2020 SWS - Single Family Site-Built - All Specifications

The National Renewable Energy Laboratory

Disclaimer

This field guide contains all of the Specifications for the Single Family Site-Built housing type

Table Of Contents

2.0101.1 Hardwired (interconnected) Smoke Alarms . . . 36
2.0101.1a Selection . . . 36
2.0101.1b Location . . . 36
2.0101.1c Installation . . . 36
2.0101.1d Occupant notification . . . 37
2.0101.2 Battery-Operated Smoke Alarms . . . 37
2.0101.2a Selection . . . 37
2.0101.2b Location . . . 37
2.0101.2c Installation . . . 38
2.0101.2d Occupant notification . . . 38
2.0102.1 CO Detection and Warning Equipment . . . 38
2.0102.1a Selection . . . 38
2.0102.1b Location . . . 39
2.0102.1c Installation . . . 39
2.0102.1d Occupant notification . . . 39
2.0103.1 Temperature and pressure relief valve . . . 40
2.0103.1a Selection . . . 40
2.0103.1b Installation . . . 40
2.0103.1c Discharge . . . 40
2.0201.1 Gutters . . . 41
2.0201.1a Selection . . . 41
2.0201.1b Attachment . . . 41
2.0201.1c Slope . . . 42
2.0201.1d Sealing . . . 42
2.0201.2 Downspouts . . . 42
2.0201.2a Selection . . . 42
2.0201.2b Attachment . . . 43
2.0201.2c Drainage . . . 43
2.0201.3 Grading . . . 43
2.0201.3a Slope . . . 44
2.0201.3b Vegetation removal . . . 44
2.0201.4 Sump Pumps . . . 44
2.0201.4a Selection . . . 44
2.0201.4b Installation . . . 45
2.0201.4c Discharge . . . 45
2.0201.4d Commissioning . . . 45
2.0201.4e Occupant notification . . . 46
2.0202.1 Un-Vented Subspaces - Ground Cover . . . 46
2.0202.1a Preparation . . . 46
2.0202.1b Material selection . . . 46
2.0202.1c Coverage . . . 47
2.0202.1d Drainage . . . 47

2.0202.1e Seams/connections 47
2.0202.1f Fastening 48
2.0202.1g Air sealing 48
2.0202.1h Signage 48
2.0202.2 Vented Subspaces - Ground Cover 49
2.0202.2a Preparation 49
2.0202.2b Material selection 49
2.0202.2c Coverage 50
2.0202.2d Drainage 50
2.0202.2e Seams 50
2.0202.2f Fastening 50
2.0202.2g Air Sealing 51
2.0202.2h Signage 51
2.0202.3 Pier and Skirting Foundations - Ground Cover 51
2.0202.3a Preparation 52
2.0202.3b Coverage 52
2.0202.3c Material selection 52
2.0202.3d Seams 53
2.0202.3e Fastening 53
2.0203.1 Stand-Alone Dehumidifier Installation 53
2.0203.1a Selection 53
2.0203.1b Installation 54
2.0203.1c Commissioning 54
2.0203.1d Disposal 55
2.0203.1e Client education 55
2.0301.1 Junctions/Splices Enclosed 55
2.0301.1a Junction box covers 56
2.0301.1b Wiring Splices 56
2.0301.2 Knob and Tube Wiring - Isolation 56
2.0301.2a Clearance 57
2.0301.2b Marking 57
2.0401.1 Soil-Gas Retarder 57
2.0401.1a Applicable Spaces 57
2.0401.1b Preparation 58
2.0401.1c Material Selection 58
2.0401.1d Coverage 58
2.0401.1e Termite Inspection Gap 59
2.0401.1f Seams 59
2.0401.1g Foundation Connections 59
2.0401.1h Penetrations 60
2.0401.1i Fastening 60
2.0401.1j Drainage 61
2.0401.2 Sump Well/Pit Covers 61
2.0401.2a Sump Covers 61
2.0401.2b Drainage 61

2.0401.3 Drain Fittings . . . 62
2.0401.3a Sealing Penetrations . . . 62
2.0401.3b Airtight Drains . . . 62
2.0402.1 New Systems . . . 63
2.0402.1a Standard for Installation . . . 63
3.0101.1 Air Sealing Holes . . . 63
3.0101.1a Sealant selection . . . 63
3.0101.1b Material selection . . . 64
3.0101.1c Backing, infill, and support . . . 64
3.0101.1d Surface preparation . . . 65
3.0101.1e Sealant application . . . 65
3.0101.1f High-temperature application . . . 66
3.0102.1 Sealing Non-Insulation Contact (IC) Recessed Light . . . 66
3.0102.1a Sealant selection . . . 66
3.0102.1b Material selection . . . 67
3.0102.1c Clearance . . . 67
3.0102.1d Enclosure top . . . 67
3.0102.1e Structural soundness . . . 67
3.0102.1f Surface preparation . . . 68
3.0102.1g Sealant application . . . 68
3.0102.1h Marking . . . 68
3.0102.2 Sealing High-Temperature Devices . . . 69
3.0102.2a Sealant selection . . . 69
3.0102.2b Material selection . . . 69
3.0102.2c Clearance and isolation . . . 70
3.0102.2d Backing and infill . . . 70
3.0102.2e Surface preparation . . . 71
3.0102.2f Sealant application . . . 71
3.0102.3 Sealing Tongue and Groove Surfaces . . . 71
3.0102.3a Sealant selection . . . 71
3.0102.3b Material selection . . . 72
3.0102.3c Backing . . . 72
3.0102.3d Surface preparation . . . 73
3.0102.3e Sealant application . . . 73
3.0102.4 Sealing Firewalls . . . 73
3.0102.4a Sealant selection . . . 73
3.0102.4b Material selection . . . 74
3.0102.4c Backing and infill . . . 74
3.0102.4d Surface preparation . . . 75
3.0102.4e Sealant application . . . 75
3.0102.9 Sealing Dropped Soffits/Bulkheads . . . 75
3.0102.9a Sealant selection . . . 76
3.0102.9b Material selection . . . 76
3.0102.9c Support . . . 76
3.0102.9d Surface preparation . . . 77

3.0102.9e Install air barrier . . . 77
3.0102.9f Attachment . . . 77
3.0102.9g Sealant application . . . 78
3.0102.9h High-temperature application . . . 78
3.0102.10 Sealing Dropped Ceilings . . . 78
3.0102.10a Sealant selection . . . 78
3.0102.10b Material selection . . . 79
3.0102.10c Support . . . 79
3.0102.10d Surface preparation . . . 80
3.0102.10e Install air barrier . . . 80
3.0102.10f Sealant application . . . 80
3.0102.10g High-temperature application . . . 81
3.0102.11 Sealing Roof/Wall Connections . . . 81
3.0102.11a Sealant selection . . . 81
3.0102.11b Material selection . . . 82
3.0102.11c Surface preparation . . . 82
3.0102.11d Support . . . 82
3.0102.11e Install air barrier . . . 82
3.0102.11f Attachment . . . 83
3.0102.11g Sealant application . . . 83
3.0102.11h High-temperature application . . . 83
3.0103.1 Access Doors and Hatches . . . 84
3.0103.1a Sealant selection . . . 84
3.0103.1b Material selection . . . 84
3.0103.1c Surface preparation . . . 85
3.0103.1d Seal framing . . . 85
3.0103.1e Seal access panel . . . 85
3.0103.1f Damming . . . 86
3.0103.1g Insulate opening . . . 86
3.0103.1h Durability . . . 86
3.0103.3 Whole-House Fan - Operable . . . 86
3.0103.3a Sealant selection . . . 87
3.0103.3b Material selection . . . 87
3.0103.3c Surface preparation . . . 88
3.0103.3d Enclosure construction . . . 88
3.0103.3e Operable cover . . . 88
3.0103.3f Insulation . . . 88
3.0103.3g Air sealing . . . 89
3.0103.3h Durability . . . 89
3.0103.4 Tenting of Wet Sprinkler Systems . . . 89
3.0103.4a Sealant selection . . . 90
3.0103.4b Material selection . . . 90
3.0103.4c Enclosure construction . . . 91
3.0103.4d Insulation . . . 91
3.0103.4e Air sealing . . . 91

3.0103.4f Fire safety . . . 91
3.0104.1 Closed Crawlspace Air Sealing . . . 92
3.0104.1a Pre-work qualifications . . . 92
3.0104.1b Sealant selection . . . 92
3.0104.1c Material selection . . . 93
3.0104.1d Backing and infill . . . 93
3.0104.1e Support . . . 94
3.0104.1f Surface preparation . . . 94
3.0104.1g Existing vent openings . . . 94
3.0104.1h Air sealing . . . 94
3.0104.1i Adjacent spaces . . . 95
3.0104.1j Fire safety . . . 95
3.0104.2 Installing New Crawlspace Access . . . 95
3.0104.2a Sealant selection . . . 96
3.0104.2b Material selection . . . 96
3.0104.2c Backing and infill . . . 97
3.0104.2d Surface preparation . . . 97
3.0104.2e Access construction . . . 97
3.0104.2f Appliance access . . . 98
3.0104.2g Air sealing . . . 98
3.0104.2h Security . . . 98
3.0104.3 Slab Foundation Sealing . . . 98
3.0104.3a Sealant selection . . . 99
3.0104.3b Material selection . . . 99
3.0104.3c Backing and infill . . . 100
3.0104.3d Surface preparation . . . 100
3.0104.3e Air sealing . . . 100
3.0104.3f High-temperature application . . . 100
3.0104.4 Covers for Intentional Slab Penetrations . . . 101
3.0104.4a Sealant selection . . . 101
3.0104.4b Material selection . . . 101
3.0104.4c Surface preparation . . . 102
3.0104.4d Sealing sump pump wells . . . 102
3.0104.4e Covering other water containing pits . . . 103
3.0105.1 Isolating Garage From Living Space . . . 103
3.0105.1a Sealant selection . . . 103
3.0105.1b Material selection . . . 104
3.0105.1c Surface preparation . . . 104
3.0105.1d Backing and infill . . . 104
3.0105.1e General air sealing . . . 105
3.0105.1f Ductwork . . . 105
3.0105.1g Doors adjacent to conditioned spaces . . . 105
3.0105.1h Glass doors or windows . . . 106
3.0105.1i High-temperature application . . . 106
3.0201.1 Window Air Sealing . . . 106

3.0201.1a Sealant selection . . . 106
3.0201.1b Material selection . . . 107
3.0201.1c Surface preparation . . . 107
3.0201.1d Operation and fit . . . 108
3.0201.1e Sash stops . . . 108
3.0201.1f Weather stripping . . . 108
3.0201.1g Sash locks . . . 109
3.0201.1h Exterior weatherproofing . . . 109
3.0201.1i Safety . . . 109
3.0201.2 Window Sash Replacement . . . 110
3.0201.2a Sealant selection . . . 110
3.0201.2b Material selection . . . 110
3.0201.2c Surface preparation . . . 111
3.0201.2d Sash replacement . . . 111
3.0201.2e Weatherproofing . . . 111
3.0201.2f Sash stops . . . 112
3.0201.2g Weather stripping . . . 112
3.0201.2h Sash locks . . . 112
3.0201.2i Disposal . . . 112
3.0201.2j Safety . . . 113
3.0201.3 Window Sill Replacement . . . 113
3.0201.3a Sealant selection . . . 113
3.0201.3b Material selection . . . 114
3.0201.3c Surface preparation . . . 114
3.0201.3d Sill replacement . . . 114
3.0201.3e Weatherproofing . . . 115
3.0201.3f Disposal . . . 115
3.0201.3g Safety . . . 115
3.0201.4 Glass Replacement . . . 116
3.0201.4a Sealant selection . . . 116
3.0201.4b Material selection . . . 116
3.0201.4c Surface preparation . . . 117
3.0201.4d New glazing selection . . . 117
3.0201.4e New glazing installation . . . 117
3.0201.4f Safety . . . 118
3.0201.5 Interior Fixed Storm Window Installation . . . 118
3.0201.5a Sealant selection . . . 118
3.0201.5b Material selection . . . 119
3.0201.5c Surface preparation . . . 119
3.0201.5d Installation . . . 120
3.0201.5e Safety . . . 120
3.0201.6 Interior Operable Storm Window Installation . . . 120
3.0201.6a Sealant selection . . . 120
3.0201.6b Material selection . . . 121
3.0201.6c Surface preparation . . . 121

3.0201.6d Installation . . . 122
3.0201.6e Safety . . . 122
3.0201.7 Exterior Fixed Storm Window Installation . . . 122
3.0201.7a Sealant selection . . . 122
3.0201.7b Material selection . . . 123
3.0201.7c Surface preparation . . . 123
3.0201.7d Installation . . . 124
3.0201.7e Sealing . . . 124
3.0201.7f Safety . . . 124
3.0201.8 Exterior Operable Storm Window Installation . . . 124
3.0201.8a Sealant selection . . . 125
3.0201.8b Material selection . . . 125
3.0201.8c Surface preparation . . . 126
3.0201.8d Installation . . . 126
3.0201.8e Sealing . . . 126
3.0201.8f Safety . . . 126
3.0201.9 Window Replacement . . . 127
3.0201.9a Sealant selection . . . 127
3.0201.9b Material selection . . . 127
3.0201.9c Window selection . . . 128
3.0201.9d Opening preparation . . . 128
3.0201.9e Installation . . . 129
3.0201.9f Safety . . . 129
3.0202.1 Door Air Sealing . . . 129
3.0202.1a Sealant selection . . . 130
3.0202.1b Material selection . . . 130
3.0202.1c Surface preparation . . . 131
3.0202.1d Operation and fit . . . 131
3.0202.1e Handle/lockset . . . 131
3.0202.1f Weather stripping . . . 131
3.0202.1g Door stop . . . 132
3.0202.1h Exterior weatherproofing . . . 132
3.0202.1i Safety . . . 133
3.0202.2 Door Replacement . . . 133
3.0202.2a Sealant selection . . . 133
3.0202.2b Material selection . . . 134
3.0202.2c Door selection . . . 134
3.0202.2d Opening preparation . . . 134
3.0202.2e Installation . . . 135
3.0202.2f Safety . . . 135
3.0202.3 Exterior Door Handle/Lockset Installation . . . 136
3.0202.3a Hardware selection . . . 136
3.0202.3b Installation . . . 136
3.0202.3c Safety . . . 137
4.0101.1 Roof Deck Insulation . . . 137

4.0101.1a Pre-work qualifications . . . 137
4.0101.1b General preparation . . . 137
4.0101.1c Material selection . . . 138
4.0101.1d Sealant selection . . . 138
4.0101.1e Installation . . . 138
4.0101.1f Air sealing . . . 139
4.0101.1g Water management . . . 139
4.0101.1h Replacement roof covering . . . 139
4.0101.1i Insulation - onsite documentation . . . 140
4.0102.1 SPF Roof Insulation - Unvented Roof Deck . . . 140
4.0102.1a Pre-work qualifications . . . 140
4.0102.1b General preparation . . . 141
4.0102.1c Material selection . . . 141
4.0102.1d Surface preparation . . . 142
4.0102.1e Installation . . . 142
4.0102.1f Ignition and thermal barriers . . . 142
4.0102.1g Insulation - onsite documentation . . . 143
4.0102.2 SPF Roof Insulation - Vented Roof Deck . . . 143
4.0102.2a Pre-work qualifications . . . 143
4.0102.2b General preparation . . . 144
4.0102.2c Material selection . . . 144
4.0102.2d Roof deck venting . . . 145
4.0102.2e Surface preparation . . . 145
4.0102.2f Installation . . . 145
4.0102.2g Ignition and thermal barriers . . . 146
4.0102.2h Insulation - onsite documentation . . . 146
4.0102.3 Inaccessible Ceilings - Dense Pack . . . 146
4.0102.3a Pre-work qualifications . . . 147
4.0102.3b General preparation . . . 147
4.0102.3c Material selection . . . 148
4.0102.3d Installation . . . 148
4.0102.3e Close access hole . . . 148
4.0102.3f Insulation - onsite documentation . . . 149
4.0103.1 Accessible Attic - Batt Installation . . . 149
4.0103.1a Pre-work qualifications . . . 149
4.0103.1b Material selection . . . 150
4.0103.1c General preparation . . . 150
4.0103.1d Installation . . . 150
4.0103.1e Insulation - onsite documentation . . . 151
4.0103.2 Accessible Attic - Loose Fill Installation . . . 151
4.0103.2a Pre-work qualifications . . . 151
4.0103.2b Material selection . . . 152
4.0103.2c General preparation . . . 152
4.0103.2d Installation . . . 153
4.0103.2e Insulation - onsite documentation . . . 153

4.0103.3 Accessible Attic - Batt Insulation Over Existing Insulation 153
4.0103.3a Pre-work qualifications 153
4.0103.3b General preparation 154
4.0103.3c Material selection 154
4.0103.3d Installation 155
4.0103.3e Insulation - onsite documentation 155
4.0103.4 Accessible Attic - Loose Fill Over Existing Insulation 155
4.0103.4a Pre-work qualifications 156
4.0103.4b Material selection 156
4.0103.4c General preparation 157
4.0103.4d Installation 157
4.0103.4e Insulation - onsite documentation 157
4.0103.5 Accessible Attic - SPF on Attic Floor 157
4.0103.5a Pre-work qualifications 158
4.0103.5b Material selection 158
4.0103.5c General preparation 159
4.0103.5d Surface preparation 159
4.0103.5e Installation 160
4.0103.5f Ignition and thermal barriers 160
4.0103.5g Insulation - onsite documentation 160
4.0103.6 Accessible Attic - Dense Pack Insulation 161
4.0103.6a Pre-work qualifications 161
4.0103.6b Material selection 162
4.0103.6c General preparation 162
4.0103.6d Installation 162
4.0103.6e Close access hole 162
4.0103.6f Insulation - onsite documentation 163
4.0103.7 Accessible Pitched/Vaulted/Cathedralized Ceilings - Loose Fill Over 163
4.0103.7a Pre-work qualifications 163
4.0103.7b Material selection 164
4.0103.7c General preparation 164
4.0103.7d Cellulose installation 165
4.0103.7e Fiberglass installation 165
4.0103.7f Insulation - onsite documentation 165
4.0103.8 Loose Fill to Capacity 166
4.0103.8a Pre-work qualifications 166
4.0103.8b General preparation 166
4.0103.8c Material selection 167
4.0103.8d Installation 167
4.0103.8e Close access hole 167
4.0103.8f Insulation - onsite documentation 168
4.0104.1 Knee Wall - Dense Packing 168
4.0104.1a Pre-work qualifications 168
4.0104.1b Material selection 169
4.0104.1c General preparation 169

4.0104.1d Install backing . . . 169
4.0104.1e Installation . . . 170
4.0104.1f Close access hole . . . 170
4.0104.1g Ignition and thermal barriers . . . 170
4.0104.1h Insulation - onsite documentation . . . 171
4.0104.2 Knee Wall - Batt Insulation . . . 171
4.0104.2a Pre-work qualifications . . . 171
4.0104.2b Material selection . . . 172
4.0104.2c General preparation . . . 172
4.0104.2d Batt installation . . . 172
4.0104.2e Install backing . . . 173
4.0104.2f Ignition and thermal barriers . . . 173
4.0104.2g Insulation - onsite documentation . . . 174
4.0104.3 Knee Wall - Existing Batt Insulation Repair . . . 174
4.0104.3a Pre-work qualifications . . . 174
4.0104.3b Material selection . . . 175
4.0104.3c General preparation . . . 175
4.0104.3d Install backing . . . 175
4.0104.3e Ignition and thermal barriers . . . 176
4.0104.3f Insulation - onsite documentation . . . 176
4.0104.4 Knee Wall - Rigid Insulation . . . 176
4.0104.4a Pre-work qualifications . . . 177
4.0104.4b Material selection . . . 177
4.0104.4c General preparation . . . 178
4.0104.4d Installation . . . 178
4.0104.4e Ignition and thermal barriers . . . 178
4.0104.4f Insulation - onsite documentation . . . 179
4.0104.5 Knee Wall - SPF With No Existing Insulation . . . 179
4.0104.5a Pre-work qualifications . . . 179
4.0104.5b Material selection . . . 180
4.0104.5c General preparation . . . 180
4.0104.5d Surface preparation . . . 181
4.0104.5e Installation . . . 181
4.0104.5f Ignition and thermal barriers . . . 181
4.0104.5g Insulation - onsite documentation . . . 182
4.0104.6 Knee Wall - SPF With Existing Insulation . . . 182
4.0104.6a Pre-work qualifications . . . 182
4.0104.6b Material selection . . . 183
4.0104.6c General preparation . . . 183
4.0104.6d Surface preparation . . . 184
4.0104.6e Installation . . . 184
4.0104.6f Ignition and thermal barriers . . . 184
4.0104.6g Insulation - onsite documentation . . . 185
4.0188.1 Radiant Barriers . . . 185
4.0188.1a Pre-work qualifications . . . 185

