

# Index

## A

AASHTO 155, 195, 196, 197, 211, 212, 221  
 Above Ground 243, 483  
 Above Ground Piping Systems 243  
 Abrasion Resistance 57, 80, 106, 151  
 Acceptable Diameter 299  
 Acceptance Deflection 265  
 Access 401, 405, 406, 476  
 Advantages 41, 466  
 Aging 101, 189  
 Air Entrapment 359  
 Allowable Operating Pressures 455  
 American Association of State Highway and Transportation Officials 195  
 American Society for Testing and Materials (ASTM) 129, 144, 327, 412  
 American Water Works Association (AWWA) 34, 45, 129, 146, 245, 327, 349  
 Anchor 243, 319, 325, 347, 385  
 Anchoring 317, 326, 327, 357  
 ANSI 21, 26, 139, 140, 144, 145, 245, 340, 343, 344, 349  
 Apparent Modulus 60, 209, 241, 308, 427, 462  
 Apparent Tensile Strength 126  
 Appearance 124  
 Applications 1, 138, 151, 152, 153, 155, 221, 267, 305, 346, 398, 429, 442, 451, 458, 466, 494  
 Arching 193, 225, 226, 249, 266, 423  
 Armored 497  
 Army Corps of Engineers 271  
 ASME 22, 245, 349  
 Asphalt Dipped 165  
 Assembly 5, 341, 354, 364

ASTM 18, 22, 26, 28, 29, 31, 34, 35, 39, 50, 54, 65, 66, 67, 68, 73, 74, 75, 76, 78, 80, 81, 82, 84, 86, 88, 99, 100, 101, 105, 107, 108, 109, 110, 117, 118, 122, 124, 125, 126, 129, 131, 132, 133, 134, 135, 136, 137, 138, 142, 143, 144, 145, 146, 148, 149, 150, 152, 153, 155, 158, 159, 161, 162, 192, 197, 201, 208, 209, 211, 213, 214, 215, 216, 221, 241, 245, 246, 260, 267, 268, 269, 273, 290, 293, 295, 296, 297, 302, 306, 326, 327, 333, 337, 338, 347, 349, 364, 376, 385, 393, 401, 412, 413, 418, 419, 429, 433, 437, 454, 455, 456, 463, 465, 468, 469, 470, 472, 475, 476, 478, 486, 487, 494, 498  
 ASTM D1586 213  
 ASTM D1598 125  
 ASTM D2321 221, 267, 327, 412  
 ASTM D2513 107, 158, 162, 338, 349  
 ASTM D2683 108  
 ASTM D2774 221, 364, 412  
 ASTM D2837 65, 66, 67, 68, 136, 161, 306, 327  
 ASTM D3035 107, 158, 327  
 ASTM D3212 214  
 ASTM D 1248 131, 133, 293  
 ASTM D 1693 133, 454  
 ASTM D 2683 454, 487  
 ASTM F1055 108  
 ASTM F894 107, 159, 208, 209, 216, 349, 401, 412  
 Aude 178, 245  
 Average Inside Diameter 135  
 AWWA 26, 34, 39, 45, 107, 129, 146, 147, 148, 149, 154, 158, 159, 190, 191, 221, 244, 245, 327, 337, 340, 343, 349, 360, 412, 419  
 Axial Bending Stress 448  
 Axial Tensile Stress 450

## B

Backfill 267, 272, 284, 285, 290, 295  
 Ballast 355, 361, 365, 367, 374, 385, 386, 387  
 Barbed Mechanical Fittings 486  
 Barrel 127, 287  
 Bead Removal 331  
 Beam Analysis 323, 324  
 Beam Deflection 322  
 Bedding 208, 248, 263, 267, 282, 285, 289, 290, 294, 295, 296, 297, 364  
 Bell and Spigot 406  
 Below Ground Installations 474  
 Bend-Back Test 126  
 Bending Radii 371, 479  
 Bending Strain Development 320  
 Bending Stress 440, 448  
 Bend Radius 479  
 Bent Strap Test 18  
 Berm 318  
 Biological Resistance 104  
 Blowing 488, 489  
 Bolting 341, 362  
 Bolt Type Mechanical Flange Adapter 343  
 Bore 387, 472, 474, 477  
 Borehole 420, 422, 423, 424, 442, 445  
 Bowles 229, 246  
 Box 287, 336  
 Bracing 280  
 Branch Saddles 345  
 Breaker Plate/Screen Pack 113  
 Bridge Structures 495  
 Broken or Damaged Fittings 32  
 Buckling 218, 220, 231, 232, 236, 246, 426, 428, 430, 432, 461  
 Building Code 497  
 Bulk Pack 6, 7  
 Bundling 118  
 Buoyant Force 376, 449

