rating, S44.9	ventilation, A15.1, 4
seasonal efficiency of furnaces, F32.19	rotary energy exchangers, S44.10	Enhanced tubes. See Finned-tube heat transfe
simulating, F32.23	runaround loops, S44.11	coils
software selection, F32.3	thermosiphon (two-phase) heat	Enthalpy
Energy management, A35	exchangers, S44.14	calculation, F1.4
cost control, A35.11, A35.13	twin-tower enthalpy recovery loops,	definition, F1.2
emergency energy use reduction, A35.17	S44.14	foods, R9.7
energy audits, A35.9	evaporative cooling, indirect, S19.3;	recovery loop, twin-tower, S44.14
energy conservation opportunity (ECO),	S44.21	water vapor, F5.9
comparing, A35.14	precooling air reheater, S44.22	wheels, S44.10
implementation, A35.17	in chemical industry, R37.4	Entropy, F1.1
improving discretionary operations, A35.11	industrial environments, A29.6	calculation, F1.4
resource evaluation, A35.2	Energy resources, F17	Environmental control
Energy modeling, F32	demand-side management (DSM), F17.6	animals. See Animal environments
calculating	integrated resource planning (IRP), F17.6	humans. See Comfort
basements, F32.7	types, F17.1	plants. See Plant environments
effectiveness-NTU, F32.10	United States, F17.10	retail food stores
slab foundations, F32.7	world, F17.7	equipment and control, R46.21
space sensible loads, F32.3	Energy savings performance contracting	store ambient effect, R46.3
classical approach, F32.1	(ESPC), A36.8	Environmental control system (ECS), A10
data-driven approach, F32.1	Energy use benchmarking, A40.9	Environmental health, F9
data-driven models, F32.2, 24	Engines, S7	background, F9.1
forward models, F32.1	air-cooled, S7.40	biostatistics, F9.2
general considerations, F32.1	air systems	cellular biology, F9.2
in integrated building design, A57.4	combustion, S7.6, 40	dusts, F9.4
system controls, F32.23	compressed, S7.6	epidemiology, F9.2
Energy monitoring, A40	applications	exposure, F9.6
applications	centrifugal compressors, S7.44	genetics, F9.3
building diagnostics, A40.2	heat pumps, S7.44	indoor, F9.1
energy end use, A40.1	reciprocating compressors, \$7.43	industrial hygiene, F9.3
performance monitoring, A40.3, 5	screw compressors, \$7.44	microbiology/mycology, F9.3
savings measurement and verification	sizing, S7.42	molecular biology, F9.3
(M&V), A40.2	codes, \$7.50	physical hazards
specific technology assessment, A40.1	continuous-duty standby, \$7.37	electrical hazards, F9.13
data	controls and instruments, S7.7	electromagnetic radiation, F9.15
acquisition, A40.11	design and installation, S7.38	noise, F9.15

thermal comfort, F9.11	Legionella pneumophila, S19.8	types, S3.3
diseases affected by, F9.12	Evaporators. (See also Coolers, liquid)	water distribution, S3.5
vibrations, F9.13	air conditioners, room, S46.2	wiring, S3.4
standards, F9.9	ammonia refrigeration systems	Fans, S18
toxicology, F9.3	equipment, R3.2	air conditioners, room, S46.2
Environmental tobacco smoke (ETS)	piping, R3.18	all-air systems, S2.3, 4, 6
contaminants, A45.2	automobile air conditioning, A9.6, 11	animal environments, A22.6
secondhand smoke, F12.17	chemical industry refrigeration, R37.7	control, A46.7; S18.9
sidestream smoke, F9.6	flooded, F4.4	cooling tower capacity control, A41.12; S36.8
superheated vapors, F12.2	halocarbon refrigeration systems, piping,	draft, S30.26
Equipment vibration, A47.38; F7.19	R2.28	duct system interface, F35.8
ERF. See Effective radiant flux (ERF)	liquid overfeed systems, R1.6	fixed- vs. variable-speed, A41.8
ESPC. See Energy savings performance	Exfiltration, F27.1	flow control, S18.9; S40.7
contracting (ESPC)	Exhaust	furnaces, S28.2
Ethylene glycol	animal buildings, A22.6	industrial exhaust systems, A30.7
coolants, secondary, F21.4	clean spaces, A16.14, 16	isolation, S18.9
hydronic systems, S12.16	engines	kitchen exhaust, A31.12
ETS. See Environmental tobacco smoke (ETS);	gas systems, S7.6	laws, S18.4
Electric thermal storage (ETS)	heat recovery, S7.23	operating principles, S18.1
Evaporation, in tubes	installation recommendations, S7.39	parallel operation, S18.7
forced convection, F4.4	engine test facilities, A15.2	plenum, \$18.1
equations, F4.6	industrial environments, A12.8; A30.1	plug, \$18.1
natural convection, F4.1	kitchens, A31.9, 28	pressure relationships, S18.5
Evaporative coolers. (See also Refrigerators)	laboratories, A14.3, 9	effect of duct system on, S18.6
liquid (See also Evaporators)	stack height, A14.13	rating, S18.4
in chillers, \$38.6, 8, 12	photographic processing areas, A20.3	selection, A47.5; S18.7
Evaporative cooling, A51	stacks	ships, naval surface, A11.4
applications	buildings, A44.1	sound level, A47.3; S18.8
air cleaning, A51.2; S19.7	design strategies, A44.1	system effects, S18.7
animal environments, A22.4; A51.14	exhaust dilution prediction equations,	testing, S18.4
combustion turbines, S7.11	A44.10	types, \$18.1
commercial, A51.9	exhaust velocity, A44.1	unstable operation, A46.10
dehumidification, A51.2; S19.7	industrial exhaust systems, A30.7	variable- vs. fixed-speed, A41.8
gas turbines, A51.13	location relative to air intake, A44.2	vehicular facilities, enclosed, A13.31
<del>-</del>	•	•
greenhouses, A22.13; A51.15	wake downwash, A44.2	Farm crops
humidification, A51.2; S19.6	vehicular facilities, enclosed, A13.35	aeration, A23.4, 9; F11.11
industrial	Exhibit buildings, temporary, A4.8	deep bed drying, F11.10
air conditioning, A12.7	Exhibit cases, A21.5, 16	dryeration, A23.4
area cooling, A51.12	Exhibition centers, A4.5	drying, F11.8
process cooling, A51.13	smoke management, A52.12	airflow resistance, F11.9
spot cooling, A51.12	Expansion joints and devices, S41.11	barley, F11.13
laundries, A51.13	bends, S41.11	combination, A23.4
makeup air pretreatment, S19.5	joints	corn, A23.1; F11.12
motors, A51.12	district heating and cooling, S11.17	cotton, A23.8; F11.12
power generation facilities, A51.13	packed, S41.14	deep-bed, A23.4; F11.10
precooling, S19.5	packless, S41.14	energy conservation, A23.3
produce storage, A51.14	loops, S41.12	equipment, A23.2
residential, A51.9	Expansion tanks, S11.4	full-bin, A23.5
wood and paper products facilities,	hydronic systems, S14.4	grain, F11.12
A51.13	closed, S12.3	hay, A23.7; F11.11
cooling towers, \$36.1	diaphragm, S12.3	layer, A23.6
direct, A51.1, 2; S19.1	expansion chamber, S12.3	peanuts, A23.8; F11.13
economics, A51.15	functions of, S12.3, 7	physiological factors, F11.1
entering air condition, A51.17	open, S12.3	rice, A23.9; F11.13
equipment	sizing equations, S12.4	seeds, F11.13
direct, S19.1	secondary coolant systems, R4.3	shallow-layer, A23.3; F11.9
indirect, S19.2	solar energy systems, A33.12	soybeans, A23.7; F11.13
maintenance, S19.7	Explosions. See Chemical, biological,	specific, A23.7
two-stage, S19.4	radiological, and explosive (CBRE) incidents	tobacco, F11.14
exhaust requirement, A51.10	Exterior insulation finishing system (EIFS),	wheat, F11.13
heat recovery and, A51.7; S19.3; S44.21	A43.4	microbial growth, A23.1
indirect, A51.1, 3; S19.2; S44.21	Fairs, A4.8	recirculation, A23.3
psychrometrics, A51.1, 11, 16, 17	Family courts, A8.3. (See also Juvenile	storing, A23
staged	facilities)	carbon dioxide, F11.3
booster refrigeration, A51.8, 16	Fan-coil units, S3.2	fungi, F11.2
two-stage (indirect/direct), A51.10, 16;	capacity control, S3.4	growth, F11.6
S19.4	performance under varying load, S3.6	grain aeration, A23.9; F11.11
water treatment, A48.9; S19.8	two-pipe systems, S3.5	insects, F11.3, 8

moisture content, F11.1, 5	test methods, S24.2	devices, A37.12
moisture migration, A23.9; F11.2	types, S24.6	district heating and cooling systems, S11.32
oxygen, F11.3	ultralow-penetration air (ULPA) filters,	flow nozzles, F14.20
rodents, F11.8	\$24.5, 7; \$25.2	hoods, F14.18
temperature, F11.3	viscous impingement, S24.6, 7	in conduits, F2.13
Faults, system	Filters, water, A48.7	orifice plates, A37.12; F14.20
frequency and costs, A38.5 reasons for detecting, A38.6	Finned-tube heat-distributing units, S32.1, 5 design, S32.3	positive-displacement meters, F14.22 rotameters, F14.21
f-Chart method, sizing heating and cooling	nonstandard condition corrections, \$32.3	turbine meters, A37.13; F14.22
systems, A33.20	rating, S32.3	ultrasonic, A37.13
Fenestration. (See also Windows)	Finned-tube heat transfer coils, F3.27	velocity impact meters, A37.13
air leakage, F31.56	energy recovery loops, S44.11	venturi meters, A37.13; F14.20
attachments, F31.43	two-phase flow in, F4.14	Fluid dynamics computations, F34.1
building envelopes, A43.6; F31.1	Fins, F3.24	Fluid flow, F2
codes, F31.65	Fire/smoke management, A52	analysis, E2.6
components, F31.1	in justice facilities, A8.3, 6	Bernoulli equation, F2.6
condensation resistance, F31.60	Firearm laboratories, A8.6	kinetic energy factor, F2.2
cooling load, F30.17	Fireplaces, \$29.4	pressure variation, F2.2
draperies, F31.47	chimney design, \$30.21	boundary layer, F2.4
durability, F31.64	Fire safety	cavitation, F2.14
energy flow, F31.3	clean space exhaust systems, A16.14	choking, F2.13 compressible, F2.13
energy performance, annual, F31.60	duct design, F35.11 fire and smoke dampers, A52.8	expansion factor, F2.13
exterior shading, F31.45 glazing (glass), F31.1	industrial exhaust gas cleaning, S25.29	pressure, F2.12
infiltration, A43.6	insulation fire resistance ratings, F26.5	continuity, F2.2
interior shading, F31.47	justice facilities, A8.3, 6	Darcy-Weisbach equation, F2.7
occupant comfort, F31.62	kitchens, A31.22	devices, F2.5
opaque elements, F31.42	laboratories, A14.11	discharge coefficients, F2.9
shading devices, F31.43	nuclear facilities, A26.2	drag, F2.5
solar angle, F31.15	penetration fire stopping, A52.1	friction factors, F2.7
solar heat gain, A43.6; F31.13, 36	smoke management, A52.1	incompressible, F2.10
standards, F31.65	thermal insulation, F26.4	laminar, F2.3
thermal radiation, F31.35	Fish, R19	measurement, A37.11, F2.10; F14.19
U-factors, F31.4, 6	fresh, R19.1	noise, F2.14
Fick's law, F5.1	frozen, R19.4	nonisothermal effects, F2.5
and moisture flow, F23.7	thermal properties, R9.1	parabolic velocity profile, Poiseuille,
Filters, air, S24	Fitness facilities. (See also Gymnasiums)	F2.3
(See also Air cleaners)	in justice facilities, A8.5	patterns, F2.4
air conditioners, room, S46.4	Fittings	pipe friction, F2.7
aircraft, A10.4, 9	duct fitting database, F35.8	properties, F2.1
clean spaces, A16.3, 8, 11	effective length, F2.9	Reynolds number, Re, F2.3
demisters, A26.7	halocarbon refrigeration systems, R2.10	section change losses, F2.7
desiccant dehumidifiers, \$22.7	loss coefficients, F2.8 local, F35.7	sensors, F15.9 separation, F2.4
dry, extended surface, S24.6 electronic, S24.5, 8	pipe	turbulent, F2.3
furnaces, S28.2	sizing, F36.1, 7	two-phase
high-efficiency particulate air (HEPA) filters,	standards, S41.2	boiling, F4.1
A26.3; S24.3, 5, 7; S25.2	tees, F36.7	condensation, F4.8
tests, S24.3	Fixed-guideway vehicles, A9.18 (See also Mass-	evaporation, F4.2, 4
hospitals, A7.2	transit systems)	pressure drop, F4.11
industrial air-conditioning, A12.7	Fixture units, A49.1, 23; F36.9	unsteady, F2.11
industrial exhaust gas	Flammability limits, gaseous fuels, F18.1	valve losses, F2.7, 9
fabric, S25.10	Flash tank, steam systems, S10.14	vena contracta, F2.4
granular bed, S25.14	Floors	wall friction, F2.3
installation, S24.9	coverings	Food. (See also specific foods)
kitchens, A31.3, 9	panel systems, S6.7	codes, R46.2
laboratories, A14.9	temperature comfort, F8.15	cooling and freezing times, R10.1
maintenance, S24.8	insulation, F24.2	cooling, R10.1
nuclear facilities, A26.3, 7	insulation, acoustic, F23.17	equivalent heat transfer dimensionality
panel, S24.6	moisture control, F24.10	R10.4
places of assembly, A4.1	slabs, heat loss, F29.12	estimating algorithms, R10.5
printing plants, A18.4	Flowers, cut	irregular shapes, R10.3
renewable media, moving-curtain, S24.7	air transport, R32.1, 3	slabs, cylinders, and spheres, R10.2
residential, A1.5 safety requirements, S24.12	cooling, R15.11 refigerators, R47.3	freezing estimating algorithms, R10.12
selection, S24.8	storage, temperatures, R11.12	geometric considerations
ships, A11.4	Flowmeters, A37.12; F14.17	equivalent heat transfer
standards, S24.3, 5	bypass spring impact meters, A37.13	dimensionality, R10.9
	-1 1 ~ 1	• •

equivalent sphere diameter,	firearm labs, A8.5, 6	Fruit juice, R25
R10.12	intake air quality, A8.6	Fruits
mean conducting path,	Fouling factor	dried
R10.12	condensers, water-cooled, S35.4	storage, R29.7
phase change, R10.8	coolers, liquid, S37.4	thermal properties, R9.1
Plank's equation, R10.7	Foundations	fresh
precooling, R10.8	insulation, A43.2; F24.2	air transport, R32.1
subcooling, R10.8	moisture control, A43.2	apples, storage, A51.14; R22.1
industrial freezing methods, R16.1	radon control, A43.3	apricots, R22.13
long-term storage, R27.7	Fountains, Legionella pneumophila control,	avocados, R23.8
microbial growth	A48.7	bananas, R23.5
control, R12.3	Fourier's law, F3.1	berries, R22.13
generalized, R12.1	and heat transfer, F23.2	cherries, sweet, R22.12
requirements, R12.2	Four-pipe systems, S3.11	citrus, A51.14; R23.1
plants, R27.3	load, S12.13	cooling, R15.1
poultry products	room control, S3.11	deciduous tree, R22
freezing, R18.5	zoning, S3.11	desiccation, R11.1
refrigeration, R18.1	Framing	deterioration rate, R11.1
processing facilities	materials, F31.2	display refrigerators, R46.8
contamination prevention, R12.3	solar gain, F31.38	figs, R22.13
dairy, R20.1	Freeze drying, A28.6	grapes, R22.8
fruits, R27.5	biological materials, R40.4	mangoes, R23.8
main dishes, R27.1	Freeze prevention. (See also Freeze protection	nectarines, R22.12
meat, R17.1	systems)	peaches, R22.12
organism destruction, R12.4	condensers, evaporative, S35.16	pears, R22.6
potato products, R27.5	coolers, liquid, S37.5	pineapples, R23.8
poultry, R18.1	cooling tower	plums, R22.11
precooked foods, R27.1	piping, S13.3	storage diseases, R22.1
refrigeration systems, R27.3, 4, 6	sump water, S36.10	strawberries, R22.13
regulations and standards, R12.5	energy recovery equipment, S44.7	thermal properties, R9.1
sanitation, R12.4	hydronic systems, S12.15	vine fruits, R22.1
vegetables, R27.3	insulation for, F26.2	frozen, R27.5
refrigeration	pipes, F24.14	Fuel cells, cogeneration, S7.36
dairy products, R20	solar energy systems, A33.24; S33.2, 18	Fuels, F18
eggs and egg products, R21.1	Freeze protection systems, A50.17, 19	altitude compensation, F18.3
fishery products, R19	Freezers	classification, F18.4
fruits, fresh, R22; R23	blast, R14.10; R16.1; R17.15, R47.3	combustion, F18
meat products, R17	household, R48.1	engines, S7.4
vegetables, R24	cabinet construction, R48.3	flammability limits, F18.1
refrigerators		gaseous, F18.4
commercial, R47	defrosting, R48.6 efficiency, R48.1	heating value, F18.3; S7.5
retail food store, R46.1	• •	•
•	refrigeration systems, R48.5	ignition temperature, F18.2
walk-in, R46.12	testing, R48.9 industrial, R16.1	liquid, F18.4
storage requirements		oil. See Oil, fuel
canned foods, R11.11	walk-in, R47.3	systems, S7.5
citrus fruit, R23.3	Freezing	solid, F18.7
commodities, R11.1	beverages, R10.7	turbines, S7.9
dried foods, R11.11	biomedical applications, R40.1	Fume hoods, laboratory exhaust, A14.3
fruit, R22	foods	Fungi, and farm crop storage, F11.6
thermal properties, R9	bakery products, R28.5	Furnaces, S28
enthalpy, R9.7	egg products, R21.9	air cleaners and filters, \$28.2
heat of respiration, R9.18, 19, 20	fish, R19.5	airflow configurations, \$28.2
ice fraction, R9.2	freezing time calculations, R10.7	air supply, \$30.22
surface heat transfer coefficient,	ice cream, R20.15	burners, S26.1; S28.1
R9.25	meat products, R17.16	casings, S28.1
thermal conductivity, R9.9, 12, 16	poultry products, R18.5	codes, S28.10
thermal diffusivity, R9.17	processed and prepared food,	commercial, S28.8
transpiration coefficient, R9.19, 25	R27.1	control, S28.1, 7
water content, initial freezing point, R9.2	industrial, R16.1	derating, S26.3
Food service	soil, R36.3, 4	duct furnaces, S26.2; S28.8
refrigerators for, R47.1	Friction, in fluid flow	efficiency, \$28.5
service water heating, A49.13, 19	conduit, F2.7	electric, S28.4, 6, 8
vending machines, R47.5	wall, F2.3	fans and motors, S28.2
Forced-air systems, residential, A1.1	Friction losses, F35.7	floor furnaces, S28.9; S29.2
multifamily, A1.5	duct design, F35.4	gas-fired, S28.5, 6
Forensic labs, A8.5	fittings, F36.1, 7	codes, S28.10
autopsy rooms, A8.5, 6	roughness factors, F35.8	commercial, S28.8
critical spaces, A8.3, 6	valves, F36.1, 87	installation, S28.10

