

Contents

Chapter No.	Page No.
UNITS CONVERSION FACTORS	xiii
1 THERMODYNAMIC PROPERTIES AND STATE OF PURE SUBSTANCES	1-A
Pressure and Temperature	1
Ideal Gas Behavior	8
Ideal Gas Equation of State	11
Tables of Thermodynamic Properties	20
2 WORK AND HEAT	33-A
Work Interactions	33
Work Done on the Moving Boundaries of a System	34
Work for Particular Processes	50
Heat	59
3 ENERGY AND THE FIRST LAW OF THERMODYNAMICS .	62-A
The First Law for Constant Mass Systems.....	62
Internal Energy, Enthalpy, and Specific Heat of Ideal Gases	88
Conservation of Mass	103
The First Law for Open Steady-State Steady-Flow Systems	106
The First Law for Closed Uniform-State Uniform-Flow Systems	126
4 ENTROPY AND THE SECOND LAW OF THERMODYNAMICS	151-A
Reversible Processes and Cycles.....	151
Entropy Change in Reversible and Irreversible Processes .	156

Entropy Change of Ideal Gases	165
Principle of the Increase of Entropy	177
Efficiency	185
The Second Law for Open Steady-State Steady-Flow Systems	191
The Second Law for Closed Uniform-State Uniform- Flow Systems	217
5 IRREVERSIBILITY AND AVAILABILITY	222-A
Reversible Work	222
Irreversibility	227
Availability	244
6 THERMODYNAMIC RELATIONS	264-A
Maxwell Relations, Gibbs and Helmholtz Functions	264
The Clausius-Clapeyron Equation	269
Enthalpy, Entropy, and Internal Energy	277
Specific Heat Relations	293
Joule-Thomson Coefficient	296
Volume Expansivity and Isothermal and Adiabatic Compressibility	300
Equations of State	303
7 IDEAL AND REAL GAS PROCESSES AND RELATIONS ...	328-A
Ideal Gas Processes Involving the First and Second Laws of Thermodynamics	328
The Air Tables	352
The Generalized Compressibility Factor Chart	357
The Generalized Enthalpy Deviation Chart	364
The Generalized Entropy Deviation Chart	380
Fugacity and the Generalized Fugacity Chart	389
8 VAPOR POWER AND REFRIGERATION CYCLES	397-A
The Rankine Cycle	397
The Reheat Cycle	407
The Regenerative Cycle	413

Other Vapor Power Cycles.....	425
The Vapor Carnot Cycle	452
Vapor Refrigeration Cycles.....	459
9 AIR STANDARD POWER AND REFRIGERATION CYCLES	487-A
Air-Standard Cycles	487
The Carnot Cycle	492
The Otto Cycle	507
The Diesel Cycle	522
The Dual Cycle.....	536
The Brayton Cycle	550
Analysis of Reciprocating Air-Compressors.....	560
The Gas Turbine Cycle	570
The Jet Propulsion Cycle.....	584
The Air-Standard Refrigeration Cycle	593
10 MIXTURES AND SOLUTIONS	605-A
Definitions of Ideal Gas Mixtures	605
Properties of Ideal Gas Mixtures.....	620
Air-Vapor Mixtures	631
Air-Conditioning Processes.....	648
11 CHEMICAL REACTIONS AND EQUILIBRIUM	671-A
Theoretical Air, Excess Air, and Air-Fuel Ratio.....	671
Analysis of the Products of Combustion	683
Enthalpy of Formation	685
First Law Analysis of Reacting Systems.....	689
Adiabatic Flame Temperature	704
Heat of Reaction	711
The Third Law of Thermodynamics	717
Second Law Analysis of Reacting Systems	728
Chemical Equilibrium	743
Equilibrium Constant	758
Equilibrium Constant Dependence on Temperature	772

12 FLOW THROUGH NOZZLES AND BLADE PASSAGES	785-A
Stagnation Properties.....	785
Nozzle Exit Conditions	791
Impulse and Reaction Stages of Turbines	806
Mass Flow Rate Through a Nozzle	816
13 HEAT TRANSFER	825-A
Conduction	825
Convection	855
Radiation	891
14 STATISTICAL THERMODYNAMICS	920-A
INDEX	972
MIXTURES AND SOLUTIONS.....	
Definitions of Ideal Gas Mixtures.....	996
Properties of Ideal Gas Mixtures.....	1000
Air-Vapor Mixtures.....	1003
Air-Conditioning Processes.....	1008
CHEMICAL REACTIONS AND EQUILIBRIUM.....	
Theoretical Air, Excess Air, and Air-Fuel Ratio.....	671
Analysis of the Products of Combustion.....	683
Enthalpy of Formation.....	685
First Law Analysis of Reacting Systems.....	689
Adiabatic Flame Temperature.....	704
Heat of Reaction.....	711
The Third Law of Thermodynamics.....	717
Second Law Analysis of Reacting Systems.....	728
CHEMICAL EQUILIBRIUM AND REVERSIBLE POWER CYCLES.....	
Equilibrium Constant.....	758
Equilibrium Constant Dependence on Temperature.....	772
The Regenerative Cycle.....	413