4.0188.1b Material selection . . . 186
4.0188.1c Installation . . . 186
4.0188.1d Air space . . . 187
4.0188.1e Sealing . . . 187
4.0188.1f Ventilation . . . 187
4.0188.1g Insulation - onsite documentation . . . 187
4.0188.2 Unconditioned Attic Ventilation . . . 188
4.0188.2a Pre-work qualifications . . . 188
4.0188.2b Vent selection . . . 188
4.0188.2c Vent openings . . . 188
4.0188.2d Vent location . . . 189
4.0188.2e Ventilation screens . . . 189
4.0188.2f Ventilation baffles . . . 189
4.0201.1 SPF Insulation . . . 190
4.0201.1a Pre-work qualifications . . . 190
4.0201.1b Material selection . . . 191
4.0201.1c General preparation . . . 191
4.0201.1d Surface preparation . . . 191
4.0201.1e Installation . . . 192
4.0201.1f Ignition and thermal barriers . . . 192
4.0201.1g Insulation - onsite documentation . . . 192
4.0201.2 Batt Insulation . . . 193
4.0201.2a Pre-work qualifications . . . 193
4.0201.2b Material selection . . . 194
4.0201.2c General preparation . . . 194
4.0201.2d Batt installation . . . 194
4.0201.2e Install backing . . . 195
4.0201.2f Ignition and thermal barriers . . . 195
4.0201.2g Insulation - onsite documentation . . . 195
4.0201.3 Dense Pack Insulation . . . 195
4.0201.3a Pre-work qualifications . . . 196
4.0201.3b Material selection . . . 196
4.0201.3c General preparation for dense packed insulation . . . 197
4.0201.3d Install backing . . . 197
4.0201.3e Installation . . . 197
4.0201.3f Close access hole . . . 198
4.0201.3g Ignition and thermal barriers . . . 198
4.0201.3h Insulation - onsite documentation . . . 198
4.0202.1 Dense Pack Insulation . . . 198
4.0202.1a Pre-work qualifications . . . 199
4.0202.1b Material selection . . . 199
4.0202.1c General preparation . . . 200
4.0202.1d Sealant selection . . . 200
4.0202.1e Access cavity . . . 200
4.0202.1f Installation . . . 201

4.0202.1g Close access hole . . . 201
4.0202.1h Insulation - onsite documentation . . . 202
4.0202.2 Exterior Rigid Insulation . . . 202
4.0202.2a Pre-work qualifications . . . 202
4.0202.2b Sealant selection . . . 203
4.0202.2c General preparation . . . 203
4.0202.2d Water management system . . . 204
4.0202.2e Installation . . . 204
4.0202.2f Exterior cladding replacement . . . 204
4.0202.2g Fire Safety . . . 205
4.0202.2h Insulation - onsite documentation . . . 205
4.0301.1 Batt Insulation in Joisted Cavities . . . 205
4.0301.1a Pre-work qualifications . . . 205
4.0301.1b Material selection . . . 206
4.0301.1c General preparation . . . 206
4.0301.1e Secure Batts . . . 207
4.0301.1f Insulation - onsite documentation . . . 207
4.0301.2 Loose Fill With Netting/Fabric in Joisted Cavities . . . 207
4.0301.2a Pre-work qualifications . . . 207
4.0301.2b Material selection . . . 208
4.0301.2c General preparation . . . 208
4.0301.2d Install netting/fabric . . . 209
4.0301.2e Installation . . . 209
4.0301.2f Close access hole . . . 209
4.0301.2g Insulation - onsite documentation . . . 210
4.0301.3 Loose Fill in Joisted Cavities With Rigid Barrier . . . 210
4.0301.3a Pre-work qualifications . . . 210
4.0301.3b Material selection . . . 211
4.0301.3c Sealant selection . . . 211
4.0301.3d General preparation . . . 212
4.0301.3e Install rigid barrier . . . 212
4.0301.3f Installation . . . 212
4.0301.3g Close access hole . . . 213
4.0301.3h Ignition and thermal barriers . . . 213
4.0301.3i Insulation - onsite documentation . . . 213
4.0301.4 Dense Pack in Joisted Cavities With Rigid Barrier . . . 214
4.0301.4a Pre-work qualifications . . . 214
4.0301.4b Material selection . . . 214
4.0301.4c Sealant selection . . . 215
4.0301.4d General preparation . . . 215
4.0301.4e Install rigid barrier . . . 216
4.0301.4f Installation . . . 216
4.0301.4g Close access hole . . . 216
4.0301.4h Ignition and thermal barriers . . . 217
4.0301.4i Insulation - onsite documentation . . . 217

4.0301.5 SPF in Open Joisted Cavities . . . 217
4.0301.5a Pre-work qualifications . . . 218
4.0301.5b Material selection . . . 218
4.0301.5c General preparation . . . 219
4.0301.5d Surface preparation . . . 219
4.0301.5e Installation . . . 219
4.0301.5f Ignition and thermal barriers . . . 220
4.0301.5g Insulation - onsite documentation . . . 220
4.0301.6 Cantilever Floor Joisted Cavities Batt Insulation . . . 220
4.0301.6a Pre-work qualifications . . . 221
4.0301.6b Material selection . . . 221
4.0301.6c General preparation . . . 222
4.0301.6d Batt installation . . . 222
4.0301.6e Secure Batts . . . 222
4.0301.6f Enclose cavity . . . 222
4.0301.6g Exterior soffit . . . 223
4.0301.6h Insulation - onsite documentation . . . 223
4.0301.7 Non-Joisted Floors Batt Insulation . . . 223
4.0301.7a Pre-work qualifications . . . 224
4.0301.7b Material selection . . . 224
4.0301.7c General preparation . . . 225
4.0301.7d Installation . . . 225
4.0301.7e Support . . . 225
4.0301.7f Insulation - onsite documentation . . . 226
4.0301.8 Non-Joisted Floors Rigid Foam . . . 226
4.0301.8a Pre-work qualifications . . . 226
4.0301.8b Material selection . . . 227
4.0301.8c Sealant selection . . . 227
4.0301.8d General preparation . . . 227
4.0301.8e Installation . . . 228
4.0301.8f Sealing . . . 228
4.0301.8g Support . . . 228
4.0301.8h Ignition and thermal barriers . . . 229
4.0301.8i Insulation - onsite documentation . . . 229
4.0301.9 Non-Joisted Floors SPF . . . 230
4.0301.9a Pre-work qualifications . . . 230
4.0301.9b Material selection . . . 230
4.0301.9c General preparation . . . 231
4.0301.9d Surface preparation . . . 231
4.0301.9e Installation . . . 231
4.0301.9f Ignition and thermal barriers . . . 232
4.0301.9g Insulation - onsite documentation . . . 232
4.0302.1 Batt Insulation With Rigid Barrier . . . 233
4.0302.1a Pre-work qualifications . . . 233
4.0302.1b Material selection . . . 234

4.0302.1c Sealant selection . . . 234
4.0302.1d General preparation . . . 234
4.0302.1e Batt installation . . . 235
4.0302.1f Secure batts . . . 235
4.0302.1g Rigid protective barrier . . . 235
4.0302.1h Sealing and rodent proofing . . . 236
4.0302.1i Weather-resistant barrier . . . 236
4.0302.1j Insulation - onsite documentation . . . 236
4.0302.2 Loose Fill With Rigid Barrier . . . 236
4.0302.2a Pre-work qualifications . . . 237
4.0302.2b Material selection . . . 237
4.0302.2c Sealant selection . . . 238
4.0302.2d General preparation . . . 238
4.0302.2e Rigid protective barrier . . . 238
4.0302.2f Installation . . . 239
4.0302.2g Close access hole . . . 239
4.0302.2h Sealing and rodent proofing . . . 239
4.0302.2i Weather-resistant barrier . . . 240
4.0302.2j Insulation - onsite documentation . . . 240
4.0302.3 Dense Pack with Rigid Barrier . . . 240
4.0302.3a Pre-work qualifications . . . 240
4.0302.3b Material selection . . . 241
4.0302.3c Sealant selection . . . 242
4.0302.3d General preparation . . . 242
4.0302.3e Rigid protective barrier . . . 242
4.0302.3f Installation . . . 243
4.0302.3g Close access hole . . . 243
4.0302.3h Sealing and rodent proofing . . . 243
4.0302.3i Weather-resistant barrier . . . 243
4.0302.3j Insulation - onsite documentation . . . 244
4.0302.4 SPF with Rigid Barrier . . . 244
4.0302.4a Pre-work qualifications . . . 244
4.0302.4b Material selection . . . 245
4.0302.4c Sealant selection . . . 245
4.0302.4d General preparation . . . 246
4.0302.4e Surface preparation . . . 246
4.0302.4f Rigid protective barrier . . . 246
4.0302.4g Installation . . . 247
4.0302.4h Sealing and rodent proofing . . . 247
4.0302.4i Weather-resistant barrier . . . 247
4.0302.4j Ignition and thermal barriers . . . 248
4.0302.4k Insulation - onsite documentation . . . 248
4.0302.5 Rigid Insulation on Joists . . . 248
4.0302.5a Pre-work qualifications . . . 249
4.0302.5b Material selection . . . 249

4.0302.5c Sealant selection . . . 250
4.0302.5d General preparation . . . 250
4.0302.5e Installation . . . 250
4.0302.5f Rigid protective barrier . . . 251
4.0302.5g Sealing and rodent proofing . . . 251
4.0302.5h Weather-resistant barrier . . . 251
4.0302.5i Ignition and thermal barriers . . . 252
4.0302.5j Insulation - onsite documentation . . . 252
4.0302.6 Non-Joisted Floors Batt Insulation . . . 252
4.0302.6a Pre-work qualifications . . . 253
4.0302.6b Material selection . . . 253
4.0302.6c Sealant selection . . . 254
4.0302.6d General preparation . . . 254
4.0302.6e Installation . . . 254
4.0302.6f Secure batts . . . 255
4.0302.6g Rigid protective barrier . . . 255
4.0302.6h Sealing and rodent proofing . . . 255
4.0302.6i Weather-resistant barrier . . . 256
4.0302.6j Insulation - onsite documentation . . . 256
4.0302.7 Non-Joisted Floors Rigid Insulation . . . 256
4.0302.7a Pre-work qualifications . . . 256
4.0302.7b Material selection . . . 257
4.0302.7c Sealant selection . . . 258
4.0302.7d General preparation . . . 258
4.0302.7e Installation . . . 258
4.0302.7f Rigid protective barrier . . . 259
4.0302.7g Sealing and rodent proofing . . . 259
4.0302.7h Weather-resistant barrier . . . 259
4.0302.7i Ignition and thermal barriers . . . 260
4.0302.7j Insulation - onsite documentation . . . 260
4.0302.8 Non-Joisted Floors SPF Insulation . . . 260
4.0302.8a Pre-work qualifications . . . 261
4.0302.8b Material selection . . . 261
4.0302.8c Sealant selection . . . 262
4.0302.8d General preparation . . . 262
4.0302.8e Surface preparation . . . 262
4.0302.8f Installation . . . 263
4.0302.8g Rigid protective barrier . . . 263
4.0302.8h Sealing and rodent proofing . . . 263
4.0302.8i Weather-resistant barrier . . . 264
4.0302.8j Ignition and thermal barriers . . . 264
4.0302.8k Insulation - onsite documentation . . . 264
4.0388.1 Foundation Skirting . . . 265
4.0388.1a Pre-work qualifications . . . 265
4.0388.1b Material selection . . . 265

4.0388.1c Sealant selection . . . 266
4.0388.1d General preparation . . . 266
4.0388.1e Coverage . . . 266
4.0388.1f Support . . . 267
4.0388.1g Fastening . . . 267
4.0388.1h Flashing . . . 267
4.0388.1i Insulation . . . 268
4.0388.1j Sealing and rodent proofing . . . 268
4.0388.1k Insulation - onsite documentation . . . 268
4.0401.1 SPF Insulation . . . 268
4.0401.1a Pre-work qualifications . . . 269
4.0401.1b Material selection . . . 269
4.0401.1c General preparation . . . 270
4.0401.1d Surface preparation . . . 270
4.0401.1e Installation . . . 270
4.0401.1f Ignition and thermal barriers . . . 271
4.0401.1g Insulation - onsite documentation . . . 271
4.0401.2 Batt Insulation . . . 271
4.0401.2a Pre-work qualifications . . . 272
4.0401.2b Material selection . . . 272
4.0401.2c Sealant selection . . . 273
4.0401.2d General preparation . . . 273
4.0401.2e Batt installation . . . 273
4.0401.2f Sealing . . . 274
4.0401.2g Insulation - onsite documentation . . . 274
4.0401.3 Rigid Insulation . . . 274
4.0401.3a Pre-work qualifications . . . 274
4.0401.3b Material selection . . . 275
4.0401.3c General preparation . . . 275
4.0401.3d Batt installation . . . 276
4.0401.3e Sealing . . . 276
4.0401.3f Ignition and thermal barriers . . . 276
4.0401.3g Insulation - onsite documentation . . . 277
4.0402.1 Closed Crawlspace - Non-Foam Insulation . . . 277
4.0402.1a Pre-work qualifications . . . 277
4.0402.1b Material selection . . . 278
4.0402.1c Sealant selection . . . 278
4.0402.1d General preparation . . . 279
4.0402.1e Installation . . . 279
4.0402.1f Attachment . . . 279
4.0402.1g Sealing . . . 280
4.0402.1h Termite inspection gap . . . 280
4.0402.1i Insulation - onsite documentation . . . 280
4.0402.2 Closed Crawlspace - Rigid Foam Insulation . . . 281
4.0402.2a Pre-work qualifications . . . 281

4.0402.2b Material selection . . . 282
4.0402.2c Sealant selection . . . 282
4.0402.2d General preparation . . . 283
4.0402.2e Surface preparation . . . 283
4.0402.2f Installation . . . 283
4.0402.2g Attachment . . . 283
4.0402.2h Sealing . . . 284
4.0402.2i Termite inspection gap . . . 284
4.0402.2j Ignition and thermal barriers . . . 284
4.0402.2k Insulation - onsite documentation . . . 285
4.0402.3 Closed Crawlspace - SPF Insulation . . . 285
4.0402.3a Pre-work qualifications . . . 285
4.0402.3b Material selection . . . 286
4.0402.3c Sealant selection . . . 287
4.0402.3d General preparation . . . 287
4.0402.3e Surface preparation . . . 287
4.0402.3f Installation . . . 288
4.0402.3g Sealing . . . 288
4.0402.3h Termite inspection gap . . . 288
4.0402.3i Ignition and thermal barriers . . . 289
4.0402.3j Insulation - onsite documentation . . . 289
4.0402.4 Basements - Without Groundwater Leakage . . . 289
4.0402.4a Pre-work qualifications . . . 290
4.0402.4b Material selection . . . 290
4.0402.4c Sealant selection . . . 291
4.0402.4d General preparation . . . 291
4.0402.4e Installation . . . 291
4.0402.4f Attachment . . . 292
4.0402.4g Sealing . . . 292
4.0402.4h Termite inspection gap . . . 292
4.0402.4i Ignition and thermal barriers . . . 293
4.0402.4j Insulation - onsite documentation . . . 293
4.0402.5 Basements - With Groundwater Leakage . . . 293
4.0402.5a Pre-work qualifications . . . 294
4.0402.5b Material selection . . . 294
4.0402.5c Drainage . . . 295
4.0402.5d Installation . . . 295
4.0402.5e Termite inspection gap . . . 295
4.0402.5f Attachment . . . 296
4.0402.5g Sealing . . . 296
4.0402.5h Ignition and thermal barriers . . . 296
4.0402.5i Vapor retarders . . . 297
4.0402.5j Insulation - onsite documentation . . . 297
4.0403.1 Raised and On-Grade Slab Edge Insulation . . . 297
4.0403.1a Pre-work qualifications . . . 297

4.0403.1b Material selection . . . 298
4.0403.1c Sealant selection . . . 298
4.0403.1d General preparation . . . 299
4.0403.1e Excavation . . . 299
4.0403.1f Installation . . . 299
4.0403.1g Flashing . . . 299
4.0403.1h Protective covering . . . 300
4.0403.1i Sealing and pest protection . . . 300
4.0403.1j Termites . . . 300
4.0403.1k Back fill . . . 300
4.0403.1l Insulation - onsite documentation . . . 301
5.0101.1 Thermostat Replacement . . . 301
5.0101.1a Pre-Work qualifications . . . 301
5.0101.1b Thermostat selection . . . 302
5.0101.1c Thermostat location . . . 302
5.0101.1d Heat pump considerations . . . 302
5.0101.1e Installer programming . . . 303
5.0101.1f Penetrations . . . 303
5.0101.1g Documentation . . . 303
5.0102.1 Condensate Removal . . . 303
5.0102.1a Condensate disposal . . . 304
5.0102.1b Connections . . . 304
5.0102.1c Slope . . . 304
5.0102.1d Vents and traps . . . 305
5.0102.1e Secondary drain pan . . . 305
5.0102.1f Float switches . . . 305
5.0102.1g Insulation . . . 306
5.0102.1h Pumps . . . 306
5.0102.1i Exterior termination . . . 306
5.0103.1 Refrigerant Lines . . . 306
5.0103.1a Material selection . . . 307
5.0103.1b Sizing . . . 307
5.0103.1c Installation . . . 307
5.0103.1d Insulation . . . 308
5.0103.1e Support . . . 308
5.0103.1f Protection . . . 308
5.0103.1g Locking refrigerant caps . . . 309
5.0103.2 Refrigerant Charge . . . 309
5.0103.2a Pre-work qualifications . . . 309
5.0103.2b Charge . . . 309
5.0103.2c Documentation . . . 310
5.0103.3 Thermostatic Expansion Valve (TXV) . . . 310
5.0103.3a Material selection . . . 310
5.0103.3b Replacement . . . 311
5.0104.1 New Duct Components . . . 311

5.0104.1a Material selection . . . 311
5.0104.1b General preparation . . . 312
5.0104.1c Duct design . . . 312
5.0104.1d Termination design . . . 312
5.0104.1e Protection . . . 313
5.0104.1f Exterior duct construction . . . 313
5.0104.1g Plenums . . . 313
5.0104.1h Reducers . . . 314
5.0104.1i Supply branches . . . 314
5.0104.1j Take-offs . . . 314
5.0104.1k Flexible ducts . . . 314
5.0104.1l Boots . . . 315
5.0104.1m Fire protection . . . 315
5.0104.1n Air filtration . . . 316
5.0104.1o Room pressure balancing . . . 316
5.0104.1p Sealing . . . 316
5.0104.1q Fastening . . . 317
5.0104.1r Support . . . 317
5.0104.1s Insulation . . . 317
5.0104.1t Manual volume dampers . . . 317
5.0105.1 Mechanical Fastening . . . 318
5.0105.1a Metal to metal . . . 318
5.0105.1b Flex to metal . . . 318
5.0105.1c Flex to flex . . . 318
5.0105.1d Duct board to duct board . . . 319
5.0105.1e Duct board to flexible duct . . . 319
5.0105.1f Duct board to metal . . . 319
5.0105.1g Duct board plenum to air handler cabinet . . . 320
5.0105.1h Duct boot to subfloor . . . 320
5.0105.1i Duct boot to gypsum . . . 320
5.0105.1j Metal plenum to air handler cabinet . . . 321
5.0105.2 Duct Support . . . 321
5.0105.2a Flex duct and duct board support . . . 321
5.0105.2b Metal duct support . . . 322
5.0105.2c Plenum support . . . 322
5.0106.1 General Duct Sealing . . . 322
5.0106.1a Sealant selection . . . 322
5.0106.1b Access ducts . . . 323
5.0106.1c Surface preparation . . . 323
5.0106.1d Securely fasten ducts . . . 323
5.0106.1e General sealing . . . 324
5.0106.1f Seal leaks less than 1/4" . . . 324
5.0106.1g Seal leaks between 1/4" and 3/4" . . . 324
5.0106.1h Seal leaks greater than 3/4" . . . 325
5.0106.1i Duct boots . . . 325

5.0106.1j Air handler jacket . . . 325
5.0106.1k Filter slot . . . 326
5.0106.2 Duct Sealing - Spray Polyurethane Foam (SPF) . . . 326
5.0106.2a Material selection . . . 326
5.0106.2b Surface preparation . . . 327
5.0106.2c Installation . . . 327
5.0106.2d Ignition and thermal barriers . . . 327
5.0106.3 Duct Sealing - Proprietary Spray Application . . . 328
5.0106.3a Material selection . . . 328
5.0106.3b Surface preparation . . . 328
5.0106.3c Installation . . . 329
5.0107.1 General Duct Insulation . . . 329
5.0107.1a Material selection . . . 329
5.0107.1b General preparation . . . 329
5.0107.1c Insulation value . . . 330
5.0107.1d Attachment . . . 330
5.0107.1e Sealing . . . 330
5.0107.1f Insulation - onsite documentation . . . 331
5.0107.2 Duct Insulation - Spray Polyurethane Foam (SPF) . . . 331
5.0107.2a Material selection . . . 331
5.0107.2b Surface preparation . . . 331
5.0107.2c Installation . . . 332
5.0107.2d Ignition and thermal barriers . . . 332
5.0107.2e Insulation - onsite documentation . . . 333
5.0108.1 Air-to-Air Split System . . . 333
5.0108.1a Load calculation . . . 333
5.0108.1b Equipment selection . . . 334
5.0108.1c Outdoor unit location . . . 334
5.0108.1d Outdoor unit support . . . 335
5.0108.1e Outdoor unit installation . . . 335
5.0108.1f Indoor unit location . . . 335
5.0108.1g Indoor unit installation . . . 335
5.0108.1h Support - all installations . . . 336
5.0108.1i Support - horizontal air flow in attic . . . 336
5.0108.1j Support - horizontal air flow in subspace . . . 336
5.0108.1k Support - upflow on a platform . . . 337
5.0108.1l Support - downflow . . . 337
5.0108.1m Connections . . . 337
5.0108.1n Intakes/terminations . . . 337
5.0108.1o Condensate drainage . . . 338
5.0108.1p Electrical wiring . . . 338
5.0108.1q Refrigerant lines and charge . . . 339
5.0108.1r Fire protection . . . 339
5.0108.1s Air handler sealing . . . 339
5.0108.1t Documentation . . . 339