Composite Index I.19

residential, S28.1	disposal, A32.4	and insulation, F23.17
standards, S28.10	temperature, A32.1, 3	in justice facilities, A8.3
humidifiers, S28.2	ground-source heat pump (GSHP) systems,	and moisture problems, F23.5
installation practices, S28.10	A32.10, 27; S8.4	silicosis, F9.5
natural gas, S26.1; S28.1, 5, 6	heat exchangers, A32.6, 26	synthetic vitreous fibers (SVFs), F9.5
draft hoods, S28.2	heat pumps, A32.10	Health care facilities, A7. (See also specifi
residential, S28.1, 6	materials performance, A32.5	types)
capacity ratings, S28.6	resources, A32.1	Heat
combustion system, S28.3	valves, A32.7	animal production, F10.2, 7
efficiency, S28.5, 7	water wells	flow rates, F30.1
heat exchangers, \$28.1	flow rate, A32.3	latent
vent dampers, S28.2, 7	pumps, A32.6, 25	respiratory loss, F8.4
venting, S28.2; S30.19	terminology, A32.24	skin loss, F8.3, 10
oil, \$28.4, 8	water quality testing, A32.4	sensible
venting, S30.20 propane, S28.4, 8	Geothermal heat pumps (GHP), A32.10 Glazing	respir <del>at</del> ory, F8.4 skin, F8.3
regulating agencies, S28.10	angular averaging, F31.25	space extraction rate, F30.2
residential, A1.3; S28.1	coated, F31.22	timers, S10.13
annual fuel utilization efficiency (AFUE),	glass, F31.1	Heat balance (HB), S8.19
S28.5	planar, F31.50	air, F30.21
efficiency, S9.12	plastic, F31.40	conduction transfer function, F30.22
floor furnaces, S29.2	solar-optical properties, F31.18	equations, F30.22
indoor or outdoor, S28.3	spectral averaging, F31.24	input procedure, F30.23
selection, S28.5	spectral range, F31.35	load calculations
selection, S28.5, 9	systems, F31.42	cooling, F30.18
standards, S28.10	GLFs. See Glass load factors (GLFs)	nonresidential, F30.1
stokers, S26.9	Glycols	model, F30.18
thermal storage, A34.13	coolants, secondary, F21.4	studies, S8.19
venting, S30.19, 20	desiccant solution, S22.2	surface, F30.19
wall furnaces, S29.1	Gobal warming potential (GWP), R5.1	Heat capacity, F23.1
Gallaries. See Museums, galleries, archives,	Graetz number, F3.14	Heaters, S29
and libraries	Grain. (See also Farm crops)	automobiles, A9.5
Garages	drying, F11.12	catalytic, S29.1
automotive repair, A13.19	insects, F11.3	control, S29.2, 4
bus, A13.20	storage moisture, F11.2	direct-contact, S14.6
contaminant criteria, A13.17	Grashof number, F3.14	electric, S15.2; S29.3
parking, A3.10; A13.17 ventilation	Greenhouses. (See also Plant environments)	fireplaces, \$29.4
airflow rate, A13.17	evaporative cooling, A51.15 heating, F10.15	gas, S15.1; S26.2; S29.1 control valves, S29.2
control, A13.18	plant environments, A22.10	efficiency requirements, S29.2
equipment, A13.31	supplemental irradiance, F10.20	infrared, S15.1
system configuration, A13.19	Grids, for computational fluid dynamics, F34.4	room, S29.1
Gases	Ground-coupled heat pumps (GCHP)	thermostats, S29.2
compressed, storage, A14.8	closed-loop ground-source, A32.10	wall furnaces, S29.1
drying, S22.11	heat exchanger, S45.10	hot-water, S31.4
liquefaction, R38.6	Ground-source heat pumps (GSHP), A32.1, 9	hydronic snow melting, A50.12
purification, R38.16, 19	Groundwater heat pumps (GWHP), A32.23	infrared, S15.1; S26.2; S28.9
separation	GSHP. See Ground-source heat pumps	indirect, S26.2
gaseous oxygen, R38.18	(GSHP)	oil-fired, S15.3
Gibbs phase rule, R38.16	Guard stations, in justice facilities, A8.4	radiant, A53.1, 4, 8
Gas-fired equipment, S30	GWHP. See Groundwater heat pumps	in-space, S29.1
(See also Natural gas)	(GWHP)	kerosene, S29.3
noise, F18.16	GWP. See Global warming potential (GWP)	oil, S15.3; S29.3
Gas vents, S30.1	Gymnasiums, A4.5; A6.4	radiant, S26; S29
GCHP. See Ground-coupled heat pumps	HACCP. See Hazard analysis and critical	electric, \$15.2
(GCHP)	control point (HACCP)	gas-fired, S15.1; S26.2; S29.1
Generators	Halocarbon	infrared, S26.2; S28.9
absorption units, R41.1, 10	coolants, secondary, F21.12	oil-fired infrared, S15.3
cogeneration, S7.28  Geothermal energy, A32	refrigerant systems, R2.1  Hartford loop, S10.3	panels, S29.4
corrosion control, A32.6	<b>Hay</b> , drying, A23.7; F11.11	quartz, S29.4 residential, S29.1
direct-use systems, A32.3	Hazard analysis and critical control point	room, S29.1
cooling, A32.9	(HACCP), R12.4	solid fuel, S29.4
equipment, A32.5	Hazen-Williams equation, F36.1	standards, S29.6, 7
heating, A32.8	HB. See Heat balance (HB)	steam, S31.4
service water heating, A32.9	Health	stoves, S29.5
district heating, A32.8	asbestosis, F9.5	testing, S29.7
geothermal fluids, A32.1	coalworker's pneumoconiosis, F9.5	unit, S26.2; S28.9; S31.4

control, S31.7	calculation,	air-to-water, S8.6, 9
location, S31.6	solar heat gain coefficient (SHGC),	balance point, S45.8
maintenance, S31.7	F30.20	compressor selection, S45.9
piping, S31.7	standard air values, F30.9	control, S45.10
ratings, S31.6	electric motors, F30.4	defrost cycle, S45.9
selection, S31.4	engine test facilities, dynamometers, A15.1	installation, S45.10
sound level, S31.6	fenestration, F30.17	refrigerant circuits, S45.9
types, S31.6	floors, F30.27	selection, S45.8
ventilators, S31.1	hospital and laboratory equipment, F30.8	boosters, A34.13
water, A49	humans, F30.3	cascade systems, S8.6
Heat exchangers, S43	laboratories, A14.2	components, S8.6
air-to-air energy recovery, S44.1	latent, permeable building materials, F30.13	compression cycles, S8.1
heat pipes, S44.13	lighting, F30.3	control, A46.16; S8.7, 8
rotary enthalpy wheels, \$44.10	office equipment, F30.8	efficiency, S45.5
thermosiphon, S44.14	radiant panels, S6.8	engine-driven, S7.44
animal environments, A22.4	space, F30.1	ground-source
antifreeze effect on, S12.16	Heating	ground-coupled, A32.10, 12; S8.14;
chimneys, S30.26	absorption equipment, R41.1	\$45.10
counterflow, F3.28; S43.1	animal environments, A22.4	heat transfer analysis, A32.13
district heating and cooling, S11.27	equipment, S4.1; S26; S33; S45	horizontal systems, A32.11, 18
double-wall construction, \$43.3	baseboard units, S32.1	vertical systems, A32.10, 12
effectiveness, capacity rate ratio, F3.28	boilers, S27.1	water loop, S8.14
enhanced surfaces, F4.14	convectors, S32.1	groundwater, A32.11, 23; S45.10
external, \$33.16	finned-tube units, S32.1	surface water, A32.11, 27; S45.10
fouling, S43.5	furnaces, S28.1	terminology, A32.10
freeze protection, S33.18	radiators, S32.1	heat recovery heat pumps, \$8.9
furnaces, S28.1	geothermal energy systems, A32.8	design principles, S8.12
geothermal energy systems, A32.6, 26	greenhouses, A22.11; F10.15	waste heat recovery, \$8.13
halocarbon refrigeration systems, R2.29	industrial environments, A12.6	heat sources and sinks, S8.2, 4
heat transfer, S43.1	infrared, S15.1	ice-source, R34.6
installation, S43.5	radiant, A53.1, 8	industrial process, S8.8
liquid suction, R2.29	load calculations	closed-cycle systems, \$8.9
number of transfer units (NTU), F3.28	nonresidential, F30.26	design, S8.12
parallel flow, F3.28	residential, F29.11	heat recovery, S8.8, 9
performance, S33.16	nonresidential, \$12.10	open-cycle systems, S8.11
plate, F3.30; R2.29; S37.2	places of assembly, A4.1	semi-open-cycle systems, \$8.11
boiling in, F4.7	plant growth chambers, A22.17	packaged terminal heat pumps (PTHPs),
brazed, S11.28; S43.3	power plants, A25.10	S46.5
components, S43.4	residential, A1.1	testing, S46.7
gasketed, S11.28; S43.3	solar energy, S33.1	residential, A1.2
plate-and-frame, S11.28; S33.16	systems	room, S46.1
pressure drop in, F4.13	all-air, S2.2, 3	split systems, S45.1
welded, S11.28; S43.3	selection, S1.1	supplemental heating, \$8.8
selection, S43.5	small forced-air, S9.1	through-the-wall, S5.2
shell-and-coil, R2.29; S11.28; S43.2	dynamic simulation model (HOUSE),	types, S8.4
shell-and-tube, R2.29; S11.28; S37.1, 2	S9.12	unitary, S45.1
components, S43.4	solar energy, A33.16, 26	application, S45.1
converters, S43.2	space requirements, S1.5	certification, S45.5
straight-tube, S43.2	steam, \$10.1	codes, \$45.5
tube-in-tube, R2.29; S33.16; S37.1	thermal storage, A34.11	desuperheaters, S45.2
U-tube, \$43.2	Heating load	installation, S45.2
systems	calculations, F30.31	space conditioning/water heating, S45.3
solar energy, A33.12; S33.15,	central plant, \$4.2	standards, S45.5
steam, S10.3	residential calculations, F29.11	types, S45.2
water, medium- and high-temperature,	Heating values of fuels, F18.3, 6, 8	water heaters, A49.3, 25
S14.8	Heat loss. (See also Load calculations)	water-source
Heat flow, F23. (See also Heat transfer)	basement, F29.12	certification, S45.11
and airflow, F23.8	crawlspaces, F29.13	design, S45.11
through flat building component, F23.4	floor slabs, F29.12	entering water temperature, S45.11
and moisture, F23.5, 8	latent heat loss, F29.13	groundwater, A32.11, 23; S45.10
apparent conductivity, F23.14	radiant panels, S6.8	indirect systems, A32.26
hygrothermal modeling, F23.8	Heat pipes, air-to-air energy recovery, S44.13	surface water, A32.11, 27
paths, series and parallel, F23.4	dehumidifiers, S47.5	closed-loop heat pumps, A32.28;
terminology, F23.1	Heat pumps	S45.10
variation, F23.3	absorption, R41.3	lake heat transfer, A32.27
Heat flux, radiant panels, S6.2	air-source, S45.1, 8	open-loop heat pumps, A32.27
Heat gain. (See also Load calculations)	add-on, S45.8	testing, \$45.11
appliances, F30.6	air-to-air, S8.4, 9	water loop, S8.14; S45.10

water-to-air, S8.4	internal, F3.14	doors, F25.14
water-to-water, \$8.6	laminar sublayer, F3.2	floor slabs, F29.12
window-mounted, S5.2	natural, F3.2, 16	pipes
Heat recovery. (See also Energy recovery)	turbulent region, F3.1	buried, F25.18
balanced heat recovery, S8.18	definition, F23.1	properties, F25.1
cascade systems, S8.13	diffuse radiation, F3.12	slab-on-grade construction, F25.15
cogeneration, \$7.19	district heating and cooling pipes, S11.9	soils, F25.15
coils, S23.3	effectiveness, F3.28	windows, F25.14
combustion turbines, S7.25	extended surfaces, F3.23	Heat traps, A49.2
evaporative cooling, A51.7; S19.3; S44.21	factor, friction, F3.14	Helium
heat-activated chillers, \$7.27	film	in air, F6.1
heat balance, S8.19	coefficient, F23.1	in cleanroom airflow modeling, A16.4
heat pumps, S8.9	resistance, F23.1, 2	in cryogenics, R38.1
industrial exhaust systems, A30.7	fins, F3.23, 25	recovery, R38.18
kitchen ventilation, A31.21	forced convection	in heat pipes, \$44.13
laboratories, A14.19	air coolers, F3.13	in leak testing, R8.2; R45.4
liquid chillers, S38.3, 11	solid-to-fluid, F3.2	properties, F19.2; F20.58, 59; F39.1
multiple buildings, \$8.21	Fourier's law, F23.2	in stirling engines, \$7.37
reciprocating engines, \$7.21	ground, F32.7	and thermal radiation, F3.12
retail food store refrigeration, R46.18	ground loops, A32.13	High-efficiency particulate air (HEPA) filters,
		•
service water heating, A49.4	heat exchangers, \$43.1	A26.3; S24.7; S25.2
steam	insulation, F14.31	High-temperature short-time (HTST)
systems, \$10.3, 14	lakes, A32.27	pasteurization, R20.2
turbines, S7.26	mass transfer	High-temperature water (HTW) systems,
supermarkets, A2.4	convection, F5.5	S12.1
terminology, S8.1	molecular diffusion, F5.2	Homeland security. See Chemical, biological,
waste heat, \$8.13	simultaneous with, F5.9	radiological, and explosive (CBRE) incidents
water loop heat pump systems, \$8.14	cooling coils, F5.12	Hoods
Heat storage. See Thermal storage	number of transfer units (NTU), F3.28	draft, S28.2; S30.25
Heat stress	radiant balance, F3.12	gaseous contaminant control, A45.5
index (HSI), A29.5; F8.20	radiation	industrial exhaust systems
industrial environments, A29.4	actual, gray, F3.2, 8	capture velocities, A30.2
thermal standards, A29.4	angle factor, F3.10	compound hoods, A30.5
Heat transfer, F3; F23. (See also Heat flow)	Beer's law, F3.12	design principles, A30.3
across air space, F23.3	blackbody, F3.1, 8	entry loss, A30.3
air infiltration, effect of, F23.16	spectral emissive power, F3.8	overhead hoods, A30.5
animal environments, F10.3	coefficient, F3.18	sidedraft hoods, A30.5
antifreeze effect on water, S12.16	energy transfer, F3.8	volumetric flow rate, A30.2
augmentation	exchange between surfaces, F3.11	kitchen exhaust, A31.27
active, F3.20	gray surface, F3.8	ductless, A31.9
passive, F3.19	hemispherical emissivity, F3.8	recirculating systems, A31.9, 13
chimneys, fireplaces, and gas vents, \$30.6	in gases, F3.12	residential, A31.27
coefficients, F31.5	Kirchoff's law, F3.9	type I, A31.3
condensation, F4.9	monochromatic emissive power, F3.8	type II, A31.3, 8
convective, F8.7	net, F3.8	laboratory fume, A14.3
convective evaporation, F4.6	Stefan-Boltzmann	sound control, A47.27
evaporative, F8.8	law, F3.8	unidirectional, A16.8
foods, R9.25	relation, F3.1	Hospitals, A7.2
Lewis relation, F8.4	thermal, F3.1	air conditioning, A7.2
low-temperature, R39.9	Wien's displacement law, F3.8	air movement, A7.3
overall, F3.18	simultaneous, F5.9	air quality, A7.2
pool boiling, F4.3	snow-melting systems, A50.1	cooling, A7.13
coils	fluids, A50.10	design criteria
air-cooling and dehumidifying, S21.7	solar energy systems, A33.11	administration, A7.11
air-heating, S23.4	steady-state, F23.2	ancillary spaces, A7.9
condensers, S35.2	terminology, F23.1	autopsy rooms, A7.10
conductance, F3.18	transient	diagnostic and treatment, A7.11
conduction, F3.1, 2	cooling time estimation, F3.5	infectious isolation, A7.8
shape factors, F3.2	cylinder, F3.5	intensive care units, A7.8
control, F23.1	multidimensional, F3.5	laboratories, A7.9
convection	performance, F23.4	nursery suites, A7.8
buffer layer, F3.2	radiation, F3.3	nursing areas, A7.8
coefficient, F3.2	slab, F3.5	operating rooms, A7.5
		humidity, \$20.2
effect of, F23.16	sphere, F3.5 temperature distribution, F3.5	patient rooms, A7.8
external, F3.13	•	pharmacies, A7.10
flow, fully developed laminar, F3.14	water, \$12.2	protective isolation, A7.8
forced, boundary layer, F3.13	Heat transmission	•
free, F3.2, 16	below-grade construction, F25.15	recovery rooms, A7.8