- Burial of HDPE Fabricated Fittings 286
- Buried PE Pipe Design 190
- Buried Piping Systems 243
- Burst Pressure 126
- Butt Fusion 17, 37, 142, 151, 330, 331, 349, 402, 487
- C**
- Cable 466, 467, 471, 477, 484, 488, 489, 490, 498, 499
- California Bearing Ratio 302
- Canadian Standards Association 129, 148, 154
- CANDE 207, 246, 264
- Capstan 435
- Casing 150, 297
- Cast Iron 165, 397
- Category 206, 222, 224, 232, 293, 338, 456
- Catenary 319
- Cell Classification 132, 468
- Cement Mortar Relined 165
- Cement Stabilized Sand 272
- Center-to-Center Span 322
- Chemical Resistance 39, 57, 88, 89, 90, 91, 92, 93, 94, 95, 96, 126, 130, 310, 469
- CIC 467
- Class 150 340
- Class II Material 297
- Class III 272, 276
- Clay 229, 234, 300, 397
- Cleaning 14, 27
- Cleanup 300
- Coarse Grain Soils 301
- Coefficient of Linear Expansion 81
- COF 468, 490, 491, 492
- Cohesion 300
- Cohesionless Soils 273
- Cold Weather Handling 13
- Collapse 236, 407, 412, 423, 424, 426, 432, 440
- Color 13, 111, 133
- Colorants 470
- Combustion Toxicity 88, 106
- Compaction 211, 212, 269, 273, 274, 275, 276, 284, 285, 286, 301
- Compressed Air 327
- Compressible Gas Flow 182
- Compression Fittings 154, 486
- Compression Nut 338
- Compressive Ring Thrust 215, 225
- Compressive Strength 75, 213
- Compressive Stress 217, 432
- Concrete 165, 187, 287, 317, 319, 363, 383, 384, 385, 386, 387, 397
- Conduit Entry Issues 497
- Conduit Wall Determination 472
- Connections 14, 296, 297, 337, 339, 390, 400, 409, 410
- Connection to Rigid Structure 318
- Constrained Pipe Repair 33
- Construction of the Land-to-Water Transition 372
- Continuous Beam Analysis 323
- Continuous Support 317, 326
- Continuous Trench 474, 479
- Contraction 81, 151, 309, 313
- Contract Documents 401
- Controlling Surge Effects 176
- Cooling 117, 126, 334
- Copper Tubing Sizes 138, 337
- Corrugated Duct 494
- Cracking 99, 469, 498
- Cradle 319
- Creep Recovery 62, 63
- Creep Rupture 60, 64, 105
- Critical Velocity 178
- Crown 214, 263, 408
- Crush 191, 477, 478
- Crystallinity 51
- CSA 129, 148, 154, 161
- CTS 122, 138, 147, 158, 333, 337, 338, 344
- Culvert Analysis and Design 207
- Cumulative Deflection Effects 323
- Currents 378
- Curvature 415, 448, 493
- Cyclic Fatigue 70
- D**
- D3350 101, 109, 133, 134, 401, 412
- Damage 9, 18, 32, 152, 155, 466, 474
- Deep Fill Installation 191, 194, 216, 224
- Definitions of Symbols 499
- Deflection 19, 20, 84, 85, 165, 207, 208, 211, 213, 214, 215, 227, 246, 248, 263, 265, 288, 303, 319, 322, 323, 324, 392, 427, 428, 429, 442, 443, 475
- Deformation Factor 228, 229, 230
- Density 50, 57, 61, 63, 80, 81, 105, 130, 132, 133, 153, 155, 184, 211, 221, 245, 273, 276, 283, 284, 290, 291, 292, 301, 322, 465, 466, 468, 472, 498
- Design 1, 45, 57, 65, 66, 105, 113, 114, 127, 133, 134, 135, 136, 137, 138, 139, 140, 143, 150, 151, 153, 154, 155, 156, 157, 158, 160, 161, 162, 165, 169, 175, 190, 191, 192, 207, 209, 215, 221, 222, 232, 240, 242, 244, 245, 246, 247, 248, 265, 306, 307, 308, 311, 313, 325, 327, 328, 353, 355, 360, 361, 370, 376, 387, 390, 398, 412, 413, 419, 420, 429, 433, 442, 447, 455, 463, 469, 471, 484, 487
- DF 137, 138, 140, 160, 161, 228, 229, 230, 242, 247, 307, 308, 455
- Diameters 116, 138, 284, 405, 471
- Dielectric Strength 86
- Digging 480
- Dimensions 124, 150, 151, 258, 384, 385, 454
- Dimension Considerations 471
- Dimension Ratio 139, 140, 150, 160, 171, 173, 192, 208, 216, 219, 228, 237, 247, 248, 403, 429, 442, 447, 479
- DIPS 138, 147, 158, 337, 439
- Directional Bores 482
- Directional Drilling 40, 150, 155, 192, 413, 414, 416, 417, 442, 482
- Direct Plow 474, 475
- Disinfecting Water Mains 26, 34
- Disinfection 151
- Dissipation Factor 86, 87
- Distributed Loads 203, 204