5.0108.2 Air-to-Air Package Unit 340
5.0108.2a Load calculation 340
5.0108.2b Equipment selection 340
5.0108.2c Unit location 341
5.0108.2d Unit support 341
5.0108.2e Unit installation 342
5.0108.2f Electrical wiring 342
5.0108.2g Refrigerant lines and charge 342
5.0108.2h Connections 343
5.0108.2i Outdoor ductwork 343
5.0108.2j Intakes/terminations 343
5.0108.2k Condensate drainage 343
5.0108.2l Fire protection 344
5.0108.2m Documentation 344
5.0108.3 Mini-Split System 344
5.0108.3a Load calculation 345
5.0108.3b Equipment selection 345
5.0108.3c Outdoor unit location 346
5.0108.3d Outdoor unit support 346
5.0108.3e Outdoor unit installation 346
5.0108.3f Indoor unit location 347
5.0108.3g Indoor unit(s) installation 347
5.0108.3h Ceiling cassette insulation 347
5.0108.3i Indoor unit(s) support 347
5.0108.3j Electrical wiring 348
5.0108.3k Intakes/terminations 348
5.0108.3l Connections 348
5.0108.3m Ducting 349
5.0108.3n Refrigerant piping 349
5.0108.3o Controls 349
5.0108.3p Condensate 350
5.0108.3q Documentation 350
5.0108.4 Furnaces 350
5.0108.4a Load calculation 351
5.0108.4b Equipment selection 351
5.0108.4c Indoor unit location 351
5.0108.4d Indoor unit installation 352
5.0108.4e Support - all installations 352
5.0108.4f Support - horizontal air flow in attic 352
5.0108.4g Support - horizontal air flow in subspace 353
5.0108.4h Support - upflow on a platform 353
5.0108.4i Support - downflow 353
5.0108.4j Connections 354
5.0108.4k Intakes/terminations 354
5.0108.4l Condensate drainage 354

5.0108.4m Electrical wiring . . . 355
5.0108.4n Fire protection . . . 355
5.0108.4o Air handler sealing . . . 355
5.0108.4p Documentation . . . 356
5.0108.5 Evaporative Coolers . . . 356
5.0108.5a Equipment selection . . . 356
5.0108.5b Installation location . . . 356
5.0108.5c Installation . . . 357
5.0108.5d Support . . . 357
5.0108.5e Connections . . . 357
5.0108.5f Electrical wiring . . . 358
5.0108.5g Water management . . . 358
5.0108.5h Intakes . . . 358
5.0108.5i Documentation . . . 359
5.0109.1 Condensers . . . 359
5.0109.1a Repair diagnosis . . . 359
5.0109.1b Service . . . 360
5.0109.1c Documentation . . . 360
5.0109.2 Air Handlers . . . 360
5.0109.2a Repair diagnosis . . . 361
5.0109.2b Service . . . 361
5.0109.2c Documentation . . . 361
5.0109.3 Evaporators . . . 362
5.0109.3a Repair diagnosis . . . 362
5.0109.3b Service . . . 362
5.0109.3c Documentation . . . 363
5.0109.4 Combustion Furnaces . . . 363
5.0109.4a Repair diagnosis . . . 363
5.0109.4b Service . . . 363
5.0109.4c Documentation . . . 364
5.0109.5 Evaporative Coolers . . . 364
5.0109.5a Repair diagnosis . . . 365
5.0109.5b Service . . . 365
5.0109.5c Documentation . . . 365
5.0201.1 Thermostat Replacement . . . 365
5.0201.1a Pre-work qualifications . . . 366
5.0201.1b Thermostat selection . . . 366
5.0201.1c Thermostat location . . . 366
5.0201.1d Installation . . . 367
5.0201.1e Installer programming . . . 367
5.0201.1f Penetrations . . . 367
5.0201.1g Documentation . . . 368
5.0202.1 Radiator Reflector . . . 368
5.0202.1a Reflector installation . . . 368
5.0202.1b Insulation . . . 368

5.0202.2 Distribution Insulation 369
5.0202.2a Insulation selection 369
5.0202.2b Installation 369
5.0202.2c Documentation 370
5.0203.1 Boilers 370
5.0203.1a Load calculation 370
5.0203.1b Equipment selection 371
5.0203.1c Installation location 371
5.0203.1d Equipment installation 371
5.0203.1e Equipment support 372
5.0203.1f Electrical wiring 372
5.0203.1g Connections 372
5.0203.1h Documentation 373
5.0204.1 Fuel-Fired Boilers 373
5.0204.1a Repair diagnosis 373
5.0204.1b Service 374
5.0204.1c Documentation 374
5.0301.1 Through-Wall and Window Units 374
5.0301.1a Pre-work qualifications 375
5.0301.1b Equipment selection 375
5.0301.1c Installation 375
5.0301.1d Support 376
5.0301.1e Sealing 376
5.0301.1f Disposal 376
5.0301.1g Documentation 377
5.0301.2 PTAC/PTHP Units 377
5.0301.2a Load calculation 377
5.0301.2b Equipment selection 378
5.0301.2c Installation 378
5.0301.2d Condensate disposal 378
5.0301.2e Sealing 379
5.0301.2f Insulation 379
5.0301.2g Disposal 379
5.0301.2h Documentation 380
5.0301.3 Wall Furnace 380
5.0301.3a Load calculation 380
5.0301.3b Equipment selection 380
5.0301.3c Installation 381
5.0301.3d Controls 381
5.0301.3e Condensate disposal 381
5.0301.3f Sealing 382
5.0301.3g Disposal 382
5.0301.3h Documentation 382
5.0401.1 Indigenous Shading 383
5.0401.1a Plant selection 383

5.0401.1b Plant size . . . 383
5.0402.1 Reflective Roof Coatings . . . 384
5.0402.1a Material selection . . . 384
5.0402.1b Preparation . . . 384
5.0402.1c Application . . . 385
5.0501.1 Isolate CAZ . . . 385
5.0501.1a Air sealing . . . 385
5.0501.1b Ductwork . . . 385
5.0501.1c Plumbing . . . 386
5.0501.1d Walls/floors/ceilings . . . 386
5.0501.1e Combustion air . . . 386
5.0502.1 Combustion Air - Fuel-Fired Appliances . . . 387
5.0502.1a Design . . . 387
5.0502.1b Installation . . . 387
5.0503.1 Fuel-Fired Appliance Venting . . . 388
5.0503.1a Design . . . 388
5.0503.1b Materials . . . 388
5.0503.1c Installation . . . 389
5.0503.1d Terminations . . . 389
5.0503.1e Chimney liners . . . 389
5.0504.1 Natural Gas/Propane Fuel Piping . . . 390
5.0504.1a Material selection . . . 390
5.0504.1b Gas piping size . . . 390
5.0504.1c Piping location . . . 390
5.0504.1d Support . . . 391
5.0504.1e Required components . . . 391
5.0504.1f Gas pressure regulator venting . . . 391
5.0504.1g Sealing . . . 392
5.0504.1h Safety devices for propane . . . 392
5.0504.1i Gas boosters . . . 392
5.0504.2 Oil Piping . . . 392
5.0504.2a Material selection . . . 393
5.0504.2b Piping location . . . 393
5.0504.2c Support . . . 393
5.0504.2d Required components . . . 393
5.0504.2e Pumps . . . 394
5.0504.2f Line connections . . . 394
5.8801.1 Decommissioning . . . 394
5.8801.1a Utility disconnect . . . 395
5.8801.1b Refrigerant recovery . . . 395
5.8801.1c Equipment disconnection . . . 395
5.8801.1d Equipment removal . . . 395
5.8801.1e Disposal . . . 396
6.0101.1 Ventilation Ducts . . . 396
6.0101.1a Material selection . . . 396

6.0101.1b Design and configuration . . . 397
6.0101.1c Combining air streams . . . 397
6.0101.1d Mechanical fastening . . . 397
6.0101.1e Sealing . . . 398
6.0101.1f Insulation . . . 398
6.0101.1g Support . . . 399
6.0101.2 Exhaust Terminations . . . 399
6.0101.2a Selection . . . 399
6.0101.2b Damper (if applicable) . . . 400
6.0101.2c Location . . . 400
6.0101.2d Installation . . . 401
6.0101.2e Duct to termination connection . . . 401
6.0101.2f Sealing . . . 401
6.0101.3 Exterior Intakes . . . 401
6.0101.3a Selection . . . 402
6.0101.3b Damper (if applicable) . . . 402
6.0101.3c Location . . . 403
6.0101.3d Installation . . . 403
6.0101.3e Duct to termination connection . . . 403
6.0101.3f Labeling . . . 404
6.0101.3g Sealing . . . 404
6.0101.4 Fan Controls . . . 404
6.0101.4a Intermittent/continuous operation . . . 404
6.0101.4b Optional sensors . . . 405
6.0101.4c Manual override . . . 405
6.0101.4d Labeling, if applicable . . . 406
6.0101.5 Airflow Control Devices . . . 406
6.0101.5a Pre-Work Qualifications . . . 406
6.0101.5b Material selection . . . 406
6.0101.5c Installation . . . 407
6.0101.5d Sealing . . . 407
6.0101.5e Fire Safety . . . 407
6.0201.1 Surface Mounted . . . 408
6.0201.1a Fan selection . . . 408
6.0201.1b Sealant selection . . . 408
6.0201.1c Damper . . . 409
6.0201.1d Location . . . 409
6.0201.1e Opening preparation . . . 409
6.0201.1f Fan orientation . . . 410
6.0201.1g Fan mounting . . . 410
6.0201.1h Wiring . . . 410
6.0201.1i Sealing . . . 410
6.0201.1j Insulate housing . . . 411
6.0201.1k Fan access . . . 411
6.0201.1l Venting . . . 411

6.0201.2 Kitchen Range Hoods 411
6.0201.2a Fan selection 412
6.0201.2b Sealant selection 412
6.0201.2c Location 413
6.0201.2d Damper 413
6.0201.2e Installation 413
6.0201.2f Wiring 414
6.0201.2g Sealing 414
6.0201.2h Fan access 414
6.0201.2i Venting 414
6.0201.2j Make-up air 415
6.0201.3 Inline and Multiport Fans 415
6.0201.3a Fan selection 415
6.0201.3b Sealant selection 415
6.0201.3c Wiring 416
6.0201.3d Fan orientation 416
6.0201.3e Fan mounting 416
6.0201.3f Damper 417
6.0201.3g Intake grill openings 417
6.0201.3h Air sealing 417
6.0201.3i Fan Access 418
6.0201.3j Venting 418
6.0201.4 Garage Exhaust Fans 418
6.0201.4a Fan selection 418
6.0201.4b Sealant selection 419
6.0201.4c Wiring 419
6.0201.4d Fan orientation 420
6.0201.4e Fan mounting 420
6.0201.4f Damper 420
6.0201.4g Controls 420
6.0201.4h Exhaust system openings 421
6.0201.4i Air sealing 421
6.0201.4j Fan access 421
6.0201.4k Outdoor termination location 422
6.0201.4l Venting 422
6.0202.1 Clothes Dryer 422
6.0202.1a Duct selection 422
6.0202.1b Venting installation 423
6.0202.1c Lint collection devices 423
6.0202.1d Mechanical fasteners 424
6.0202.1e Make-up air 424
6.0202.1f Duct insulation 424
6.0202.1g Termination fitting 424
6.0202.1h Sealing 425
6.0202.1i Condensing dryers 425

6.0301.1 Fresh Air Intake In Forced Air System 425
6.0301.1a Pre-work qualifications 426
6.0301.1b Intake location 426
6.0301.1c Labeling 426
6.0301.1d Pest exclusion 427
6.0301.1e Motorized damper 427
6.0301.1f System control 427
6.0301.1g Wiring 428
6.0301.1h Fresh air filtration 428
6.0301.1i Filter accessibility and fit 428
6.0301.1j Access 429
6.0301.1k Ducting 429
6.0301.1l Fire dampers 429
6.0301.1m System balancing 429
6.0302.1 Individual Exhaust Fan Serving Entire Dwelling 430
6.0302.1a Fan selection 430
6.0302.1b Sealant selection 430
6.0302.1c Termination location 431
6.0302.1d Pest exclusion 431
6.0302.1e Damper 432
6.0302.1f Interior intake location 432
6.0302.1g Opening preparation 432
6.0302.1h Fan orientation 432
6.0302.1i Fan mounting 433
6.0302.1j Wiring 433
6.0302.1k Sealing 433
6.0302.1l Insulate housing 433
6.0302.1m Fan access 434
6.0302.1n Venting 434
6.0302.1o System balancing 434
6.0303.1 HRV/ERV Installation 435
6.0303.1a Fan selection 435
6.0303.1b Wiring 435
6.0303.1c Exterior exhaust termination location 435
6.0303.1d Exterior intake location 436
6.0303.1e Pest exclusion 436
6.0303.1f Interior intake location 437
6.0303.1g Interior supply location 437
6.0303.1h Combining air streams 437
6.0303.1i Backdraft prevention 438
6.0303.1j Fresh air filtration 438
6.0303.1k Fan mounting 438
6.0303.1l Sealing 439
6.0303.1m Condensate drain 439
6.0303.1n Access 439

6.0303.1o Fire dampers . . . 439
6.0303.1p System balancing . . . 440
6.0303.1q Very cold climate considerations . . . 440
6.0303.1r Hot-humid climate considerations . . . 440
6.0305.1 Ventilator Dehumidifiers . . . 441
6.0305.1a Equipment selection . . . 441
6.0305.1b Sizing . . . 441
6.0305.1c Equipment location . . . 442
6.0305.1d Mounting . . . 442
6.0305.1e Installation . . . 442
6.0305.1f Wiring . . . 443
6.0305.1g Controls . . . 443
6.0305.1h Sealing . . . 443
6.0305.1i Condensate drain . . . 443
6.0305.1j Access . . . 444
6.0305.1k Fire dampers . . . 444
6.0306.1 Decommissioning Ventilation Systems . . . 444
6.0306.1a Power supply . . . 445
6.0306.1b Fan and component removal . . . 445
6.0306.1c Sealing holes and openings . . . 445
6.0306.1d Disposal . . . 446
7.0101.1 Refrigerator and Freezer Replacement . . . 446
7.0101.1a Pre-work qualifications . . . 446
7.0101.1b Selection . . . 446
7.0101.1c Installation . . . 447
7.0101.1d Accessibility . . . 447
7.0101.1e Disposal . . . 447
7.0101.1f Documentation . . . 448
7.0101.2 Refrigerator/Freezer Clean and Tune . . . 448
7.0101.2a Clearances and location . . . 448
7.0101.2b Coil cleaning . . . 449
7.0101.2c Condensation settings . . . 449
7.0101.2d Temperature settings . . . 449
7.0102.1 Consumer Electronics Replacement . . . 449
7.0102.1a Pre-work qualifications . . . 450
7.0102.1b Selection . . . 450
7.0102.1c Installation . . . 450
7.0102.1d Disconnecting means . . . 451
7.0102.1e Disposal . . . 451
7.0102.1f Documentation . . . 451
7.0103.1 Lighting Replacement . . . 452
7.0103.1a Selection . . . 452
7.0103.1b Installation . . . 452
7.0103.1c Electrical installation . . . 453
7.0103.1d Disposal . . . 453

7.0103.1e Documentation 453
7.0103.2 Lighting Reduction 454
7.0103.2a Design 454
7.0103.2b Removal 454
7.0103.2c Reuse 455
7.0103.2d Disposal 455
7.0103.3 Ballast Replacement 455
7.0103.3a Selection 456
7.0103.3b Removal and installation 456
7.0103.3c Disposal 456
7.0103.3d Documentation 457
7.0103.6 Security Lighting 457
7.0103.6a Selection 457
7.0103.6b Installation 458
7.0103.6c Controls 458
7.0103.6d Disposal 458
7.0103.6e Documentation 459
7.0103.7 Daylighting 459
7.0103.7a Daylighting 459
7.0104.1 Occupancy Sensors 459
7.0104.1a Selection 460
7.0104.1b Installation 460
7.0104.1c Documentation 460
7.0104.2 Stand-Alone Timers 461
7.0104.2a Selection 461
7.0104.2b Installation 461
7.0104.2c Timer settings 462
7.0104.2d Documentation 462
7.0104.3 Motion Control Sensors 462
7.0104.3a Selection 463
7.0104.3b Location 463
7.0104.3c Installation 463
7.0104.3d Settings 463
7.0104.3e Documentation 464
7.0104.4 Outdoor Photo Sensors 464
7.0104.4a Selection 464
7.0104.4b Installation 465
7.0104.4c Documentation 465
7.0105.1 Washing Machine 465
7.0105.1a Pre-work qualifications 466
7.0105.1b Selection 466
7.0105.1c Installation 466
7.0105.1d Water management 467
7.0105.1e Accessibility 467
7.0105.1f Disposal 467

7.0105.1g Documentation 468
7.0105.2 Clothes Dryer 468
7.0105.2a Pre-work qualifications 468
7.0105.2b Selection 468
7.0105.2c Installation 469
7.0105.2d Dryer venting 469
7.0105.2e Accessibility 470
7.0105.2f Disposal 470
7.0105.2g Documentation 470
7.0188.1 Ceiling Fan Replacement 471
7.0188.1a Pre-work qualifications 471
7.0188.1b Selection 471
7.0188.1c Installation 472
7.0188.1d Lighting 472
7.0188.1e Disposal 472
7.0188.1f Documentation 472
7.0201.1 Low-Flow Devices 473
7.0201.1a Pre-work qualifications 473
7.0201.1b Selection 473
7.0201.1c Installation 474
7.0201.1d Disposal 474
7.0201.1e Documentation 474
7.0201.2 Dishwasher 475
7.0201.2a Pre-work qualifications 475
7.0201.2b Selection 475
7.0201.2c Installation 476
7.0201.2d Disposal 476
7.0201.2e Documentation 476
7.0301.1 Pipe Insulation 476
7.0301.1a Pre-work qualifications 477
7.0301.1b Insulation selection 477
7.0301.1c Installation 477
7.0301.1d Clearance 478
7.0301.2 Tank Insulation 478
7.0301.2a Pre-work qualifications 478
7.0301.2b Insulation selection 479
7.0301.2c Insulation installation 479
7.0301.2d Clearance 479
7.0301.2e Service access 480
7.0302.1 Electric Storage Tank Water Heater 480
7.0302.1a Pre-work qualifications 480
7.0302.1b Equipment selection 481
7.0302.1c Location 481
7.0302.1d Installation 481
7.0302.1e Equipment accessibility 482

7.0302.1f TandP valve and piping . . . 482
7.0302.1g Emergency drain pan . . . 482
7.0302.1h Shut-off valves . . . 483
7.0302.1i Expansion tank . . . 483
7.0302.1j Dielectric unions . . . 483
7.0302.1k Heat traps . . . 484
7.0302.1l Discharge temperature settings . . . 484
7.0302.1n Disposal . . . 484
7.0302.1o Documentation . . . 484
7.0302.2 Fuel-Fired Storage Tank Water Heater . . . 485
7.0302.2a Pre-work qualifications . . . 485
7.0302.2b Equipment selection . . . 485
7.0302.2c Location . . . 486
7.0302.2d Installation . . . 486
7.0302.2e Equipment accessibility . . . 486
7.0302.2f Fuel supply . . . 487
7.0302.2g Emergency drain pan . . . 487
7.0302.2h Shut-off valves . . . 487
7.0302.2i Expansion tank . . . 488
7.0302.2j TandP valve and piping . . . 488
7.0302.2k Dielectric unions . . . 488
7.0302.2l Heat traps . . . 489
7.0302.2m Discharge temperature settings . . . 489
7.0302.2o Disposal . . . 489
7.0302.2p Documentation . . . 490
7.0302.3 Heat Pump Storage Tank Water Heater . . . 490
7.0302.3a Pre-work qualifications . . . 490
7.0302.3b Equipment selection . . . 490
7.0302.3c Location . . . 491
7.0302.3d Installation . . . 491
7.0302.3e Equipment accessibility . . . 491
7.0302.3f TandP valve and piping . . . 492
7.0302.3g Emergency drain pan . . . 492
7.0302.3h Shut-off valves . . . 493
7.0302.3i Expansion tank . . . 493
7.0302.3j Dielectric unions . . . 493
7.0302.3k Heat traps . . . 494
7.0302.3l Discharge temperature settings . . . 494
7.0302.3m Disposal . . . 494
7.0302.3n Documentation . . . 494
7.0302.5 Tankless On-Demand/Point-Of-Use Appliances . . . 495
7.0302.5a Pre-work qualifications . . . 495
7.0302.5b Equipment selection . . . 495
7.0302.5c Location . . . 496
7.0302.5d Installation . . . 496

