

Glass block walls
coefficient of transmission, 123
solar heat gain, 191-194
Globe thermometer, 624
Graphical symbols for drawings, 9-12
air conditioning, 9, 11, 12
ductwork, 10-12
heating, 9-11
piping, 9-10
refrigerating, 11, 12
ventilating, 10, 11
Grate area, 3

Greek alphabet, 6

Grille, grilles (see Registers), 237, 267
275, 343
air supply noises, 343
attenuation, 343-344
exhaust, 279
locations, 237, 276, 279
door, 279
floor, 279
wall, 279
mechanical furnace systems, 237
noises, 279, 343
railway car, 664
recirculating, 664
return, 237, 279
velocity, 237, 269, 279
Ground temperatures, 159

Guarded hot plate, 634
Gun type oil burners, 488

H

Hangers, pipe, 448

Hartford return connection, 356, 374, 375

Hay fever symptoms, 90
Hazards
high temperature, 64, 86, 691
Health, 83

Heat, 3
area transmitting surface, 758
auxiliary sources, 163, 197
balance, 481
combustion, 468, 473, 475
cramps, 64
emission of
appliances, 197, 200, 201
occupants, 66, 67, 197
pipe coils, 209, 420
exchange measurements, 62
flow resistance, 51
flow through glass, 123, 184
flow through roofs, 102-110, 178
flow through walls, 110-118, 178
gain, 167
generated by motors, 197
humid, 3
infiltration equivalent, 196
instantaneous load, 169, 191
introduced by outside air, 196
lag, 191
latent, 3, 162, 167, 196, 198, 204
liquid, 3
loss, pipe, 455
mechanical equivalent of, 4, 8
methods of, transfer, 47
radiant, 48, 51, 52
ratio, sensible, 199
removal, natural ventilation, 144
sensible, 3, 161, 198
gain, 167, 196
loss, 161
specific, 3

Heat (continued)
stroke, 64
total, 3
transfer, 47, 102-118, 300, 758
boiler rates, 502
convective, 2
overall coefficients, 93, 97, 102-118, 320, 753
surface coils, 320
symbols, 9, 50, 93
through building materials, 93
upper limits, 65
water coils, 758

Heat gain
appliances, 197, 200, 201
ceilings, 195
components of, 167
ducts, 194, 300
electrical heating equipment, 200
floors, 195
gas burning equipment, 200
glass, 184-189
glass blocks, 188-194
infiltration, 196
instantaneous, 169, 191
latent, 169, 196, 198
lights, 197
miscellaneous, 199
moisture, 198
occupants, 197, 198
outside air, 196
partitions, 195
people, 66, 198
roof, 178-184
sensible, 169, 196
shaded windows, 195
solar, 184
steam heated equipment, 201
various sources, 163, 199
ventilation, 196
wall, 178, 182, 183

Heat loss
air change, 161
bare pipe, 209, 455
basement, 160
building materials, 99-101
ceiling, 110, 112, 113
computations, 151
calculated method, 151
crack method, 162
exposure factors, 163
factors of safety, 163
number of air changes, 162
duct, 300
glass, 123
floor slab, 160
infiltration, 161
insulated pipe, 458-463
latent, 162
pipe, 209, 455
residence problems, 163
roofs, 114-118
sensible, 161
surface to air, 98, 99
through ceilings and roofs, 161
transmission, 93, 161
ceilings and roofs, 110, 112-118
walls, 102-109

Heat pump, 3, 563
application, 574
basic circuits, 565
coefficient of performance, 565
components, 572
cooling load, 575
criteria for feasibility, 574
design, 575
distribution system, 575

Heat pump (continued)
equipment selection, 572-575
heating load, 571
heat sink, 567-569
heat source, 567-569
heat storage, 575
history, 563
operating cost, 572
performance characteristics, 569
performance factor, 565
seasonal performance, 571
selection, 575
system balance, 570
types, 563, 569

Heat removal, 144
Heat stress index, 1, 692

Heater, heaters
blast, 1
direct-fired unit, 217, 218
electric, 217, 220, 232
gas, 514
design, 514
efficiency, 514
materials, 514
oil, 513
design, 514
materials, 513
rating, 513
testing, 513
radiant, 495
solar water, 760
solid fuel, 512
design, 513
material, 512
rating, 512
testing, 512
space, 512
installation, 514
unit, 217, 232
vertical blow unit, 218

Heating
air-conditioning units, 223
boilers, 501
surface, 1, 502
coil selection, 318
comfort, 151
district, 383
effect, radiator, 211
electric, 231
hot water, 756
load, 151, 261, 506
performance of coils, 320, 758
reversed cycle refrigeration, 563
steam systems, 355
surface, 5
square foot of, 4
symbols for drawing, 9
vacuum systems, 6, 355, 359
vapor, 6, 358
warm air system, 6, 237
water, 391, 409, 753
Heavy duty fan furnace, 510
High duty humidifiers, 591
High temperature hazards, 64, 86