DR 12, 19, 28, 30, 35, 138, 139, 158, 159, 160, 169, 170, 171, 173, 175, 188, 190, 192, 193, 194, 208, 209, 214, 215, 216, 217, 218, 219, 221, 222, 223, 226, 227, 228, 237, 238, 245, 247, 258, 259, 260, 293, 307, 308, 327, 354, 355, 356, 357, 370, 371, 376, 392, 393, 394, 403, 419, 426, 429, 430, 433, 434, 435, 437, 438, 439, 442, 444, 445, 446, 447, 449, 454, 455, 462, 481, 482

Drag Resistance 434

Drawn Tubing 165

Dredging 374

Drilling Mud 415

Drilling Process 414

Ductile 66, 138, 337, 339, 340, 397, 439

Ductility 42, 58, 352, 466

Duncan 210, 212, 246

## E

E' 39, 105, 126, 133, 192, 193, 195, 201, 202, 206, 207, 208, 209, 210, 211, 212, 213, 214, 219, 220, 221, 222, 225, 226, 227, 228, 231, 237, 241, 245, 246, 247, 269, 270, 275, 285, 293, 295, 302, 314, 315, 327, 328, 391, 412, 428, 429, 430, 442, 444, 445, 454, 462

E'N 212, 213, 214

Earth and Groundwater Pressure 422, 425, 428

Earth Load 193, 428

Earth Pressure 227

Effluent 367

Electrical 76, 78, 80, 85, 86, 466, 488, 497, 498

Electrofusion 39, 108, 122, 142, 150, 153, 334, 335, 336, 346, 347, 488, 498

Elevation Change 167

Elongation 130

Embankment 191, 206, 412

Embedment 211, 212, 263, 265, 266, 267, 268, 269, 270, 273, 276, 290, 295, 300

End Restrained Thermal Effects 240

Engineering Properties 43, 47, 135, 161

Enveloping Soil 264

Environmental Stress Crack Resistance 55, 99, 100, 150

Equipment 9, 10, 17, 118, 151, 333, 405, 417

Equivalent Length of Pipe 167

ESC 88, 89, 99

ESCR 55, 99, 100, 101, 108, 110, 124, 126, 130, 132, 133, 150, 469

Existing Pipe 401, 408

Expansion Joints 486

Explosive Failure 25

Exposure to UV and Weather 13

External Hydraulic Load

External Load 245, 420

External Pressure 439

Extruded Profile Pipe 13

Extruder 109, 111

Extrusion 50, 54, 108, 109, 111, 112, 126, 127, 498

## F

Fabricated Fittings 108, 121, 123, 153, 286

Factory Mutual Research 148

Fanning Formula 162

Fat Clays (CH) 300

FDA 103

Features 38, 458, 467

Fibrillation 75

Field Effects of Friction 492

Field Fusion Joining 15

Field Handling 15

Field Joining 14

Fine Grain Soil 300

Finish 124

Fire Protection 148

Fittings 65, 107, 108, 118, 119, 120, 121, 122, 123, 124, 125, 131, 134, 141, 142, 146, 148, 150, 151, 152, 153, 154, 166, 167, 245, 248, 286, 336, 338, 344, 349, 412, 454, 485, 486, 498

Flame Retardant 495

Flammability 88

Flanges 349

Flange Adapter 120, 339, 340, 342, 343

Flange Assembly 341

Flange Gasket 341

Flat-Bottomed Ballasts 361

Flattening 29, 126

Flexibility 40, 351

Flexible Pavement 197, 198

Flexible Pipe 245, 246, 262, 288, 300, 302, 412

Flexural Modulus 132, 133, 468

Flexural Strength and Modulus 76

Flex Pipe Restraint 347

Float 353, 357, 369

Flotation 191, 207, 232, 233, 235, 238

Flows for Slipliners 187, 188

Flow Capacity 158, 395

Flushing 457

FM 122, 148

Fold and Form 411

Food and Drug Administration 103

Forklift 10

Foundation 103, 105, 246, 263, 267, 288, 412

Fracture Mechanics 69, 105

Freeze Tolerant 459

Friction 87, 168, 169, 247, 396, 490, 491, 492

Frictional Forces 498

Fuel Oil 99

Fusion 15, 16, 17, 37, 108, 120, 142, 151, 153, 329, 330, 331, 332, 333, 336, 349, 402, 410, 456, 461, 487, 498

## G

Galvanized Iron 165

Gas Flow 182, 183

Gas Permeation 81, 183

Gaube 191, 225, 227, 228, 229, 230, 246

General Guidelines 151, 349, 416

Geotechnical 246, 288, 417, 418

Geotextile Separation Fabrics 272

Geothermal Heat Pump System 463

Glass Transition Temperature 83

Grade Beam 317

Gravel 234

Gravity 22, 26, 34, 151, 155, 177,  
180, 184, 185, 188, 245, 267, 291,  
396, 398, 400, 410