7.0302.5e Equipment accessibility 496
7.0302.5f Shut-off valves 497
7.0302.5g TandP valve and piping 497
7.0302.5h Fuel supply 497
7.0302.5i Dielectric unions 498
7.0302.5j Discharge temperature settings 498
7.0302.5k Disposal 498
7.0302.5l Documentation 499
7.0302.6 Solar Water Heater 499
7.0302.6a Pre-work qualifications 499
7.0302.6b Storage tank selection 499
7.0302.6c Solar collector location 500
7.0302.6d Installation 500
7.0302.6e Accessibility 500
7.0302.6f Freeze protection 501
7.0302.6g Emergency drain pan 501
7.0302.6h TandP valve and piping 501
7.0302.6i Dielectric unions 502
7.0302.6j Heat traps 502
7.0302.6k Isolation valves 502
7.0302.6l Expansion tank 503
7.0302.6m Insulate piping 503
7.0302.6n Discharge temperature settings 503
7.0302.6p Disposal 504
7.0302.6q Documentation 504
7.0303.1 Mixing Valves 504
7.0303.1a Pre-work qualifications 505
7.0303.1b Location 505
7.0303.1c Installation 505
7.0303.1d Equipment accessibility 505
7.0303.1e Isolation valves 506
7.0303.1f Check valves 506
7.0303.1g Heat traps 506
7.0303.1h Temperature gauges 506
7.0303.1i Wiring 507
7.0303.1j Dielectric unions 507
7.0303.1k Discharge temperature settings 507
7.0303.1l Documentation 508
7.0303.2 Piping 508
7.0303.2a Pre-work qualifications 508
7.0303.2b Material selection 508
7.0303.2c Decommissioning existing piping 509
7.0303.2d Piping location 509
7.0303.2e New pipe installation 509
7.0303.2f Insulate piping 510

7.0303.2g Friction loss 510
7.0303.2h Dielectric unions 510
7.0303.2i Stray voltage protection 511
7.0303.2j Disposal 511
7.0303.5 Expansion Tank (Potable Water) 511
7.0303.5a Expansion tank selection 512
7.0303.5b Location 512
7.0303.5c Installation 512
7.0303.5d Support 512
7.0303.5e Air pressure 513
7.0303.5f Documentation 513
7.8802.1 Motor Replacement 513
7.8802.1a Pre-work qualifications 514
7.8802.1b Equipment Selection 514
7.8802.1c Installation 514
7.8802.1d Disposal or reuse 515
7.8802.1e Documentation 515
7.8802.2 Control Replacement 515
7.8802.2a Pre-work qualifications 516
7.8802.2b Equipment selection 516
7.8802.2c Installation 516
7.8802.2d Disposal or reuse 516
7.8802.2e Documentation 517
7.8803.1 Water Softening System Installation 517
7.8803.1a Pre-work qualifications 517
7.8803.1b Equipment selection 518
7.8803.1c Location 518
7.8803.1d Equipment accessibility 518
7.8803.1e Installation 519
7.8803.1f Electrical wiring 519
7.8803.1g Isolation and bypass valves 519
7.8803.1h Salt storage 519
7.8803.1i Documentation 520

2.0101.1 Hardwired (interconnected) Smoke Alarms

Section:Health and Safety
Topic:Safety Devices
Sub-Topic:Smoke Alarms

Desired Outcome

Properly selected and installed interconnected smoke alarms

2.0101.1a Selection

Specification

Select hardwired (interconnected) smoke alarms that are listed and labeled in accordance with UL 217

Objective

Ensure proper equipment selection

2.0101.1b Location

Specification

Install hardwired (interconnected) smoke alarms in the locations required by the Authority Having Jurisdiction (AHJ)

Objective

Ensure proper location

2.0101.1c Installation

Specification

Install hardwired (interconnected) smoke alarms in accordance with the manufacturer's instructions

Objective

Ensure proper installation

2.0101.1d Occupant notification

Specification

Provide occupants the manufacturer's written instructions

Objective

Ensure occupants have access to written user's manuals

2.0101.2 Battery-Operated Smoke Alarms

Section:Health and Safety
Topic:Safety Devices
Sub-Topic:Smoke Alarms

Desired Outcome

Properly selected and installed battery-operated smoke alarms

2.0101.2a Selection

Specification

Select battery-operated smoke alarms that are listed and labeled in accordance with UL 217 and have sealed, non-replaceable, 10-year batteries

Objective

Ensure proper equipment selection

2.0101.2b Location

Specification

Install battery-operated smoke alarms in the locations required by the Authority Having Jurisdiction (AHJ)

Objective

Ensure proper location

2.0101.2c Installation

Specification

Install battery-operated smoke alarms in accordance with the manufacturer's instructions

Objective

Ensure proper installation

2.0101.2d Occupant notification

Specification

Provide occupants the manufacturer's written instructions

Objective

Ensure occupants have access to written user's manuals

2.0102.1 CO Detection and Warning Equipment

Section:Health and Safety
Topic:Safety Devices
Sub-Topic:Carbon Monoxide (CO) Alarms

Desired Outcome

Properly selected and installed CO alarms

2.0102.1a Selection

Specification

Select CO alarms that are listed and labeled in accordance with UL 2034, or approved by the authority having jurisdiction, and have a minimum of:

10-year manufacturer's warranty

Contain internal non-replaceable batteries

Objective

Ensure proper equipment selection

2.0102.1b Location

Specification

Install CO alarms in the locations required by the Authority Having Jurisdiction (AHJ)

Objective

Ensure proper location

2.0102.1c Installation

Specification

Install CO alarms in accordance with the manufacturer's instructions

Objective

Ensure proper installation

2.0102.1d Occupant notification

Specification

Provide occupants the manufacturer's written instructions

Objective

Ensure occupants have access to written user's manuals

2.0103.1 Temperature and pressure relief valve

Section:Health and Safety
Topic:Safety Devices
Sub-Topic:Water Heating

Desired Outcome

Safely discharge excessive energy (pressure or temperature) from water heating system

2.0103.1a Selection

Specification

Select temperature and pressure relief valve in accordance with IRC and according to manufacturer specifications that comply with ANSI Z21.22

Objective

Ensure proper equipment selection

2.0103.1b Installation

Specification

Temperature and pressure relief valve will be installed in compliance with IRC, HUD code, and according to manufacturer specifications

Objective

Ensure proper installation

2.0103.1c Discharge

Specification

Install discharge tube of temperature and pressure relief valve so that it:

Discharges to a readily observable location either 6 inches or less from the floor or overflow pan or to the outdoors

Discharges in a manner that does not cause personal injury or structural damage

Flows by gravity and without any trap

Is not directly connected to the dwelling drainage system

Does not contain any valves or tees, nor end with a threaded connection

Objective

Ensure proper discharge location

2.0201.1 Gutters

Section:Health and Safety
Topic:Moisture
Sub-Topic:Drainage

Desired Outcome

Direct bulk water away from dwelling

2.0201.1a Selection

Specification

Size gutters appropriately for the area drained

Objective

Properly sized gutters

2.0201.1b Attachment

Specification

Attach gutters to dwelling using screws

Fasten gutter sections with mechanical fasteners

Objective

Durable attachment

2.0201.1c Slope

Specification

Slope all gutters toward the downspout(s) a minimum of 1/4" per 10 feet

Objective

Ensure complete drainage

2.0201.1d Sealing

Specification

Make all seams watertight using compatible sealant

Objective

Prevent water leaks

2.0201.2 Downspouts

Section:Health and Safety
Topic:Moisture
Sub-Topic:Drainage

Desired Outcome

Direct bulk water away from dwelling

2.0201.2a Selection

Specification

Size and number of downspouts shall be appropriate for the area drained

Objective

Properly sized downspouts

2.0201.2b Attachment

Specification

Mechanically attach downspouts to gutter

Mechanically attach downspout(s) to dwelling a minimum of every 4' of length

Objective

Durable attachment

2.0201.2c Drainage

Specification

Assemble downspout sections so that the upper section is inside the lower section

Drain downspouts a minimum of 6' away from the structure

Objective

Bulk water directed away from dwelling

2.0201.3 Grading

Section:Health and Safety
Topic:Moisture
Sub-Topic:Drainage

Desired Outcome

Direct bulk water away from dwelling

2.0201.3a Slope

Specification

Slope ground away from the house at least 6" per 10'

Objective

Ensure positive drainage away from dwelling

2.0201.3b Vegetation removal

Specification

With occupant approval:

Clear all vegetation within 3' of the home or

Trim all landscaping so that it is at least 1' away from the home

Objective

Stop vegetation from preventing drainage

2.0201.4 Sump Pumps

Section:Health and Safety
Topic:Moisture
Sub-Topic:Drainage

Desired Outcome

Remove bulk water from inside the foundation

2.0201.4a Selection

Specification

Select a sump pump that will meet the flow requirements of the home.

Select the most energy efficient pump available, prefer Electrically Commutated Motors (ECM) when possible.

Objective

Efficient, properly sized sump pump

2.0201.4b Installation

Specification

Install sump pumps per the manufacturer's instructions

Install a check valve to prevent water from reentering the sump well

Objective

Properly installed sump pump

2.0201.4c Discharge

Specification

Discharge sump water a minimum of 10' away from the building

Objective

Discharge water away from foundation

2.0201.4d Commissioning

Specification

Verify safe operation and ensure that all operable floats are functioning as intended

Objective

Verify correct operation

2.0201.4e Occupant notification

Specification

Provide occupant with manufacturer's instructions and all manuals

Objective

Ensure occupant is aware of function and maintenance

2.0202.1 Un-Vented Subspaces - Ground Cover

Section:Health and Safety
Topic:Moisture
Sub-Topic:Ground Vapor Retarders

Desired Outcome

Minimize ground moisture vapor and soil gas with a durable, effective vapor retarder

2.0202.1a Preparation

Specification

Remove all vegetation and organic material from area to be covered

Remove all debris that can cause injury or puncture ground vapor retarder (e.g., nails, glass, sheet metal screws, etc.)

Objective

Minimize punctures

2.0202.1b Material selection

Specification

Select a 6-mil minimum ground vapor retarder of 0.1 perm or less

Objective

Durable material selected

2.0202.1c Coverage

Specification

Cover all exposed soil

Extend ground vapor retarder a minimum of 6" up all foundation walls and piers, but do not install in contact with non-treated structural wood

Objective

Create a continuous ground vapor retarder layer that does not compromise wooden foundation materials

2.0202.1d Drainage

Specification

The ground vapor retarder will not interfere with the established drainage pattern (e.g., to sump pits, French drains, etc.)

Objective

Ensure proper drainage

2.0202.1e Seams/connections

Specification

Overlap seams a minimum of 12" with reverse or upslope lapping technique

For wall to floor connection, install the wall vapor retarder under the ground vapor retarder

Seal all seams and connections to foundations and piers air tight with a durable, compatible, sealant

Mechanically attach ground vapor retarder to foundation and piers where practical

Objective

Provide airtight seal for ground vapor retarder

2.0202.1f Fastening

Specification

Fasten ground vapor retarder to ground with durable fasteners or ballast(s) when installed on sloping ground, or space is accessed for routine maintenance or storage

Objective

Prevent movement and uplift of the air barrier and ground moisture barrier

2.0202.1g Air sealing

Specification

Seal all penetrations in the ground vapor retarder with a compatible sealant

Objective

Ensure ground vapor retarder is air tight

2.0202.1h Signage

Specification

Install a durable (minimum of 10-year service life), easily seen sign, sized a minimum of 8.5"x 11" at each access to the space

Sign shall minimally include the following items:

Warning to prohibit storage of hazardous and flammable materials

Caution not to damage the ground vapor retarder, air barrier, insulation, and mechanical components specific to the space

Immediate repairs are needed in the case of damage

Objective

Provide essential safety and maintenance information

2.0202.2 Vented Subspaces - Ground Cover

Section:Health and Safety
Topic:Moisture
Sub-Topic:Ground Vapor Retarders

Desired Outcome

Minimize ground moisture vapor and soil gas with a durable, effective vapor retarder

2.0202.2a Preparation

Specification

Remove all vegetation from area to be covered

Remove all debris that can cause injury or puncture ground vapor retarder (e.g., nails, wood, glass, sheet metal screws, etc.)

Objective

Minimize punctures

2.0202.2b Material selection

Specification

Select a 6-mil minimum ground vapor retarder of 0.1 perm or less

Objective

Durable material selected

2.0202.2c Coverage

Specification

Cover all exposed soil

Extend ground vapor retarder a minimum of 6" up all foundation walls and piers, but do not install in contact with non-treated structural wood

Objective

Create a continuous ground vapor retarder layer that does not compromise wooden foundation materials

2.0202.2d Drainage

Specification

The ground vapor retarder will not interfere with the established drainage pattern (e.g., to sump pits, French drains, etc.)

Objective

Ensure proper drainage

2.0202.2e Seams

Specification

Overlap seams a minimum of 12" with reverse or upslope lapping technique

For wall to floor connection, install the wall vapor retarder under the ground vapor retarder

Objective

Keep bulk moisture under ground cover

2.0202.2f Fastening

Specification

Fasten ground vapor retarder to ground with durable fasteners or ballast(s) when installed on sloping ground, or space is accessed for routine maintenance or storage

Objective

Prevent movement and uplift of the air barrier and ground moisture barrier

2.0202.2g Air Sealing

Specification

Seal all penetrations in the ground vapor retarder with a compatible sealant

Objective

Ensure ground vapor retarder is air tight

2.0202.2h Signage

Specification

Install a durable (minimum of 10-year service life), easily seen sign, sized a minimum of 8.5"x 11" at each access to the space

Sign shall minimally include the following items:

Warning to prohibit storage of hazardous and flammable materials

Caution not to damage the ground vapor retarder, air barrier, insulation, and mechanical components specific to the space

Immediate repairs are needed in the case of damage

Objective

Provide essential safety and maintenance information

2.0202.3 Pier and Skirting Foundations - Ground Cover

Section:Health and Safety
Topic:Moisture
Sub-Topic:Ground Vapor Retarders

Desired Outcome

Minimize ground moisture vapor and soil gas with a durable, effective vapor retarder

2.0202.3a Preparation

Specification

Remove all debris that can cause injury or puncture ground vapor retarder (e.g., nails, glass, sheet metal screws, etc.)

Objective

Minimize punctures

2.0202.3b Coverage

Specification

Cover all exposed soil

Extend ground vapor retarder a minimum of 6" up all foundation walls and piers, but do not install in contact with non-treated structural wood

Objective

Create a continuous ground vapor retarder layer that does not compromise wooden foundation materials

2.0202.3c Material selection

Specification

Select a 6-mil minimum ground vapor retarder of 0.1 perm or less

Objective

Durable material selected

2.0202.3d Seams

Specification

Overlap seams a minimum of 12" with reverse or upslope lapping technique

For wall to floor connection, install the wall vapor retarder under the ground vapor retarder

Objective

Keep bulk moisture under ground cover

2.0202.3e Fastening

Specification

Fasten ground vapor retarder to ground with durable fasteners

Objective

Prevent movement of the ground moisture barrier

2.0203.1 Stand-Alone Dehumidifier Installation

Section:Health and Safety
Topic:Moisture
Sub-Topic:Space Conditioning

Desired Outcome

Minimize energy used for humidity control

2.0203.1a Selection

Specification

Appliance will have:

An efficiency level of ENERGY STAR or better

A fan-off option

Ability to retain settings after power-off

Features that reduce both peak electric use (e.g., internal and external timers) and absolute energy use

Standby losses of 1 watt or less

Controls that are labeled so they are understandable, readable, and accurate for occupant needs

Appliances located in a basement or crawl space will be rated for cold temperature operation

Operating environment will be evaluated and appropriate appliance will be selected for that environment (e.g., low temperature and high relative humidity)

Objective

Provide durable, efficient, and appropriate appliance

2.0203.1b Installation

Specification

Install appliance according to manufacturer specifications

Install appliance to permit adequate air flow

Seal any penetrations to the exterior of the home created by the installation of the appliance

Set relative humidity and temperature settings that are appropriate for the space

Connect the appliance directly to a condensate line that drains to a suitable drain or outdoors

Objective

Properly installed new appliance

2.0203.1c Commissioning

Specification

Verify appliance is functioning as designed per the manufacturer's guidelines

Verify appliance relative humidity measurement is accurate using a secondary independent measurement

Objective

Verify proper operation

2.0203.1d Disposal

Specification

Permanently remove old appliance from job site and recycle or dispose of removed appliance and refrigerant in accordance with local and federal law (e.g. EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old appliance

Objective

Old appliance is permanently removed from service, protect the environment, and comply with regulation

2.0203.1e Client education

Specification

Provide the occupant with:

Manufacturer specific appliance maintenance information

Warranty information, operation manuals, and installer contact information

A user guide for dehumidifier settings in different climate conditions

Objective

Ensure proper operation and maintenance

2.0301.1 Junctions/Splices Enclosed

Section:Health and Safety
Topic:Electrical
Sub-Topic:High Voltage (50 volts or more)

Desired Outcome

Prevent electrocution

2.0301.1a Junction box covers

Specification

Cover all junction boxes with a location-appropriate (e.g. wet-location, outdoor, indoor, etc.) UL listed cover per the NEC

Objective

Junction boxes are securely covered with appropriate, durable covers

2.0301.1b Wiring Splices

Specification

Enclose all wiring splices inside a location-appropriate (e.g. wet-location, outdoor, indoor, etc.) UL listed electrical enclosure per the NEC

Objective

Wiring splices are safely enclosed in appropriate enclosure

2.0301.2 Knob and Tube Wiring - Isolation

Section:Health and Safety
Topic:Electrical
Sub-Topic:High Voltage (50 volts or more)

Desired Outcome

Prevent electrocution and reduce fire hazards

2.0301.2a Clearance

Specification

Maintain a minimum of 3" of clearance around live knob and tube wiring

Objective

Prevent fire hazards

2.0301.2b Marking

Specification

Mark all live knob-and-tube wiring with caution tape that is visible from at least 5' away and post appropriate signage

Objective

Provide essential safety and maintenance information and maintain safe operation of knob-and-tube wiring

2.0401.1 Soil-Gas Retarder

Section:Health and Safety
Topic:Radon
Sub-Topic:Radon Precautionary Measures

Desired Outcome

Reduce potential for radon to enter living space through exposed soil in subspaces

2.0401.1a Applicable Spaces

Specification

This detail applies when installing soil-gas retarders over bare earth for the purpose of limiting radon intrusion into a building space

Objective

Apply correct details

2.0401.1b Preparation

Specification

Remove all vegetation and organic material from area to be covered

Remove all debris that can cause injury or puncture soil-gas retarder (e.g., nails, glass, sheet metal screws, etc.)

Objective

Prevent soil-gas retarder damage

2.0401.1c Material Selection

Specification

Select flexible membranes that are a minimum of 6 mil (0.15-mm) polyethylene or equivalent flexible material

3 mil (0.08-mm) thickness is permitted if a cross-laminated product is selected

When the space is used for storage or entry is required for maintenance of utilities; heavier gauge sheeting or a protective covering (such as rubber roofing membrane) shall be installed in these areas

Objective

Select appropriate and durable material for all spaces

2.0401.1d Coverage

Specification

For Unvented/Conditioned Spaces:

Cover any under-floor area not covered with poured concrete

Cover any air permeable foundation wall or pier material, such as hollow core block

Do not install in contact with non-treated structural wood

For Vented/Unconditioned Spaces:

Cover any under-floor area not covered with poured concrete

Do not install in contact with non-treated structural wood

Objective

Complete coverage of permeable foundation surfaces without compromising wooden foundation material

2.0401.1e Termite Inspection Gap

Specification

Maintain a 3" inspection gap between the top of the soil-gas retarder and any wood if local codes require

Objective

Allow for termite inspection

2.0401.1f Seams

Specification

Overlap seams a minimum of 12" with reverse or upslope lapping technique and seal all seams with a durable, compatible sealant

Objective

Durably sealed seams

2.0401.1g Foundation Connections

Specification

Extend soil-gas retarder a minimum of 6" up all non air-permeable foundation walls and piers. (i.e., solid core block, brick, or poured concrete)

Seal it to all foundation walls and piers with a compatible material that creates an airtight, durable seal

Use mechanical foundation connections where feasible

Do not install in contact with non-treated structural wood

Extend soil-gas retarder over all air-permeable foundation walls or piers (i.e., hollow core block, brick, or rubble) except for required termite inspection gap

Do not install in contact with non-treated structural wood

Objective

Cover all potential entry points of radon with soil-gas retarder without compromising wooden foundation material

2.0401.1h Penetrations

Specification

Seal all necessary penetrations in the soil-gas retarder with compatible materials using a lapped-patching technique that assures a tight-fitting seal

Objective

Restrict soil-gas intrusion through penetrations

2.0401.1i Fastening

Specification

Do not install stakes to secure soil-gas retarders

Install ballasts or weights to secure it on the ground where movement is likely with ballast materials that are smooth and free from protrusions

Objective

Restrict movement or uplift of the barrier without damaging soil-gas retarders

2.0401.1j Drainage

Specification

The soil-gas retarder will not interfere with the established drainage pattern (e.g., to sump pits, French drains, etc.)

