

Contents

List of Figures, vii

List of Tables, xi

Foreword, xiii

Acknowledgments, xv

Chapter 1 History, Uses, and Physical Characteristics of Steel Pipe	1
History, 1	
Uses, 2	
Chemistry, Casting, and Heat Treatment, 3	
Physical Characteristics, 6	
Ductility and Yield Strength, 6	
Stress and Strain, 7	
Strain in Design, 9	
Analysis Based on Strain, 11	
Ductility in Design, 12	
Effects of Cold Working on Strength and Ductility, 13	
Brittle Fracture Considerations in Structural Design, 13	
Good Practice, 17	
Evaluation of Stresses in Spiral-Welded Pipe, 18	
References, 18	
Chapter 2 Manufacture and Testing	21
Manufacture, 21	
Testing, 24	
References, 25	
Chapter 3 Hydraulics of Pipelines	27
Formulas, 27	
Calculations, 31	
Economical Diameter of Pipe, 42	
Distribution Systems, 43	
Air Entrainment and Release, 43	
Good Practice, 43	
References, 43	
Chapter 4 Determination of Pipe Wall Thickness	45
Internal Pressure, 45	
Allowable Tension Stress in Steel, 46	
Corrosion Allowance, 48	
External Fluid Pressure—Uniform and Radial, 48	
Minimum Wall Thickness, 50	
Good Practice, 50	
References, 50	

Chapter 5 Water Hammer and Pressure Surge	51
Basic Relationships, 51	
Checklist for Pumping Mains, 54	
General Studies for Water Hammer Control, 55	
Allowance for Water Hammer, 56	
Pressure Rise Calculations, 56	
References, 56	
Chapter 6 External Loads	59
Load Determination, 59	
Deflection Determination, 60	
Buckling, 63	
Extreme External Loading Conditions, 65	
Computer Programs, 68	
References, 68	
Chapter 7 Supports for Pipe	69
Saddle Supports, 69	
Pipe Deflection as Beam, 73	
Methods of Calculation, 75	
Gradient of Supported Pipelines to Prevent Pocketing, 76	
Span Lengths and Stresses, 76	
Ring Girders, 79	
Ring-Girder Construction for Low-Pressure Pipe, 100	
Installation of Ring Girder Spans, 101	
References, 109	
Chapter 8 Pipe Joints	111
Bell-and-Spigot Joint With Rubber Gasket, 111	
Welded Joints, 112	
Bolted Sleeve-Type Couplings, 113	
Flanges, 113	
Grooved-and-Shouldered Couplings, 115	
Expansion and Contraction—General, 116	
Ground Friction and Line Tension, 117	
Good Practice, 118	
References, 119	
Chapter 9 Fittings and Appurtenances	121
Designation of Fittings, 121	
Elbows and Miter End Cuts, 122	
Reducers, 130	
Bolt Hole Position, 130	
Design of Wye Branches, Laterals, Tees, and Crosses, 130	
Testing of Fittings, 131	
Unbalanced Thrust Forces, 131	
Frictional Resistance Between Soil and Pipe, 131	
Anchor Rings, 131	
Nozzle Outlets, 131	

Connection to Other Pipe Material, 132	
Flanged Connections, 132	
Valve Connections, 132	
Blowoff Connections, 132	
Manholes, 133	
Insulating Joints, 133	
Air-Release Valves and Air/Vacuum Valves, 133	
Casing Spacers, 134	
Good Practice, 135	
References, 136	
Chapter 10 Principles of Corrosion and Corrosion Control	137
General Theory, 137	
Internal Corrosion of Steel Pipe, 146	
Atmospheric Corrosion, 147	
Methods of Corrosion Control, 147	
Cathodic Protection, 147	
References, 149	
Chapter 11 Protective Coatings and Linings	151
Requirements for Good Pipeline Coatings and Linings, 151	
Selection of the Proper Coating and Lining, 151	
Recommended Coatings and Linings, 153	
Epoxy-Based Polymer Concrete Coatings, 156	
Coating Application, 156	
Good Practice, 156	
References, 157	
Chapter 12 Transportation, Installation, and Testing	159
Transportation and Handling of Coated Steel Pipe, 159	
Trenching, 160	
Installation of Pipe, 163	
Anchors and Thrust Blocks, 168	
Field Coating of Joints, 171	
Pipe-Zone Bedding and Backfill, 171	
Hydrostatic Field Test, 171	
References, 173	
Chapter 13 Supplementary Design Data and Details	175
Layout of Pipelines, 175	
Calculation of Angle of Fabricated Pipe Bend, 176	
Reinforcement of Fittings, 176	
Collar Plate Design, 180	
Wrapper-Plate Design, 182	
Crotch-Plate (Wye-Branch) Design, 183	
Nomograph Use in Wye-Branch Design, 185	
Thrust Restraint, 191	
Anchor Rings, 1997	
Joint Harnesses, 197	
Special and Valve Connections and Other Appurtenances, 202	

Freezing in Pipelines, 202
Design of Circumferential Fillet Welds, 218
Submarine Pipelines, 220
References, 222

Appendix A Table of Working Pressures for Allowable Unit Stresses, 223

Index, 233

List of AWWA Manuals, 239