Grip Ring 338

Groundwater Pressure 422, 425,  
428

Ground Heat Exchangers 451,  
452, 455

Ground Source Heat Pump  
Systems 451

Ground Water 218, 232, 233, 238

## H

H<sub>2</sub>O 183, 199, 248, 396, 432

Handling 6, 9, 13, 15, 110, 351

Hardness 57, 79, 80, 130

Haunching 267, 282, 285, 290

HDB 65, 127, 134, 135, 136, 137,  
138, 140, 143, 151, 160, 161, 242,  
293, 307, 308, 455

HDD 192, 413, 414, 416, 417, 418,  
419, 421, 422, 423, 424, 425, 426,  
428, 433, 434, 440, 441, 442

HDPE 1, 2, 32, 37, 38, 39, 40, 41,  
42, 43, 52, 64, 81, 86, 89, 90, 91,  
92, 93, 94, 95, 96, 97, 99, 105,  
139, 144, 148, 153, 155, 157, 176,  
208, 209, 214, 217, 220, 238, 241,  
243, 246, 266, 267, 272, 286, 287,  
291, 292, 293, 295, 296, 297, 308,  
367, 374, 375, 379, 380, 382, 385,  
391, 418, 427, 432, 433, 434, 437,  
438, 439, 440, 441, 442, 444, 447,  
452, 453, 454, 455, 456, 465, 466,  
467, 468, 469, 472, 473, 474, 476,  
492, 498

Head Loss 162, 166, 167

Health Effects 103, 105, 146, 149

Heat Pump Systems 451, 463

High Density Polyethylene Pipe  
245

High Pressure 25, 182, 489

High Temperature 459

Hooke's Law 58

Hoop 68, 135, 215, 226, 249

Horizontal Directional Drilling  
150, 155, 191, 192, 413, 414, 416,  
442, 482 *See also* HDD

Howard 210, 211, 213, 245, 246,  
264, 288, 412

HSB 143

HVAC 2, 451

Hydrokinetic 436, 450

Hydrostatic Design Basis 65, 66,  
105, 127, 134, 135, 136, 138, 150,  
160, 161, 242, 248, 327, 471  
*See also* HDD

Hydrostatic Design Stress 65, 105,  
134, 137, 138, 140, 327

Hydrostatic Load 412

Hydrostatic Pressure 150, 155

Hydrostatic Strength 65, 105, 132,  
134, 136, 469

Hydrostatic Stress Board 65, 110,  
143, 306

Hydrostatic Testing 23

## I

IAPMO 147, 349

ICC 147

ID Controlled Pipe 159

IGSHPA 454, 455, 456, 458

IGT Distribution Equation 182

Immersion Testing 89

Impact 57, 77, 78, 79, 126, 150, 195,  
196, 197, 275, 311, 469, 474, 498

Improperly Made Fusion 32

Infiltration 299, 485

Influence Value 202, 203, 204,  
205, 248

Infrastructure 414

Initial Service Testing 26

Injection Molded Fittings 118

Innerducts 471

Inspection 6, 8, 16, 19, 23, 265,  
288, 298

Installation 11, 14, 15, 20, 22, 26,  
34, 40, 41, 45, 84, 105, 151, 154,  
155, 156, 191, 194, 195, 206, 207,  
216, 221, 222, 224, 232, 245, 246,  
261, 262, 264, 267, 268, 272, 278,  
282, 288, 289, 290, 294, 296, 297,  
300, 302, 306, 316, 327, 353, 359,  
360, 366, 369, 373, 401, 406, 412,  
413, 433, 437, 439, 440, 442, 444,  
455, 456, 458, 460, 463, 467, 473,  
474, 475, 476, 477, 478, 479, 482,  
483, 484, 486, 488, 498

Intermittent Support 317

Internal Pressure 65, 105, 125, 134,  
135, 150, 248

International Ground Source Heat  
Pump Association 454, 458, 463

International Plumbing Code  
(IPC) 147

Iowa Formula 191, 207, 208, 209,  
213, 428

IPC 147

IPS 17, 28, 31, 122, 138, 147, 158,  
169, 251, 329, 337, 338, 382, 384,  
385, 438, 442, 444

Iron Pipe Size 138, 337, 438, 439

ISO 65, 96, 132, 134, 135, 140, 143,  
144, 145, 147, 148, 155

Izod 78, 469

## J

Janson 246, 358, 362, 376, 379, 442

Jetting 489

Joining 14, 15, 34, 37, 134, 141, 142,  
150, 151, 153, 329, 334, 336, 338,  
339, 349, 363, 364, 390, 456, 461,  
484, 487, 488, 498

Joint 17, 287, 330, 332, 333, 335,  
336, 343, 344, 390, 409

## K

Katona 207, 246

KBULK 171, 248

Kinetic COF 491

Kinked Pipe 33

Knight 428, 442

## L

L/D Ratio 113

Lag Factor 209, 211, 213

Land-to-Water Transition 364, 372

Landfill Gas 184

Lateral Connections 409

Lateral Deflection 319

Lateral Service Connection 400

Launching 354, 363, 366

Loading 63, 105, 130, 191, 195, 197,  
200, 201, 207, 222, 311, 395, 412,  
426, 442, 474