Objective

Prevent water accumulation above or below the barrier

2.0401.2 Sump Well/Pit Covers

Section:Health and Safety
Topic:Radon
Sub-Topic:Radon Precautionary Measures

Desired Outcome

Reduce potential for radon to enter the living space through sump wells/pits while ensuring continued drainage

2.0401.2a Sump Covers

Specification

Cover sump pump wells or pits with an airtight cover that allows for all necessary penetrations to be tightly sealed

Objective

Prevent radon intrusion from sump well or pits

2.0401.2b Drainage

Specification

Install sump pump covers to allow bulk moisture to drain from above the cover utilizing trapped or one-way ball valve fittings, or equivalent

Objective

Allow drainage of water from above the sump pump cover into the well or pit

2.0401.3 Drain Fittings

Section:Health and Safety
Topic:Radon
Sub-Topic:Radon Precautionary Measures

Desired Outcome

Reduce potential for radon to enter the living space through foundation drain penetrations.

2.0401.3a Sealing Penetrations

Specification

Seal around the perimeter of all drain fittings that penetrate a concrete slab using urethane caulk or equivalent sealing material

Sealant must not affect the ability of the drain to function and be compatible with the surfaces it contacts

Objective

Durable, airtight seals around functional drain fittings

2.0401.3b Airtight Drains

Specification

Install a one way valve in all untrapped, below grade drain fittings that does not interfere with appropriate drain function

Objective

Prevent air infiltration from below grade drains without affecting drain function

2.0402.1 New Systems

Section:Health and Safety
Topic:Radon
Sub-Topic:Radon Mitigation

Desired Outcome

Reduce radon in buildings to an acceptable level

2.0402.1a Standard for Installation

Specification

Install active radon mitigation systems in compliance with ASTM E2121 or AARST standards for the applicable building type.

Objective

Consistent installation of radon mitigation systems that meet recognized industry standards

3.0101.1 Air Sealing Holes

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:General Air Sealing

Desired Outcome

Prevent air movement through holes @ 50 Pascals of pressure

3.0101.1a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealant

3.0101.1b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0101.1c Backing, infill, and support

Specification

If backing or infill is installed, it will not bend, sag, or move once installed, and will adequately support any insulation installed on the surface

For small holes (less than 1/4"):

if using, install backing or infill material at least 1/8" below the surface where sealant is applied

For medium holes (1/4" to 3"):

install backing or infill in or over all holes to be sealed

For large holes (greater than 3"):

install rigid backing or infill in or over all holes to be sealed

Install support material for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)

Support material installed for any walking/working surface (attics or floors) will support the weight of a worker and any insulation applied in the area

Mechanically fasten backing or infill materials sufficient to prevent movement

Objective

Prevent excessive sealant movement and support applied loads

3.0101.1d Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0101.1e Sealant application

Specification

Apply a continuous seal at all seams, cracks, joints, edges, penetrations, and connections in sealing surface while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Objective

Fully adhered, airtight, and durable seal

3.0101.1f High-temperature application

Specification

Install only noncombustible materials and sealants with an ASTM E136 listing in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

Objective

Prevent a fire hazard

3.0102.1 Sealing Non-Insulation Contact (IC) Recessed Light

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Specific Air Sealing

Desired Outcome

Airtight, durable, and fire safe enclosure that remains in place and prevents air movement @ 50 Pascals of pressure

3.0102.1a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0102.1b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0102.1c Clearance

Specification

Maintain a minimum clearance of 3 inches between enclosure and all portions of fixture (e.g. wiring, box, and ballast)

Enclosure must be at least as tall as the surrounding insulation

Objective

Prevent overheating of fixture

3.0102.1d Enclosure top

Specification

Enclosure top must be R-1 or less and left free of insulation

Objective

Prevent heat buildup

3.0102.1e Structural soundness

Specification

Enclosure must withstand applied loads

Objective

Durable enclosure

3.0102.1f Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0102.1g Sealant application

Specification

Apply a continuous seal at all seams, cracks, joints, edges, penetrations, and connections of the enclosure while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Sealant exposed to the interior of the enclosure must meet the same fire rating as the enclosure

Objective

Fully adhered, safe, and durable sealant

3.0102.1h Marking

Specification

Visibly flag enclosure above the final insulation level

Objective

Visually identify enclosure for future access

3.0102.2 Sealing High-Temperature Devices

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Specific Air Sealing

Desired Outcome

Fully adhered, airtight, fire safe, and durable seal that prevents air movement @ 50 Pascals of pressure

3.0102.2a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers) and are rated for the operating temperature of the device they are in contact with, and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0102.2b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers) and are rated for the operating temperature of the device they are in contact with, and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0102.2c Clearance and isolation

Specification

Maintain a minimum clearance of 3" between combustible materials or sealants and any portion of the high-temperature device (e.g. chimney, vent, flue), unless the venting material is listed and labeled for less clearance

Install a rigid, fixed dam higher than the insulation that maintains the required clearance between high-temperature devices and combustible materials

Do not allow combustible insulation between a high-temperature device and a dam unless insulation material is rated for contact with the device

Objective

Prevent fire hazards

3.0102.2d Backing and infill

Specification

Install non-combustible backing or infill in any gap or crack greater than 1/4"

Install rigid non-combustible backing or infill for gaps or cracks greater than 1" using mechanical fasteners

Once installed, backing or infill will not bend, sag, or move

Objective

Prevent excessive sealant movement

3.0102.2e Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0102.2f Sealant application

Specification

Apply a continuous seal at all seams, cracks, joints, edges, and penetrations of the sealing area while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Objective

Fully adhered sealant

3.0102.3 Sealing Tongue and Groove Surfaces

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Specific Air Sealing

Desired Outcome

Airtight, durable, safe, and aesthetic seal that remains in place and prevents air movement @ 50 Pascals of pressure

3.0102.3a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0102.3b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0102.3c Backing

Specification

Install rigid air barrier material behind tongue and groove surfaces

Objective

Reduce sealant application area

3.0102.3d Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0102.3e Sealant application

Specification

Apply a continuous seal at all seams, cracks, joints, edges, penetrations, and connections of the backing material while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

No sealant may be visible in the living space

Objective

Fully adhered, airtight, durable, and aesthetic seal

3.0102.4 Sealing Firewalls

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Specific Air Sealing

Desired Outcome

Restore firewall functionality with safe, durable, airtight sealing that remains in place and prevents air movement @ 50 Pascals of pressure

3.0102.4a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0102.4b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0102.4c Backing and infill

Specification

Install backing or infill in any gap or crack greater than 1/4"

Install rigid backing or infill for gaps or cracks greater than 3" using mechanical fasteners

Once installed, backing or infill will not bend, sag, or move

Objective

Prevent excessive sealant movement

3.0102.4d Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0102.4e Sealant application

Specification

Apply a continuous seal at all seams, cracks, joints, edges, penetrations, and connections of the firewall while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

If firewall assembly is not monolithic (e.g., balloon framing, CMU, open chase, attic bypass, or with similar penetration through the attic floor plane), attic floor plane penetrations within the firewall assembly will be accessed through the firewall, fully sealed, and firewall surface restored to prevent current or future breaches of the firewall below the attic floor plane from establishing an air flow path to the attic space

Objective

Fully adhered, airtight, and durable seal

3.0102.9 Sealing Dropped Soffits/Bulkheads

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Specific Air Sealing

Desired Outcome

Airtight, safe, durable seals that remain in place, and prevent moisture and air movement @ 50 Pascals of

pressure

3.0102.9a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0102.9b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0102.9c Support

Specification

Install support material for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)

Support material installed for any walking/working surface (attics or floors) will support the weight of a worker and any insulation applied in the area

Objective

Ensure sealing materials remain in place and support applied loads

3.0102.9d Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0102.9e Install air barrier

Specification

Install rigid air barrier material over the entire soffit opening in alignment with the attic's pressure boundary

Objective

Pressure boundary aligned

3.0102.9f Attachment

Specification

Mechanically fasten air barrier material to prevent movement

Objective

Durable attachment

3.0102.9g Sealant application

Specification

Apply a continuous seal at all seams, cracks, joints, edges, penetrations, and connections of the soffit while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Objective

Fully adhered, airtight, and durable seal

3.0102.9h High-temperature application

Specification

Install only noncombustible materials and sealants with an ASTM E136 listing in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

Objective

Prevent a fire hazard

3.0102.10 Sealing Dropped Ceilings

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Specific Air Sealing

Desired Outcome

Airtight, safe, durable seals that remain in place, and prevent moisture and air movement @ 50 Pascals of pressure

3.0102.10a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0102.10b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0102.10c Support

Specification

Install support material for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)

Support material installed for any walking/working surface (attics or floors) will support the weight of a worker and any insulation applied in the area

Objective

Ensure sealing materials remain in place and support applied loads

3.0102.10d Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0102.10e Install air barrier

Specification

Install a permanent air barrier either above or below the existing ceiling material that will structurally support the final insulation level

Objective

Align pressure boundary

3.0102.10f Sealant application

Specification

Apply a continuous seal at all seams, cracks, joints, edges, penetrations, and connections of the pressure boundary while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Objective

Fully adhered, airtight, and durable seal

3.0102.10g High-temperature application

Specification

Install only noncombustible materials and sealants with an ASTM E136 listing in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

Objective

Prevent a fire hazard

3.0102.11 Sealing Roof/Wall Connections

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Specific Air Sealing

Desired Outcome

Continuous air barrier at roof/wall connections that is safe, durable, stays in place, and prevents air movement @ 50 Pascals of pressure

3.0102.11a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0102.11b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0102.11c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0102.11d Support

Specification

Install support material for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)

Install support materials that will support all applied loads

Objective

Ensure sealing materials remain in place and support applied loads

3.0102.11e Install air barrier

Specification

Install a continuous rigid air barrier in alignment with the wall's pressure boundary

Objective

Align pressure boundary

3.0102.11f Attachment

Specification

Mechanically fasten air barrier material to the sub-framing per manufacturer's specifications

Objective

Durable attachment

3.0102.11g Sealant application

Specification

Apply a continuous seal at all seams, cracks, joints, edges, penetrations, and connections of the pressure boundary while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Objective

Fully adhered, airtight, and durable seal

3.0102.11h High-temperature application

Specification

Install only noncombustible materials and sealants with an ASTM E136 listing in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

Objective

Prevent a fire hazard

3.0103.1 Access Doors and Hatches

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Intentional Attic Openings

Desired Outcome

Attic access door safely and durably sealed and insulated to prevent air movement @ 50 Pascals of pressure

3.0103.1a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0103.1b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0103.1c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0103.1d Seal framing

Specification

Apply a continuous seal at all seams, cracks, joints, and edges of access framing while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Objective

Prevent air and moisture movement

3.0103.1e Seal access panel

Specification

Seal access using gaskets, weather stripping or equivalent method

Permanently attach gaskets, weatherstripping, etc. per manufacturer's instructions

Secure attic door or hatch with a latch, lock or frictionally engaging components

Objective

Prevent air and moisture movement

3.0103.1f Damming

Specification

Install a rigid and durable dam having a height greater than the insulation at attic opening and does not interfere with the operation of the access

Objective

Prevent insulation movement

3.0103.1g Insulate opening

Specification

Insulate access to the same R-value as adjoining insulated assembly

Permanently fasten insulation to access in complete contact with the air barrier

Objective

Align thermal barrier

3.0103.1h Durability

Specification

Completed measure will have a minimum expected service life of 20 years

Objective

Ensure minimum service life

3.0103.3 Whole-House Fan - Operable

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Intentional Attic Openings

Desired Outcome

Airtight, safe, durable fan coverings that allow for fan operation when open, and prevent moisture and air movement @ 50 Pascals of pressure when closed

3.0103.3a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0103.3b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0103.3c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0103.3d Enclosure construction

Specification

Construct a durable, rigid enclosure on all sides of the fan housing that is taller than the surrounding insulation

Objective

Keep insulation out of fan components

3.0103.3e Operable cover

Specification

Install an operable cover for the fan enclosure that opens when the fan is operated and closes when the fan is turned off

Operable lid must have an airtight seal when closed

Objective

Align pressure and thermal boundary and maintain fan operation

3.0103.3f Insulation

Specification

Insulate fan enclosure to a minimum of R-20

Install insulation in full contact with the enclosure

Mechanically fasten insulation to fan cover

Objective

Uniform pressure and thermal boundary

3.0103.3g Air sealing

Specification

Apply a continuous seal at all seams, cracks, joints, and edges of enclosure while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Provide an airtight seal for the enclosure cover when it is closed using weatherstripping, gaskets, or equivalent

Objective

Prevent air and moisture movement

3.0103.3h Durability

Specification

Material integrity will meet a minimum expected service life of 20 years

Objective

Ensure a minimum expected service life

3.0103.4 Tenting of Wet Sprinkler Systems

Section:Air Sealing

Topic:General Pressure Boundary
Sub-Topic:Intentional Attic Openings

Desired Outcome

Contiguous thermal and pressure boundary that prevents sprinkler system from freezing

3.0103.4a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0103.4b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0103.4c Enclosure construction

Specification

Install a rigid enclosure around entire sprinkler system exposed within the attic maintaining a minimum 3" clearance from all portions of the system

Objective

Durably enclose entire sprinkler system

3.0103.4d Insulation

Specification

Insulate enclosure to an equivalent R-value as the rest of the attic

Objective

Prevent sprinkler system from freezing

3.0103.4e Air sealing

Specification

Apply a continuous seal at all seams, cracks, joints, edges, penetrations, and connections of the enclosure while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Sealant exposed to the interior of the enclosure must meet the same fire rating as the enclosure

Objective

Fully adhered, safe, and durable sealant

3.0103.4f Fire safety

Specification

Install only noncombustible materials and sealants with an ASTM E136 listing in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

Foam plastics, where permissible, will be provided with ignition and thermal barriers as required by applicable fire safety code

Objective

Prevent fire hazards

3.0104.1 Closed Crawlspace Air Sealing

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Foundation Spaces

Desired Outcome

Reduce moisture, soil gases, and pests in foundation spaces with durable seals that remain in place and prevent air movement @ 50 Pascals of pressure

3.0104.1a Pre-work qualifications

Specification

Verify that all exterior bulk moisture is directed away from the foundation with appropriate drainage techniques and exterior foundation drainage details are functioning properly (e.g. rain screens, weep holes)

Objective

Prevent bulk moisture intrusion

3.0104.1b Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0104.1c Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers),

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols, and

pest-resistant materials that are rated for ground contact anywhere they are in contact with the exterior foundation walls, piers, or bare earth

Objective

Select safe and effective materials

3.0104.1d Backing and infill

Specification

Install steel wool or other pest-proof material as infill in gaps greater than 1/4" before sealing

Objective

Prevent pest intrusion and secure sealants

3.0104.1e Support

Specification

Install support material for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)

Objective

Air barrier materials remain in place and support applied loads

3.0104.1f Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0104.1g Existing vent openings

Specification

Permanently close vent openings using a durable, rigid, and pest resistant material

Objective

Fully aligned pressure boundary

3.0104.1h Air sealing

Specification

Apply a continuous seal at all seams, cracks, joints, penetrations, and connections of foundation walls, sills, floors, etc. that are adjacent to unconditioned spaces while applying sufficient pressure to push

sealant into any gaps or cracks and contact any backing or infill material required

Weatherstrip exterior access doors/hatches and seal door/hatch framing using compatible sealant

Objective

Prevent air and moisture intrusion

3.0104.1i Adjacent spaces

Specification

Install a continuous air barrier and vapor barrier between adjacent unconditioned spaces and closed crawlspace

Objective

Prevent moisture intrusion

3.0104.1j Fire safety

Specification

Install only noncombustible materials and sealants in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

Foam plastics, where permissible, will be provided with ignition and thermal barriers as required by applicable fire safety code

Objective

Prevent fire hazards

3.0104.2 Installing New Crawlspace Access

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Foundation Spaces

Desired Outcome

Provide safe, durable, and appropriate access that remains in place and prevents air movement between conditioned and unconditioned spaces @ 50 Pascals of pressure

3.0104.2a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0104.2b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers),

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols, and

pest-resistant materials that are rated for ground contact anywhere they are in contact with the exterior foundation walls, piers, or bare earth

Objective

Select safe and effective materials

3.0104.2c Backing and infill

Specification

Install steel wool or other pest-proof material as infill in gaps greater than 1/4" before sealing

Objective

Prevent pest intrusion and secure sealants

3.0104.2d Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0104.2e Access construction

Specification

Access openings through the floor will be a minimum of 18" by 24" or as constrained by existing framing members

Openings through a perimeter wall will be not less than 16" by 24" or as constrained by existing framing members

When any portion of the through-wall access is below grade, an area way not less than 16" by 24" will be provided

Under-floor spaces containing appliances will be provided with an unobstructed access large enough to remove the largest appliance but not less than 30" high and 22" wide and no more than 20 feet away from the appliance measured along the center line of the passageway from the opening to the appliance

Objective

Provide adequate access to foundation space

3.0104.2f Appliance access

Specification

A level service space at least 30" deep and 30" wide will be present at the front or service side of the appliance

If the depth of the passageway or the service space exceeds 12" below the adjoining grade, the walls of the passageway will be lined with concrete or masonry extending 4" above the adjoining grade in accordance with Chapter 4 IRC

Objective

Provide adequate access to appliances in foundation spaces

3.0104.2g Air sealing

Specification

Apply a continuous seal at all seams, cracks, joints, penetrations, and connections of access framing while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Install weather stripping, gaskets, or equivalent to exterior access doors/hatches

Objective

Prevent air, moisture, and pest intrusion

3.0104.2h Security

Specification

Install a latch, clasp, handle or equivalent that securely fastens access door/hatch closed and is designed for an optional lock installation

Objective

Prevent unauthorized access

3.0104.3 Slab Foundation Sealing

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Foundation Spaces

Desired Outcome

Effective, durable air barrier between the conditioned space and the ground that remains in place and prevents air movement @ 50 Pascals of pressure

3.0104.3a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0104.3b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers),

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols, and

pest-resistant materials that are rated for ground contact anywhere they are in contact with the exterior foundation walls, piers, or bare earth

Objective

Select safe and effective materials

3.0104.3c Backing and infill

Specification

Install steel wool or other pest-proof material as infill in gaps greater than 1/4" before sealing

Objective

Prevent pest intrusion and secure sealants

3.0104.3d Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0104.3e Air sealing

Specification

Apply a continuous seal at all seams, cracks, joints, penetrations, and connections of the slab while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Objective

Prevent air, moisture, and pest intrusion

3.0104.3f High-temperature application

Specification

Install only noncombustible materials and sealants with an ASTM E136 listing in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

Objective

Prevent a fire hazard

3.0104.4 Covers for Intentional Slab Penetrations

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Foundation Spaces

Desired Outcome

Reduce moisture, soil gases, and pests in foundation spaces

3.0104.4a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0104.4b Material selection

Specification

Select materials that:

adequately support applied load and are permanent air barriers,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers),

for use inside the pressure boundary select low volatile organic compound (VOC) materials that meet independent testing and verification protocols, and

pest-resistant materials that are rated for ground contact anywhere they are in contact with the exterior foundation walls, piers, or bare earth

Objective

Select safe and effective materials

3.0104.4c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0104.4d Sealing sump pump wells

Specification

Cover sump pump wells or pits with an airtight cover that allows for all necessary penetrations to be tightly sealed

Sump pump covers must allow bulk moisture to drain from above the cover utilizing trapped or one-way ball valve fittings, or equivalent

Objective

Reduce soil gas, moisture and air intrusion, and allow proper drainage pattern

3.0104.4e Covering other water containing pits

Specification

Cover all exposed water sources with an operable (able to be opened for maintenance) access

Covers must be rigid, durable, and suitable for high-moisture exposure

Required cap penetrations will be close fitting (do not have to be airtight) and not interfere with drainage of water from above or below the basement floor

Objective

Reduce soil gas and moisture accumulation

3.0105.1 Isolating Garage From Living Space

Section:Air Sealing
Topic:General Pressure Boundary
Sub-Topic:Attached Garages

Desired Outcome

Garage isolated outside the dwelling pressure boundary with durable, safe seals that remain in place and prevent air movement @ 50 Pascals of pressure

3.0105.1a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet

independent testing and verification protocols

Objective

Select safe and effective sealants

3.0105.1b Material selection

Specification

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0105.1c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Objective

Surface is clean and ready to accept sealant

3.0105.1d Backing and infill

Specification

Install steel wool or other pest-proof material as infill in gaps greater than 1/4" before sealing

Objective

Prevent pest intrusion and secure sealants

3.0105.1e General air sealing

Specification

Apply a continuous seal at all seams, cracks, joints, penetrations, and connections between garage and living space while applying sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Objective

Prevent air, pollutant, and pest intrusion

3.0105.1f Ductwork

Specification

Seal all accessible ductwork joints and connections with UL 181B or 181B-M welds, gaskets, adhesive mastics, or mastic-plus- embedded-fabric systems

Where the same duct system serves any other living space, all supply and return openings in the garage (including intentional openings designed to heat or cool the garage space) must be disconnected, capped with sheet metal using mechanical fasteners, and completely sealed

Objective

Prevent ductwork from distributing pollutants

3.0105.1g Doors adjacent to conditioned spaces

Specification

Install weather stripping, door sweep, and/or threshold if needed so that door is significantly airtight

If door is replaced, door must meet fire separation requirements

Objective

Existing door openings prevent air, pollutant, and pest intrusion and new doors meet fire safety requirements as well

3.0105.1h Glass doors or windows

Specification

Replace, point, and glaze broken glass panes in doors or windows where needed

Where glazing is permitted by code, verify that replacement glass meets the intended fire resistance of the assembly penetrated and is safety glazing

Glazing located in walls connecting garages to conditioned spaces with fire-resistance ratings may be prohibited; confirm that existing glazing application is consistent with all applicable building codes

Objective

Safely prevent air, pollutant, and pest intrusion

3.0105.1i High-temperature application

Specification

Install only noncombustible materials and sealants with an ASTM E136 listing in contact with any device producing 200 degrees F or more (chimneys, vents, flues, etc.)