service areas, A7.11	plant environments, F10.20	sampling, F9.8
sterilizing and supply, A7.11	sensors, F15.8	sources, F9.6
surgery and critical care, A7.5	sound transmission affected by, S20.2	environmental tobacco smoke (ETS), F9.6
energy conservation, A7.13	static electricity affected by, S20.2	gaseous contaminant control, A45.1
heating and hot-water standby, A7.12	Hydrogen	hospitals, A7.2
indoor air quality (IAQ), A7.2	liquid, R38.2	hotels and motels, A5.6
infection sources and control, A7.2	properties, F19.2; F20.54; F39.1	infiltration, F27.9
insulation, A7.13	Hydronic systems	kitchens, A31.13
Legionella pneumophila, A7.2	capacity control, A46.20	modeling, F34.1
pressure relationships and ventilation, A7.4	central multifamily, A1.5	particulate matter, F9.4
smoke control, A7.5	cogeneration, S7.33	polycyclic aromatic compounds (PAC), F9.6
zoning, A7.12	heating and cooling design, S12.1	polycyclic aromatic hydrocarbons (PAH),
Hot-box method, of thermal modeling, F23.4	heat transfer vs. flow, A37.6, 7	F9.6
Hotels and motels, A5	pipe sizing, F36.6	radon action levels, F9.16
accommodations, A5.3	residential, A1.3	sensors, F15.9
back-of-the-house (BOTH) areas, A5.6	snow melting, A50.10	standards, F9.9
central plant, A5.7	testing, adjusting, balancing, A37.6, 8	synthetic vitreous fibers, F9.5
design criteria, A5.1	water treatment, A48.10	ventilation, F27.9
guest rooms, A5.3	Hydronic units, S32. (See also Water systems)	volatile organic compounds (VOC), F9.8  Indoor environmental health, F9. (See also
indoor air quality (IAQ), A5.6 load characteristics, A5.1	baseboard, S32.1, 3, 5 convectors, S32.1, 3, 5	Indoor air quality)
makeup air units, A5.7	finned-tube, S32.1, 3, 5	Indoor an quarty) Indoor environmental modeling, F34
public areas, A5.6	heaters, S31.4	computational fluid dynamics (CFD), F34.1
service water heating, showers, A49.12, 19	makeup air, S31.9	contaminant transport, F34.16
sound control, A5.7	pipe coils, S32.1	multizone network, F34.14
systems, A5.2	radiant panels, S6.11; S32.6	verification and validation, F34.17
Hot-gas bypass, R2.34	ceiling, S6.13	Induction
HOUSE dynamic simulation model, S9.12	design, S6.11	air-and-water systems, A37.5
Houses of worship, A4.3	floor, S6.15	units under varying load, S3.6
HSI. See Heat stress index (HSI)	wall, S6.15	Industrial applications
HTST. See High-temperature short-time	radiators, S32.1, 2, 5	burners
(HTST) pasteurization	ventilators, S31.1	gas, S26.2
Humidification, S20	Hygrometers, F14.10, 10; F15.8	oil, S26.5
air washers, S19.6	Hygrothermal modeling, F23.8	gas drying, S22.11
all-air systems, S2.4, 6	IAQ. See Indoor air quality (IAQ)	heat pumps, S8.8
control, A46.13, 14; S20.1	Ice	humidifiers, S20.6
design, S20.3	commercial, R34.6	process drying, S22.11
direct evaporative cooling, A51.2	delivery systems, R34.5	process refrigeration, R37.1
evaporative coolers, \$19.6	manufacture, R34.1	thermal storage, A34.17
load calculations, S20.4	storage, R34.4	service water heating, A49.23
Humidifiers, S20	thermal storage, A34.7; R34.3	steam generators, A25.4
all-air systems, S2.6	Ice makers	Industrial environments, A12; A29; A30
bacterial growth, S20.1	commercial, R47.6	air conditioning, A12
central air systems	heat pumps, R34.6	cooling load, A12.5
industrial and commercial, S20.6, 7	household refrigerator, R48.3	design, A12.5
residential, S20.5	large commercial, R34.1	evaporative systems, A12.7
commercial, S20.6	storage, R34.4	maintenance, A12.8
controls, S20.8	thermal storage, R34.3	refrigerant systems, A12.7
energy considerations, \$20.3	types, R34.1	spot cooling, A29.3, A51.12
equipment, S20.4	water treatment, A48.7, 9	ventilation, A29.1
evaporative cooling, \$20.7	Ice rinks, A4.5; R35	air distribution, A29.2
furnaces, S28.2	conditions, R35.4	air filtration systems, A12.7; S24.2; S25.1
industrial, S20.6	dehumidifiers, \$47.4	contaminant control, A12.5, 8
Legionella pneumophila control, A48.7	energy conservation, R35.5	energy conservation, A29.6
load calculations, S20.3	floor design, R35.7	energy recovery, A29.6
nonducted, S20.6	heat loads, R35.2	evaporative cooling, A51.12
portable, \$20.6	pebbling, R35.10	heat control, A29.4
residential, A1.5; S9.1; S20.5	refrigeration, R35.5	heat exposure control, A29.5
scaling, S20.4	surface building and maintenance, R35.9	heating systems, A12.6
supply water, \$20.4	water quality, R35.10	heat stress, A29.4
terminal, S2.12	ID <sub>50</sub> , mean infectious dose, A58.4	local exhaust systems, A29.5; A30.1
Humidity building envelope affected by, S20.2	Ignition temperatures of fuels, F18.2 IGUs. See Insulating glazing units (IGUs)	air cleaners, A30.7 airflow near hood, A30.3
control, A46.13; F22.1; F24.4; S20.1; S22.1	Indoor air quality (IAQ)	air-moving devices, A30.7
disease prevention and treatment, \$20.1	(See also Air quality)	ducts, A30.5; S25.28
human comfort conditions, S20.1	bioaerosols	energy recovery, A30.7
measurement, F14.10	health effects, F9.7	exhaust stacks, A30.7
odors affected by, F13.2	particles, F9.4	fans, A30.7

Composite Index I.23

hoods, A30.2	description, S3.2	installation, R33.7
operation and maintenance, A30.8	induction systems, S3.2	jacketing, R33.7
system testing, A30.8	performance under varying load, \$3.6	joint sealant, R33.4
process and product requirements, A12.1	primary air, \$3.6	maintenance, R33.9
spot cooling, A29.3, 5	refrigeration load, S3.7	vapor retarders, R33.4
thermal control, A12.4	ventilation air, S3.5	refrigerated facilities, R13.1; R14.12
ventilation systems, A29.1	Insects, farm crop storage, F11.8	roof deck construction, F24.3
ndustrial exhaust gas cleaning, S25	Instruments, F14. (See also specific instruments	roofs, A43.5
(See also Air cleaners)	or applications)	safety issues, F23.17
auxiliary equipment, \$25.28 equipment selection, \$25.1	Insulating glazing units (IGUs), F31.1 Insulation, electrical, R5.8	smoke developed index, F26.4 solar energy systems, S33.7, 13
gaseous contaminant control, \$25.17	Insulation, thermal	steel frame construction, F24.1, 2
absorption, \$25.17	airflow retarders, F23.17	tanks, vessels, and equipment, F26.11
adsorption, S25.24, 26	heating climates, F24.5	thermal bridging, F24.2
incineration, S25.27	mixed climates, F24.7	thermal conductivity, F26.6
spray dry scrubbing, S25.18	warm/humid climates, F24.8	thermal control, F24.1
wet-packed scrubbers, S25.18, 24	animal environments, A22.4	thermal storage systems, water, A34.6
gas stream, S25.2	apparent thermal conductivity of, F23.14	types, F23.14
monitoring, S25.1	below-ambient system, R33.2	walls, A43.4
operation and maintenance, S25.29	ceilings, A43.5	water absorption, F26.6
particulate contaminant control, S25	clothing, F8.8	water vapor permeability, F26.6
collector performance, \$25.3	compressive resistance, F26.6	water vapor permeance, F26.6
electrostatic precipitators, \$25.8	condensation control, F26.2	water vapor retarders, F23.17, 18; F26.8
fabric filters, S25.10 inertial collectors, S25.4	and convection, effects of, F23.16	weather protection, F26.6
scrubbers (wet collectors), \$25.15	corrosion under, F26.5 cryogenic, R38.23	weather protection, F26.6 wood frame construction, F24.1
settling chambers, \$25.3	ducts, F24.15, F26.11; F35.11; S16.6	Integrated building design (IBD), A57.1
regulations, S25.1	flexible, F26.9	budgeting, A57.5
safety, S25.29	process, F26.11	commissioning, A57.8
scrubbers (wet collectors), \$25.15	economic thickness	communication, A57.5
ndustrial hygiene, F9.3	mechanical systems; F26.1	construction
nfiltration. (See also Air leakage)	energy conservation, F26.1	contract administration, A57.7
air exchange, R13.4	fire resistance ratings, F26.5	document phase, A57.8
rate, F27.3, 10	fire safety, F26.4	post-construction activities, A57.8
air leakage	flame spread index, F26.4	design
air-vapor retarder, F27.14	floors, F24.2	basis, A57.6
building data, F27.13	foundations, A43.2; F24.2	criteria, A57.6
controlling, F27.14	freeze protection, F26.2	development, A57.8
calculation, residential, F27.20 climatic zones, F27.16	green buildings, F26.1 heat gain, F26.14	intent, A57.8 team, A57.5, A57.7
commercial buildings, F27.23	heat loss, F26.14	design-phase contract, A57.1
direct flow through doorways, R13.6	heat transfer, F14.31	documentation, A57.7
driving mechanisms, F27.10	hospitals, A7.13	drawings, A57.7
examples, F27.21	insertion loss, F26.4	energy modeling, A57.4
fenestration, F31.56	limited combustible, F26.5	objectives, A57.1
indoor air quality (IAQ), F27.9	masonry construction, F24.2	organization, A57.4
infiltration degree-days, F27.10	materials, F23.13; F26.6	programming, A57.4
leakage function, F27.12	cellular, F26.6	project
measurement, F14.22	fibrous, F26.6	closeout, A57.8
refrigerated facilities, R13.4	foil, scrim, and kraft paper (FSK),	delivery, A57.8
residential buildings, F27.12	F26.9	design, A57.6
terminology, F27.1	foil-reinforced kraft (FRK), F26.10	manual, A57.7
thermal loads, F27.9 ventilation, R46.4	granular, F26.6 reflective, F26.6	predesign, A57.8 quality assurance/quality control (QA/QC),
nfrared applications	moisture control, F24.1	A57.5
comfort, F8.22, 23	noise control, F23.17; F26.3	schematic design, A57.1
drying, A28.3	noncombustible, F26.5	specifications, A57.7
energy generators, S15.1	operating temperature, F26.6	training, A57.5
greenhouse heating, A22.12	performance, F24.3	Integrated design process (IDP), A57.1
heaters, A53.1, 4, 8; S15.1	personnel protection, F26.2	Intercoolers, ammonia refrigeration systems,
electric, S15.2	pipes, F26.9	R3.3
gas-fired, S15.1; S26.2	economic thickness, S11.16	Jail cells, A8.5
industrial environments, A12.7	hangers, F26.9	Jails, A8.3
oil-fired, \$15.3	underground, F24.14, F26.10; S11.7	Joule-Thomson cycle, R38.6
system efficiency, S15.4	properties, F23.14, 17	Judges' chambers, A8.4
snow-melting systems, A50.16	reflective, F23.3	Juice, R25.1
n-room terminal systems	refrigerant piping, R33.1	Jury facilities, A8.4
changeover temperature, S3.7	design, R33.1	Justice facilities, A8

control rooms, A8.3, 4	prevention of fire spread, A31.24	Large eddy simulation (LES), turbulence
controls, A8.3	protection, A31.22	modeling, F34.3
courthouses, A8.4	residential, A31.28	Laser Doppler anemometers (LDA), F14.17
courtrooms, A8.4, 4	grease removal, A31.3, 9	Laser Doppler velocimeters (LDV), F14.17
dining halls, A8.4	heat recovery, A31.21	Latent energy change materials, A34.2
energy considerations, A8.2	indoor air quality (IAQ), A31.13	Laundries
fire/smoke management, A8.3	in justice facilities, A8.4	evaporative cooling, A51.13
fitness, A8.5	integration and balancing, A31.18	in justice facilities, A8.4
forensic labs, A8.1, 5	maintenance, A31.26	service water heating, A49.21
guard stations, A8.3, 4	makeup air systems	LCCP. See Life-cycle climate performance
health issues, A8.3	air distribution, A31.15	(LCCP)
heating and cooling plants, A8.2	maintenance, A31.26	LCR. See Load collector ratio (LCR)
jail cells, A8.5	replacement, A31.13	LD <sub>50</sub> , mean lethal dose, A58.4
jails, A8.3	residential, A31.28	LDA. See Laser Doppler anemometers (LDA)
judges' chambers, A8.4, 4	operation, A31.25	LDV. See Laser Doppler velocimeters (LDV)
jury rooms, A8.4	residential, A31.27	LE. See Life expectancy (LE) rating
juvenile, A8.1	service water heating, A49.7	Leakage, ducts, F35.11; S16.2
kitchens, A8.4	ventilation, A31	Leakage function, relationship, F27.12
laundries, A8.4	Kleemenko cycle, R38.13	Leak detection of refrigerants, F19.7; R8.2
libraries, A8.3, A8.5	Krypton, recovery, R38.17	methods, R45.4
police stations, A8.1	Laboratories, A14	Legionella pneumophila, A48.6
prisons, A8.3	air distribution, A14.9	air washers, S19.8
system requirements, A8.1	air filtration, A14.9	control, A48.7
terminology, A8.1	air intakes, A14.13	cooling towers, S36.12, 13
types, A8.1	animal labs, A14.14	decorative fountains, A48.7
U.S. Marshals, A8.5	cage environment, A22.9	evaporative coolers, S19.8
uvenile facilities, A8.1. (See also Family	heat and moisture production, F10.14	hospitals, A7.2
courts)	ventilation performance, A22.9	Legionnaires' disease, A48.6
<b>-12 schools</b> , A6.3	biological safety cabinets, A14.6	service water systems, A49.9
elvin's formula, F23.8	biosafety levels, A14.17	Legionnaires' disease. See Legionella
irchoff's law, F3.9	clean benches, A14.8	pneumophila
itchens, A31	cleanrooms, A16.1	LES. See Large eddy simulation (LES)
air balancing, A31.18	clinical labs, A14.18	Lewis relation, F5.8; F8.4
multiple-hood systems, A31.20	commissioning, A14.19	Libraries. See Museums, galleries, archives,
air conditioning, A3.5, 6	compressed gas storage, A14.8	and libraries
air filtration, A31.3, 9	containment labs, A14.16	Life-cycle climate performance (LCCP), R5.1
controls, A31.27	controls, A14.12	Life expectancy (LE) rating, film, A20.3
cooking effluent	design parameters, A14.2	Lighting
control of, A31.9	duct leakage rates, A14.10	animal environments, F10.3
generation of, A31.1	economics, A14.19	cooling load, F30.3
plume, A31.1	exhaust devices, A14.8	greenhouses, A22.14
thermal plume behavior, A31.2	exhaust systems, A14.10	heat gain, F30.3
dishwashers, piping, A49.7	fire safety, A14.11	plant environments, A22.17; F10.18
energy conservation	fume hoods, A14.3	return air light fixtures, F30.4
economizers, A31.21	controls, A14.13	sensors, F15.9
reduced airflow, A31.22	performance, A14.4	Light measurement, F14.29
residential hoods, A31.28	hazard assessment, A14.2	LIMS. See Laboratory information
restaurants, A31.21	heat recovery, A14.19	management systems (LIMS)
exhaust hoods, A31	hospitals, A7.9	Linde cycle, R38.6
ductless, A31.9	loads, A14.2	Line sizing for halocarbon systems, R2.2
recirculating systems, A31.9, 13	nuclear facilities, A26.9	Liquefied petroleum gas (LPG), F18.4
residential, A31.27	paper testing labs, A24.3	Liquid overfeed (recirculation) systems, R1
systems, A31.2	radiochemistry labs, A14.18	ammonia refrigeration systems, R3.21
type I, A31.3	safety, A14.2, 11	circulating rate, R1.3
type II, A31.3, 8	scale-up labs, A14.17	evaporators, R1.6
exhaust systems, A31.2, 9, 28	stack heights, A14.13	line sizing, R1.7
ducts, A31.12; S16.5	supply air systems, A14.9	liquid separators, R1.7
effluent control, A31.9	system maintenance, A14.18	overfeed rate, R1.3
fans, A31.12	system operation, A14.18	pump selection, R1.5
fire safety, A31.9	teaching labs, A14.18	receiver sizing, R1.7
hoods, A31.2	types, A14.1	recirculation, R1.1
maintenance, A31.26	ventilation, A14.8	refrigerant distribution, R1.2
multiple-hood systems, A31.20, 24	Laboratory information management systems	terminology, R1.1
residential, A31.28	(LIMS), A8.7	Lithium bromide/water, F20.1, 69
terminations, A31.13	Lakes, heat transfer, A32.27	Lithium chloride, S22.2
fire safety, A31.22, 24	Laminar flow	Load calculations
fire suppression, A31.22	air, A16.4	air-and-water systems, S3.7
multiple-hood systems, A31.24	fluids, F2.3	cargo containers, R30.8