Load Per Unit Length 322

Long-Term Deflection 213

Long-Term Hydrostatic Strength  
*See* LTHS

Long-Term Loading 130, 474

- Longitudinal Force vs. Temperature Change 314
  - Longitudinal Stress vs. Temperature Change 314
  - Loose Storage Stacking Heights 12, 13
  - Love's Equation 391, 392
  - Low Pressure 26, 34, 183, 489
  - Low Temperature 57, 130, 309
  - LPG 161, 162
  - LTHS 65, 66, 67, 134, 135, 136, 151, 161, 306, 307
  - Lubricants 105
- M**
- Make-up Water 23
  - Manhole Placements 399
  - Manning 185, 186, 187, 395, 396, 397
  - Manual 55 147, 154
  - Marking 145
  - Marston 225, 246
  - Material Selection 131, 468, 483
  - Maxwell Model 59
  - MDPE 39, 81, 86, 105, 209, 427
  - Measuring Density 301
  - Mechanical Connections 337, 390
  - Mechanical Couplings 155, 486, 498
  - Mechanical Fittings 152, 338, 485, 486
  - Mechanical Impact 311
  - Mechanical Properties 57, 71
  - Mechanical Protection 497
  - Mechanical Pulling Heads 407
  - Mechanical Stress 478
  - Medium Density PE (MDPE)  
*See* MDPE
  - Melt Index 54, 55, 57, 130, 132, 133, 468
  - Mesh 179
  - Migration 271
  - Mining 306
  - Model Specifications 134, 143, 149, 463
  - Modulus 60, 61, 62, 63, 73, 75, 76, 132, 133, 208, 209, 210, 213, 226, 241, 245, 246, 247, 269, 288, 308, 427, 430, 447, 462, 468
  - Modulus of Soil Reaction Values 246, 269
  - Molded Fittings 118
  - Moody Diagram 163, 166
  - Moore-Selig Equation 191, 218, 231
  - Mounting 354, 365
  - MRS 127, 135, 143, 151, 160
  - Ms 226, 227, 248
  - Mueller Equation 182, 183
  - Multi-Cell Conduit 497
- N**
- Native Soil 213, 284
- O**
- Open Trench 474, 479
  - Organic Silts 234
  - Original Line 405
  - Ovality 237, 238, 247, 391, 392, 429, 431, 443, 444, 446, , 479
  - Ovality Compensation Factor 238, 431
  - Ovality Correction Factor 237, 247, 392
  - Ovalization 427, 428, 429, 479
- P**
- Packing List 8
  - Particle Size 177, 179, 181, 271
  - Passive Resistance 245
  - Path Profile 447
  - Pavement (Rigid) 197
  - PC 170, 172, 173, 174, 175, 207, 248
  - PDB 127, 135, 143, 151, 160
  - PE 34, 35, 39, 40, 41, 42, 43, 45, 47, 81, 101, 105, 106, 107, 108, 125, 131, 133, 134, 136, 137, 141, 142, 143, 144, 145, 146, 147, 148, 150, 151, 152, 153, 154, 155, 161, 165, 168, 169, 171, 190, 191, 192, 193, 194, 207, 208, 209, 215, 216, 217, 221, 225, 227, 228, 230, 240, 241, 243, 245, 246, 247, 248, 262, 263, 265, 267, 276, 278, 281, 282, 289, 291, 293, 298, 302, 303, 312, 327, 339, 343, 346, 347, 349, 351, 352, 353, 354, 355, 356, 357, 358, 360, 361, 362, 363, 367, 368, 369, 372, 373, 374, 375, 376, 378, 390, 396, 401, 410, 412, 414, 416, 420, 421, 423, 424, 425, 426, 427, 428, 429, 431, 432, 435, 437, 442, 443, 451, 452, 454, 455, 456, 458, 459, 460, 461, 462, 465, 466, 467, 468, 469, 470, 474, 475, 480, 482, 483, 484, 485, 486, 487, 492, 497
  - PE2406 28, 30, 307, 308
  - PE3408 28, 30, 162, 171, 172, 173, 175, 223, 251, 307, 308, 313, 403, 433, 440
  - Performance Limits 192, 426
  - Permanent Repair 33
  - Permeability 57, 81, 130, 184
  - Permeation 55, 81, 106, 183
  - Personal Protection 21
  - PEX 143, 151, 154
  - Physical Properties 77, 184, 468, 469
  - Physical Property Tests 125
  - Pilot Hole 414, 415
  - Pipeline Being Floated Out 367
  - Pipeline Research Council 433
  - Pipe Bursting 411
  - Pipe, Damaged 30, 33
  - Pipe Deflection 165, 246, 288
  - Pipe Deformation 264
  - Pipe Directly Beneath a Surcharge Load 202
  - Pipe Embedment 211, 212, 265, 266, 290
  - Pipe Extrusion 108, 126
  - Pipe Hanger 326
  - Pipe ID for Flow Calculations 158
  - Pipe Installation 84, 105, 262, 300, 456
  - Pipe Joining Methods 456
  - Pipe Laying 293, 297

