Marine (*see ship heating, ventilating, air conditioning*)
Mass, 6
Mean radiant temperature, 119, 601, 961

Meter, meters, 78, 732
area, 78, 85, 732
condensate, 732
flow, 78, 85, 732
force, 78
head, 78, 83, 732
installation, 732
orifice, 79, 1228
selection, 733
velocity, 733
venturi, 1229
Metering, liquids, 78, 732
Micromanometers, 1225
Micron, 6
Mist, 152

Moist air, 25
properties of, 25
saturation, 26
specific volume, 32

Moisture, 217, 1128, 1135
content, 1128, 1130, 1136
in building construction, 217
load, 331, 942
loss per person, 122, 326
movement in materials, 220
permeability, 224
regain, 1128
transmission, 220
Mol, 6
Molecular force of water, 219
Monofluorotrichloromethane, 899, 903

Motor, motors, 282, 327, 973
alternating current, 977
capacitor type, 980
classification, 976
control, 984, 987
control equipment for, 984
current limitation, 985
design limits, 974
drives, 974
electric, 973
enclosures, 989
glossary, 988
heat generated by, 282
hermetically enclosed, 982
increment limitation, 985
multi-speed, 979, 986
polyphase, 977
rating, 986
repulsion induction, 981
selection, 973
single phase, 980
speed characteristics, 976
speed classification, 989
speed ranges, 974
split phase, 981
squirrel cage, 977, 984
starting methods, 984
synchronous, 978, 985
wound rotor, 978, 985
Mountings, flexible, 1022

N

Natural draft, 433
towers, 863
Natural ventilation, 247
general rules, 253
heat removal, 249

Noise, noises, 991, 1205
absorptive material, 1014
air conditioning system, 991, 1205
air supply opening, 1006
apparatus for measuring, 994
attenuation, 993
control, 991, 996
controlling vibration, 1022
cross transmission between rooms, 1021
design room level, 1014

Noise, noises (*continued*)
duct sound absorbers, 1008–1013
duct system attenuation, 1007
fans, 1002
general problem, 994
grille, 1006
intakes, 776
kinds of, 1001
levels, 767, 998, 999, 1001
loudness, 993
measurement, 994
plate cells, 1011
plenum absorption, 1011
recommended levels, 1001
through building construction, 1001, 1021
transmitted through ducts, 1001, 1021
unit of measurement, 991–994
Nozzle flow, 75, 78

Nurseries for premature infants, 141
air conditioning equipment, 142
air conditioning requirements, 141

O

Odors, 111, 113, 148, 156, 842
human body, 111

Oil burners, 394
atomizing, 394
boiler settings, 393
classification, 387, 394
combustion adjustments, 391
combustion efficiency, 392
combustion process, 390
commercial, 394
controls, 954
domestic, 387
furnace design, 393
gun type, 387
industrial, 394
measurement of efficiency of combustion, 392
mechanical draft, 387
operating requirements, 390
rotary type, 388, 394
vaporizing type, 389

Oil Fuel, 352
analysis, 353
calorific value, 356
classification of, 352, 355
combustion index, 357
combustion of, 356, 390
estimating consumption, 404 467
heating of, 395
piping, 395
storage, 395
Oil storage tanks, 395

One-pipe system, 506, 560
gravity air-vent, 507, 527
hot water, 6, 560
steam, 6
supply riser, 6
unit heater connection, 506
vapor, 508

Opening, openings
air supply noises, 955
sealing of, 246
stacks, 253
types of, 252
doors, 252
roof ventilators, 252
skylights, 252
vertical, 246
windows, 252

Operating rooms, 138
conditions, 139
reducing explosion hazard, 138
sterilization of air in, 140

Orifice
discharge, 75, 517
flow, 75
formulas, 77, 1228
heating systems, 514
Orsat apparatus, 1236
Outdoor air, 113, 735, 1162, 1165

