



Table of Contents

Chapter 1 Introduction	7
1.1 The Evolution of Canadian Housing Technology	8
1.2 Features of Quality Housing	9
1.3 The House as a System	12
1.4 The Canadian Housing Industry	13
1.5 How to Use This Manual	16
PART 1 — Building Science	19
Chapter 2 Select History of Housing	19
2.1 Renovation Hierarchy	19
2.2 Insulation	27
2.3 Windows	29
2.4 Roofs	32
2.5 Plumbing	34
2.6 Wiring	35
2.7 Heating Systems	37
Chapter 3 Building Science	43
3.1 Heat Flow	44
3.2 Airflow	50
3.3 Moisture Movement	53
3.4 Factors Affecting Comfort	62
Chapter 4 Air, Vapour, Weather, Thermal, Moisture, and Termite Barriers	67
4.1 Air Barriers	68
4.2 Vapour Barriers	71
4.3 Weather Barriers	72
4.4 Thermal Barriers	74
4.5 Basement Moisture Barriers and Foundation Dampproofing	74
4.6 Termite Barriers	76



Chapter 5 Materials	77
5.1 Insulation	78
5.2 Vapour Barriers	84
5.3 Air Barriers	86
5.4 Weather Barriers	91
5.5 Moisture Barriers	96
Chapter 6 Indoor Air Quality	97
6.1 Factors that Affect Air Quality	98
6.2 Designing for Air Quality	102
6.3 Homeowner Responsibilities	108
Chapter 7 Housing and the Environment	109
7.1 Features of Green Housing	109
7.2 Original EnerGuide Rating System for Houses	113
7.3 ENERGY STAR® for Products	117
7.6 Water Conservation	119
7.7 Water Filtration	124
7.8 Construction Waste Management	125
7.9 Marketing Environmental Features	129
PART 2 – On Site Conditions.....	131
Chapter 8 Foundations.....	131
8.1 Foundation Techniques	132
8.2 Common Foundation Problems	133
8.3 Foundation Moisture Issues	135
8.4 Diagnosing Cracks in Foundations	139
8.5 Installing a New Foundation	142
8.6 Digging Out a Basement	143
8.7 Basement Fundamentals	144
8.8 Crawl Spaces	153
8.9 Slab-On-Ground Foundations	154
Chapter 9 Above Grade Walls	157
9.1 Moisture, Temperature and Airtightness Considerations in Exterior Walls	158
9.2 How Brick Walls Fail	161
9.3 How Stucco Walls Fail	167
9.4 How Siding Fails	169
9.5 Wall Rot	171
9.6 Plants Growing on Walls	175
9.7 Wall Fundamentals	176



Chapter 10 Windows and Doors	191
10.1 Window and Door Failure	192
10.2 Window Fundamentals	194
10.3 Window Ratings	202
10.4 Replacing Windows	206
10.5 Window Flashings	213
10.6 Skylights	214
10.6 Door Fundamentals	215
10.7 Replacing Doors	217
Chapter 11 Attics and Roofs	221
11.1 Roof Failures	222
11.2 Re-roofing	227
11.3 Roof Fundamentals	229
11.4 Attic Insulation	230
11.5 Moisture and Ventilation	232
11.6 Ceiling Penetrations	233
11.7 Roof Framing Options for Additions	236
Chapter 12 Mechanical Systems	239
12.1 Heating	244
12.2 Cooling	260
12.3 Ventilation	262
12.4 Air Filtration	264
12.5 Water Heating	267
12.6 Water Conditioning	274
12.7 Combination Heating Systems	275
12.8 Arc-Fault Circuit Interrupters (AFCI) and Renovations	275
Chapter 13 Additions	281
13.1 Foundations	284
13.2 Above Grade Walls	285
13.3 Windows and Doors	285
13.4 Attics and Roofs	285
13.5 Mechanical Systems	286
Chapter 14 Building Hazards	287
14.1 Demolition	288
14.2 Mould	288
14.3 Lead	291
14.4 Asbestos	293
14.5 Pest Infestation	301
14.6 Radon	305

**PART 3 – Specialized Knowledge.....313****Chapter 15 Disaster Recovery.....313**

15.1 Damage from Fire	314
15.2 Damage from Floods	317
15.3 Renovations After Wind Damage	321

Chapter 16 Renovating for Energy Efficiency and Healthy Housing323

16.1 How it Starts.....	324
16.2 Assessing the Building	326
16.3 Detailed Planning and Design.....	333
16.4 Renovation Approaches	340
16.5 Heating, Ventilating and Air Conditioning Systems	364
16.6 Healthy Housing.....	374

Chapter 17 Septic Systems375

17.1 System Design	376
17.2 Septic System Components	380
17.3 Take Aways.....	385

Chapter 18 Renovating for Accessibility387

18.1 Understanding the Accessibility Market.....	388
18.2 Distinctive Design Approaches	401

Chapter 19 Renovations to Historic Buildings.....407

19.1 What Makes a Building Historic	408
19.2 Features of the House	409
19.3 Communications Plan.....	413

**PART 4 — Checklists and Contracts 415**

Chapter 20 The Renovator's Checklist	415
20.1 The Building Envelope	416
20.2 The House as a System.....	416
20.3 Checklist: Basement/Foundation.....	417
20.4 Mechanical Systems and Services.....	418
20.5 Checklist: Main Floor	421
20.6 Checklist: Attic/Ceiling Space	424
20.7 Checklist: Exterior Inspection	426
20.8 Checklist: Services	428
20.9 Checklist: Homeowner Interview	429
20.10 Digging Deeper.....	430
Chapter 21 The Renovator's Contract	431
21.1 What goes into a contract?	432
21.2 Types of Contracts	433
21.3 Estimating project costs	436
21.4 How Things Work During a Project	439
21.5 Making changes once the work starts	440
21.6 Warranty coverage and follow-up service	441
21.7 Insurance and Workers' Compensation.....	442
21.8 Liens and Permits	443
21.9 Professional Associations	444
Appendix 1 – Insulation Values	445
Appendix 2 – Vapour and Air Permeance	449
Appendix 3 – Conversion Factors	453
Appendix 4 – Glossary	455
Appendix 5 – Index	461