- Pipe Length vs. Temperature Change 313
  - Pipe Liner Diameter 391
  - Pipe Restraint 21, 347
  - Pipe Sizing Operation 115
  - Pipe Specifications and Requirements 453
  - Pipe Splitting 411
  - Pipe Support in Transition 284
  - Pipe Surface Condition, Aging 189
  - Pipe Surface Damage 18
  - Pipe Trench 263
  - Pipe Tunnels and Casing 297
  - Pipe Wall Buckling 218, 236
  - PL 199, 200, 201, 202, 205, 206, 208, 216, 223, 248, 377
  - Placement Planning 493
  - Plastic Pipe to Steel 344
  - Plastometer 54, 498
  - Plenum 496
  - Plow 474, 475, 481
  - Plowing 475, 481
  - Plumbing Codes 147
  - Pneumatic Testing 25
  - Poisson's Ratio 75, 229, 231, 250, 430, 443, 462
  - Poisson's Ratio 75, 229, 231, 250, 430, 443, 462
  - Polyethylene Grade 133
  - Polyethylene Plastics 47, 50, 131, 150, 498, 515
  - Polyethylene Resin Properties 130
  - Polymeric water-soluble 491
  - Polymer Characteristics 49
  - Portable Trench Shield 281
  - Post-Installation Survey 373
  - Pre-Installation Storage 11
  - Preferred Number Series 139, 140, 521
  - Preparing an Installation 290
  - Preparing the Land-to-Water Transition Zone 354
  - Pressure Capability 306, 311
  - Pressure Flow 168, 176
  - Pressure Pipe 31, 34, 84, 105, 107, 146, 152, 154, 155, 175, 245, 288, 349, 391, 395, 400, 516, 518
  - Pressure Rating 134, 151, 159, 170, 173, 174, 249, 307, 518, 522
  - Pressure Surge 172, 175, 176
  - Pressure Test 21, 22, 125, 290, 521
  - Primary Initial Backfill 267
  - Prism 194, 424, 445
  - Proctor 211, 214, 221, 226, 227, 269, 273, 275, 283, 284, 285, 286, 287, 290, 295, 296, 297, 301, 302
  - Product Design 419
  - Profile Pipe 13, 246
  - Profile Wall 107, 117, 153, 209, 224, 245, 296, 297, 349, 404, 412
  - Proofing 482
  - Properties of Gases 184
  - Properties of Water 168
  - Proper Transition 284
  - Pull-line Construction 492
  - Pulling 371, 402, 403, 406, 407, 442, 449, 471, 476, 477, 478, 483, 488, 498, 499
  - Purchase Order 8
  - Purging 457
  - Push 407, 471, 480, 493
  - Pushing Force 404
  - Pushing Length 404
  - Pushing Technique 408
  - Pylon 319
- Q**
- Quality Assurance 124, 126, 291, 470, 518
  - Quality Control 68, 105, 124, 127, 518
  - Quick Burst Test 518
- R**
- Radius of Curvature 448
  - Railroad Loading 201
  - Rapid Crack Propagation 105, 519, 531
  - Rate Process Method 67, 105, 106, 151, 519
  - Ravine Crossing 317
  - Raw Materials 108, 110
  - RCP 309, 510, 519, 531
  - Reaming 415
  - Receiving Report 9
  - Recurring Surge Pressure 170, 174, 176, 248
  - Reduction Factor 444
  - Reel Method 484
  - Rehabilitation Methods 410
  - Repairs 32, 33, 345
  - Repair Clamps 345
  - Repair Operations 488
  - Repair Saddle 346
  - Reporting Damage 9
  - Required Strength 127, 132, 135, 143, 151, 160, 515, 516, 531
  - Required Weighting 355, 359
  - Resin Parameters 130
  - Resistance to External Collapse 440
  - Restrained Joints 39
  - Restrained Pipelines 318
  - Restraining 346
  - Reynolds Numbers 178
  - Rigidity Factor 228, 229, 230
  - Rigid Pavement 426
  - Ring Compression 217, 519
  - Ring Stiffness 208, 209, 249, 262, 292, 394
  - Riser Raceways 496
  - River Crossings 155, 192, 413, 418
  - Riveted steel 165
  - Roadway 519
  - Rock Trench Bottom 284
  - Rodent and Mechanical Protection 497
  - Rolldown 411
- S**
- Saddle Fusion 120, 153, 332, 349
  - Safety 5, 15, 88, 329, 349, 393, 394, 417, 430, 443, 445, 447, 462, 526, 528, 531
  - Safety Factor 393, 394, 447,
  - Safe Deflection Limits for Pressurized Pipe 215
  - Safe Pull Load 438, 439
  - Safe Pull Stress 427, 447
  - Safe Pull Tensile Stress 427
  - Sand Stabilized with Cement 287
  - Saturated and Dry Soil Unit 234
  - Saturated and Dry Soil Unit Weight 234
  - Scale 179