Objective

Prevent a fire hazard

3.0201.1 Window Air Sealing

Section:Air Sealing
Topic:Shell Components
Sub-Topic:Windows

Desired Outcome

Weathertight window repairs

3.0201.1a Sealant selection

Specification

Select sealants that:

- are compatible with their intended surfaces,
- allow for differential expansion and contraction between dissimilar materials,
- meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and
- for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0201.1b Material selection

Specification

Select:

- pest-resistant materials that adequately support applied load and are permanent air barriers,
- materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and
- low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0201.1c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the sash contact areas that will prevent a tight seal or safe operation

Objective

Surface is clean and ready to accept sealant

3.0201.1d Operation and fit

Specification

Adjust window sash(es) to properly fit the jamb and allow for ease of operation and security

Verify intentional drainage is functioning correctly

Objective

Proper window sash operation and drainage

3.0201.1e Sash stops

Specification

Install new or adjust existing sash stops so as to eliminate visible gaps between the stop and window jamb while ensuring sash operates smoothly and securely

Objective

Operable, weathertight sash

3.0201.1f Weather stripping

Specification

Remove existing weather stripping or sealing strips that are damaged

Install continuous and complete weather stripping on the bottom of the lower sash where it makes contact with the sill and at the top of the upper sash where it makes contact with the upper part of the window frame while maintaining the operability of the window

Mechanically installed weather stripping will be sealed to surface

Objective

Complete seal of window sash

3.0201.1g Sash locks

Specification

Adjust existing lock or install new lock so that the rails of the upper and lower sashes are flush and in full contact and no gaps are visible between the sash(es)

Objective

Securely fastened sash

3.0201.1h Exterior weatherproofing

Specification

Replace any missing/damaged weatherproofing on exterior portions of window (flashing, glazing, caulking, sealant, paint, etc.)

Seal any holes in frame left by abandoned hardware

Do not seal weep holes or intentional drainage locations

Objective

Prevent water intrusion

3.0201.1i Safety

Specification

Verify safe operation and size of egress windows as required by local codes

Objective

Safe egress maintained

3.0201.2 Window Sash Replacement

Section:Air Sealing
Topic:Shell Components
Sub-Topic:Windows

Desired Outcome

Weathertight window repairs

3.0201.2a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0201.2b Material selection

Specification

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet

independent testing and verification protocols

Objective

Select safe and effective materials

3.0201.2c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the sash contact areas that will prevent a tight seal or safe operation

Objective

Surface is clean and ready to accept sealant

3.0201.2d Sash replacement

Specification

Install new sash per manufacturer's instructions

Ensure lower sash has a bottom rail bevel that is matched to the bevel of the lower sill

Ensure new sash seals against all stops, jambs, existing sash, etc. with no visible gaps

Adjust window sash(es) to properly fit the jamb and allow for ease of operation and security

Objective

Weatherproof sash installation

3.0201.2e Weatherproofing

Specification

Water-seal and prime new sash if water permeable

Objective

Prevent water damage

3.0201.2f Sash stops

Specification

Install new or adjust existing sash stops so as to eliminate visible gaps between the stop and window jamb while ensuring sash operates smoothly and securely

Objective

Operable, weathertight sash

3.0201.2g Weather stripping

Specification

Install continuous and complete weather stripping on the bottom of the lower sash where it makes contact with the sill and at the top of the upper sash where it makes contact with the upper part of the window frame while maintaining the operability of the window

Objective

Complete seal of window sash

3.0201.2h Sash locks

Specification

Adjust existing lock or install new lock so that the rails of the upper and lower sashes are flush and in full contact and no gaps are visible between the sash(es)

Objective

Securely fastened sash

3.0201.2i Disposal

Specification

Wrap old sash and any removed materials in plastic and dispose of them off-site in a manner that is compliant with local, state, and federal regulation

Objective

Prevent reuse of old components and protect health and the environment

3.0201.2j Safety

Specification

Verify safe operation and size of egress windows as required by local codes

Objective

Safe egress maintained

3.0201.3 Window Sill Replacement

Section:Air Sealing
Topic:Shell Components
Sub-Topic:Windows

Desired Outcome

Weathertight, fully operational window repairs

3.0201.3a Sealant selection

Specification

Select sealants that:

- are compatible with their intended surfaces,
- allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0201.3b Material selection

Specification

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0201.3c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the sash contact areas that will prevent a tight seal or safe operation

Objective

Surface is clean and ready to accept sealant

3.0201.3d Sill replacement

Specification

Install beveled sill flush with interior wall and sloped to the exterior of home at a minimum of 14 degrees

Apply continuous and complete seal at all connections/joints of the sill to the jambs, frame, and exterior wall

Objective

Weatherproof sill

3.0201.3e Weatherproofing

Specification

Water-seal and prime new sill if water permeable

Objective

Prevent water damage

3.0201.3f Disposal

Specification

Wrap old sill/ and any removed materials in plastic and dispose of them off-site in a manner that is compliant with local, state, and federal regulation

Objective

Prevent reuse of old components and protect health and the environment

3.0201.3g Safety

Specification

Verify safe operation and size of egress windows as required by local codes

Objective

Safe egress maintained

3.0201.4 Glass Replacement

Section:Air Sealing
Topic:Shell Components
Sub-Topic:Windows

Desired Outcome

Weathertight glazing repairs

3.0201.4a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0201.4b Material selection

Specification

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0201.4c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the glazing contact areas that will prevent a tight seal

Remove push point or stops from replacement area

Objective

Surface is clean and ready to accept sealant

3.0201.4d New glazing selection

Specification

Select tempered safety glass as required by applicable codes

Select replacement glazing with comparable tint and coating (color and look) that meets or exceeds existing glazing for thickness, including multiple IG panes, inert gas, and thermal performance

Size replacement glazing 1/8" to 3/16" smaller than opening to allow for movement of frame

Objective

Properly select and size replacement glazing

3.0201.4e New glazing installation

Specification

Secure glazing in frame using push points or appropriate stops on each side of opening

Install glazing compound or sealant at all edges of the glass in accordance with manufacturer specifications

Seal glazing, stops, and exterior window surfaces in accordance with original installation design

Objective

Secure and seal glazing

3.0201.4f Safety

Specification

Verify safe operation and size of egress windows as required by local codes

Objective

Safe egress maintained

3.0201.5 Interior Fixed Storm Window Installation

Section:Air Sealing
Topic:Shell Components
Sub-Topic:Windows

Desired Outcome

Airtight and safe fixed storm window installation

3.0201.5a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0201.5b Material selection

Specification

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0201.5c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the installation area that will prevent a tight seal

Objective

Surface is clean and ready to accept sealant

3.0201.5d Installation

Specification

Install new storm window in compliance with the manufacturer's instructions

Storm window installation must be substantially airtight

Objective

Airtight and proper installation

3.0201.5e Safety

Specification

Do not install fixed storm windows in required egress locations

Objective

Safe egress maintained

3.0201.6 Interior Operable Storm Window Installation

Section:Air Sealing
Topic:Shell Components
Sub-Topic:Windows

Desired Outcome

Airtight and safe operable storm window installation

3.0201.6a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0201.6b Material selection

Specification

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0201.6c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the installation area that will prevent a tight seal

Objective

Surface is clean and ready to accept sealant

3.0201.6d Installation

Specification

Install new storm window in compliance with the manufacturer's instructions

Installation must be substantially airtight when closed

Objective

Airtight and proper installation

3.0201.6e Safety

Specification

Verify safe operation and size of egress windows as required by local codes

Objective

Safe egress maintained

3.0201.7 Exterior Fixed Storm Window Installation

Section:Air Sealing
Topic:Shell Components
Sub-Topic:Windows

Desired Outcome

Weathertight and safe fixed storm window installation

3.0201.7a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0201.7b Material selection

Specification

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0201.7c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the installation area that will prevent a tight seal

Objective

Surface is clean and ready to accept sealant

3.0201.7d Installation

Specification

Install new storm window in compliance with the manufacturer's instructions

Installation must be substantially airtight

Objective

Weathertight and proper installation

3.0201.7e Sealing

Specification

Apply a continuous bead of sealant under the top and side flanges of frame before installation

Do not seal the lower flange or designed drainage openings (i.e., weep holes)

Objective

Weathertight installation

3.0201.7f Safety

Specification

Do not install fixed storm windows in required egress locations

Objective

Safe egress maintained

3.0201.8 Exterior Operable Storm Window Installation

Section:Air Sealing

Topic:Shell Components
Sub-Topic:Windows

Desired Outcome

Weathertight and safe operable storm window installation

3.0201.8a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0201.8b Material selection

Specification

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0201.8c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the installation area that will prevent a tight seal

Objective

Surface is clean and ready to accept sealant

3.0201.8d Installation

Specification

Install new storm window in compliance with the manufacturer's instructions

Installation must be substantially airtight

Objective

Weathertight and proper installation

3.0201.8e Sealing

Specification

Apply a continuous bead of sealant under the top and side flanges of frame before installation

Do not seal the lower flange or designed drainage openings (i.e., weep holes)

Objective

Weathertight installation

3.0201.8f Safety

Specification

Verify safe operation and size of egress windows as required by local codes

Objective

Safe egress maintained

3.0201.9 Window Replacement

Section:Air Sealing
Topic:Shell Components
Sub-Topic:Windows

Desired Outcome

Continuous, weathertight air and thermal boundary

3.0201.9a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0201.9b Material selection

Specification

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0201.9c Window selection

Specification

Select windows that meet the SHGC, U-value, and air leakage requirements of the work order

Select windows that meet the egress and safety glass requirements of the location where they are installed

Objective

Choose correct and safe new window

3.0201.9d Opening preparation

Specification

Remove existing window stops, sashes, parting strips, pulleys, and weights

Insulate and seal existing window weight pockets if they will remain after new installation

Replace any damaged or rotting framing

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the installation area that will prevent a level and firm installation

Seal the rough opening to the wall system's air and thermal boundary with non-expanding sealants

Install flashing to direct water away from the window opening in accordance with manufacturer's instructions

Objective

Rough opening sealed, insulated, and properly prepared for installation

3.0201.9e Installation

Specification

Install new window in accordance with manufacturer specifications in alignment with the wall system's air and thermal boundary

Install flashing per the manufacturer's specifications

Gaps between the new window and existing opening will be sealed with low-expanding foam or equivalent sealant

Final installation will be air and watertight

Objective

Continuous and contiguous air and thermal boundary

3.0201.9f Safety

Specification

Verify safe operation and size of egress windows as required by local codes

Objective

Safe egress maintained

3.0202.1 Door Air Sealing

Section:Air Sealing

Topic:Shell Components
Sub-Topic:Doors

Desired Outcome

Weathertight door repairs that maintain operability

3.0202.1a Sealant selection

Specification

Select sealants that:

- are compatible with their intended surfaces,
- allow for differential expansion and contraction between dissimilar materials,
- meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and
- for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0202.1b Material selection

Specification

Select:

- pest-resistant materials that adequately support applied load and are permanent air barriers,
- materials that meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and
- low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0202.1c Surface preparation

Specification

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the sash contact areas that will prevent a tight seal or safe operation

Objective

Surface is clean and ready to accept sealant

3.0202.1d Operation and fit

Specification

Adjust door hinges and slab to properly fit the jamb and allow for ease of operation and security

Verify intentional drainage is functioning correctly

Objective

Proper door operation

3.0202.1e Handle/lockset

Specification

Adjust or replace handle, lockset, or strike plate so that door closes tightly without hindering safe operation of latching or locking mechanisms

Objective

Proper latching mechanism function

3.0202.1f Weather stripping

Specification

Remove existing weather stripping and clean surface

Install continuous and complete weather stripping for sides and top of door so no visible gaps exist when the door is closed

Lap exterior weather stripping to channel water away from the door

Install a door sweep on the bottom of the door slab with no visible gaps when door is closed

Seal mechanically installed weather stripping to installation surface

Door operation may not be interfered with by any installation

Objective

Complete seal of door slab

3.0202.1g Door stop

Specification

Seal door stop to door frame

Objective

Complete seal of door frame

3.0202.1h Exterior weatherproofing

Specification

Replace any missing/damaged weatherproofing on exterior portions of door (seals, flashing, glazing, caulking, sealant, paint, etc.)

Seal any holes in frame left by abandoned hardware

Adjust and seal threshold as needed

Objective

Prevent water intrusion

3.0202.1i Safety

Specification

Verify safe operation of door and all components

Where doors are required to have a fire-resistance rating, all weather strips and sealants applied to the door will be compatible with the listing of the door

Objective

Safe egress and fire safety maintained

3.0202.2 Door Replacement

Section:Air Sealing
Topic:Shell Components
Sub-Topic:Doors

Desired Outcome

Continuous, weathertight air and thermal boundary that maintains door operability

3.0202.2a Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealants

3.0202.2b Material selection

Specification

Select:

pest-resistant materials that adequately support applied load and are permanent air barriers,

materials that meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

low volatile organic compound (VOC) materials for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective materials

3.0202.2c Door selection

Specification

Select doors that meet the SHGC, U-value, and air leakage requirements of the work order

Select doors that meet the egress and safety glass requirements of the location where they are installed

Objective

Choose correct and safe new door

3.0202.2d Opening preparation

Specification

Remove existing door frame and all components

Replace any damaged or rotting framing

Remove any material from the sealing area that will prevent full adhesion of the selected sealant

Remove any material from the installation area that will prevent a level and firm installation

Seal the rough opening to the wall system's air and thermal boundary with non-expanding sealants

Install flashing to direct water away from the door opening in accordance with manufacturer's instructions

Objective

Rough opening sealed, insulated, and properly prepared for installation

3.0202.2e Installation

Specification

Install new door in accordance with manufacturer specifications in alignment with the wall system's air and thermal boundary

Install exterior flashing and weatherstripping per the manufacturer's specifications

Gaps between the new door frame and the rough opening will be sealed with low-expanding foam

Door rail (bottom) and threshold will be adjusted to ensure tight but operable fit

Final installation will be air and watertight

Objective

Continuous and contiguous air and thermal boundary

3.0202.2f Safety

Specification

Verify safe operation of door and all components

Where doors are required to have a fire-resistance rating, all weather strips and sealants applied to the door will be compatible with the listing of the door

Objective

Safe egress and fire safety maintained

3.0202.3 Exterior Door Handle/Lockset Installation

Section:Air Sealing
Topic:Shell Components
Sub-Topic:Doors

Desired Outcome

Secure and operational door

3.0202.3a Hardware selection

Specification

Select interior hardware that operates door lock mechanism without the use of a key or any special tools

Select exterior hardware that covers all holes from previously installed hardware

Objective

Safe egress maintained

3.0202.3b Installation

Specification

Install new handle/lockset per the manufacturer's specifications

Handle/lockset will be installed substantially airtight

Install new strike plate that catches door appropriately so that no visible gaps exist around the door slab when door is closed

Installation will not interfere with door operation

Objective

Proper airtight installation

3.0202.3c Safety

Specification

Verify safe operation of door and all components

Objective

Safe egress maintained

4.0101.1 Roof Deck Insulation

Section:Insulation
Topic:Attics
Sub-Topic:Exterior Roof Insulation

Desired Outcome

Durable, weather-proof, and effective, exterior thermal boundary

4.0101.1a Pre-work qualifications

Specification

Verify that:

roof structure is sound and can support additional weight of insulation and roofing materials installation

all roof necessary roof penetrations are complete (ventilation, plumbing vents, combustion flues, chimneys, etc.)

Objective

Ensure roof deck can be safely insulated

4.0101.1b General preparation

Specification

Remove existing roof covering down to the roof sheathing materials including all fasteners, flashing, etc.

Air seal all holes, gaps, seams and penetrations in existing roof deck

Replace any damaged or rotten roof sheathing materials

Remove any extraneous materials or obstructions from roof deck surface

Objective

Solid, clean, and airtight roof surface

4.0101.1c Material selection

Specification

Select insulation materials that have a flame spread and smoke development index of 75/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe insulation

4.0101.1d Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Objective

Select safe, durable, and effective sealants

4.0101.1e Installation

Specification

Install insulation to prescribed R-value without gaps, voids, compressions, misalignments, or wind intrusions and according to manufacturer specifications

Offset the seams of multi-layer installations a minimum of 12"

Objective

Install insulation properly

4.0101.1f Air sealing

Specification

Install a continuous bead of sealant along the entire perimeter of roof deck between insulation layers and roof sheathing and again at subsequent layers of insulation

Seal all seams or joints in insulation with gaskets, tapes, or equivalent material

Seal all connections, penetrations, corners, etc.

Objective

Prevent air and moisture intrusion under or between insulation layers

4.0101.1g Water management

Specification

Install appropriate flashing and water management systems that direct bulk moisture off of roof and away from building

Objective

Direct bulk moisture away from building

4.0101.1h Replacement roof covering

Specification

Install new roof covering in accordance with manufacturer specifications and applicable code requirements

Objective

Compliant roof covering installation

4.0101.1i Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0102.1 SPF Roof Insulation - Unvented Roof Deck

Section:Insulation
Topic:Attics
Sub-Topic:Interior Roof Insulation

Desired Outcome

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0102.1a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

Objective

Ensure roof deck can be safely insulated

4.0102.1b General preparation

Specification

Cover all existing attic ventilation openings (gable vents, ridge vents, roof vents, vented soffits, etc.) with a class II vapor retarder that provides a suitable substrate for SPF application and is mechanically fastened in place

Prepare the surface according to manufacturers specifications

Install flags at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

Objective

Prevent insulation escape and condensation

Provide future access to utility junctions

4.0102.1c Material selection

Specification

Select insulation materials that have a flame spread and smoke development index of 75/450 or less when

tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe insulation

4.0102.1d Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Objective

Properly bonded SPF

4.0102.1e Installation

Specification

Apply SPF to prescribed R-value in a continuous layer from exterior wall top-plate to peak of roof and over all surfaces exposed to ambient temperatures using a pass thickness maximum in accordance with manufacturer specifications

In colder climates (IECC Zones 5-8), install SPF to a thickness of at least a class II vapor retarder or have at least a class II vapor retarder coating or covering in direct contact with the underside of the SPF

Objective

Continuous and contiguous pressure and thermal boundary that prevents vapor intrusion

4.0102.1f Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum

wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0102.1g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0102.2 SPF Roof Insulation - Vented Roof Deck

Section:Insulation
Topic:Attics
Sub-Topic:Interior Roof Insulation

Desired Outcome

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals and allows adequate roof deck venting

4.0102.2a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

Objective

Ensure roof deck can be safely insulated

4.0102.2b General preparation

Specification

Prepare the surface according to manufacturer's specifications

Install flags at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

Objective

Protect installed insulation

4.0102.2c Material selection

Specification

Select insulation materials that have a flame spread and smoke development index of 75/450 or less when

tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe insulation

4.0102.2d Roof deck venting

Specification

Install continuous ventilation path from soffit to ridge in each truss/rafter bay without any opening that SPF can penetrate or obstruct ventilation airflow

Install continuous damming at the exterior wall plate, without blocking or compromising ventilation pathway, that will allow for highest possible R-value application but prevent any SPF from entering venting path or exterior soffit

Objective

Maintain sufficient roof deck ventilation without reducing installed R-value

4.0102.2e Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Objective

Properly bonded SPF installation

4.0102.2f Installation

Specification

Apply SPF to prescribed R-value in a continuous layer from exterior wall top-plate to peak of roof and

over all surfaces exposed to ambient temperatures using a pass thickness maximum in accordance with manufacturer specifications

In colder climates (IECC Zones 5-8), install SPF to a thickness of at least a class II vapor retarder or have at least a class II vapor retarder coating or covering in direct contact with the underside of the SPF

Objective

Continuous and contiguous pressure and thermal boundary that prevents vapor intrusion

4.0102.2g Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0102.2h Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0102.3 Inaccessible Ceilings - Dense Pack

Section:Insulation
Topic:Attics
Sub-Topic:Interior Roof Insulation

Desired Outcome

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0102.3a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight and installation pressure

Objective

Ensure space can be safely insulated

4.0102.3b General preparation

Specification

Setup a dust control enclosure for all interior access locations that limits insulation and construction dust exposure to the occupant and occupant belongings

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures

Objective

Prevent occupant exposure to construction dust

Airtight, durable insulation cavities aligned with the pressure boundary

4.0102.3c Material selection

Specification

Select insulation materials that have a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe insulation

4.0102.3d Installation

Specification

Fill 100% of each cavity with insulation to the correct density that prevents air movement

Objective

Complete, consistent, and airtight insulation coverage

4.0102.3e Close access hole

Specification

Install closure system over all access holes that is airtight, durable, and aesthetically pleasing

Objective

Airtight, durable, and aesthetic access closure

4.0102.3f Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0103.1 Accessible Attic - Batt Installation

Section:Insulation
Topic:Attics
Sub-Topic:Attic Floors - Unconditioned Attics

Desired Outcome

Continuous, contiguous, safe, and compliant thermal barrier installation

4.0103.1a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0103.1b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe insulation

4.0103.1c General preparation

Specification

When vented eaves or soffits exist, mechanically fasten insulation baffles in every roof bay that extend above the final insulation level by at least 6"