coils, air-cooling and dehumidifying, S21.15	requirements, R7.2	selection, S31.8
computer calculation, A39.5	separators, R44.22	standards, S31.9
humidification, S20.3	solubility	types, S31.9
hydronic systems, S12.2	air, R7.26	Malls, A2.6
nonresidential	hydrocarbon gages, R7.21	Manometers, differential pressure readout,
cooling, F30.1	refrigerant solutions, R7.9, 11, 13	A37.12
heating, F30.26	water, R7.26	Manufactured homes, A1.6
precooling fruits and vegetables, R15.1	stability, R7.27	airflow modeling example, F34.18
refrigerated facilities	synthetic lubricants, R7.3	Masonry, insulation, F24.2
air exchange, R13.4	testing, R7.1	(See also Building envelopes)
direct flow through doorways, R13.6	wax separation, R7.20	Mass transfer, F5
equipment, R13.6	Lubrication	convection, F5.4
infiltration, R13.4	combustion turbines, S7.10	eddy diffusion, F5.8
internal heat load, R13.3	compressors	<ul><li>Lewis relation, F5.8; F8.4</li></ul>
product, R13.3	centrifugal, S34.34	energy recovery, air-to-air, S44.5, 7
transmission, R13.1	reciprocating, S34.8	heat transfer simultaneous with, F5.9
residential	rotary, S34.10	air washers, F5.11
cooling, F29.8	single-screw, S34.12	cooling coils, F5.12
heating, F29.11	twin-screw, S34.20	cooling towers, F5.12
snow-melting systems, A50.1	engines, S7.6	dehumidifying coils, F5.12
Load collector ratio (LCR), A33.21	Mach number, S34.29	direct-contact equipment, F5.9
Local exhaust. See Exhaust	Maintenance. (See also Operation and	enthalpy potential, F5.9
Loss coefficients	maintenance)	molecular diffusion, F5.1
control valves, F2.9	absorption units, R41.7	in liquids and solids, F5.4
duct fitting database, F35.8	air cleaners, S24.8	two-film theory, S25.21
fittings, F2.8	air conditioners, retail store, A2.1	simultaneous, F5.9
flexible ducts, F35.8	air washers, \$19.7	Mass-transit systems
Louvers, F31.45, F35.13	chillers, S38.5, 12	buses, A9.12, 13
Low-temperature water (LTW) system, S12.1	cogeneration systems, S7.42	bus garages, A13.20
LPG. See Liquefied petroleum gases (LPG)	coils	bus terminals, A13.22
LTW. See Low-temperature water (LTW)	air-cooling and dehumidifying, S21.15	diesel locomotive facilities, A13.25
system	air-heating, S23.5	enclosed vehicular facilities, A13.1
Lubricants, R7. (See also Lubrication; Oil)	condensers, \$35	environmental control, A9.1
additives, R7.4	air-cooled, \$35.13	fixed-guideway vehicles, A9.12
ammonia refrigeration, R3.6	evaporative, \$35.19	rail cars, A9.12, 16
component characteristics, R7.3	water-cooled, S35.7	rapid transit, A9.16; A13.10
effects, R7.27	cooking equipment, A31.26	stations, A13.13
evaporator return, R7.18	coolers, liquid, \$37.6	thermal comfort, A9.12; A13.13
foaming, R7.26	cooling towers, \$36.11	thermal load analysis, A9.13; A13.14
halocarbon refrigeration	costs, A36.6	tunnels
compressor floodback protection, R2.31	documentation, A38.3	railroad, A13.14
liquid indicators, R2.32	energy recovery equipment, S44.7, 11	rapid transit, A13.10
lubricant management, R2.10	engines, S7.7	subway, A13.10
moisture indicators, R2.31	evaporative coolers, \$19.7	ventilation, A9.12; A13
purge units, R2.32	filters, air, S24.8	McLeod gages, F14.14
receivers, R2.32	gaseous air cleaners, A45.14	Mean infectious dose (ID <sub>50</sub> ), A58.4
refrigerant driers, R2.31	heat pumps, unitary, \$45.2	Mean lethal dose (LD <sub>50</sub> ), A58.4
separators, R2.30	industrial air-conditioning systems, A12.8	Mean radiant temperature (MRT), A53.1
strainers, R2.32	infrared heaters, \$15.5	Mean temperature difference, F3.28 Measurement, F14. (See also Instruments)
surge drums or accumulators, R2.31	kitchen ventilation systems, A31.25, 28	air exchange rates, F27.10
mineral oil	laboratory HVAC equipment, A14.18 liquid chillers; S38.15	airflow, A37.2
aromatics, R7.3 naphthenes (cycloparaffins), R7.2	makeup air units, \$33.10	air infiltration, F14.22
nonhydrocarbons, R7.3	management, A38	air leakage, F27.13
paraffins, R7.2	manual, A38.3	airtightness, F14.22
miscibility, R7.13	•	carbon dioxide, F14.23
moisture content, R45.1	solar energy systems, A33.24 terminology, A38.1	combustion analysis, F14.32
oxidation, R7.26	turbines	contaminants, F14.32
properties, R7.4	combustion, \$7.13	data acquisition, F14.32
* *	·	electricity, F14.24
floc point, R7.20 viscosity, R7.5	steam, S7.19 unit heaters, S31.7	fluid flow, A37.11; F2.10; F14.19
refrigerant	Makeup air units, S31.8	gaseous contaminants, A45.4
contamination, R6.7	applications, S31.9	heat transfer in insulation, F14.31
reactions with, R5.5	codes, S31.9	humidity, F14.10
solutions, R7.8	commissioning, S31.10	light levels, F14.19
density, R7.8	controls, A46.18; S31.9	moisture content, F14.30; R6.3
solubility, R7.9, 11, 13	design, S31.8	farm crops, F11.5
viscosity, R7.13	maintenance, S31.10	refrigeration systems, R45.3

moisture transfer, F14.30	thermal (hot-box method), F23.4	sorption isotherms, F14.30
odors, F13.5	validation, F32.31	in walls, A43.4
pressure, F14.13	Moist air, F6	water vapor retarders, F23.18; F27.14
rotative speed, F14.25	psychrometrics, F6.1	heating climates, F24.5
sound, F14.27	thermal conductivity, F6.19	mixed climates, F24.7
temperature, F14.4	thermodynamic properties	warm/humid climates, F24.8
thermal comfort, F14.29	standard pressure, F6.14	in windows, A43.7
uncertainty analysis, A40.12; F14.3	temperature scale, F6.2	Mold, F23.5
velocity, F14.15	transport properties, F6.19	Montreal Protocol, F19.1
vibration, F14.28	viscosity, F6.19	Motors, S40
Meat, R17	Moisture	codes, S40.1
display refrigerators, R46.7	animal production, F10.8, 14	compressors, S34.4
food processing, R17.1	in attics, F24.5	controls, S40.6
frozen, R17.16	in building materials, F23.6	efficiency, S40.2
packaged fresh cuts, R17.11	in buildings	evaporative cooling, A51.12
processing facilities	animal facilities, A22.2	field assembly and refrigerant contamination,
boxed beef, R17.7	commercial and institutional, F24.12	R6.8
carcass coolers	condensation prevention; F24.4	furnaces, residential, S28.2
beef, R17.2	envelope component intersections, F24.11	general purpose, \$40.2
calves, R17.10	humidity control, F24.4	hermetic, S40.4
hogs, R17.8	capacity, F23.2	burnout, R6.8, 8
lamb, R17.10	in cathedral ceilings, F24.5	integral thermal protection, \$40.4
energy conservation, R17.17	in ceilings, A43.6	power supply (ac), S40.1
pork trimmings, R17.10	combustion, F18.10	pumps, centrifugal, S39.8, 12, 13
processed meats	condensation, S20.2	standards, S40.1
bacon slicing rooms, R17.13	content, F23.2	starting, and electricity, S40.7
freezing, R17.15	control, F23	in variable-speed drives, \$40.8
lard chilling, R17.14	heating climates, F24.4, 6	Movie theaters, A4.3
sausage dry rooms, R17.13	mixed climates, F24.7	MRT. See Mean radiant temperature (MRT)
smokehouses, R17.12	options, F24.4	Multifamily residences, A1.5
sanitation, R17.1	terminology, F23.1	Multiple-use complexes
shipping docks, R17.17	warm/humid climates, F24.8, 8	air conditioning, A5.8
variety meats, R17.10	diffusivity, F14.31	design criteria, A5.1
retail storage, R46.12	farm crops content, A23.1; F11.1, 5, 6	load characteristics, A5.1
thermal properties, R9.1	flow	systems, A5.1, 2
Mechanical traps, steam systems, \$10.8	and airflow, F23.8	energy inefficient, A5.2
• · · · · · · · · · · · · · · · · · · ·	and heat flow, F23.5, 8	
Medium-temperature water (MTW) systems, S12.1	isothermal, F23.8	total energy, A5.2  Multizone airflow modeling, F34.14
	•	<u>.</u>
Meshes, for computational fluid dynamics, F34.4	mechanisms, F23.7 modeling, F23.8	applications example, F34.18 approaches, F34.16
refining, F34.11	<u>.</u>	* *
Metabolic rate, F8.6	nonisothermal, F23.8	verification and validation, F34.17
Metals and alloys, low-temperature, R39.6	in foundations, A43.2; F24.10	Museums, galleries, archives, and libraries
Microbial growth, R12.4	and heat storage, F23.6	air distribution, A21.18
Microbiology of foods, R12.1	hygrothermal modeling, F23.8	air filtration, A21.18
Mines, A27	in insulation, F24.1	artifact deterioration, A21.4
heat sources, A27.2	for refrigeration piping, R33	building construction, A21.12
mechanical refrigeration plants, A27.9	measurement, F14.30	dehumidification, A21.17, 19
spot coolers, A27.10	in membrane roofs, F24.9	exhibit cases, A21.5
ventilation, A27.1	migration; F24.4	humidification, A21.17
wall rock heat flow, A27.2	paint, effects on, F23.5	mold growth, A21.4
Modeling. (See also Data-driven modeling;	permeability, F14.31	outside air, A21.17
Energy modeling)	permeance, F14.31	relative humidity, effect on artifacts, A21.4
airflow, A16.4	problems, in buildings, F23.5	system selection, A21.14
around buildings, F16.10	ratio, F23.2	temperature, effect on artifacts, A21.3
in buildings, F34.1	in refrigerant systems	Mycotoxins, F11.6
contaminant transport, F34.16	control, R6.1	Naphthenes, R7.2
multizone, F34.1, 14	desiccants, R6.3	Natatoriums. (See also Swimming pools)
pollutant transport, F34.1, 18	driers, R6.6	air conditioning, A4.6
turbulence, F34.3	drying methods, R6.2	dehumidifiers, S47.4
boilers, F32.14	effects, R6.1	duct design, A4.7
compressor, F32.15	factory dehydration, R45.1	envelope design, A4.7
condenser and evaporator, F32.15	hydrocarbon gages solubility, R7.21	load estimation, A4.6
controls, F32.23	indicators, R6.3	pool water chemistry, A4.7
cooling tower, F32.17	lubricant solubility, R7.26	ventilation requirements, A4.6
moisture in buildings, F23.8	measurement, R6.3; R45.3	Natural gas, F18.4
scale simulation and testing, A44.10	solubility, R6.1	liquefaction, R38.8
small forced-air heating systems, \$9.12	sources, R6.1; R45.1	liquefied, R38.3
systems F32 17	in roofs A43.6	nine sizing, F36 20

processing, R38.18	Nusselt number, F3.14	Oxygen
separation, R38.18	Nuts, storage, R29.7	in aircraft cabins, A10.9
Navier-Stokes equations, F34.1	Odors, F13	liquid, R38.3
Reynolds-averaged, F34.3	analytical measurement, F13.5	properties, F19.2, 4, F20.64; F39.1
NC curves. See Noise criterion (NC) curves	control of, in industrial exhaust gas cleaning,	recovery, R38.17
Net positive suction, S39.9	S25.26, 27	Ozone
Net positive suction head (NPSH), A32.6, 24;	factors affecting, F13.2, 5	absorption bands, F31.15
A34.6; R3.3; S12.4	odor units, F13.5	activated carbon air cleaner, A45.12
Nightclubs, A3.6	olf unit, F13.6	in aircraft cabins
Night setback	sense of smell, F13.1	catalytic converters, A10.7, 8
furnaces, residential, S9.15, 16	sensory measurement, F13.2	limits, A10.1
recovery, A41.27	acceptability, F13.5	electronic air filters \$24.8
Nitrogen	sources, F13.1	Ozone depletion potential (ODP), R5.1
liquid, R38.3	suprathreshold intensity, F13.3	PAC. See Polycyclic aromatic compounds
properties, F19.2, 4; F20.60; F39.1	threshold, F13.1	(PAC)
recovery, R38.17	ODP. See Ozone depletion potential (ODP)	Packaged terminal air conditioners (PTACs),
Noise, F7.14. (See also Sound)	Office buildings	S46.5 *
air conditioners, room, \$46.4	air conditioning, A3.6	residential, A1.6
combustion, F18.16	space requirements, A3.7	Packaged terminal heat pumps (PTHPs), S46.
compressors	service water heating, A49.13, 16	residential, A1.6
centrifugal, S34.32	Oil, fuel, F18.5	PAH. See Polycyclic aromatic hydrocarbons
scroll, S34.24	characteristics, F18.5	(РАН)
single-screw, S34.16	distillate oils, F18.5	Paint, and moisture problems, F23.5
condensing units, R46.18	handling, S26.8	Panel heating and cooling, S6. (See also
control, with insulation, F26.3	heating value, F18.6	Radiant heating and cooling)
controls, A16.17	pipe sizing, F36.20	advantages, S6.1
engine test facilities, A15.4	preparation, S26.9	air-heated/cooled panels, S6.19
fans, S18.8	residual oils, F18.5	capillary tube mats, S6.7
fluid flow, F2.14	storage buildings, A25.9	control, S6.19
health effects, F9.15	storage tanks, S26.7	cooling, S6.1
valves, S42.2	sulfur content, F18.6	design, S6.6
water pipes, F36.5	viscosity, F18.5	calculations, S6.8
Noise criterion (NC) curves, A47.31; F7.16	Oil. (See also Lubricants)	disadvantages, S6.2
balanced (NCB), A47.32	in refrigerant systems, R7.2	electric heating systems, S6.16
Noncondensable gases	in two-phase flow, F4.11	ceiling, S6.16
condensers, water-cooled, \$35.6	Olf unit, F13.6	floor, S6.18
refrigerant contamination, R6.7	One-pipe systems	wall, S6.18
Nonhydrocarbons, R7.2	chilled-water, S12.12	heat flux
NPSH. See Net positive suction head (NPSH)	steam convection heating, S10.11; 1993	combined, S6.4
NTU. See Number of transfer units (NTU)	Fundamentals, Chapter 33, pp. 18-19 (See	natural convection, S6.3
Nuclear facilities, A26	explanation on first page of index.)	thermal radiation, S6.2
air filtration, A26.3, 7	Operating costs, A36.4	heating, S6.1
basic technology, A26.1	Operation and maintenance, A38. (See also	hybrid HVAC, S6.1
codes, A26.10	Maintenance)	hydronic systems, S6.11
criticality, A26.1	compressors, S34.34	ceiling, S6.13
decommissioning, A26.10	condition monitoring, A38.5	design considerations, S6.11
Department of Energy facilities requirements	desiccant dehumidifiers, S22.7	distribution and layout, S6.14
confinement systems, A26.4	documentation, A38.3	floor, S6.15
ventilation, A26.4	industrial exhaust systems, A30.8	wall, S6.15
fire protection, A26.2	exhaust gas cleaning equipment, S25.29	Paper
HVAC design considerations, A26.1	laboratory HVAC equipment, A14.18	moisture content, A18.2
Nuclear Regulatory Commission	management	photographic, A20.1
requirements	condition monitoring, A38.5	storage, A20.3
boiling water reactors, A26.7	results-oriented maintenance, A38.2	Paper products facilities, A24
laboratories, A26.9	system complexity, A38.4	air conditioning, A24.2
medical and research reactors, A26.9	manuals, A38.3	conduction drying, A28.3
other buildings and rooms, A26.8	new technology, A38.7	control rooms, A24.3
power plants, A26.5	responsibilities, A38.6	evaporative cooling, A51.13
pressurized water reactors, A26.7	Outlets, air diffusion,	finishing area, A24.3
radioactive waste facilities, A26.10	location, F33.15	machine area, A24.2
safety design, A26.1	performance, F33.9	system selection, A24.4
standards, A26.10	selection, F33.15	testing laboratories, A24.3
tornado and wind protection, A26.2	Outpatient health care facilities, A7.13	Paraffins, R7.2
Number of transfer units (NTU)	Outside air, free cooling	Parallel compressor systems, R46.14
cooling towers, \$36.16	cooling towers, \$36.9	Particulate matter, indoor air quality (IAQ),
heat transfer, F3.28	liquid chillers, S38.11	F9.4, 5
Nursing facilities, A7.14	Outside air fraction, F27.8	Pasteurization, R20.2
service water heating, A49.13	Owning costs, A36.1	beverages, R26.6

dairy products, R20.2	respiratory heat loss, F8.4	codes, S41.6
eggs, R21.4, 10	seasonal rhythms, F8.16	cooling towers, S13.2; S36.8
juices, R25.4, 7	sensible heat loss, F8.3	district heating and cooling
Peanuts, drying, A23.8; F11.13	sex, F8.16	distribution system, S11.6
Peclet number, F3.14	skin heat loss, F8.3, 5	heat transfer, S11.9
PEL. See Permissible exposure limits (PEL)	skin wettedness, F8.20	insulation thickness, S11.16
Performance contracting, A40.2	thermal exchanges, F8.2	geothermal energy systems, A32.7
Permafrost stabilization, R36.4	thermoregulation, F8.1	heat carrying capacity, S12.3
Permeability	vasodilation, F8.1	hydronic snow melting, A50.11
air, F23.2	Pigs. See Swine	insulation, R33.1
clothing, F8.8	Pipes, S41. (See also Piping)	radiant panels, hydronic, S6.14
vapor, F14.31	buried, F25.18	refrigerant
water vapor, F23.2	heat transfer analysis, S11.10	ammonia systems, R3.1
Permeance	codes, S41.6	below-ambient, R33.1
air, F23.2	cold springing, S11.17; S41.12	carbon dioxide systems, R3.26
thickness, F14.31	computer analysis, A39.7	halocarbon systems, R2.1
water vapor, F23.2	copper tube, S41.1	insulation, R33.1
Permissible exposure limits (PEL), F9.5	expansion, S11.17	jacketing, R33.7
Pharmaceutical manufacturing cleanrooms,	expansion bends, S41.11	pipe preparation, R33.2
A16.6	expansion joints, S41.13	supports and hangers, R33.8
Phase-change materials, thermal storage of,	expansion loops, S41.11, 12	vapor retarders, R33.4
A34.11, 21	fluid flow, F2.1	service hot water, A49.4
Photographic materials, A20	freeze prevention, F24.14	solar energy, A33.12; S33.3
processing and printing requirements, A20.1	heat transfer analysis, S11.9	sound
storage, A20.1, 3	insulation, F24.13; F26.9	control, A47.44
unprocessed materials, A20.1	hangers, F26.9	transmission, A37.24
Photovoltaic (PV) systems. See Solar energy	installation, F26.9	standards, S11.18; S41.6
Physical properties of materials, F39	underground, F26.10	system identification, F37.10
boiling points, F39.1, 2	iron, S41.2	systems
density	joining methods, S41.2, 5	ammonia refrigeration, R3.7
liquids, F39.2	plastic, F36.11; S41.8, 9	compressor piping, R3.10, 12
solids, F39.3	selection, S41.7	condenser and receiver piping, R3.1
vapors, F39.1	sizing, F36	evaporator piping, R3.18
emissivity of solids, F39.3	ammonia systems capacity tables, R3.8, 9	carbon dioxide refrigeration, R3.26
freezing points, F39.2	fittings, F36.1, 7	halocarbon refrigeration
heat of fusion, F39.2	fuel oil, F36.20	capacity tables, R2.3-9, 11-15
heat of vaporization, F39.2	gas, F36.20	compressor, R2.24
solids, F39.3	hydronic systems, F36.6; S12.15	defrost gas supply lines, R2.21
specific heat	air separation, F36.7	discharge lines, R2.19
liquids, F39.2	insulation and vapor retarders, R3.10	double hot-gas risers, R2.19
solids, F39.3	isolated line sections, R3.10	draining prevention, R2.20
vapors, F39.1, 2	pressure drop equations, F36.1	evaporator, R2.28
thermal conductivity	refrigerant	gas velocity, R2.1
solids, F39.3	halocarbon systems, R2.2	hot-gas
vapors, F39.1	retail food store refrigeration, R46.13	(discharge) mufflers, R2.20
viscosity	service water, F36.9	bypass, R2.34
liquids, F39.2	cold water sizing procedure, F36.11	insulation, R2.5
vapors, F39.1	steam, F36.12	liquid cooler, flooded, R2.26
Physiological principles, humans. (See also	condensate return, F36.15	location and arrangement, R2.5
Comfort)	high-pressure, F36.15	minimum gas velocities, R2.19
adaptation, F8.15	low-pressure, F36.13	oil transport up risers, R2.19
age, F8.15	two-pipe systems, F36.15	pressure drop, R2.2
body surface area (DuBois), F8.3	valves, F36.1, 7; R3.8	refrigerant feed devices, R2.26
clothing, F8.8	water	single riser and oil separator, R2.19
cooling load, F30.3	fixture units, F36.9	vibration and noise, R2.5
DuBois equation, F8.3	flow rate limitations, F36.5	solar energy, A33.12; S33.8, 9
energy balance, F8.2	aging allowances, F36.6	steam, S10.3, 5
heat stress, F8.20, 24	erosion, F36.6	water, S14.7
heat transfer coefficients	noise, F36.5	circuits, S12.8
convective, F8.7	water hammer, F36.6	distribution, S12.5
evaporative, F8.8	standards, fittings, S41.2	unit heaters, S31.7
Lewis relation, F8.4	steel, S41.1	vibration control, A47.44
radiative, F8.7	stress calculations, S41.7	vibration transmission, A37.24
hypothalamus, F8.1	supporting elements, S11.17; S41.10	Pitot tube, A37.2; F14.17
hypothermia, F8.1	underground, F24.14	Places of assembly, A4
latent heat loss, F8.3, 10	Piping. (See also Pipes)	air conditioning, A4.2
mechanical efficiency, F8.6	boilers, S10.3	air distribution, A4.2
metabolic rate, F8.6	capacity tables, R2.10-15	air filtration, A4.1