- Scrapes 32
- Screen Mesh 179
- Screen Pack 113
- Screw 111, 112, 119, 121, 127
- SDB 127, 135, 143, 151, 160, 516, 521
- SDR 28, 101, 107, 118, 139, 140, 153, 154, 159, 215, 220, 230, 232, 245, 251, 252, 253, 254, 255, 256, 257, 260, 262, 265, 266, 273, 282, 288, 292, 312, 313, 320, 353, 354, 356, 357, 412, 429, 440, 441, 454, 462, 463, 472, 474, 475, 477, 479, 494, 510, 520, 521, 531
- Secondary Initial Backfill 267
- Selection of an Appropriate Pipe Diameter 353, 354
- Selection of an Appropriate Site for Staging, Joining and Launching the Pipe 353
- Select a Pipe Liner Diameter 391
- Service and Lateral Connections 409
- Service Connections 400
- Service Loads 426, 442
- Service Temperatures 84, 161
- Service Temperature Design Factors 162
- Service Temperature vs. Modulus of Elasticity 308
- Service Testing 26
- Shallow Cover 191, 195, 207, 222, 223, 232
- Shear Properties 76
- Sheathing 280
- Sheeting 520
- Shield 281
- Shipping Claims 9
- Shop Drawings 292, 520
- Short-Term Mechanical Properties 71
- SIDR 35, 107, 139, 153, 159, 245, 337, 472, 494
- Silo 6, 9
- Silts 234
- Sizing 115, 116
- Slipliners 187, 188
- Sliplining 389, 400, 401, 405, 406
- Sloping of Trench Walls 280
- Slow Crack Growth 101, 105, 132, 133, 134, 150, 469, 498, 520, 531
- Slurry 180, 245, 449
- Smooth Pipes 165
- Softening 57, 130, 521
- Soft pigs 27
- Soil Arching 266
- Soil Classification 300
- Soil Group Symbol 269
- Soil Pressure 193, 197, 198, 201
- Soil Reaction 210, 213, 246, 269
- Soil Support Factor 208, 212, 213, 247
- Soil Tests 18
- Soil Type 211, 229, 234
- Soil Unit Weight 234
- Solar 151, 451, 458, 459, 521
- Solid Wall 151, 155, 392, 402, 408, 468, 472, 498
- Spacing of Ballasts 360
- Span 323, 324, 521
- Spangler 207, 213, 215, 245, 246, 264, 288, 412, 426, 442, 475
- Special Applications 494
- Specifications 20, 129, 134, 141, 142, 143, 149, 155, 197, 327, 349, 412, 453, 454, 463, 465, 509, 521
- Specific Gravity 177, 180, 184, 521
- Specific Heat 82, 83
- Spitzglass Equation 182, 183
- Springline 408
- Stability 131, 246, 278, 279, 280, 385
- Stabilization 102, 279, 319, 470
- Stabilize 409
- Stabilizer 133, 521
- Stable 277, 289, 422
- Stab Type Fitting 338
- Stacking Heights 12, 13, 292
- Staging 363
- Standard Dimension Ratio *See* SDR
- Standard Mesh 179
- Standard Practice 142, 144, 150, 153, 155, 267, 327, 349, 412, 498
- Standard Proctor 214, 221, 227, 269, 273, 275, 283, 284, 285, 286, 287, 290, 295, 296, 297, 302
- Standard Specification 34, 35, 50, 107, 108, 131, 141, 142, 144, 151, 152, 153, 154, 155, 209, 245, 327, 349, 412, 465, 468, 486, 498
- Standard Test Method 22, 26, 34, 54, 73, 75, 76, 78, 80, 81, 84, 88, 99, 100, 124, 125, 144, 150, 154, 155, 498, 513, 521
- Static Charge 87
- Static COF 490
- Stationary Reel 484
- Steel 154, 165, 327, 339, 344, 397, 410, 412
- Stiffener 338, 514
- Stiffness 57, 130, 151, 208, 209, 226, 249, 262, 292, 394, 405, 477
- Storage 6, 11, 12, 13, 15, 292, 363
- Strain 43, 58, 60, 71, 74, 77, 88, 320, 328, 521
- Strength Design Bases *See* SDR
- Strength of Embedment Soil 267
- Stress Distribution 266
- Stress Rating 134
- Strip Load Truckload 8
- Stub Ends 340
- Submarine Outfalls 376
- Submerged 357, 360, 376, 378
- Submersion 354, 369
- Sudden Velocity Change 172, 173
- Sulphuric Acid 99
- Sunlight 522
- Support 208, 212, 213, 247, 284, 287, 317, 322, 325, 326
- Surcharge Load 202, 205
- Surface Damage 18
- Surface Resistivity 86
- Surface Roughness 165
- Suspended from Rigid Structure 317
- Suspended Pipelines 321
- Suspension Spacing 322
- Sustained Pressure 126, 521
- Swagelining 410
- Swelling 89
- Swivels 441
- Symbols 499