Outlet, outlets
air noises, 1006
ceiling, 769
duct approaches, 773
location, 477, 770
perforated, 768, 770
performance, 765, 771
selection, 770
side outlets, 477
slotted, 769
sound absorbers, 1011
types, 477, 754
vaned, 766
wall outlets, 768
Outside temperature, 263, 291
Overhead distribution, 510, 1195
Overhead system, 6, 510, 1195
Owen jet dust collector, 153
Oxygen
chambers, 146
tents, 146
therapy, 145
Ozone, 113, 160

P

Panel heating, 6, 597
application methods, 597
calculation principles, 600–607
convection transfer, 602
design of panel, 608–622
electric, 600, 622, 1033–1035
embedded piping, 598, 599
hot water, 597, 608
installation, 622
output from surface, 597, 600
piping, 597
radiation transfer, 601
starting system, 599
steam, 597
warm air, 6, 497, 600
Panel radiator, 6
Particle size chart, 153
Perfect gas relationships, 27
Perforated ceilings, 770
Perforated outlets, 761, 770
Permeability, 221, 225
Permeance, 221, 224, 225
pH value, 421, 1046, 1050
Physical impurities in air, 113

Physiological principles, 111
acclimatization, 116
application to problems, 121
comfort chart, 126
effective temperature, 122
high temperature hazards, 117
thermal interchanges, 113
upper limits of heat, 119
Pipe coils, 592, 623
heat emission, 591, 698–700
wall, 592

Pipe, piping, 665
application, 692–694
breeching, 419
capacity, 519, 520, 522–529, 553, 1177
coatings, 1065
coil connections, 544
coil output, 592
cold water, 1177
color identification, 22
commercial dimensions, 666–669
conduits for, 722
connection to heating units, 544
corrosion, 1045, 1057
covering, 695
design, hot water system, 551
dimensions, 666–669
economical thickness insulation, 707

Pipe, piping (*continued*)
expansion, 686
fittings, 672–683
fitting equivalent, 521, 556, 557, 1178, 1184
flexibility, 686
forced circulation, 551
freezing, 712
friction loss, 552, 554, 555, 581, 1180–1182
gas, 401
hangers, 690
heat losses, 698–705
hot water heating systems, 551
hot water supply, 1194
inside dimensions, 666–669
insulation, 695, 727
insulation prevent freezing, 712
low temperature insulation, 710
materials, 665, 1065
one-pipe forced circulation, 557
one pipe gravity, 527
one-pipe vapor, 528
overhead distribution, 511, 1195
pressure loss, 69, 72
properties, 666–669, 688
sizes, 518, 551
cooling systems, 1186
forced circulation, 551–568
gas, 401
high pressure steam, 526–528
high temperature water, 580
hot water forced circulation, 551–556
hot water gravity circulation, 547
indirect heating units, 531
low pressure, 524, 525
one pipe riser, 522, 529
one pipe vapor, 528
orifice systems, 514
pressure drop, 518
tables for steam, 519–527
threading data, 671
two-pipe forced circulation, 557
two-pipe low pressure, 529
two-pipe riser, 522
two-pipe vapor systems, 529
vacuum systems, 530
water supply systems, 1177, 1180–1182
steam distribution, 522, 721
steam heating systems, 522–527
supports, 690
surface, 666–669
symbols for drawings, 17
tax, 415
threading practice, 671
tunnels, 725
underground insulation, 714
unit heater connections, 506, 546, 642
water supply, 1177
welding, 684
wrought-iron, 665
wrought-steel, 665
Pitot tubes, 84, 1226
Plate cell, 1011
Plenum absorbers, 1011
Plenum chambers, 6
Pneumatic control systems, 946
Pollen, atmospheric, 163

Pollution of air, 151, 154
Polyphase motors, 977
Ponds, 861
Potentiometer, 6, 1221
Power, 6
Precipitators, 835, 848
Precooling, 747
Premature infant nurseries, 140

