
Contents

1	Preliminary Considerations	1
1.1	Mechanical Characteristics of Steel	1
1.2	Allowable Stress	7
1.3	Theories of Failure	9
1.4	Plasticity Collaboration	13
1.5	Verification Criteria	18
1.5.1	General Membrane Stresses (σ_m)	19
1.5.2	Local Membrane Stresses (σ_{ml})	19
1.5.3	Primary Bending Stresses (σ_f)	19
1.5.4	Secondary Stresses (σ_{sec})	20
1.5.5	Peak Stresses (σ_{pic})	21
2	General Calculation Criteria	23
2.1	Membrane Stresses in Revolution Shells	23
2.2	Edge Effects in Cylinders and Spheres	26
2.3	Stress Concentration Around Holes	36
3	Cylinders Under Internal Pressure	47
3.1	General Design Criteria	47
3.2	Thick Cylinders	61
3.3	Thermal Stresses	63
3.4	Allowable Out of Roundness	77
3.5	Two-Wall, Multilayer, and Stiffened Cylinders	81
3.6	Partially Plastic Deformed Cylinders	100
3.7	Stresses Due to Thickness Variation	109
4	Cylinders Under External Pressure	127
4.1	Thick Cylinders	127
4.2	Thin Cylinders of Infinite Length	132
4.3	Stiffened Cylinders	139
4.4	Stiffening Rings	147

5	Spherical Vessels	155
5.1	Spheres Under Internal Pressure	155
5.2	Thick Spheres	165
5.3	Thermal Stresses	167
5.4	Partially Plastic Deformed Spheres	175
5.5	Spheres Under External Pressure	184
6	Heads	189
6.1	Hemispherical Heads	189
6.2	Dished Heads	199
6.3	Conical Heads and Truncated Cones	205
6.4	Flat Heads	211
7	Special Components and Tubes	241
7.1	Elliptical Tubes	241
7.2	Torus and Bended Tubes	244
7.3	Quadrangular Vessels	251
7.4	Flanges	266
7.5	Piping with Internal Warm Fluid	290
7.6	Expansion Compensators	297
8	The Influence of Holes	313
8.1	Hole Lines on Cylinders, Spheres, and Cones	313
8.2	High Thickness Nozzles and Equivalent Diameter	330
8.3	Isolated Holes on Cylinders, Spheres, and Cones: Y and T Branches	335
8.4	Flat Head with Central Hole	353
8.5	Drilled Plates	363
8.6	Holes in Quadrangular Vessels	370
9	The Influence of Supports	379
9.1	Cylindrical Vessels on Saddle Supports	379
9.2	Spherical Vessels Resting on a Parallel	387
9.3	Local Effects of Forces and Moments on Cylinders	396
9.4	Local Effects of Forces and Moments on Spheres	417
10	Fatigue Analysis	423
10.1	General Approach	423
10.2	Fatigue Curves	425
10.3	Vessels not Requiring Fatigue Analysis	428
10.4	Basic Criteria for Fatigue Analysis	431
	Bibliography	437
	Index	443



<http://www.springer.com/978-3-540-49142-2>

Pressure Vessel Design

Annaratone, D.

2007, XII, 443 p., Hardcover

ISBN: 978-3-540-49142-2