air stratification, A4.2	Potatoes	steam systems, S10.4
arenas, A4.4	processed, R27.5	units, F14.13
atriums, A4.8	storage, A51.14	vacuum, F14.13
auditoriums, A4.3	Poultry. (See also Animal environments;	Pressure drop. (See also Darcy-Weisbach
concert halls, A4.4	Chickens; Turkeys)	equation)
convention centers, A4.5	chilling, R18.1	correlations, F4.11
exhibition centers, A4.5	decontamination, R18.4	in plate heat exchangers, F4.13
fairs, A4.8	freezing, R18.5	pipe sizing, F36.1
gymnasiums, A4.5	packaging, R18.7	two-phase fluid flow, F4.11
houses of worship, A4.3	processing, R18.1, 4	Printing plants, A18
lighting loads, A4.1	processing plant sanitation, R18.9	air conditioning, A18.1
mechanical equipment rooms, A4.3	recommended environment, A22.8	air filtration, A18.4
movie theaters, A4.3	refrigeration, retail, R18.10	binding areas, A18.4
natatoriums, A4.6	storage, R18.10	collotype printing rooms, A18.4
playhouses, A4.3	tenderness control, R18.9	letterpress areas, A18.2
precooling, A4.2	thawing, R18.11	lithographic pressrooms, A18.3
sound control, A4.1	Power-law airflow model, F34.14	paper moisture content control, A18.2
space conditions, A4.1	Power plants, A25	platemaking rooms, A18.2
stadiums, A4.4	buildings	relief printing areas, A18.2
temporary exhibit buildings, A4.8	oil pump, A25.9	rotogravure pressrooms, A18.4
vibration control, A4.1	oil storage, A25.9	salvage systems, A18.4
Planes. See Aircraft	steam generator, A25.4	shipping areas, A18.4
Plank's equation, R10.7	turbine generator, A25.7	ink drying, A28.3
Plant environments, A22.10; F10.15	coal-handling facilities, A25.6, 9	Prisons, A8.3
air, F10.21	cogeneration, S7.1	Produce
controlled environment rooms, A22.16	combined cycle, \$7.35	desiccation, R11.1
design, A22.10	combustion turbine areas, A25.8	deterioration rate, R11.1
energy balance, F10.15	control center, A25.9	display refrigerators, R46.8
greenhouses, A22.10	cooling, A25.10	Propane
carbon dioxide enrichment, A22.14	design criteria, A25.1	commercial, F18.4
cooling, A22.12	evaporative cooling, A51.13	furnaces, residential, S28.8
energy conservation, A22.15	fuel cells, S7.36	properties, F19.2, 4; F20.44; F39.1
evaporative cooling, A22.13	heating, A25.10	Propylene glycol
heating, A22.11; F10.15	turbines	coolants, secondary, F21.4
<u>.</u>		•
heat loss calculation, A22.11	combustion, S7.8	hydronic systems, S12.16
humidity control, A22.14	steam, \$7.13	Psychrometers, F6.13
photoperiod control, A22.14	ventilation, A25.3	Psychrometrics, F6
shading, A22.13	rates, A25.2	air composition, F6.1
site selection, A22.10	PPD. See Predicted percent dissatisfied (PPD)	air handlers, S2.3
supplemental irradiance, A22.14; F10.20	Prandtl number, F3.14	chart, F6.15
ventilation, A22.12	Precooling	adiabatic mixing, F6.17
humidity, F10.20	buildings, A41.28	of water, F6.17
lighting, F10.18	flowers, cut, R15.11	heat absorption and moisture gain,
other facilities, A22.21	fruits and vegetables,	F6.18
photoperiod control, A22.14; F10.20	load calculation, R15.1	moist air
phytotrons, A22.18	indirect evaporative, A51.3	cooling, F6.16
plant growth chambers, A22.16	places of assembly, A4.2	heating, F6.16
supplemental irradiance, A22.14; F10.19	Predicted mean vote (PMV), F14.30	thermodynamic properties, F6.14
temperature, F10.15	comfort, F8.17	evaporative cooling systems, A51.1, 11, 16.
Plate heat exchangers (PHEs), S11.27	Predicted percent dissatisfied (PPD), F8.17	17
Plenums	Preschools, A6.1	humidity parameters, F6.2
construction, \$16.4	Pressure	industrial drying, A28.1
mixing, S2.5	absolute, F14.13	moist air
sound attenuation, A47.12	aircraft cabins, A10.2, 4, 6, 8	standard atmosphere, U.S., F6.1
stratification in, A37.2	clean spaces, A16.15	thermal conductivity, F6.19
PMV. See Predicted mean vote (PMV)	differential	thermodynamic properties, F6.2, 14
Police stations, A8.1	conversion to head, A37.12	transport properties, F6.19
Pollutant transport modeling. See	hospitals, A7.3, 4	viscosity, F6.19
Contaminants, indoor, concentration	readout, A37.12	perfect gas equations, F6.12
prediction	differential, F14.13	water at saturation, thermodynamic
Pollution, air, and combustion, F18.6, 13	dynamic, F14.13	properties, F6.2
Polycyclic aromatic compounds (PAC), F9.6	gage, F14.13	PTACs. See Packaged terminal air
Polycyclic aromatic hydrocarbons (PAH),	losses, district heating and cooling, S11.6	conditioners (PTACs)
F9.6	measurement, A37.2; F14.13	PTHPs. See Packaged terminal heat pumps
Polydimethylsiloxane, F21.12	sensors, F15.9	(PTHPs)
Ponds, spray, S36.6	smoke control, A52.5, 9	Public buildings. See Commercial and public
Pope cell, F14.12	stairwells, A52.9, 10	buildings
Positive positioners, F15.7	static control, A46.8; F14.13	Pulldown load, R46.5

Pumps	oil-fired, \$15.3	Railroad tunnels, ventilation
centrifugal, S39	precautions, S15.4	design, A13.15
affinity laws, S39.7	reflectors, S15.4	diesel locomotive facilities, A13.25
antifreeze effect on, S12.17	installation, A53.8	equipment, A13.31
arrangement, S39.10		* * .
•	intensity, \$15.1	locomotive cooling requirements, A13.15
compound, S12.6	panels, A53.1, 8; S29.4; S32.6	tunnel aerodynamics, A13.16
pumping	applications, A53.8	tunnel purge, A13.16
distributed, S39.13	control, A46.4	RANS. See Reynolds-Averaged Navier-Stoke
parallel, S12.6; S39.10	cooling, A53.1	(RANS) equation
primary-secondary, S12.6; S39.12	heating, S29.4	Rapid-transit systems. See Mass-transit
series, S12.6; S39.11	hydronic systems, S32.6	systems
variable-speed, S39.12	radiation patterns, A53.5	Rayleigh number, F3.14
• •		• 0
standby pump, S12.6; S39.12	snow-melting systems, A50.16	RC curves. See Room criterion (RC) curves
two-speed motors, S39.12	terminology	Receivers
casing, S39.2	adjusted dry-bulb temperature, A53.1	ammonia refrigeration systems
cavitation, S39.9	ambient temperature, A53.1	high-pressure, R3.3
commissioning, S39.14	angle factor, S15.5	piping, R3.14
construction, \$39.1	effective radiant flux (ERF), A53.2; S15.5	through-type, R3.15
efficiency, best efficiency point (BEP),	fixture efficiency, S15.4	halocarbon refrigerant, R2.21
S39.7	mean radiant temperature (MRT), A53.1;	liquid overfeed systems, R1.7
	• • • • • • • • • • • • • • • • • • • •	•
energy conservation, \$39.13	S6.1	Recycling refrigerants, R8.3
impellers	operative temperature, A53.1	Reflectance, thermal, F23.2
operation, S39.2	pattern efficiency, S15.4	Reflectors, S15.4
trimming, S39.6, 7, 9	radiant flux distribution, S15.5	Refrigerant/absorbent pairs, F1.15
installation, S39.14	radiation-generating ratio, S15.4	Refrigerant-control devices, R44
motors, S39.13	test instruments, A53.7	air conditioners; \$46.2, \$45.6
		· · · · · · · · · · · · · · · · · · ·
operation, S39.2, 14	total space heating, A53.6	automobile air conditioners, A9.8
performance	Radiant time series (RTS), F30.24	capillary tubes, R44.23
net positive suction, \$39.9	load calculations, nonresidential, F30.1	coolers, liquid, S37.5
operating point, S39.5	Radiation	heat pumps
pump curves, S12.5; S39.3, 5	atmospheric, A33.5	system, S8.7
power, \$39.6	diffuse, F31.16, 37	unitary, S45.9
radial thrust, S39.9	electromagnetic, F9.15	lubricant separators, R44.22
	_	
selection, S39.10	ground-reflected, F31.16	pressure transducers, R44.4
types, \$39.2	optical waves, F9.16	sensors, R44.4
chilled-water, A41.2, 6, 16, 17	radiant balance, F3.12	short tube restrictors, R44.30
sequencing, A41.16, 20	radio waves, F9.17	switches
condenser water, A41.6	solar, A33.3	differential control, R44.2
as fluid flow indicators, A37.13	thermal, F3.1, 8; S6.1	float, R44.3
geothermal wells, A32.25	angle factors, F3.10	pressure control, R44.1
lineshaft, A32.6	•	•
	blackbody, F3.1, 8	valves, control
submersible, A32.6	spectral emissive power, F3.8	check, R44.20
hydronic snow melting, A50.13	display cases, R46.4	condenser pressure regulators, R44.14
liquid overfeed systems, R1.5	energy transfer, F3.8	condensing water regulators
solar energy systems, A33.12	exchange between surfaces, F3.11	operation, R44.20
systems, water, S12.5; S14.7	in gases, F3.12	year-round, R44.19
variable-speed, A41.8, 17	gray, F3.2, 8	expansion
* '		•
Purge units, centrifugal chillers, \$38.11	heat transfer, F3.1	constant pressure, R44.11, 13
Radiant heating and cooling, A53; S6.1; S15;	infrared, F31.17	electric, R44.10
S29.4	Kirchoff's law, F3.9	thermostatic, R44.5
(See also Panel heating and cooling)	monochromatic emissive power, F3.8	float, R44.16
applications, A53.8	nonblack, F3.8	pressure relief devices, R44.21
asymmetry, A53.5	transient, F3.3	solenoid, R44.17
beam heating design, A53.4; S15.5	Radiators, S32.1, 5	suction pressure regulators, R44.14
control, A46.4	design, S32.3	Refrigerants, F19
design, A53.2, 3	nonstandard condition corrections, S32.3	absorption solutions, F20.1, 69
direct infrared, A53.1, 4, 8	types, S32.1	ammonia, F20.1, 34-35; R5.3
equations, A53.2	Radioactive gases, contaminants, F12.18	chemical reactions, R5.5
floor reradiation, A53.5	Radiometers, A53.7	refrigeration system practices, R3.1
infrared, A53.1, 4, 8; S15	Radio stations, A3.8	ammonia/water, F20.1, 69
	·	
beam heater design, S15.5	Radon, F9.9, 11, 16	analysis, R5.4
control, S15.4	control, A43.3; A45.12; F27.18	automobile air conditioners, A9.11
efficiency, S15.4	indoor concentrations, F12.16	azeotropic, F1.6
electric, S15.2	Rail cars	bakeries, R28.7
energy conservation, S15.1	air conditioning, A9.15	carbon dioxide, F20.1, 38-39
gas-fired, S15.1	air distribution, A9.17	refrigeration system practices, R3.26
9		cascade refrigeration systems, R39.3
indirect, \$15.2	heaters, A9.17	• •
maintenance, S15.5	vehicle types, A9.15	CFC conversion, R7.27

Composite Index

compatibility with other materials, R5.8	lubricants, R7.1	biomedical applications, R40.1
database, R5.11	thermodynamic properties	breweries, R26.3
elastomers, R5.10	pressure-enthalpy diagrams, F20.1	carbon dioxide systems, R3.26
electrical insulation, R5.8	saturated liquid and vapor data, F20.1	cascade systems
plastics, R5.10	tabular data, F20.1	compressors, R39.5
compositional groups, R5.1	thermophysical properties, R3.26	refrigerants, R39.4
ammonia, R5.3	transport properties, F20.1	chemical industry, R37.1, 2, 5
chlorofluorocarbons, R5.1	water/steam, F20.1, 36-37	coefficient of performance (COP), F1.3, 13
fluoroethanes, R5.3	zeotropic, F1.6, 9	compression cycles
fluoroethers, R5.3	Refrigerant transfer units (RTU)	Carnot cycle, F1.6, F1.7
fluoromethanes, R5.3	liquid chillers, S38.11	Lorenz cycle, <b>M</b> .9
fluoropropanes, R5.3	Refrigerated facilities, R14	multistage, F1.10
hydrocarbons, R5.3	air	zeotropic mixture, F1.9
hydrochlorofluorocarbons, R5.1	circulation, R11.10	concrete, R36.1
hydrofluorocarbons, R5.3	purification, R11.10	condensers, cascade, R43.1
computer analysis, A39.12	automated, R14.4, 15	food
contaminants in, R6	construction, R14.4	eggs and egg products, R21.1
generation by high temperature, R5.8	controlled-atmosphere storage, R14.3	fish, R19.1
cryogenic fluids, F20.1, 54-67	controls, R11.10	vegetables, R24.1
electrical properties, F19.5, 6	design	food processing facilities, R27.1
emissions, R8.1	building configuration, R14.1	banana ripening rooms, R23.5
environmental acceptability, R5.1	initial building considerations, R14.1	control of microorganisms, R12.3
halocarbons, F20.1; R5.3	location, R14.1	meat plants, R17.1
azeotropic blends, F20.1, 33	shipping and receiving docks, R14.3	food service equipment, R47
ethane series, F20.1, 10-21	single-story structures, R14.2	fruits, fresh, R22.1; R23
flow rate, R2.1	specialized storage facilities, R14.3	halocarbon systems, R2
hydrolysis, R5.5	stacking arrangement, R14.2	accessories, R2.29
methane series, F20.1, 2-3	utility space, R14.3	heat exchangers, R2.29
propane series, F20.1, 25	freezers, R14.10	lubricant management, R2.10
refrigeration system practices, R2.1	insulation, R14.12	piping, R2.2
thermal stability, R5.4	load calculations, R13.1	refrigerant receivers, R2.23
zeotropic blends, F20.1, 26–31	refrigerated rooms, R14.4	subcoolers, R2.30
hydrocarbons, F20.1; R5.3	refrigeration systems	valves, R2.10
ethane, F20.1, 42–43	condensate drains, R14.9	heat reclaim, service water heating, A49.4, 25
ethylene, F20.5051	defrosting, R14.9	ice rinks, R35.1
isobutane, F20.48–49	fan-coil units, R14.8	insulation, R33.1
methane, F20.1, 40–41	multiple installations, R14.10	liquid overfeed systems, R1.1
<i>n</i> -butane, F20.1, 46–47	unitary, R14.7	loads, R13.1; R27.3
propane, F20.1, 44–45	valves, R14.9	low-temperature
propylene, F20.1, 52–53	sanitation, R11.10	autocascade systems, R39.1
leak detection, F19.7, R8.2; R45.4	temperature pulldown, R14.15	cascade systems, R39.3
lines	vapor retarders, R14.5, 12	heat transfer, R39.9
oil management, R2.10	Refrigeration, F1.1. (See also Absorption)	material selection, R39.6
sizing, R2.2	absorption cycle, F1.13	secondary coolants, R39.11
lithium bromide/water, F20.1, 69	air coolers, forced-circulation, R42.1	
lubricant solutions, R7.8	air transport, R32.3, 4	single-refrigerant systems, R39.2 lubricant coolers, R43.2
moisture in, R6.1	ammonia systems, R3	marine, R31
performance, F19.6	compressors	fishing vessels, R31.7
phaseout, F19.1	cooling, R3.11, 12	ships' stores, R31.4
costs, A36.8	piping, R3.10, 12	refrigerated-facility design, R14.1
piping, R2.1	types, R3.2	retail food store systems, R46.12
design, R33.1	controls, R3.6	secondary coolant systems, R4.1
insulation, R33.1	converting systems, R3.21	applications, R4.5
pressure drop	equipment, R3.2	coolant selection, R4.1
discharge lines, R2.5	evaporative condensers, R3.15	design
liquid lines, R2.2	liquid recirculation (overfeed), R3.21,	control valves, R4.2
suction lines, R2.4	R3.22	expansion tanks, R4.3, 5
•		piping, R4.2
properties, F19.1, 4; R5.1, 4	lubricant management, R3.6	
rail car air conditioning, A9.15	multistage systems, R3.20	pulldown time, R4.4
reclamation, R8.3	piping, R3.7	storage tanks, R4.2
removing contaminants, R8.2	safety, R3.25	system costs, R4.5
recovery, R8.2	system selection, R3.1	soils, subsurface, R36.3, 4
recycling, R8.3	two-stage screw compressor, R3.20	systems
safety, F19.7	valves, R3.8	charging, factory, R45.4
safety classifications, F19.2	vessels, R3.3	chemical reactions, R5.4
sound velocity, F19.5	autocascade systems, R39.1	component balancing, R43.1
systems	azeotropic mixture, F1.6	contaminant control, R6
chemistry, R5.1	beverage plants, R26.11	of moisture, R6.1