Pressure
absolute, 6
atmospheric, 1
changes in ducts, 781, 794

Pressure (*continued*)
dynamic, 6
gages, 6, 1223
loss, elbows, 495, 521, 556, 583, 1184
loss, water supply piping, 1180–1182
measurement, 1223
barometer, 1225
regulators, 531, 729
saturation, 7
static, 7
taps, 82
total, 7
vapor, 7
velocity, 7
Prime surface (*see Heating Surface*), 9
Process and product air conditioning, 1117
calculations, 1132
conditioning and drying, 1129
contaminant control, 156
control of chemical reactions, 1129
general requirements, 1117
humidities, 1118–1128
laboratories, 1132
machining tolerance, 1131
moisture content and regain, 1128
polished surfaces, 1132
process, 1117
temperatures, 1118–1128
Propeller fan, 813, 821
Protective coatings, 1065
Psychrometer, 7, 1233
Psychrometric chart, 51–53, 124
Psychrometry, 7

Pump, pumps
condensate return, 535
high temperature, 582
mechanical circulators, 567, 582
vacuum heating, 536
controls, 537
piston displacement, 537
Pyrometer, 7, 1223
optical, 1223
radiation, 1223

R

Radial flow fan, 813
Radiant drying, 1154

Radiant heating, (*see Panel heating*)
Radiation, 7, 89
baseboard, 590
equation, 92
finned tube, 591
load, 415
ratings, 592
shape factor, 95
thermal, 7

Radiator, radiators, 7, 587–589
baseboard, 590
codes, 589, 592, 1241
concealed, 7, 589
connections, 544
correction factor, 594
direct, 7
effect of paint, 595
enclosed, 595
gas-fired, 399
heat emission of, 587
heating, 595
heating effect, 593
output of, 587, 594
panel, 6
ratings, 592
recessed, 7, 591
tube, 7, 588
types of, 588
warm air, 399

Radioactive contaminants, 165

Railway air conditioning, 1161
air cleaning, 1162
air distribution, 1162
heating, 1161
humidity control, 1164
refrigeration, 1162
summer systems, 1162
temperature control, 1164
ventilation, 1163
winter systems, 1161
Reciprocating compressors, 918
Recording equipment, 950
Rectangular duct equivalents, 787–789
Reducing valves, 531, 729
Reflective insulation, 176, 178

Refrigerant, refrigerants, 7, 899
dichlorodifluoromethane, 890, 891
feeds, 884
monochlorodifluoromethane, 902, 903
monofluorotrichloromethane, 904
pipe size, 928
water, 912

Refrigeration, 897, 1162, 1166
absorption system, 912
accessories, 929
air cycle, 911
basic concepts, 897
complex cycles, 910
compressors, 918–923
condensers (*see Condensers*), 923
control, 926
coolers, 925
definitions, 897
discharge pressure, 908
equipment selection, 931
evaporators, 925
expansion valves, 926
float valves, 926
heat pump, 915, 916
load, 287
mechanical, 897, 906, 1166, 1174
piping, 928
reverse cycle, 898, 916
ship, 1172
simple cycle, 905
steam jet, 911
subcooling, 909
suction, 908
superheating, 909
symbols for drawing, 17
theory, 897
ton of, 7, 897
types of compressors (*see Compressors*), 918
vapor compression cycle, 905
water jacket, 909

Regain, 1128
control of, 1117
hygroscopic materials, 935
static, 801

Register, registers, (*see Grilles*), 476, 751, 769, 776
air noises, 1006
mechanical furnace systems, 476
noises, 767, 1006
selection, 476, 770
Regulator, 389, 392
Reheat, 736, 748
Relative humidity, 5, 25, 52, 229
measurement of, 1232
Relief valve, 579, 1196

Residence
control systems, 957
air conditioning, 957, 1201
domestic hot water supply, 1199
heating, 957
cooling methods, 503, 1201