High temperature systems, 409
basic system, 409
boilers for, 411
control, 413, 416
design, 409, 414
direct contact heaters, 413
expansion cushion, 411
features, 409
fittings, 414
fitting pressure loss, 416
heat exchangers, 413
pipe, 414
pumps, 414

High temperature systems (continued)
storage, 418
water treatment, 418
High velocity systems, 263, 295
design, 295
control, 296
Hood, hoods, 701
Hot process exhaust, 703
Horsepower, boiler, 1

Hospital, hospitals
air conditioning in, 83, 91
operating rooms, 86
air conditions, 87
reducing explosion hazard, 86
sterilization of air, 83
ventilation requirements, 87

Hot water
boiler supply load, 506, 753
coil surface, 758
demand per
fixture, 747, 748, 755
person, 754
distribution, 390
electric heating, 756
heat pump, 762
heating surface, 758
indirect heater, 757
methods of heating, 755
panel heating, 419, 424
safety devices, 760
service, 753
service piping, 759
solar heaters, 760
storage tank, 753
supply
boilers, 501, 755-758
piping, 759
temperature control, 759

Hot water heating systems, 3, 391
circulation head, 391, 392
direct return system, 2
elbow equivalents, 396, 416
expansion tank, 403
forced circulation, 391
friction heads, 393-396
gravity, 391
high temperature, 409
basic system, 409
boilers, 411
control, 413, 416
design, 409, 414
direct contact heaters, 413
expansion cushion, 411
features, 409
heat exchangers, 413
pipe fittings, 414
pumps, 414
storage, 418
water treatment, 418
mechanical circulators, 402, 414
one-pipe
forced circulation, 398
pipe sizes, 393-396, 415
piping design, 393, 414
relief valve, 408
reversed return system, 397
two-pipe, forced, 397

Human body
acclimatization, 64
adaptation, 62, 64
cold conditions, 63
hot conditions, 63
heat emission, 66
reflective, 98, 100
sound, 344-347
thermal conductivity, 454
underground pipe, 388

Human body (continued)
thermal interchanges, 62
zone of evaporative regulation, 63
Humid heat, 3

Humidification, 3, 224, 591, 594
control, 254, 621
direct, 594
evaporative pans, 512
forced furnace systems, 254

Humidifier, humidifiers
air washer, 591
atomizing, 591
cleaning, 512
evaporating pans, 512
high duty, 591
self-contained, 591
spray, 591
unit, 591
Humidistat, 3, 612

Humidity, 3
absolute, 3
control, 260, 621, 691, 697
influence of, 66, 88
measurement of, 633
nurseries for premature infants, 88
ratio, 3, 14
relative, 3, 14
specific, 3

Hygrometers, 633
Hygroscopic materials, 687
Hygrostat, 3

Impulse trap, 378
Inch of water, 3
Indoor temperature, 157, 167, 168
Induction units, 267, 263
high pressure types, 262
low pressure types, 262

Industrial
air conditioning, 681
chimneys, 516
degree days, 538, 539
exhaust systems, 701

Infiltration
causes, 139
due to wind pressure, 139
heat losses, 161
latent, 162
sensible, 161
measurement, 633
prevention by sealing, 143
temperature differences, 142
through outside doors, 140, 141
through walls, 139
through windows, 140
Inflammability, 80
Instruments, 627
Insulated constructions, 111, 113, 119-121
Insulating materials, 108, 454
calculating coefficients, 111, 113
conductivities and conductances, 99-101

Insulation, 3, 453
economical pipe thickness, 459, 461
edge, 160
low temperature pipe, 463
pipe, 453
pipes to prevent freezing, 463
reflective, 98, 100
sound, 344-347
thermal conductivity, 454
underground pipe, 388

Ionization, 62
Intermittently heated buildings, 163
Isobaric, 3
Isothermal, 3

Jets, 268
expansion, 269
radial, 271
velocity, 269
Joints, duct, 298, 299

K

Kata thermometer, 632
Kitchen hood, 705

L

Laboratories, 690

Latent heat, 3, 162, 167
loss, 162
Laws of thermodynamics, 6

Leakage of air, 139 (see Infiltration)
door, 140-142
window, 140, 141
Light heat gain, 197
Lignite, 469
Liquid
absorbents, 601
heat of, 3
Lithium bromide, 552, 553, 601
Lithium chloride, 601

Load
cooling, 167, 191, 261
factor, 539
heating, 151, 261
lighting, 197
maximum, 3, 506, 539
refrigeration, 167

M

Mach number, 38, 39

Machine vibration, 352
Manometer, 3, 629
Marine (see Ship heating, ventilating, air conditioning)
Mass, 4
Mean radiant temperature, 65, 421, 432

Meter, meters, 40, 389, 629
area, 40, 44, 389
condensate, 389
flow, 40, 44, 389
force, 40
head, 40, 43, 389
installation, 389
orifice, 44, 631
selection, 389
velocity, 389
venturi, 631
Metering, liquids, 40, 389
Micromanometers, 629
Micron, 4
Mist, 73

Moist air, 13
properties, 13
saturation, 14
specific volume, 18

Moisture, 127, 687, 715
content, 687, 688, 716
in building construction, 127