retrofitting, during, R6.9	size effect, S9.16	enclosed facility, A13.4
copper plating, R5.7	type effect, S9.15	enhancements, A13.7
dehydration, factory, R45.1	night setback effect, S9.15, 16	
- · · · · · · · · · · · · · · · · · · ·		equipment, A13.31
design balance points, R43.2	zone control, S9.9	hybrid, A13.7
energy and mass balance, R43.3	furnaces, S28.1	mechanical, A13.4
evaluating system chemistry, R5.10	gas burners, S26.1	natural, A13.4
moisture in, R45.1	heating and cooling systems, A1.1	normal air quantities, A13.7
performance, R43.4	humidifiers, S9.1; S20.5	normal conditions, A13.1
reactions, R5.7	kitchen ventilation, A31.27	pressure evaluation, A13.8
testing, factory, R45.4	load calculations, F29.1	temporary, A13.1
ultralow-temperature, R39.1	oil burners, S26.4	Rodents, and farm crop storage, F11.8
wineries, R26.8	ventilation, F27.15	Roof ponds, Legionella pneumophila control,
Refrigeration load, R13. (See also Load	water heating, A49.11	A48.7
calculations)	Resistance, thermal, F3.2, 26; F23. (See also R-	Roofs
Refrigeration oils, R7. (See also Lubricants)	values)	air movement, A43.6
Refrigerators	contact, F3.26	insulation, A43.5; F24.3
commercial	of flat assembly, F23.2	membrane roof systems, F24.9
blast, R47.3	of flat building components, F23.2	moisture control, A43.6; F24.9
energy efficiency, R47.7	overall, F3.18	radiant barriers, A43.5
freezers, R47.3	radiant panels, S6.6	R-values, F25.14
temperatures, R47.2	surface film, F23.1	wall interface, A43.7
types, R47.1	water vapor, F23.2	Room air distribution, A56
cryocoolers, R38.11	Resistance temperature devices (RTDs), F14.6;	Room criterion (RC) curves, A47.31; F7.17
food service, R47.1	F15.8	Mark II, A47.32
household	Resistivity, thermal, F23.1	Root mean square (RMS), F14.1
	Resource utilization factor (RUF), F17.5	Rotary vane compressors, S34.11
absorption cycle, R41.8		· · · · · · · · · · · · · · · · · · ·
cabinet construction, R48.3	Respiration of fruits and vegetables, R9.18	Rotative speed, F14.25
defrosting, R48.6	Restaurants	Roughness factors, ducts, F35.6
design and construction, R48.1	air balancing, A31.18	RTDs. See Resistance temperature devices
efficiency, R48.1	air conditioning, A3.4, 5	(RTDs)
ice makers, R48.3	commercial and public buildings, A3.4	RTS. See Radiant time series (RTS)
refrigeration systems, R48.5	energy conservation, A31.21	RTU. See Refrigerant transfer units (RTU)
testing, R48.9	kitchen ventilation, A31.1	RUF. See Resource utilization factor (RUF)
mortuary, R47.3	service water heating, A49.13, 14, 19	Rusting, of building components, F23.5
retail food store	Retail facilities, A2	<b>R-values</b> , F3; F23; F25; F26. (See also
display, A2.3; R46.1	air conditioning, A2.1	Resistance, thermal)
	<del>-</del>	,
storage, R46.11	convenience centers, A2.6	calculation
walk-in, R47.3	department stores, A2.5	modified zone method, F25.11
Regulators. (See also Valves)	design considerations, A2.1	overall thermal resistances; F25.2
condenser pressure, R44.14	discount and big-box stores, A2.2	zone method, F25.10
condensing water, R44.19	load determination, A2.1	calculation, F3.2, 18
draft, S30.25	malls, A2.6	overall thermal resistances, F3.18
pressure, steam, \$10.9	multiple-use complexes, A2.7	ceilings, F25.12
suction pressure, R44.14	refrigeration, R46.1, R47	masonry construction, F25.3
Residential systems, A1	shopping centers, A2.6	roofs, F25.12
air cleaners, S24.9	small stores, A2.1	steel frame construction, F25.9
air leakage, F27.13	supermarkets, A2.2	wood frame construction, F25.2
calculation, F27.21	refrigerators, R46.1	Safety
climatic infiltration zones, F27.16	service water heating, A49.14	against attacks, A58.1
dehumidifiers, A1.5	Retrofit performance monitoring, A40.3	air cleaners, A45.14; S24.12
duct construction, S16.2	Reynolds-Averaged Navier-Stokes (RANS)	ammonia systems, R3.25
equipment sizing, A1.2	equation, F34.3	automatic controls, A46.20
forced-air systems	Reynolds number, F2.3; F3.14	burners, S26.13
air outlets and returns, \$9.3	<b>Rice</b> , drying, A23.9; F11.13	chemical plants, R37.2
selection, S9.10	RMS. See Root mean square (RMS)	cryogenic equipment, R38.28
controls, S9.3	Road tunnels, A13.4	electrical, A55.1
	carbon monoxide	filters, air, S24.12
design, S9.1, 3		
distribution design, \$9.7	allowable concentrations, A13.7	industrial exhaust gas cleaning, \$25.29
ducts, S9.6	analyzers and recorders, A13.9, 10	nuclear facilities, A26.1
efficiency testing, S9.11	computer analysis, A13.2	refrigerants, F19.2, F19.7
furnace, S28.1	vehicle emissions, A13.7	service water heating, A49.9
heating performance	ventilation	solar energy systems, A33.24
climate effect, \$9.15	air quantities, A13.7, A13.8	thermal insulation and fires, F26.4
dynamic simulation model (HOUSE),	computer analysis, A13.2	thermal insulation for, F26.2
S9.12	controls, A13.9	water systems, \$14.9
factors, S9.12	ducts, A13.8	wood stoves, S29.6
	·	Safety showers, Legionella pneumophila control,
furnace	emergency, A13.1	
efficiency, S9.12	air quantities, A13.8	A48.7

**Composite Index** 

Sanitation	requirements, A49.11	elevators, 11
food production facilities, R12	residential, A49.11	hospitals, A7.5
control of microorganisms, R12.4	safety, A49.9	large open spaces
egg processing, R21.12	scale, A49.8	plugholing, A52.16
HACCP, R12.4	sizing water heaters	plume, A52.14
meat processing, R17.1	instantaneous and semi-instantaneous,	prestratification layer, A52.16
poultry processing, R18.9	A49.23	smoke filling, A52.14
regulations and standards, R12.5	refrigerant-based, A49.25	steady clear height and upper layer
refrigerated storage facilities, R11.10	storage heaters, A49.11, 15	exhaust, A52.14
Scale	solar energy, A33.13, 18, 25; A49.4	steady fire, A52.13, 14
control, A48.4	steam, S10.1	unsteady fire, A52.13, 14
humidifiers, S20.4	system planning, A49.2	zone fire models, A52.14
service water systems, A49.8	terminology, A49.1	methods
water treatment, A48.4	thermal storage, A34.11	airflow, A52.5
Schematic design, A57.8	water heating equipment	buoyancy, A52.6
Schneider system, R14.7	placement, A49.10	compartmentation, A52.4, 9
Schools	sizing, A49.11, 23, 25	dilution near fire, A52.5
air conditioning, A6.3	types, A49.2	pressurization, A52.5, 9, 10
service water heating, A49.21	water quality, A49.8	remote dilution, A52.4
elementary, A49.13	SES. See Subway environment simulation	rapid-transit systems, A13.12
high schools, A49.13, 16	(SES) program	road tunnels, A13.8
Security. See Chemical, biological,	Shading	smoke dampers, A52.8
radiological, and explosive (CBRE) incidents	coefficient, F31.38	smoke movement
Seeds	devices, indoor, F31.54	buoyancy, A52.3
drying, F11.13	fenestration, F31.2	expansion, A52.3
storage, A23.11	Sheep, F10.9	HVAC systems, A52.4
Seismic restraint, A47.48; A54.1	Ship docks, A3.10	stack effect, A52.2
anchor bolts, A54.14	Ships, All	wind, A52.3
design, A54.1	air conditioning	stairwells
design calculations	air distribution, A11.3, 4	analysis, A52.10
examples, A54.15–21	controls, A11.3, 4	compartmentation, A52.9
static analysis, A54.3, 7	design criteria, A11.1, 3	open doors, A52.10
duct construction, S16.6	equipment selection, A11.2, 4	pressurization, A52.10, 11
dynamic analysis, A54.2	systems, A11.2, 4	pressurized, A52.9
installation problems, A54.22	cargo holds, R31.2	zones, A52.12
snubbers, A54.15	cargo refrigeration, R31.1	Smudging air outlets, S17.2
terminology, A54.2	coils, A11.4	Snow-melting systems, A50
weld capacities, A54.15	ducts, A11.3	back and edge heat losses, A50.6, 8
Sensible heat	fish freezing, R31.8	control, A50.10
load calculations, F29; F30	fish refrigeration	electric system design
psychrometrics, F6.18	icing, R19.1; R31.7	constant wattage systems, A50.15
ratio	refrigerated seawater, R19.2; R31.8	electrical equipment, A50.13
coils, S21.6, 12–14	merchant, A11.1	gutters and downspouts, A50.17
dehumidifiers, S47.1	naval surface, A11.3	heat flux, A50.13
refrigeration load, R13	refrigerated stores, R31.4	idling, A50.18
room air conditioners, \$46.2	refrigeration systems, R31.1	heating elements, A50.13
small forced-air systems, S9.8	regulatory agencies, A11.3	infrared systems, A50.16
Sensors	Single-duct systems, all-air, S2.8	installation, A50.16
automatic controls, F15.7, 9	Skating rinks, R35.1	mineral insulated cable, A50.13
location, A46.23	Skylights, and solar heat gain, F31.40	free area ratio, A50.1
Separators, lubricant, R44.22	Slab heating, A50	freeze protection systems, A50.10, 17
Service water heating, A49	Slab-on-grade foundations, A43.2	heat balance, A50.1
cogeneration, S7.33	moisture control, A43.3	heating requirement
commercial and institutional, A49.11	SLF. See Shade line factor (SLF)	annual operating data, A50.8
corrosion, A49.8	SLR. See Solar-load ratio (SLR)	heat flux equations, A50.2
design considerations, A49.4	Smoke management, A52	hydronic and electric, A50.1
distribution system	acceptance testing, A52.18	load frequencies, A50.6
for commercial kitchens, A49.7	atriums, A52.12	surface size, A50.6
manifolding, A49.8	computer analysis, A52.12, 14	transient heat flux, A50.6
piping, A49.4	design	weather data, A50.6
pressure differential, A49.5	door-opening forces, A52.6	wind speed, A50.6
return pump sizing, A49.6	flow areas	hydronic system design
two-temperature service, A49.8		
•	airflow paths, A52.6	components, A50.10
geothermal energy, A32.9	effective, A52.7	controls, A50.13
indirect, A49.3, 25	open doors, A52.8	fluid heater, A50.12
industrial, A49.23	pressure differences, A52.8	heat transfer fluid, A50.10
Legionella pneumophila, A49.9 pipe sizing, F36,9	weather data, A52.8 duct design, F35.11	piping, A50.11 pump selection, A50.13

thermal stress, A50.13	control, A33.13	chillers, A47.10
operating costs, A50.10	design, S33.1	combustion, F18.16
slab design, hydronic and electric, A50.8	direct circulation, S33.2	compressors, A47.10
snow detectors, A50.10	drain-down, A33.14	computerized analysis, A39.8
Snubbers, seismic, A54.15	hybrid, A33.16	cooling towers, S36.10
Sodium chloride brines, F21.1	indirect	ducts, A47.7
Soft drinks, R26.10	circulation, S33.2	loudness, F7.14
Soils	drainback, A33.15; S33.2	measurement, F14.27
stabilization, R36.3, 4	nonfreezing fluid, \$33.2	basics, F7.5
temperature calculation, \$11.9	water heating, A33.14	instrumentation, A37.18; F7.4
thermal conductivity, F25.15; S11.8	integral collector storage systems,	level meter, F7.4
Solar angle, determining, F31.15	A33.15; S33.3	power, F7.2
Solar energy, A33; S33.1	liquid, S33.9, 11	pressure, F7.1
active systems, A33.16, 17, 19	freezing protection, S33.1	rating methods, A47.31
airflow, A33.25 collectors, A33.5, 6, 11, 25; S33.3	passive, A33.16 pool heating, A33.15	speed, F7.2
array design	recirculation, A33.15	terminology bandwidths, F7.8
piping, S33.9	residential, A1.4	controlling, F7.11
shading factor, S33.10	sizing, A33.19	decibel, F7.1
concentrating, A33.8	thermosiphon, A33.13	frequency, F7.2
construction	heat pump systems, S8.4	frequency spectrum, F7.15
absorber plates, \$33.5	hybrid systems, A33.16	intensity, F7.3
glazing, S33.6	hydraulics, A33.25	level, F7.1
housing, S33.5	installation, A33.23	loudness, F7.14
insulation, S33.7	irradiation, A33.4	pressure, F7.1
manifolds, S33.5, 8	maintenance, A33.24	quality, F7.14
design and installation, A33.25	overheat protection, A33.24	wavelength, F7.2
efficiency, A33.10	passive systems, A33.16, 21	testing, A37.18
flat plate, A33.5, 6	photovoltaic (PV) systems, A33.26; S33.18	time averaging, F7.4
glazing materials, A33.7	quality and quantity, A33.1	transmission, A37.20; A47.20
plates, A33.8	radiation at earth's surface, A33.3, 4	humidity affecting, S20.2
module design	safety, A33.24	paths, F7.9
piping, S33.8	service water heating systems, A33.13, 18,	typical sources, F7.10
thermal expansion, S33.9	25; A34.2; A49.4	unit heaters, \$31.6
velocity limits, S33.8	combined with space heating, A33.18	Sound control, A47; F7
mounting, A33.23	sizing heating and cooling systems, A33.19	acoustical design of HVAC systems, A47.1
performance, A33.9; S33.4	spectrum, A33.3	air handlers, S2.7
operational results, S33.5	start-up procedure, A33.24	A-weighted sound level (dBA), A47.32;
steady conditions, S33.4	thermal storage systems, A33.11, 25	F7.16
selection, S33.7	short circuiting, \$33.14	barriers, A47.26; F7.11
testing, S33.4	sizing, S33.14	ceiling sound transmission, A47.30
types, S33.3	time, A33.1, 3	chillers, A47.10
constant, A33.1	types, S33.14	clean spaces, A16.17
control, A33.24, 26; S33.16	uses, A33.25	cogeneration, \$7.41
automatic temperature, \$33.16	Solar heat gain	combustion turbines, \$7.13
differential temperature controller, \$33.17	calculation, F31.40 coefficient, F31.36	cooling towers, \$36.11
hot-water dump, S33.18 over-temperature protection, S33.17	roof overhangs, F31.46	data reliability, A47.1
cooling systems, A33.16, 18, 26	skylights, F31.40	design, A47.2, 35; F7.15 ducts, A47.7; S16.4
absorption refrigeration, A33.18; S33.3, 7	Solar-load ratio (SLR), A33.21	sound attenuation, A47.12; F7.13
sizing, A33.19	Solar-optical glazing, F31.18	branch division, A47
types, A33.16	Solar radiation	end reflection loss, A47.20
design, installation, operation checklist,	daylighting, F31.1	insulated flexible, A47.16
A33.25	flux, F31.13	plenums, A47.12
design values, solar irradiation, A33.4	optical properties, F31.17	sheet metal, A47.15
domestic hot water, A33.13, 25	Solar-thermal separation, F31.44	silencers, A47.16
equipment, S33.1	Solid fuel	sound transmission, A47.20
freeze protection, A33.24; S33.2, 18	burners, S26.9	enclosures, F7.13
heat exchangers, A33.12; S33.15	coal, F18.7	engines, S7.7
external, S33.16	coke, F18.10	engine test facilities, A15.4
freeze protection, S33.18	Solvent drying, constant-moisture, A28.6	equipment sound levels, A47.3
internal, S33.15	Soot, F18.16	fans, A47.4, 5
performance, S33.16	Sorbents, F22.1	fume hood duct design, A47.27
requirements, S33.15	Sorption isotherm, F23.6	hotels and motels, A5.7
heating systems, A33.16; A34.2	Sound, F7. (See also Noise)	indoor sound rating, A47.31
active, A33.16, 17	air outlets, S17.2	insertion loss, A47.16
air, S33.1, 10, 11	attenuators, A47.12	insulation, F23.17
components, A33.11	bandwidths, F7.4	justice facilities, A8.5, 6