**T**

Take-off Equipment 118  
 Tamping 274, 290  
 Temperature 42, 57, 59, 60, 75, 83, 84, 85, 105, 130, 151, 152, 160, 161, 162, 168, 173, 217, 241, 247, 306, 307, 308, 309, 313, 314, 320, 432, 452, 459, 467, 508, 511, 512, 513, 521  
 Temporary Floating Lines 375  
 Temporary Repair 34  
 Tensile Creep 59, 60, 61, 63  
 Tensile Properties 58, 71, 73  
 Tensile Strength 57, 73, 75, 126, 130, 133, 469, 507, 509, 521, 523  
 Tensile Stress 58, 427, 437, 450, 523  
 Terminal Connections 409  
 Testing 16, 20, 21, 22, 23, 25, 26, 30, 34, 35, 50, 70, 72, 88, 89, 105, 106, 124, 126, 129, 144, 149, 150, 151, 155, 245, 290, 298, 299, 325, 327, 412, 457, 463, 467, 507, 511, 531  
 Test Duration 22  
 Test Pressure 22  
 Test Procedure 26  
 Thermal Conductivity 82  
 Thermal Expansion 81, 151, 509  
 Thermal Heat Fusion Methods 329  
 Thermal Properties 81  
 Thermal Stability 131  
 Thermal Stresses 441  
 Thermoformed Fittings 122  
 The International Organization for Standardization (ISO) 145  
*See also* International Organization for Standardization (ISO);  
*See also* ISO  
 Threaded Mechanical Fittings 486  
 Thrust Anchor 243  
 Thrust Block 319  
 Time-Dependent Behavior 427  
 Timoshenko 198, 199, 201  
 Titelineer 411  
 Torsion Stress 441  
 Toxicological 103

Traffic 405

Transition 83, 152, 284, 344, 364, 372, 410, 512  
 Transport 15, 34, 89, 106, 151, 327, 469, 498  
 Trench 191, 206, 263, 272, 276, 277, 278, 279, 280, 281, 282, 284, 289, 290, 294, 296, 297, 474, 479, 480  
 Trenching 289, 474, 479  
 Truckload 6, 7, 8  
 Tunnels 297  
 Turbulent 177  
 Typical Electrofusion Join 335  
 Typical Impact Factors for Paved Roads 196

**U**

Ultraviolet 101, 306, 310, 522  
 Unconfined Compressive Strength 213  
 Unconstrained Buckling 430  
 Unconstrained Pipe Wall Buckling 236  
 Undercut 480  
 Underwater Bedding 364  
 Uniform Particle Size 181  
 Uniform Plumbing Code 147  
 Unloading 9, 10, 427  
 Unpaved 197, 198  
 Unrestrained Thermal Effects 240  
 UPC 147  
 USBR 211, 246, 288  
 Use of Embedment Materials 270  
 UV 13, 101, 102, 103, 109, 133, 311, 454, 459, 468, 470, 483, 495, 522

**V**

Vacuum 115, 116, 176, 432, 451, 461, 463  
 Valve 167, 287, 342, 531  
 Vehicles 198  
 Vehicle Loading 197  
 Vehicle Loads 196  
 Vehicular Load 191, 195, 207, 222  
 Velocity 172, 173, 176, 178, 181,

188, 522

Venting 23, 31  
 Vertical Arching Factor 225, 226, 249  
 Vertical Deflection 214  
 Vertical Soil Pressure 193  
 Vertical Surcharge 204, 206  
 Viscoelastic 105, 327  
 Viscoelasticity 225  
 Voids 119, 522  
 Volume Resistivity 86

**W**

Wall Buckling 218, 236  
 Wall Compressive Stress 432  
 Wall Determination 472  
 Wall Thickness 135, 160, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 391  
 Water-Base Slurry Specific Gravities 180  
 Water-Soluble Lubricants 491  
 Water Jetting 276  
 Water Pressure Pipe Design Example 175  
 Water Service 146, 154, 245, 349  
 Water Test 23, 24, 299  
 Watkins 190, 191, 207, 222, 225, 227, 228, 229, 230, 245, 246, 264, 288, 412, 428, 442  
 Watkins and Spangler 264  
 Weatherability 101, 102, 105, 151, 522  
 Weld Lengths of Polyethylene Pipe 402  
 Working Pressure Rating 170, 173, 174, 249, 522  
 Workmanship 124  
 WPR 170, 173, 174, 175, 176, 249, 522

**Y**

Yield Strength 469, 523  
 Young's Modulus 73