Install a minimum of one insulation depth marker and one marker every additional 300 ft2 throughout installation area with measurement beginning at the air barrier

Install flags at all utility junctions that can be seen above the final level of the insulation

Objective

Protect insulation R-value, provide depth measurement, and locate junctions for future access

4.0103.1d Installation

Specification

Install batt insulation to prescribed R-value in every joist bay in full contact with the air barrier and all

sides of the ceiling cavity without gaps, voids, compressions, or misalignments

If batt contains a facing material, install it in contact with the conditioned space

Objective

Continuous and contiguous pressure and thermal barrier of consistent R-value

4.0103.1e Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0103.2 Accessible Attic - Loose Fill Installation

Section:Insulation
Topic:Attics
Sub-Topic:Attic Floors - Unconditioned Attics

Desired Outcome

Continuous, contiguous, safe, and compliant thermal barrier installation

4.0103.2a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0103.2b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe insulation

4.0103.2c General preparation

Specification

When vented eaves or soffits exist, mechanically fasten insulation baffles in every roof bay that extend above the final insulation level by at least 6"

Install a minimum of one insulation depth marker and one marker every additional 300 ft2 throughout installation area with measurement beginning at the air barrier

Install flags at all utility junctions that can be seen above the final level of the insulation

Objective

Protect insulation R-value, provide depth measurement, and locate junctions for future access

4.0103.2d Installation

Specification

Install loose fill insulation to prescribed R-value in every joist bay in full contact with the air barrier without gaps, voids, compressions, or misalignments

Objective

Continuous and contiguous pressure and thermal barrier of consistent R-value

4.0103.2e Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0103.3 Accessible Attic - Batt Insulation Over Existing Insulation

Section:Insulation
Topic:Attics
Sub-Topic:Attic Floors - Unconditioned Attics

Desired Outcome

Continuous, contiguous, safe, and compliant thermal barrier installation

4.0103.3a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0103.3b General preparation

Specification

When vented eaves or soffits exist, mechanically fasten insulation baffles in every roof bay that extend above the final insulation level by at least 6"

Install a minimum of one insulation depth marker and one marker every additional 300 ft2 throughout installation area with measurement beginning at the air barrier

Install flags at all utility junctions that can be seen above the final level of the insulation

Objective

Protect insulation R-value, provide depth measurement, and locate junctions for future access

4.0103.3c Material selection

Specification

Select only unfaced insulation batts for installation over existing batt insulation that have a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Prevent condensation in insulation layers and choose fire safe insulation

4.0103.3d Installation

Specification

Install batt insulation to prescribed R-value in full contact with the existing insulation batts without gaps, voids, compressions, or misalignments

If the top of the existing insulation is below the top of the framing, install new batts parallel with framing members

If the top of the existing insulation is above the top of the framing, install new batts perpendicular to framing members

Objective

Uniform insulation depth in continuous contact with existing insulation without voids

4.0103.3e Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0103.4 Accessible Attic - Loose Fill Over Existing Insulation

Section:Insulation
Topic:Attics
Sub-Topic:Attic Floors - Unconditioned Attics

Desired Outcome

Continuous, contiguous, safe, and compliant thermal barrier installation

4.0103.4a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0103.4b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe insulation

4.0103.4c General preparation

Specification

When vented eaves or soffits exist, mechanically fasten insulation baffles in every roof bay that extend above the final insulation level by at least 6"

Install a minimum of one insulation depth marker and one marker every additional 300 ft2 throughout installation area with measurement beginning at the air barrier

Install flags at all utility junctions that can be seen above the final level of the insulation

Objective

Protect insulation R-value, provide depth measurement, and locate junctions for future access

4.0103.4d Installation

Specification

Install loose fill insulation to prescribed R-value in every joist bay in full contact with the existing insulation or the air barrier without gaps, voids, compressions, or misalignments

Objective

Uniform insulation depth in continuous contact with existing insulation without voids

4.0103.4e Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0103.5 Accessible Attic - SPF on Attic Floor

Section:Insulation
Topic:Attics
Sub-Topic:Attic Floors - Unconditioned Attics

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

4.0103.5a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0103.5b Material selection

Specification

Select insulation materials that have a flame spread and smoke development index of 75/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe insulation

4.0103.5c General preparation

Specification

Prepare the surface according to manufacturers specifications

Install durable backing material over any escape holes in the air barrier and utility junctions that will be covered with SPF

When vented eaves or soffits exist, mechanically fasten insulation baffles in every roof bay that extend above the final insulation level by at least 6"

Install a minimum of one insulation depth marker and one marker every additional 300 ft2 throughout installation area with measurement beginning at the air barrier

Install flags at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

Objective

Provide depth measurement, and locate junctions for future access

4.0103.5d Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Objective

Properly bonded SPF

4.0103.5e Installation

Specification

Apply SPF to prescribed R-value in a continuous layer over entire attic ceiling from exterior wall top-plate to exterior wall top-plate using a pass thickness maximum in accordance with manufacturer specifications

In colder climates (IECC Zones 5-8), install SPF to a thickness of at least a class II vapor retarder or have at least a class II vapor retarder coating or covering in direct contact with the underside of the SPF

Objective

Continuous and contiguous pressure and thermal boundary that prevents vapor intrusion

4.0103.5f Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0103.5g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0103.6 Accessible Attic - Dense Pack Insulation

Section:Insulation
Topic:Attics
Sub-Topic:Attic Floors - Unconditioned Attics

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

4.0103.6a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight and installation pressure

Objective

Ensure space can be safely insulated

4.0103.6b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe insulation

4.0103.6c General preparation

Specification

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures

Objective

Durable and airtight insulation cavity that aligns with the pressure boundary

4.0103.6d Installation

Specification

Fill 100% of each cavity with insulation to the correct density that prevents air movement

Objective

Complete, consistent, and airtight insulation coverage

4.0103.6e Close access hole

Specification

Install closure system over all access holes that is airtight, and permanent

Objective

Airtight, durable access closure

4.0103.6f Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0103.7 Accessible Pitched/Vaulted/Cathedralized Ceilings - Loose Fill Over

Section:Insulation
Topic:Attics
Sub-Topic:Attic Floors - Unconditioned Attics

Desired Outcome

Continuous, contiguous, safe, and compliant thermal barrier installation

4.0103.7a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion

appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0103.7b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe insulation

4.0103.7c General preparation

Specification

When vented eaves or soffits exist, mechanically fasten insulation baffles in every roof bay that extend above the final insulation level by at least 6"

Install a minimum of one insulation depth marker and one marker every additional 300 ft2 throughout installation area with measurement beginning at the air barrier

Install flags at all utility junctions that can be seen above the final level of the insulation

Objective

Protect insulation R-value, provide depth measurement, and locate junctions for future access

4.0103.7d Cellulose installation

Specification

Install stabilized cellulose (i.e., wet-spray applied) when available

If ceiling pitch is less than 6/12, install loose fill cellulose to prescribed R-value without gaps, voids, misalignments, or wind intrusions

If ceiling pitch is 6/12 or greater, install baffles of the same height as the insulation perpendicular to slope a maximum of every 6' that prevent loose fill insulation from sliding downward then fill each bay to prescribed R-value without gaps, voids, misalignments, or wind intrusions

Objective

Cellulose insulation remains in place when installed on sloped surface

4.0103.7e Fiberglass installation

Specification

Install stabilized fiberglass (i.e., wet-spray applied) when available

If ceiling pitch is less than or equal to 6/12, install loose fill fiberglass insulation to prescribed R-value without gaps, voids, misalignments, or wind intrusions

If ceiling pitch is greater than 6/12, loose fill fiberglass insulation may not be used (dense pack fiberglass may be used)

Objective

Fiberglass insulation remains in place when installed on sloped surface of appropriate pitch

4.0103.7f Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0103.8 Loose Fill to Capacity

Section:Insulation
Topic:Attics
Sub-Topic:Attic Floors - Unconditioned Attics

Desired Outcome

Continuous, contiguous, safe, and compliant thermal barrier

4.0103.8a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0103.8b General preparation

Specification

Setup a dust control enclosure for all interior access locations that limits insulation and construction dust exposure to the occupant and occupant belongings

Objective

Prevent occupant exposure to construction dust

4.0103.8c Material selection

Specification

Select insulation materials that have a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe insulation

4.0103.8d Installation

Specification

Install blown insulation to maximum R-value from attic floor to ceiling to full capacity without dense packing, but without voids

Objective

Complete and consistent insulation coverage

4.0103.8e Close access hole

Specification

Install closure system over all access holes that is airtight, durable, and aesthetically pleasing

Objective

Airtight, durable, and aesthetic access closure

4.0103.8f Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0104.1 Knee Wall - Dense Packing

Section:Insulation
Topic:Attics
Sub-Topic:Attic Knee Walls

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

4.0104.1a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero

clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight and pressure, and air sealed (including blockers under kneewalls in alignment with the interior side of the kneewall)

Objective

Ensure space can be safely insulated

4.0104.1b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material for attics used for storage with a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0104.1c General preparation

Specification

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures

Objective

Durable and airtight insulation cavity that aligns with the pressure boundary

4.0104.1d Install backing

Specification

Install airtight backing material over entire area to be insulated that will withstand dense packing pressures

Secure backing material using mechanical fasteners that penetrate the sub framing a minimum of 1"

Installation must have a minimum of a 30-year service life

Objective

Airtight, durable insulation backing

4.0104.1e Installation

Specification

Fill 100% of each cavity with insulation to the correct density that prevents air movement

Objective

Complete, consistent, and airtight insulation coverage

4.0104.1f Close access hole

Specification

Install closure system over all access holes that is airtight and permanent

Objective

Airtight, durable, access closure

4.0104.1g Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0104.1h Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0104.2 Knee Wall - Batt Insulation

Section:Insulation
Topic:Attics
Sub-Topic:Attic Knee Walls

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

4.0104.2a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed (including blockers under kneewalls in alignment with the interior side of the kneewall)

Objective

Prepare for safe, effective, and airtight installation of dense-packed insulation

4.0104.2b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material for attics used for storage with a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0104.2c General preparation

Specification

Remove any existing insulation or vapor barrier materials from installation area

Objective

Prevent condensation

4.0104.2d Batt installation

Specification

Install batt insulation to prescribed R-value in every joist bay in full contact with the air barrier and all sides of the ceiling cavity without gaps, voids, compressions, or misalignments

If batt contains a facing material, install it in contact with the conditioned space

Objective

Continuous and contiguous thermal boundary

4.0104.2e Install backing

Specification

Install airtight backing material in full contact with the existing cavity insulation

Secure backing material using mechanical fasteners that penetrate the sub framing a minimum of 1"

Installation must have a minimum of a 30-year service life

Objective

Airtight, durable insulation cavity

4.0104.2f Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0104.2g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0104.3 Knee Wall - Existing Batt Insulation Repair

Section:Insulation
Topic:Attics
Sub-Topic:Attic Knee Walls

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

4.0104.3a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed (including blockers under kneewalls in alignment with the interior side of the kneewall)

Objective

Ensure space can be safely insulated

4.0104.3b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material for attics used for storage with a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0104.3c General preparation

Specification

Permanently secure existing batt insulation in full contact with the existing air barrier and sides of the existing cavity without gaps, voids, compressions, or misalignments

Objective

Align pressure and thermal boundary

4.0104.3d Install backing

Specification

Install airtight backing material in full contact with the existing cavity insulation

Secure backing material using mechanical fasteners that penetrate the sub framing a minimum of 1"

Installation must have a minimum of a 30-year service life

Objective

Airtight, durable insulation cavity

4.0104.3e Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0104.3f Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0104.4 Knee Wall - Rigid Insulation

Section:Insulation
Topic:Attics
Sub-Topic:Attic Knee Walls

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

4.0104.4a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed (including blockers under kneewalls in alignment with the interior side of the kneewall)

Objective

Ensure space can be safely insulated

4.0104.4b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 75/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0104.4c General preparation

Specification

Remove any existing insulation or protrusions that prevent full insulation contact with existing air barrier

Objective

Align pressure and thermal boundary

4.0104.4d Installation

Specification

Install rigid insulation to prescribed R-value using mechanical fasteners

Seal all insulation seams, joints and connections with compatible sealant (caulk, tape, mastic, etc.)

Objective

Continuous pressure and thermal boundary of correct R-value

4.0104.4e Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a

thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0104.4f Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0104.5 Knee Wall - SPF With No Existing Insulation

Section:Insulation
Topic:Attics
Sub-Topic:Attic Knee Walls

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

4.0104.5a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed (including blockers under kneewalls in alignment with the interior side of the kneewall)

Objective

Ensure space can be safely insulated

4.0104.5b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 75/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0104.5c General preparation

Specification

Install durable backing material over any escape holes in the air barrier

Install flags at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

Objective

Prevent SPF leakage

4.0104.5d Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Objective

Properly bonded SPF installation

4.0104.5e Installation

Specification

Apply SPF to prescribed R-value in a continuous layer over entire surface of knee wall from roof deck to attic floor air barrier using a pass thickness maximum in accordance with manufacturer specifications

In colder climates (IECC Zones 5-8), install SPF to a thickness of at least a class II vapor retarder or have at least a class II vapor retarder coating or covering in direct contact with the underside of the SPF

Objective

Continuous and contiguous pressure and thermal boundary that prevents vapor intrusion

4.0104.5f Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a

thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0104.5g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0104.6 Knee Wall - SPF With Existing Insulation

Section:Insulation
Topic:Attics
Sub-Topic:Attic Knee Walls

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

4.0104.6a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed (including blockers under kneewalls in alignment with the interior side of the kneewall)

Objective

Ensure space can be safely insulated

4.0104.6b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 75/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0104.6c General preparation

Specification

Install durable backing material over any escape holes in the air barrier

Install flags at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

Objective

Prevent SPF leakage

4.0104.6d Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Objective

Properly bonded SPF installation

4.0104.6e Installation

Specification

Apply SPF to prescribed R-value in a continuous layer over entire surface of knee wall from roof deck to attic floor air barrier using a pass thickness maximum in accordance with manufacturer specifications

In colder climates (IECC Zones 5-8), install SPF to a thickness of at least a class II vapor retarder or have at least a class II vapor retarder coating or covering in direct contact with the underside of the SPF

Objective

Continuous and contiguous pressure and thermal boundary that prevents vapor intrusion

4.0104.6f Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a

thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0104.6g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0188.1 Radiant Barriers

Section:Insulation
Topic:Attics
Sub-Topic:Unique Installations

Desired Outcome

Safely, and effectively reduce radiant heat flow while preserving attic ventilation

4.0188.1a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

existing insulation is aligned with and in full contact with the air barrier

Objective

Ensure space can be safely insulated

4.0188.1b Material selection

Specification

Select radiant barrier that has a flame spread and smoke development index of 25/450 or less and backing material for attics used for storage with a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0188.1c Installation

Specification

Install radiant barrier using mechanical fasteners according to manufacturer specifications

Objective

Compliant installation

4.0188.1d Air space

Specification

Install radiant barrier with the manufacturer's prescribed air space between it and the protected surface

Objective

Adequate air space for prescribed performance

4.0188.1e Sealing

Specification

Seal all seams, joints, and connections of the radiant barrier airtight

Objective

Airtight barrier

4.0188.1f Ventilation

Specification

When installed on attic ceiling (i.e., roof framing) maintain a minimum clearance of 3" from ridge vents

When installed on gable walls, do not block gable vents

In vented spaces, install radiant barrier so that it withstands local wind loads

Objective

Maintain adequate attic ventilation while preserving installation durability

4.0188.1g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage

area, number and thickness of the air spaces, the direction of heat flow, and the installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0188.2 Unconditioned Attic Ventilation

Section:Insulation
Topic:Attics
Sub-Topic:Unique Installations

Desired Outcome

Effective, safe, and pest-resistant attic ventilation

4.0188.2a Pre-work qualifications

Specification

Verify the presence of an effective air barrier and thermal boundary between the attic and living space

Objective

Reduce moisture intrusion from living space

4.0188.2b Vent selection

Specification

Attic vent types will be consistent with requirements for their specific location (e.g., exterior soffit, gable end, roof) and material and intended use (e.g., metal vent on metal roof)

Install only passive ventilation, no powered ventilators may be installed

Objective

Ensure vent meets proper performance characteristics for location and roofing type

4.0188.2c Vent openings

Specification

Ventilation opening area and configuration will comply with applicable building code

Objective

Provide sufficient ventilation air flow

4.0188.2d Vent location

Specification

Install between 40 and 50 percent of attic ventilation within 3 feet of the highest point in the ventilated space

Install attic vents in locations that prevent entry of wind-driven precipitation

Objective

Encourage proper air flow

Minimize entry of wind driven bulk moisture

4.0188.2e Ventilation screens

Specification

All attic ventilation sources with holes greater than 1/4" will have corrosion-resistant wire mesh screens installed with openings of 1/16" to 1/4"

Existing vents that are not screened will be covered with corrosion-resistant wire mesh with openings of 1/16" to 1/4"

Objective

Prevent pest entry

4.0188.2f Ventilation baffles

Specification

If soffit venting is installed, mechanically fasten baffles (i.e., soffit chutes) in each truss bay that terminate at least 6" above final insulation level and provide a minimum of 1" clearance between insulation and roof deck material

Objective

Ensure vent allows proper air flow without compromising insulation performance

4.0201.1 SPF Insulation

Section:Insulation
Topic:Walls
Sub-Topic:Accessible Walls

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

4.0201.1a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, supply and/or return air ducts, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight

Objective

Ensure space can be safely insulated

4.0201.1b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 75/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0201.1c General preparation

Specification

Remove existing insulation and vapor retarders from installation area

Cover all finished surfaces areas (e.g., windows, doors) in the installation area with appropriate materials (e.g., plastic, masking tape)

Install durable backing material over any escape holes in the air barrier and ensure utility junctions remain accessible per local code requirements

Objective

Protect finished surfaces from overspray and prevent SPF leakage

4.0201.1d Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Objective

Properly bonded SPF installation

4.0201.1e Installation

Specification

Apply SPF to prescribed R-value in a continuous layer over entire surface of wall from bottom plate to top plate using a pass thickness maximum in accordance with manufacturer specifications

Objective

Continuous pressure and thermal boundary

4.0201.1f Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If attic is used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If attic is used for storage or occupancy, spray foam will be separated from the attic space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0201.1g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0201.2 Batt Insulation

Section:Insulation
Topic:Walls
Sub-Topic:Accessible Walls

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

4.0201.2a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, supply and/or return air ducts, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0201.2b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0201.2c General preparation

Specification

Remove any existing insulation or vapor barrier materials from the installation area that are installed improperly

Objective

Prevent condensation

4.0201.2d Batt installation

Specification

Install batt insulation to prescribed R-value in every joist bay in full contact with the air barrier and all sides of the cavity without gaps, voids, compressions, or misalignments

If batt contains a facing material install it in contact with the conditioned space

Objective

Continuous and contiguous thermal boundary

4.0201.2e Install backing

Specification

Install an airtight backing material in full contact with the existing cavity insulation

Secure backing material using mechanical fasteners that penetrate the sub framing a minimum of 1"

Installation must have a minimum of a 30-year service life

Objective

Airtight, durable insulation cavity

4.0201.2f Ignition and thermal barriers

Specification

Separate all foam products from occupiable space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0201.2g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0201.3 Dense Pack Insulation

Section:Insulation
Topic:Walls
Sub-Topic:Accessible Walls

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

4.0201.3a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, supply and/or return air, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight and pressure

Objective

Prepare for safe, effective, and airtight installation of dense-packed insulation

4.0201.3b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in

accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0201.3c General preparation for dense packed insulation

Specification

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures

Objective

Airtight dense packed cavity insulation

4.0201.3d Install backing

Specification

Install airtight backing material over entire area to be insulated that will withstand dense packing pressures

Secure backing material using mechanical fasteners that penetrate the sub-framing a minimum of 1"

Installation must have a minimum of a 30-year service life

Objective

Airtight, durable insulation backing

4.0201.3e Installation

Specification

Fill 100% of each cavity with insulation to the correct density that prevents air movement

Objective

Complete, consistent, and airtight insulation coverage

4.0201.3f Close access hole

Specification

Install closure system over all access holes that is airtight and permanent

Objective

Airtight, durable, access closure

4.0201.3g Ignition and thermal barriers

Specification

Separate all foam products from occupiable space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0201.3h Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0202.1 Dense Pack Insulation

Section:Insulation

Topic:Walls
Sub-Topic:Enclosed Walls

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary that prevents air movement @ 50 Pascals

4.0202.1a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, supply and/or return air, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight and pressure

Objective

Prepare for safe, effective, and airtight installation of dense-packed insulation

4.0202.1b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0202.1c General preparation

Specification

Setup a dust control enclosure for all interior access locations that limits insulation and construction dust exposure to the occupant and occupant belongings

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures

Objective

Prevent occupant exposure to construction dust

Airtight, durable insulation cavities aligned with the pressure boundary

4.0202.1d Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective sealants

4.0202.1e Access cavity

Specification

Exterior access:

Remove the exterior cladding at the insulation access point when feasible

Neatly cut any vapor retarder installed and minimize air barrier and drainage plane disruption

Create an access hole through the sheathing sufficient to access the cavity with fill tube

Interior access:

Set up dust containment enclosure in installation area

Create access holes through the interior wall surface in a straight horizontal line sufficient to access the cavity with fill tube without damaging the wall surface

Objective

Access all wall cavities safely and prepare for access closure

4.0202.1f Installation

Specification

Fill 100% of each cavity with insulation to the correct density that prevents air movement

Objective

Complete, consistent, and airtight insulation coverage

4.0202.1g Close access hole

Specification

Exterior access holes will be closed as follows:

Plug holes in sheathing with durable materials and seal with weatherproof exterior sealant

Close weather barrier and seal seams with compatible sealant tape

Reinstall exterior cladding and secured with mechanical fasteners

Interior access holes will be closed as follows:

Interior holes will be coated and patched to match original interior surface characteristics or covered with trim as agreed upon with client

Objective

Airtight, durable hole closure

4.0202.1h Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0202.2 Exterior Rigid Insulation

Section:Insulation
Topic:Walls
Sub-Topic:Enclosed Walls

Desired Outcome

Continuous, contiguous, safe, and compliant thermal boundary

4.0202.2a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0202.2b Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Objective

Select safe and effective sealants

4.0202.2c General preparation

Specification

Remove all exterior cladding from the installation area

Seal all holes, gaps, and penetrations in existing sheathing airtight

Remove any existing insulation or protrusions that prevent full insulation contact with existing air barrier

Replace any rotten or structurally weak substrate

Objective

Provide secure attachment for insulation in full contact with the exterior sheathing

4.0202.2d Water management system

Specification

Insulation will either be installed fully in contact with the exterior sheathing, or a drainage plane will be installed that allows moisture to drain completely to outdoors from behind the rigid insulation

Objective

Prevent moisture buildup behind insulation layer

4.0202.2e Installation

Specification

Install continuous rigid insulation to prescribed R-value using mechanical fasteners that penetrate sub-framing a minimum of 1-1/2"

Overlap seam of multiple layers a minimum of 12"

Seal all insulation seams, joints and connections in each layer with compatible sealant (caulk, tape, mastic, etc.)