mechanical equipment rooms, A47.28	indoor air quality (IAQ), F9.9	two-pipe systems, S10.12
noise criterion (NC) curves, A47.31; F7.16	liquid chillers; \$38.5	unit
outdoor	makeup air units, S31.9	heaters, S31.4
criteria, A47.35	motors, \$40.1, 10, 13	ventilators, S31.1
equipment, A47.26	nuclear facilities, A26.10	valves
piping, A47.44, 45	pipe fittings, S41.2	pressure-reducing, S10.9
places of assembly, A4.1	piping, S11.18; S41.6	safety, S10.9
return air system sound transmission,	sound control, A47.48	temperature control, \$10.13
A47.30	turbines, S7.50	water, effects of, S10.2
rooftop air handlers, A47.6	vibration control, A47.48	Steam traps, S10.7
room criterion (RC) curves, A47.31, 32;	Stanton number, F3.14	Stefan-Boltzmann equation, F3.1, 8
	•	
F7.17	Static electricity and humidity, \$20.2	Stevens' law, F13.3
room sound correction, A47.24	Steam	Stirling cycle, R38.14
standards, A47.48	psychrometric properties, F6.19	Stokers, §26.9
terminology, F7.11	quality, S10.2	types, S26.10
transmission loss, A47.21	sources, S10.2	Storage
troubleshooting, A37.20; A47.46	testing, adjusting, balancing, A37.14	apples, A51.14; R22.1, 3
variable-air-volume (VAV) systems, A47.5	thermophysical properties, F20.1, 36–37	controlled atmosphere, R22.1, 3
• • • •		
Soybeans, drying, A23.7; F11.13	Steam systems, S10	bakery ingredients, R28.1
Specific heat	air, effects of, \$10.2	candy, R29.5
equation, F1.4	boilers, S10.3; S27.1	carbon dioxide, R26.12
foods, R9.7	classification, S10.2	citrus, A51.14; R23.3
liquids, F39.2	cogeneration distribution, \$7.31	cold, facility design, R14.1
materials, F39.1	coils, air-heating, S23.2	compressed gases, A14.8
Spot cooling	combined steam and water, \$10.15	controlled-atmosphere (CA), R14.3
•		* * */
evaporative, A51.12	condensate removal, S10.6	cryogenic fluids, R38.26
industrial environments, A29.3, 5; A51.12	drainage and return, S11.7	desiccant dehumidification, S22.8
makeup air units, \$31.9	drip stations, S11.7	high-pressure, S22.11
mines, A27.10	return pipes, S11.18	design, refrigerated-facility, R14.1
Spot heating, A53.4	convection heating, S10.11	eggs, R21.5
Stack effect	design, S10.2; S32.3	farm crops, A23.9; F11.1
duct design, F35.2	piping, S10.5	fish
<del>-</del>		
multizone airflow modeling, F34.14	pressure, \$10.4	fresh, R19.3
smoke movement, A52.2	distribution, S10.12	frozen, R19.7
Stadiums, A4.4	district heating and cooling, \$11.18	flowers, cut, R11.12
Stainless steel boilers, S27.3	district heating and cooling, \$11.3, 18, 29	food, canned or dried, R11.11
Stairwells, smoke control, A52.9	flash steam, S10.14	fruit
Standard atmosphere, U.S., F6.1	percentage, S10.2	dried, R29.7
Standards, A59. (See also Codes)	flash tank, S10.14	fresh, R22.1
,		
air cleaners, S24.3, 5	gas, effects of, S10.2	furs and fabrics, R11.11
air conditioners, S45	generator buildings, A25.4	ice, R34.4
packaged terminal, S46.7	heat exchangers, S10.3	meat products, frozen, R17.16
room, S46.4	heating, A48.11	milk, R20.4
unitary, S45.5, 6	heat recovery	nursery stock, R11.12
air distribution, A56.1	direct recovery, S10.15	nuts, R29.7
boilers, S27.5	flash steam, S10.14	photographic materials, A20.3, 4
chimneys, fireplaces, and gas vents,	waste heat boilers, \$10.3	unprocessed, A20.1
S30.24, 29	makeup air units, S31.9	potatoes, A51.14
cogeneration, S7.50	one-pipe systems, \$10.11; 1993	poultry products, R18.10
condensers, S35	Fundamentals, Chapter 33, pp. 18-19 (See	refrigerated-facility design, R14.1
evaporative, \$35.19	explanation on first page of index.)	seeds, A23.11; R11.13
water-cooled, S35.7	piping	tanks, secondary coolant systems, R4.2
coolers, liquid, S37.4	distribution, S10.5	vegetables, R24.3
		,
data processing, A17.15	Hartford loop, \$10.3	dried, R29.7
dehumidifiers, room, S47.3	inlet orifices, \$10.12	wine, R26.10
duct construction, S16.1	return, S10.3, 6	wood products, A24.2
commercial, \$16.2	sizing, F36.12	Stoves, heating, S29.5
industrial, S16.4	supply, S10.3, 5, 12	Stratification
residential, S16.2	terminal equipment, S10.6	of air
electrical, A55.15	• -	in places of assembly, A4.2
	temperature control, \$10.13	•
engines, \$7.50	terminal equipment	in plenums, A37.2
filters, air, S24.3, 5	forced-convection, S10.11	of water, in thermal storage tanks, A34.4
furnaces, S28.10	natural convection, S10.11	Stroboscopes, F14.25
heaters, S29.6, 7	units, S32.1	Subcoolers
heat pumps, S45	piping design, \$10.6	condensers, S35
packaged terminal, S46.7	radiant panel, \$10.11	evaporative, S35.18
	traps, S10.7	water-cooled, S35.5
unitary, \$45.5, 6	• *	
water-source, S45.11	turbines, S7.13	two-stage, R2.30

Subway environment simulation (SES)	changeover, S3.7, 9	solar collectors, S33.4
program, A13.2	dew-point, F6.12, 13	sound
Subway systems. (See also Mass-transit	dry-bulb, adjusted, A53.1	instrumentation, A37.18
systems)	effective, A51.11; F8.19	procedure, A37.19
car air conditioning, A9.16	humid operative, F8.20	transmission problems, A37.19, 24
station air conditioning, A13.13	mean radiant, A53.1; F8.10; F14.29; S6.1	vibration
ventilation, A13.10	measurement, F14.4	equipment, A37.22
Suction risers, R3.24	odors affected by, F13.2	instrumentation, A37.21
Sulfur content, fuel oils, F18.6	operative, A53.1	isolators, A37.21; A47.47
Superconductivity, diamagnetism, R38.5	plane radiant, F8.11; F14.29	piping transmission, A37.24
Supervisory control, A41	plant environments, F10.15	procedure, A37.21
air-handling systems	radiant asymmetry, F8.11	Testing, adjusting, and balancing. (See also
air distribution, A41.2	sensors, F15.8	Balancing)
sequencing, A41.26	sol-air, F30.26	air diffusers, A37.2
set point reset, A41.27	vertical differences, F8.14	air distribution systems, A37.3
boilers, optimizing, A41.3	wet-bulb, F6.12, 13	reporting results, A37.6
building temperature set point	globe, F8.20	airflow measurement, A37.2
night setback recovery, A41.27	wet-globe, F8.21	balancing procedure, A37.5
precooling, A41.28	wind chill index, F8.21	central plant chilled-water systems, A37.14
chilled-water pumps, A41.6, 16, 17	Temperature-controlled transport, R30.1	cooling towers, A37.18
chillers	Temperature index, S20.2	dampers, F35.18
load distribution, A41.21	Terminal units, A46.14; S2.7; S17.7	design considerations, A37.1
sequencing, A41.6, 20, 23	air distribution, S2.7, 11	dual-duct systems, A37.4
computerized, A39.14	boxes	duct design, F35.13
cooling systems without storage, A41.5	reheat, A46.14; S2.11	energy audit field survey, A37.17
cooling tower fans, A41.8, 12	variable-air-volume (VAV), A47.6 ceiling induction, S17.8	fluid flow measurement, A37.12 HVAC systems, A37.1
cool thermal storage systems, A41.29 ice storage control optimization, A41.37	constant volume, S2.11	hydronic systems, A37.6
forecasting energy requirements, A41.31	dual-duct, S17.8	heat transfer vs. flow, A37.6, 7
optimization methods	dump, S17.8	water-side balancing
dynamic, A41.36	fan-coil, S3.2	instrumentation, A37.8
static, A41.32	fan-powered, A46.14; S2.11; S17.8	proportional method, A37.9
system based, A41.33	humidifiers, S2.12	rated differential method, A37.11
performance measures, A41.2	induction, A46.15; S2.11; S3.2	sizing balancing valves, A37.8
Supply air outlets, S17.1. (See also Air outlets)	reheat, S17.7	temperature difference method, A37.9
Surface effect. See Coanda effect	steam systems, S10.11	total heat transfer method, A37.11
Surface transportation	throttling, S2.11	induction systems, A37.5
automobiles, A9.1	variable-air-volume (VAV), S2.11	instruments, A37.3
	Terrorism. See Chemical, biological,	sound transmission problems, A37.20, 24
fixed-guideway vehicles, A9.18	radiological, and explosive (CBRE) incidents	steam distribution systems, A37.14
mass transit, A9.12	Testing	temperature controls, A37.16
	-: 1 145 15, 624 2	
rail cars, A9.15	air cleaners, A45.15; S24.3	terminology, A37.1
rail cars, A9.15 Surface water heat pump (SWHP)	air cleaners, A45.15; S24.3 air conditioners, packaged terminal, S46.7	terminology, A37.1 variable-air-volume (VAV) systems,
Surface water heat pump (SWHP)	air conditioners, packaged terminal, S46.7	variable-air-volume (VAV) systems,
Surface water heat pump (SWHP) heat exchanger, S45.10	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12	variable-air-volume (VAV) systems, A37.6
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6	variable-air-volume (VAV) systems, A37.6 TETD/TA. See Total equivalent temperature
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11 Sustainability, F17.2	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors	variable-air-volume (VAV) systems, A37.6 TETD/TA. See Total equivalent temperature differential method with time averaging
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11 Sustainability, F17.2 design, A56.2	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30	variable-air-volume (VAV) systems, A37.6 TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11 Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4	variable-air-volume (VAV) systems, A37.6 TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA) TEWI. See Total equivalent warming impact
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11 Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7 SVFs. See Synthetic vitreous fibers (SVFs)	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7 water heating for, A49.22	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11 fans, S18.4	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5 health considerations, A19.7
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7 water heating for, A49.22  Swine	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11 fans, S18.4 filters, air, S24.3	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5 health considerations, A19.7 energy conservation, A19.7
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7 water heating for, A49.22  Swine growth, F10.10	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11 fans, S18.4 filters, air, S24.3 heaters, S29.7	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5 health considerations, A19.7 energy conservation, A19.7 fabric making, A19.3
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7 water heating for, A49.22  Swine growth, F10.10 heat and moisture production, F10.11	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11 fans, S18.4 filters, air, S24.3 heaters, S29.7 heat pumps	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5 health considerations, A19.7 energy conservation, A19.7 fabric making, A19.3 fiber making, A19.1
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7 water heating for, A49.22  Swine growth, F10.10 heat and moisture production, F10.11 recommended environment, A22.7	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11 fans, S18.4 filters, air, S24.3 heaters, S29.7 heat pumps packaged terminal air conditioners	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5 health considerations, A19.7 energy conservation, A19.7 fabric making, A19.3 fiber making, A19.1 yarn making, A19.2
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7 water heating for, A49.22  Swine growth, F10.10 heat and moisture production, F10.11 recommended environment, A22.7 reproduction, F10.11	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11 fans, S18.4 filters, air, S24.3 heaters, S29.7 heat pumps packaged terminal air conditioners (PTACs), S46.7	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5 health considerations, A19.7 energy conservation, A19.7 fabric making, A19.3 fiber making, A19.1 yarn making, A19.2  TFM. See Transfer function method (TFM)
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7 water heating for, A49.22  Swine growth, F10.10 heat and moisture production, F10.11 recommended environment, A22.7 reproduction, F10.11  Symbols, F37	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11 fans, S18.4 filters, air, S24.3 heaters, S29.7 heat pumps packaged terminal air conditioners (PTACs), S46.7 water-source, S45.11	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5 health considerations, A19.7 energy conservation, A19.7 fabric making, A19.3 fiber making, A19.1 yarn making, A19.2  TFM. See Transfer function method (TFM) Theaters, A4.3
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7 water heating for, A49.22  Swine growth, F10.10 heat and moisture production, F10.11 recommended environment, A22.7 reproduction, F10.11  Symbols, F37  Synthetic vitreous fibers (SVFs), F9.5	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11 fans, S18.4 filters, air, S24.3 heaters, S29.7 heat pumps packaged terminal air conditioners (PTACs), S46.7 water-source, S45.11 industrial exhaust systems, A30.8	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5 health considerations, A19.7 energy conservation, A19.7 fabric making, A19.3 fiber making, A19.1 yarn making, A19.2  TFM. See Transfer function method (TFM) Theaters, A4.3 Thermal
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7 water heating for, A49.22  Swine growth, F10.10 heat and moisture production, F10.11 recommended environment, A22.7 reproduction, F10.11  Symbols, F37  Synthetic vitreous fibers (SVFs), F9.5  Tachometers, F14.25	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11 fans, S18.4 filters, air, S24.3 heaters, S29.7 heat pumps packaged terminal air conditioners (PTACs), S46.7 water-source, S45.11 industrial exhaust systems, A30.8 radiant heating system, A53.7	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5 health considerations, A19.7 energy conservation, A19.7 fabric making, A19.3 fiber making, A19.1 yarn making, A19.2  TFM. See Transfer function method (TFM) Theaters, A4.3 Thermal bridges, building envelopes, A43.8
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7 water heating for, A49.22  Swine growth, F10.10 heat and moisture production, F10.11 recommended environment, A22.7 reproduction, F10.11  Symbols, F37  Synthetic vitreous fibers (SVFs), F9.5  Tachometers, F14.25  Tanks, secondary coolant systems, R4.2	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11 fans, S18.4 filters, air, S24.3 heaters, S29.7 heat pumps packaged terminal air conditioners (PTACs), S46.7 water-source, S45.11 industrial exhaust systems, A30.8 radiant heating system, A53.7 refrigeration systems	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5 health considerations, A19.7 energy conservation, A19.7 fabric making, A19.3 fiber making, A19.1 yarn making, A19.2  TFM. See Transfer function method (TFM) Theaters, A4.3 Thermal bridges, building envelopes, A43.8 mass, of buildings, A43.11
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7 water heating for, A49.22  Swine growth, F10.10 heat and moisture production, F10.11 recommended environment, A22.7 reproduction, F10.11  Symbols, F37  Synthetic vitreous fibers (SVFs), F9.5  Tachometers, F14.25  Tanks, secondary coolant systems, R4.2  Television studios, A3.8	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11 fans, S18.4 filters, air, S24.3 heaters, S29.7 heat pumps packaged terminal air conditioners (PTACs), S46.7 water-source, S45.11 industrial exhaust systems, A30.8 radiant heating system, A53.7 refrigeration systems leak detection, R45.4	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5 health considerations, A19.7 energy conservation, A19.7 fabric making, A19.3 fiber making, A19.1 yarn making, A19.2  TFM. See Transfer function method (TFM) Theaters, A4.3 Thermal bridges, building envelopes, A43.8 mass, of buildings, A43.11 (See also Building thermal mass)
Surface water heat pump (SWHP) heat exchanger, S45.10 subset of GSHPs, A32.11  Sustainability, F17.2 design, A56.2 in integrated building design, A57.2, 7  SVFs. See Synthetic vitreous fibers (SVFs)  SWHP. See Surface water heat pump (SWHP)  Swimming pools. (See also Natatoriums) dehumidifiers, S47.4 solar heating, A33.15 water chemistry, A4.7 water heating for, A49.22  Swine growth, F10.10 heat and moisture production, F10.11 recommended environment, A22.7 reproduction, F10.11  Symbols, F37  Synthetic vitreous fibers (SVFs), F9.5  Tachometers, F14.25  Tanks, secondary coolant systems, R4.2	air conditioners, packaged terminal, S46.7 air leakage, fan pressurization, F27.12 clean spaces, A16.6 compressors centrifugal, S34.30 positive-displacement, S34.4 condensers, S35 evaporative, S35.19 water-cooled, S35.7 cooling towers, A37.15; S36.15 desiccant dehumidification for, S22.10, 11 duct efficiency, S9.11 fans, S18.4 filters, air, S24.3 heaters, S29.7 heat pumps packaged terminal air conditioners (PTACs), S46.7 water-source, S45.11 industrial exhaust systems, A30.8 radiant heating system, A53.7 refrigeration systems	variable-air-volume (VAV) systems, A37.6  TETD/TA. See Total equivalent temperature differential method with time averaging (TETD/TA)  TEWI. See Total equivalent warming impact (TEWI)  Textile processing plants, A19 air conditioning design air cleaning, A19.5, 7 air distribution, A19.6 collector systems, A19.5 health considerations, A19.7 energy conservation, A19.7 fabric making, A19.3 fiber making, A19.1 yarn making, A19.2  TFM. See Transfer function method (TFM) Theaters, A4.3 Thermal bridges, building envelopes, A43.8 mass, of buildings, A43.11

Thermal bridges, F23.4 Thermal comfort. <i>See</i> Comfort Thermal control, F23	Thermodynamics, F1.1 absorption refrigeration cycles, F1.13 bubble point, F1.5	Transmitters, pneumatic pressure, F15.9 Transpiration, R9.19 Transportation centers
terminology, F23.1	compressed liquid, F1.2	commercial and public buildings, A3.9
Thermal diffusivity, F23.1	compression refrigeration cycles, F1.6	ventilation, A13.10, 22
Thermal emittance, F23.2	cooling and freezing of foods, R10.1	Transport properties of refrigerants, F20.1
Thermal properties of food, R9	cycle, F1.2	Traps
Thermal resistivity, F23.1	dew point, F1.6	ammonia refrigeration systems
Thermal storage, A34	dry saturated vapor, F1.2	liquid, R3.17
applications, A34.16	enthalpy, F1.4	liquid level indicators, R3.5
benefits, A34.3	entropy, F1.4	purge units, R3.5
building mass, A34.14	equations of state, F1.3	suction accumula r, R3.4
cogeneration, S7.35	laws, F1.2	vertical suction, R3.4
controls, A34.1	liquid, F1.2	steam systems, S10.7
sequence, A34.23	multicomponent systems, F1.5	thermostatic, S10.7
strategies, A41.27	principles, F1.1	Trigeneration, S7
precooling, A41.28	process, F1.2	Trucks, refrigerated, R30. (See also Cargo
cool storage, A34.1, 17; A41.2	properties, F1.2	containers)
district cooling, A34.17; S11.3	calculation, F1.4	Tuning automatic control systems, F15.16
district heating, A34.7; S11.3	zeotropic mixture, F1.9	Turbines, S7
electrically charged storage, A34.11	pure substance, F1.2	codes, \$7.50
brick storage heaters, A34.12	refrigeration cycle analysis, F1.3	combustion, S7.8, 45
central furnace, A34.13	saturated liquid or vapor, F1.2	Brayton cycle, S7.9
heat pump boosters, A34.13	subcooled liquid, F1.2	components, \$7.9
room units, A34.12	superheated vapor, F1.2	controls, \$7.11
underfloor heat, A34.14	terminology, F1.1	dual-shaft, S7.9
water heaters, A34.11, 13	vapor, F1.2	emissions, \$7.13
equipment	Thermometers, F14.5	evaporative cooling applications, \$7.1
cooling, A34.4 heating, A34.11	black globe, A53.7	exhaust gas systems, S7.10 fuels, S7.9
heat storage, A34.1, 11	error sources, F14.5 infrared	heat recovery, S7.25
ice storage, A34.1, 2; R34.3	radiometers, A53.7; F14.9	inlet air cooling (CTIAC), S7.10
charging and discharging, A41.29	thermography, F14.10	instruments, \$7.11
control optimization, A41.37	liquid-in-glass, F14.5	lubrication, S7.10
encapsulated ice, A34.2, 9, 11	resistance	maintenance, S7.13
harvesting system, A34.2, 9	semiconductors, F14.7	noise control, \$7.13
ice on coil, A34.1, 7, 8	temperature devices (RTDs), F14.6	performance, S7.12
piping, A34.21	thermistors, F14.6	single-shaft, S7.9
slurries, A34.10	thermocouples, F14.8	split-shaft, S7.9
industrial refrigeration, A34.17	<b>Thermopile</b> , F14.9; F15.4; R36.4; S26.12	starting systems, S7.10
insulation, A34.6	Thermosiphons	thermal output, \$7.20
latent energy change, A34.2	heat exchangers, S44.14	engine test facilities, gas, A15.3
media, A34.2, 4	solar energy systems, A33.13	expansion, S7.38; S38.1
mission-critical operations, A34.17	Thermostats	gas, S7.9
off-peak	heater control, S29.2, 4	evaporative cooling, A51.13
heating, A34.11	heating/cooling, F15.10	microturbines S7.8
operation, A34.23	location, A46.23	standards, S7.50
phase-change materials, A34.2, 11, 21	types, F15.10	steam
piping,	Three-pipe distribution, S3.5	applications, \$7.45
ice storage, A34.21	Tobacco, drying, F11.14	axial flow, S7.13
process cooling, A34.17	Tobacco smoke	economics, S7.19
retrofits, A34.12	contaminants, A45.2, 7, 11; F12.2, 17	heat recovery
solar energy systems, A33.11, 16, 25; A34.2; S33.3, 11	environmental (ETS), F9.6 Tollbooths	extraction turbines, S7.26 noncondensing turbines, S7.26
system sizing, A34.17	air quality criteria, A13.25	maintenance, S7.19
terminology, A34.1	ventilation, A13.25, 31	performance, S7.16
water storage, A34.4, 27	Total equivalent temperature differential	thermal output, S7.21
aquifers, A34.6	method with time averaging (TETD/TA),	Turbochargers
performance, A34.5	F30.45	heat recovery, \$7.23
tank insulation, A34.6; S33.13	Total equivalent warming impact (TEWI),	supercharger engines, S7.6
temperature range, A34.4	R5.1; R46.16	Turbulence
thermal stratification, A34.4, A34.5	Trailers and trucks, refrigerated, R30. (See	modeling, F34.3
water heaters, A34.11, 13	also Cargo containers)	identification, F34.10
water systems, medium- and high-	Transducers, pneumatic pressure, F15.9	Turbulent flow, fluids, F2.3
temperature, S14.9	Transmittance, thermal, F23.1	Turkeys. (See also Animal environments;
water treatment, A34.6	of flat building component, F23.4	Poultry)
Thermistors, R44.4	thermal bridging, F23.4	growth, F10.12
Chermocouples R44-4	hot-box method F23.4	heat and moisture production, F10 14

1 4 510.14	1 1 0 44 00 640 13	
reproduction, F10.14	check, R44.20; S42.13	testing, adjusting, balancing, A37.4
Turndown ratio, design capacity, S12.3	compressors, reciprocating, S34.7	variable-speed drives, S40.8
Two-pipe systems, S3.8; S12.12	condensing-pressure-regulating, R44.14	Variable-speed drives, S40.8
air-to-transmission ratio, \$3.8	constant-pressure expansion, R44.13	carrier frequencies
central ventilation, S3.8	control valves, F2.7	effect on drive ratings, S40.11
changeover temperature, S3.9	coefficient, F2.9	effect on motor noise, S40.10
chilled-water, S12.12	discharge bypass, R44.15	conductor impedance, S40.8
electric heat, S3.10	expansion	control, S40.8
fan-coil systems, S3.5	constant-pressure, R44.11, 13	harmonic disturbances, S40.11
nonchangeover design, S3.10	electric, R44.10	load side, S40.12
steam convection heating, S10.12	thermostatic, R44.5	motors, S40.10
zoning, S3.10	float control, R44.16	impedance, S40.8
U.S. Marshal spaces, A8.5		
	flow coefficient, S42.2, 9	pulse width modulation, S40.8
U-factor	geothermal energy, A32.7	transistors, S40.8
center-of-glass, F31.4	halocarbon refrigeration systems	voltage waveform distortion, \$40.11
doors, F25.14; F31.11	equivalent lengths, R2.10	VAV. See Variable-air-volume (VAV) systems
edge-of-glass, F31.4	float control, R2.26	Vegetables, R24
fenestration products, F31.6	hydronic systems	air transport, R32.1
frame, F31.4	control, S12.10	
		cooling, R15.1
thermal transmittance, F31.4	safety relief, \$12.13	deterioration rate, R11.1
windows, F25.14	manual, S42.3	display refrigerators, R46.8
Ultralow-penetration air (ULPA) filters, S24.7;	materials, S42.1	dried, storage, R29.7
S25.2	multiple-purpose, S42.10	frozen, R27.3
Uncertainty analysis	noise, S42.2	misters and Legionella pneumophila control,
measurement, A40.12, 13	pressure drop, F36.1, 7	A48.7
	1 1	
precision uncertainty, F14.3	pressure-reducing makeup water, S42.13	refrigeration, R24.1
sources, F14.3	pressure relief, S42.11	storage, R24.3
systematic uncertainty, F14.3	safety, R44.21	thermal properties, R9.1
statistical regression, A40.13	ratings, S42.1	transport, R24.2
Unitary systems, S5.3; S45	refrigerant control, R44.5	Vehicles
floor-by-floor systems, \$5.6	regulating and throttling, R44.10	ac- or dc-powered, transit, A9.16
heat pumps, S5.2; S45.1, 8, 10	safety, S42.11	design, R30.1
	•	
outdoor equipment, S5.7	solar energy systems, A33.12	equipment attachment provisions, R30.3
room-by-room systems, S5.3	solenoid, R44.17; S42.6	sanitation, R30.3
self-contained, S5.6	steam system, S10.9, 13	temperature-controlled, R30.1
split systems, S5.5; S45.1	stop-check, S42.13	use, R30.9
through-the-wall, S5.2	suction pressure regulating, R44.14	Vena contracta, F2.4
window-mounted, S5.2	thermostatic, S10.13; S42.12	Vending machines, R47.5
Unit heaters. See Heaters	water hammer, S42.2	Ventilation, F27
		•
Units and conversions, F38.1	zone control, S10.13	age of air, F27.4
Unit ventilators, S31.1	Vapor pressure, F39.2	air change effectiveness, F27.4
Utility interfacing, electric, S7.28	Vapor retarders, A43; F26.8	aircraft, A10.1, 4
Vacuum cooling, of fruits and vegetables,	jackets, F26.8	air exchange rate, F27.3, 10
R15.9	Variable-air-volume (VAV) systems	airflow, F27.2
Validation, of airflow modeling, F34.9, 10, 17	all-air	animal environments, A22.5
Valves, S42. (See also Regulators)	dual-duct, S2.9	bus garages, A13.20
actuators, S42.5	single-duct, S2.8	bus terminals, A13.22
ammonia refrigeration systems	versus constant-air-volume (CAV), A14.12;	cargo containers, R30.5
control, R3.8	A37.4	climatic infiltration zones, F27.16
float control, R3.19	control, A41.2, 27	dilution, A29.2; A45.5
relief, R3.10	diversity, A37.5	displacement, F33.10; S2.10
solenoid, R3.10	dual-duct systems, S2.9	design, F33.11
stop, R3.8	duct static pressure control, A46.8, 9	driving mechanisms, F27.10
		•
authority, 842.8	fan	effectiveness, F27.4
automatic, \$42.5	selection, A47.5	engine test facilities, A15.1
actuators, S42.5	sequencing, A46.10	forced, F27.1
applications, S42.9	unstable operation, A46.10	gaseous contaminant control, A45.5
control, F15.4	humidity control, S20.8	greenhouses, A22.13
computerized, S42.6	museums, galleries, archives, and libraries,	health care facilities, A7.1
•		
expansion, S21.2	A21.19	hospitals, A7.2
flow characteristics, S42.87	pressure-dependent systems, A37.4	nursing facilities, A7.14
sizing, S42.8	pressure-independent systems, A37.4	outpatient, A7.13
types, S42.6	single-duct, S2.8	indoor air quality (IAQ), F27.9
backflow-prevention devices, S42.13	sound control, A47.5	industrial environments, A29
balancing, S42.10	static pressure control, A37.4	exhaust systems, A30.1
sizing, A37.8	static pressure reset, A41.27	in-room terminal systems, S3.5
•		· · · · · · · · · · · · · · · · · · ·
body styles, \$42.3	system types, A37.5	kitchens, A31
cavitation, S42.2	terminal boxes, A46.14; A47.6	laboratories, A14.8

leakage function, F27.12	testing, A37.21; A47.47	vapor. (See also Moisture)
mechanical, F27.1	piping	control, F23.2
mines, A27	connectors	flow, F23.2, 7
natatoriums, A4.6	expansion joint or arched, A47.45	and heat flow, F23.5
natural	flexible, A47.45	pressure, saturation, F23.8
airflow, F27.1, 10	hose, A47.45	resistance, F23.2
guidelines, F27.I1	noise, A47.44	retarders; F24.8
stack effect, F27.11	resilient hangers and supports, A47.44	condensation, S20.2
wind, F27.10	places of assembly, A4.1	heating climates, F24.5
nuclear facilities, A26.4	resonance, A47.47	mixed climates, F24.7
odor dilution, F13.5	seismic restraint, A47.46; A54.1	refrigerant piping insulation, R33.4
power plants, A25.3	standards, A47.48	refrigerated facilities, R14.5, 12
railroad tunnels, A13.14	troubleshooting, A37.23; A47.46	warm/humid climates, F24.8
rapid-transit systems, A13.10	Virgin rock temperature (VRT), and heat	terminology, F23.2
residential, F27.15	release rate, A27.3	transmission, F25.1
road tunnels, A13.4	Viscosity, F2.1	Water heaters
roof ventilators, A29.3	fuel oils, F18.5	blending injection, A49.4
security concerns, A58.3	lubricants, R7.5	boilers (indirect), A49.25
ships, A11.1	modeling, F34.10	circulating tank, A49.4
terminology, F27.1	moist air, F6.19	combination, A49.4
thermal loads, F27.9	Volatile organic compounds (VOC), F9.8	electric, A49.2
tollbooths, A13.24	contaminants, A45.2	gas-fired, A49.2, 2
unidirectional, F33.12	Voltage, A55.1	heat pump, S45.3
warm/humid climates, F24.8	Volume ratio, compressors	indirect, A49.3, 25
wind effect on, F16.7	rotary vane, S34.11	instantaneous, A49.3, 23
entilators	single-screw, S34.14	oil-fired, A49.2, 2
roof, A29.3	twin-screw, S34.18	placement, A49.10
unit, S31	VRT. See Virgin rock temperature (VRT)	refrigeration heat reclaim, A49.4, 25
capacity, S31.1	Walls, A43.3	semi-instantaneous, A49.3, 23
control, A46.17; S31.3	acoustic insulation, F23.17	sizing, A49.11, 23, 25
location, S31.3	airflow retarders, A43.4	solar energy, A49.4
selection, S31.3	glass block, F31.40	storage, A49.2, 3, 11
types, S31.1	insulation, exterior, A43.4	terminology, A49.1
enting	masonry construction, A43.4; F24.2	usable hot-water storage, A49.10
furnaces, S28.2	moisture control, A43.4	waste heat recovery, A49.4
gas appliances, S30.19	panelized, A43.4	Water/lithium bromide absorption
oil-fired appliances, S30.20	residential, A43.3	components, R41.1
erification, of airflow modeling, F34.9, 10, 17	roof interface	control, R41.6
essels, ammonia refrigeration systems, R3.3	air leakage, A43.7	double-effect chillers, R41.3
ibration, F7.19	moisture control, A43.8	maintenance, R41.7
compressors	steel frame construction, F24.2	operation, R41.6
centrifugal, S34.32	window interface, A43.6	single-effect chillers, R41.2
positive-displacement, S34.3	wood frame construction, A43.3; F24.1	single-effect heat transformers, R41.3
scroll, S34.24	Warehouses, A3.11	terminology, R41.1
single-screw, S34.16	Water	Water-source heat pump (WSHP), S45.10
critical speeds, \$18.8	boiler thermal models, F32.14	Water systems, S12
health effects, F9.13	coils, S21.2	air elimination, S12.14
measurement, F14.28	air-heating, S23.2	antifreeze, S12.16
accelerometer, F7.21	coolers, R26.11	precautions, S12.17
instrumentation, A37.21	distribution, S4.4; S12.5; S14.7	capacity control, \$12.9
testing, A37.21	central plants, S11.4	chilled-water, S12.1, 11
ibration control, A47	district heating and cooling, S11.18	cogeneration distribution, S7.31
air handlers, S2.7	fan-coil systems, S3.5	district heating and cooling, S11.19, 31
chillers, A47.12	filtration, A48.7	closed, S12.1; S14.1
clean spaces, A16.17	hammer, F36.6	components, S12.2
cogeneration, S7.41	pipe stress, S11.6	condenser water, \$13.1
criteria, A47.38	heating	closed, S13.3
data reliability, A47.1	geothermal energy systems, A32.9	once-through, S13.1
ducts, A47.46	solar energy systems, A33.13	open cooling tower, S13.1
engines, S7.7	water treatment for, A48.10	air and vapor precautions, S13.2
equipment vibration, A37.22	humidifier supply, S20.4	freeze protection, S13.3
analysis, A37.23	properties, A48.1; S14.2	piping, S13.2
fans, S18.9	references, F6.19	water treatment, S13.2
floor flexibility, A47.47	refrigerant, F20.1, 36-37	overpressure precautions, S13.3
isolators	in refrigerant systems. See Moisture, in	water economizer, S13.3
noise, A47.38	refrigerant systems	control valve sizing, S12.10
resonance, A47.48	systems, pipe sizing, F36.5	Darcy-Weisbach equation, \$39.4
specifications, A47.39	thermal storage systems, A34.4, 11, 27	district heating and cooling, S11.3

dual-temperature (DTW), S12.1, 12	pump curves, S12.5; S39.3	heating, F28.5
equipment layout, S12.15	pumping	relationships, F28.4
expansion tanks	compound, S12.6	residential infiltration zones, F27.16
functions of, S12.3, 7	distributed, S39.13	sources, F28.3
sizing equations, S12.4	parallel, S12.6; S39.10	Welding sheet metal, S16.6
fill water, S12.13	primary-secondary, S12.6; S39.12	Wet-bulb globe temperature (WBGT), heat
four-pipe, S12.13	series, S12.6; S39.11	stress, A29.4
freeze prevention, S12.15	variable-speed, S39.12	Wheat, F11.13
hot-water	standby pump, S12.6; S39.12	Wheels, rotary enthalpy, S44.10
boilers, S27.1	two-speed motors, S39.12	Whirlpools and spas
cogeneration distribution, S7.32	safety relief valves, \$12.13	Legionella pneumophila control, A48.7
district heating and cooling, \$11.29	steam and, combined, S10.15	service water heating, A49.23
high-temperature (HTW), S12.1	temperature classifications, S12.1	Wien's displacement law, F3.8
loads, S12.2	turndown ratio, S12.3	Wind. (See also Climate design information;
low-temperature (LTW), S12.1	two-pipe, S12.12	Weather data)
design considerations, S12.8; S32.3	water horsepower, \$39.6	data sources, F16.6
heating systems, S12.10	Water treatment, A48	effect on
loads, S12.2	air washers, A48.9; S19.8	chimneys, S30.3, 27
nonresidential, S12.10	biological control, A48.5	smoke movement, A52.3
terminal equipment, S32.1	Legionella pneumophila, A48.6	system operation, F16.7
medium- and high-temperature, S12.1;	boilers, A48.10	pressure, F16.3
S14	brine systems, A48.10	Wind chill index, F8.21
air-heating coils, S14.8	closed recirculating systems, A48.10	Windows. (See also Fenestration)
boilers, S14.2	condensers, evaporative, S35.18	air leakage, A43.7; F31.56
cascade systems, S14.6	condenser water, S13.2	heat transfer, A43.6
circulating pumps, S14.7	cooling towers, A48.4, 8; S36.13	moisture control, A43.7
control, S14.8	corrosion control, A48.2, 9	solar gain, A43.6; F31.13, 36
design, S14.2	evaporative coolers, S19.8	U-factors, F25.14; F31.4, 6
direct-contact heaters, S14.6	filtration, A48.7	wall interface, A43.6
direct-fired generators, S14.2	fundamentals, A48.1	Wind restraint design, A54.22
distribution, \$14.7	heating systems, A48.10	minimum design wind load, A54.22
expansion tanks, S14.4	ice makers, A48.7, 9	Wineries
heat exchangers, S14.8	medium- and high-temperature systems,	refrigeration, R26.8
piping design, S14.7	S14.9	temperature control
pressurization, S14.4	nonchemical (physical), A48.5	fermentation, R26.9
safety, S14.9	once-through systems, A48.9	storage, R26.10
space heating, S14.8	open recirculating systems, A48.9	wine production, R26.8
thermal storage, S14.9	scale control, A48.4	Wood construction, and moisture, F23.5
water treatment, \$14.9	sprayed coil units, A48.9	dimensional changes, F23.6
medium-temperature (MTW), S12.2	steam and condensate systems, A48.11	Wood products facilities, A24.1
loads, S12.2	terminology, A48.11	evaporative cooling, A51.13
loads, S12.2	thermal storage, A34.6	process area, A24.1
makeup, S12.13	Water vapor retarders, F23.18	storage, A24.2
open, S12.1; S13.1	Water wells, A32.24	Wood pulp, A24.2
pipe sizing, \$12.15	Weather data	Wood stoves, S29.5
piping, S12.8	design conditions, F28.1	World Wide Web (WWW), A39.17
water distributuion, S12.5	calculation, F28.4	WSHP. See Water-source heat pump (WSHP)
pressure drop determination, S12.15; S39.4	cooling, F28.5	WWW. See World Wide Web (WWW)
pumps, S39.1	dehumidification, F28.5	<b>Xenon</b> , R38.17