Objective

Continuous pressure and thermal boundary of correct R-value

4.0202.2f Exterior cladding replacement

Specification

Reinstall exterior cladding using mechanical fasteners over the new insulation per the manufacturer's specifications

Objective

Weathertight cladding installation

4.0202.2g Fire Safety

Specification

For structures covered by the International Building Code (IBC), all exterior walls to be insulated will be assessed for provision of a thermal boundary (fire stopping) when foam insulating materials are to be used (IBC 2603.4)

Objective

Ensure that insulation retrofit complies with applicable code regarding fire separation

4.0202.2h Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0301.1 Batt Insulation in Joisted Cavities

Section:Insulation
Topic:Floors
Sub-Topic:Accessible Floors

Desired Outcome

Continuous, contiguous, and safe thermal boundary

4.0301.1a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0301.1b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0301.1c General preparation

Specification

Remove any existing insulation or vapor barrier materials from installation area

Install flags that can be seen below the floor joists at any utility junctions that will be covered by

insulation

Objective

Prevent condensation, identify utility junctions for future access

4.0301.1e Secure Batts

Specification

Secure batts in full contact with the pressure boundary using physical fasteners that do not compress the insulation and have a minimum service life of 20 years (e.g., strapping, netting, wood strips, or rodent barrier)

Objective

Insulation remains in contact with pressure boundary

4.0301.1f Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0301.2 Loose Fill With Netting/Fabric in Joisted Cavities

Section:Insulation
Topic:Floors
Sub-Topic:Accessible Floors

Desired Outcome

Continuous, contiguous, and safe thermal boundary

4.0301.2a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0301.2b Material selection

Specification

Select insulation and netting/fabric that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0301.2c General preparation

Specification

Install flags that can be seen below the floor joists at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

Objective

Identify utility junctions for future access

4.0301.2d Install netting/fabric

Specification

Install netting/fabric using mechanical fasteners spaced according to netting/fabric manufacturer specifications

Installation must have a minimum service life of 20 years

Objective

Secure insulation

4.0301.2e Installation

Specification

Fill netted/fabric covered cavities to capacity with loose fill insulation in accordance with manufacturer specifications

Install insulation to prescribed R-value and in continuous contact with the air barrier

Objective

Continuous and contiguous thermal boundary

4.0301.2f Close access hole

Specification

Install closure system over all access holes that prevents insulation loss and is permanent

Objective

Durable, access closure prevent insulation loss

4.0301.2g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0301.3 Loose Fill in Joisted Cavities With Rigid Barrier

Section:Insulation
Topic:Floors
Sub-Topic:Accessible Floors

Desired Outcome

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0301.3a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless

they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0301.3b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

Objective

Select fire safe materials

4.0301.3c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective sealants

4.0301.3d General preparation

Specification

Install flags that can be seen below the floor joists at any utility junctions that will be covered by insulation

Objective

Identify utility junctions for future access

4.0301.3e Install rigid barrier

Specification

Install a rigid air barrier material over entire area to be insulated that will withstand insulation pressures

Secure backing material using mechanical fasteners that penetrate the sub framing a minimum of 1"

Seal all seams, joints, connections, etc. with a compatible sealant

Installation must have a minimum of a 30-year service life

Objective

Airtight, durable insulation backing

4.0301.3f Installation

Specification

Fill 100% of each cavity to capacity with the insulation in full contact with the air barrier

Objective

Complete and consistent insulation coverage

4.0301.3g Close access hole

Specification

Install closure system over all access holes that is airtight and permanent

Objective

Airtight, durable, access closure

4.0301.3h Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, spray foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0301.3i Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0301.4 Dense Pack in Joisted Cavities With Rigid Barrier

Section:Insulation
Topic:Floors
Sub-Topic:Accessible Floors

Desired Outcome

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0301.4a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight and installation pressure

Objective

Ensure space can be safely insulated

4.0301.4b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

Objective

Select fire safe materials

4.0301.4c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective sealants

4.0301.4d General preparation

Specification

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and

will not fail under dense pack pressures

Install flags that can be seen below the floor joists at any utility junctions that will be covered by insulation

Objective

Identify utility junctions for future access

4.0301.4e Install rigid barrier

Specification

Install an air barrier material over entire area to be insulated that will withstand insulation pressures

Secure backing material using mechanical fasteners, spaced a maximum of 6" apart, that penetrate the sub framing a minimum of 1"

Seal all seams, joints, connections, etc. with a compatible sealant

Installation must have a minimum of a 30-year service life

Objective

Airtight, durable insulation backing

4.0301.4f Installation

Specification

Fill 100% of each cavity to capacity with the insulation in full contact with the air barrier

Objective

Complete, consistent, and airtight insulation coverage

4.0301.4g Close access hole

Specification

Install closure system over all access holes that is airtight and permanent

Objective

Airtight, durable, access closure

4.0301.4h Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, spray foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0301.4i Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0301.5 SPF in Open Joisted Cavities

Section:Insulation

Topic:Floors
Sub-Topic:Accessible Floors

Desired Outcome

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0301.5a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure insulation can be safely installed

4.0301.5b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 75/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0301.5c General preparation

Specification

Prepare the surface according to manufacturer's specifications

Install durable backing material over any escape holes in the air barrier

Install flags that can be seen below the floor joists at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

Objective

Prevent SPF leakage, identify utility junctions for future access

4.0301.5d Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Objective

Properly bonded SPF installation

4.0301.5e Installation

Specification

Apply SPF to prescribed R-value over bottom of subfloor, and all surfaces of the floor joists (including the bottom), using a pass thickness maximum as indicated by manufacturer specifications

Install to a thickness of least a class I vapor retarder or have at least a class I vapor retarder coating or

covering in direct contact with the underside of the SPF

Objective

Continuous pressure and thermal boundary that prevents moisture vapor movement

4.0301.5f Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, spray foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0301.5g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0301.6 Cantilever Floor Joisted Cavities Batt Insulation

Section:Insulation

Topic:Floors
Sub-Topic:Accessible Floors

Desired Outcome

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0301.6a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0301.6b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0301.6c General preparation

Specification

Remove any existing insulation or vapor barrier materials from installation area

Install airtight blocking between each floor joist at the interior edge of the exterior wall plate

Objective

Prevent condensation, prevent air and moisture movement in attached floor cavities

4.0301.6d Batt installation

Specification

Install batt insulation to prescribed R-value in every joist bay in full contact with the air barrier and all sides of the cavity without gaps, voids, compressions, or misalignments

If batt contains a facing material install it in contact with the conditioned space

Objective

Continuous and contiguous thermal boundary

4.0301.6e Secure Batts

Specification

Secure batts in full contact with the pressure boundary using physical fasteners that do not compress the insulation and have a minimum service life of 20 years (e.g., strapping, netting, wood strips)

Objective

Insulation remains in contact with pressure boundary

4.0301.6f Enclose cavity

Specification

Mechanically fasten a continuous, airtight, rigid air barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact

Objective

Weathertight, pest resistant, rigid enclosure

4.0301.6g Exterior soffit

Specification

Install durable exterior soffit material over the rigid enclosure materials

Objective

Protect enclosed cavity from weather

4.0301.6h Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0301.7 Non-Joisted Floors Batt Insulation

Section:Insulation
Topic:Floors
Sub-Topic:Accessible Floors

Desired Outcome

Continuous, contiguous, and safe thermal boundary

4.0301.7a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Verify all plumbing and ductwork will be inside the thermal boundary

Verify that existing floor air barrier is smooth and is not ribbed or fluted metal decking material

Objective

Ensure space can be safely insulated

4.0301.7b Material selection

Specification

Select insulation and support materials that have a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0301.7c General preparation

Specification

Remove any existing insulation or vapor barrier materials from installation area

Install flags that can be seen below the insulation level at any utility junctions that will be covered by insulation

Objective

Prevent condensation, identify utility junctions for future access

4.0301.7d Installation

Specification

Install batts over 100% of accessible area to prescribed R-value in full contact with the air barrier and all structural framing without gaps, voids, compressions, or misalignments

If vapor retarder facing exists, install it facing the conditioned area

Objective

Continuous and contiguous thermal boundary that prevents excessive vapor intrusion

4.0301.7e Support

Specification

Install a support system for batt insulation that is mechanically fastened to the floor deck and supports the batt insulation without compression and has a minimum service life of 20 years

Objective

Secure batts to floor

4.0301.7f Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0301.8 Non-Joisted Floors Rigid Foam

Section:Insulation
Topic:Floors
Sub-Topic:Accessible Floors

Desired Outcome

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0301.8a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Verify all plumbing and ductwork will be inside the thermal boundary

Objective

Ensure space can be safely insulated

4.0301.8b Material selection

Specification

Select insulation and support materials that have a flame spread and smoke development index of 75/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0301.8c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective sealants

4.0301.8d General preparation

Specification

Remove any existing insulation or vapor barrier materials from installation area

Install flags that can be seen below the insulation level at any utility junctions that will be covered by insulation

Objective

Prevent condensation, identify utility junctions for future access

4.0301.8e Installation

Specification

Install rigid insulation continuously over entire accessible area to prescribed R-value in full contact with the air barrier and all structural framing without gaps, voids, or misalignments

If installing multiple layers, offset seams at least 12" and seal the seams of each layer before applying the next

Where rigid foam plastics are used, in no case will the final thickness exceed the manufacturer's tested thickness used to determine the maximum 75 flame spread and 450 smoke-development index when tested to ASTM E84 or UL 723

Objective

Continuous and contiguous thermal boundary that prevents excessive vapor intrusion

4.0301.8f Sealing

Specification

Seal all seams, joints, connections, etc. of rigid insulation at entire perimeter and at all support beams

Objective

Airtight insulation that prevents condensation

4.0301.8g Support

Specification

Install a support system for rigid insulation that is mechanically fastened to the floor deck that has a minimum service life of 30 years

Objective

Secure insulation to floor

4.0301.8h Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, spray foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0301.8i Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0301.9 Non-Joisted Floors SPF

Section:Insulation
Topic:Floors
Sub-Topic:Accessible Floors

Desired Outcome

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0301.9a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Verify all plumbing and ductwork will be inside the thermal boundary

Objective

Ensure space can be safely insulated

4.0301.9b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 75/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select fire safe materials

4.0301.9c General preparation

Specification

Prepare the surface according to manufacturers specifications

Install durable backing material over any escape holes in the air barrier and utility junctions that will be covered with SPF

Install flags that can be seen below the floor joists at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

Objective

Prevent SPF leakage, identify utility junctions for future

4.0301.9d Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Objective

Properly bonded SPF installation

4.0301.9e Installation

Specification

Apply SPF to prescribed R-value to bottom side of floor deck and top of support beams using a pass thickness maximum as indicated by manufacturer specifications

Install to a thickness of least a class I vapor retarder or have at least a class I vapor retarder coating or covering in direct contact with the underside of the SPF

Objective

Continuous pressure and thermal boundary that prevents moisture vapor movement

4.0301.9f Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, spray foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0301.9g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0302.1 Batt Insulation With Rigid Barrier

Section:Insulation
Topic:Floors
Sub-Topic:Exposed Floors

Desired Outcome

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

4.0302.1a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0302.1b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

Objective

Select fire safe materials

4.0302.1c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Objective

Select safe and effective sealants

4.0302.1d General preparation

Specification

Remove any existing insulation or vapor barrier materials from installation area

Objective

Prevent condensation

4.0302.1e Batt installation

Specification

Install batt insulation to prescribed R-value in every joist bay in full contact with the air barrier and all sides of the cavity without gaps, voids, compressions, or misalignments

If batt contains a vapor retarder facing material install it in contact with the conditioned space

Objective

Continuous and contiguous thermal boundary

4.0302.1f Secure batts

Specification

If insulation batts are not full cavity depth, secure batts in full contact with the pressure boundary using physical fasteners that do not compress the insulation and have a minimum service life of 20 years (e.g., strapping, netting, wood strips)

Objective

Insulation remains in contact with pressure boundary

4.0302.1g Rigid protective barrier

Specification

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

Objective

Insulation protected from weather, pests, and moisture

4.0302.1h Sealing and rodent proofing

Specification

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

Objective

Airtight, pest resistant exterior

4.0302.1i Weather-resistant barrier

Specification

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

Objective

Protect insulation from weather, light and impact

4.0302.1j Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0302.2 Loose Fill With Rigid Barrier

Section:Insulation
Topic:Floors
Sub-Topic:Exposed Floors

Desired Outcome

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

4.0302.2a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0302.2b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing

material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

Objective

Select fire safe materials

4.0302.2c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Objective

Select safe and effective sealants

4.0302.2d General preparation

Specification

Remove any existing insulation or vapor barrier materials from installation area

Objective

Prevent condensation, identify utility junctions for future access

4.0302.2e Rigid protective barrier

Specification

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

Objective

Insulation protected from weather, pests, and moisture

4.0302.2f Installation

Specification

Fill 100% of each cavity to capacity with the insulation in full contact with the air barrier and the rigid barrier

Objective

Complete and consistent insulation coverage

4.0302.2g Close access hole

Specification

Install closure system over all access holes that is airtight, pest-resistant, and permanent

Objective

Airtight, durable, access closure

4.0302.2h Sealing and rodent proofing

Specification

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

Objective

Airtight, pest resistant exterior

4.0302.2i Weather-resistant barrier

Specification

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

Objective

Protect insulation from weather, light and impact

4.0302.2j Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0302.3 Dense Pack with Rigid Barrier

Section:Insulation
Topic:Floors
Sub-Topic:Exposed Floors

Desired Outcome

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

4.0302.3a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight and pressure

Objective

Ensure space can be safely insulated

4.0302.3b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

Objective

Select fire safe materials

4.0302.3c Sealant selection

Specification

Select sealants that:

- are compatible with their intended surfaces
- allow for differential expansion and contraction between dissimilar materials
- meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Objective

Select safe and effective sealants

4.0302.3d General preparation

Specification

Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures

Objective

Prevent insulation gaps or voids

4.0302.3e Rigid protective barrier

Specification

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

Objective

Insulation protected from weather, pests, and moisture

4.0302.3f Installation

Specification

Fill 100% of each cavity to manufacturer's density requirements keeping insulation in full contact with the air barrier

Objective

Complete, consistent, and airtight insulation coverage

4.0302.3g Close access hole

Specification

Install closure system over all access holes that is airtight and permanent

Objective

Airtight, durable, access closure

4.0302.3h Sealing and rodent proofing

Specification

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

Objective

Airtight, pest resistant exterior

4.0302.3i Weather-resistant barrier

Specification

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

Objective

Protect insulation from weather, light and impact

4.0302.3j Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, minimum settled thickness, installed R-value, and number of bags installed

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0302.4 SPF with Rigid Barrier

Section:Insulation
Topic:Floors
Sub-Topic:Exposed Floors

Desired Outcome

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

4.0302.4a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight

Objective

Ensure space can be safely insulated

4.0302.4b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 75/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

Objective

Select fire safe materials

4.0302.4c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Objective

Select safe and effective sealants

4.0302.4d General preparation

Specification

Remove existing insulation and vapor retarders from installation area

Install durable backing material over any escape holes in the air barrier

Install flags that can be seen below the floor joists at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

Objective

Prevent condensation and SPF leakage insulation gaps or voids

4.0302.4e Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Objective

Properly bonded SPF installation

4.0302.4f Rigid protective barrier

Specification

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

Objective

Insulation protected from weather, pests, and moisture

4.0302.4g Installation

Specification

Apply SPF to prescribed R-value to bottom of all exposed subfloor, and all surfaces of the floor joists, excluding the bottom using a pass thickness maximum as indicated by manufacturer specifications

Install to a thickness of a class I vapor retarder or have a class I vapor retarder coating or covering in direct contact with the underside of the SPF

Objective

Complete and consistent insulation coverage

4.0302.4h Sealing and rodent proofing

Specification

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

Objective

Airtight, pest resistant exterior

4.0302.4i Weather-resistant barrier

Specification

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

Objective

Protect insulation from weather, light and impact

4.0302.4j Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0302.4k Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0302.5 Rigid Insulation on Joists

Section:Insulation
Topic:Floors
Sub-Topic:Exposed Floors

Desired Outcome

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @

50 Pascals

4.0302.5a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0302.5b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 75/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

Objective

Select fire safe materials

4.0302.5c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Objective

Select safe and effective sealants

4.0302.5d General preparation

Specification

Remove any obstacles, fasteners, or protruding objects that will prevent insulation from fully contacting the bottom of the floor joist

Objective

Prevent insulation gaps or voids

4.0302.5e Installation

Specification

Install rigid insulation continuously over entire accessible area to prescribed R-value in full contact with the floor joists without gaps, voids, or misalignments

If installing multiple layers, offset seams at least 12" and seal the seams of each layer before applying the next

Where rigid foam plastics are used, in no case will the final thickness exceed the manufacturer's tested thickness used to determine the maximum 75 flame spread and 450 smoke-development index when tested to ASTM E84 or UL 723

Objective

Continuous and contiguous thermal boundary that prevents excessive vapor intrusion

4.0302.5f Rigid protective barrier

Specification

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

Objective

Insulation protected from weather, pests, and moisture

4.0302.5g Sealing and rodent proofing

Specification

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

Objective

Airtight, pest resistant exterior

4.0302.5h Weather-resistant barrier

Specification

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

Objective

Protect insulation from weather, light and impact

4.0302.5i Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0302.5j Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0302.6 Non-Joisted Floors Batt Insulation

Section:Insulation
Topic:Floors
Sub-Topic:Exposed Floors

Desired Outcome

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

4.0302.6a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0302.6b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 25/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

Objective

Select fire safe materials

4.0302.6c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Objective

Select safe and effective sealants

4.0302.6d General preparation

Specification

Remove any existing insulation or vapor barrier materials from installation area

Install flags that can be seen below the floor joists at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

Objective

Prevent condensation

4.0302.6e Installation

Specification

Install batts over 100% of accessible area to prescribed R-value in full contact with the air barrier and all

structural framing without gaps, voids, compressions, or misalignments

If vapor retarder facing exists, install it facing the conditioned area

Objective

Continuous and contiguous thermal boundary that prevents excessive vapor intrusion

4.0302.6f Secure batts

Specification

If insulation batts are not full cavity depth, secure batts in full contact with the pressure boundary using physical fasteners that do not compress the insulation and have a minimum service life of 20 years (e.g., strapping, netting, wood strips)

Objective

Insulation remains in contact with pressure boundary

4.0302.6g Rigid protective barrier

Specification

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

Objective

Insulation protected from weather, pests, and moisture

4.0302.6h Sealing and rodent proofing

Specification

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

Objective

Airtight, pest resistant exterior

4.0302.6i Weather-resistant barrier

Specification

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

Objective

Protect insulation from weather, light and impact

4.0302.6j Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0302.7 Non-Joisted Floors Rigid Insulation

Section:Insulation
Topic:Floors
Sub-Topic:Exposed Floors

Desired Outcome

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

4.0302.7a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0302.7b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 75/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

Objective

Select fire safe materials

4.0302.7c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Objective

Select safe and effective sealants

4.0302.7d General preparation

Specification

Remove any existing insulation or vapor barrier materials from installation area

Remove any obstacles, fasteners, or protruding objects that will prevent insulation from fully contacting the bottom of the floor joist

Objective

Prevent condensation, create uninterrupted installation surface

4.0302.7e Installation

Specification

Install rigid insulation continuously over entire accessible area to prescribed R-value in full contact with the air barrier and all structural framing without gaps, voids, or misalignments

If installing multiple layers, offset seams at least 12" and seal the seams of each layer before applying the next

Where rigid foam plastics are used, in no case will the final thickness exceed the manufacturer's tested thickness used to determine the maximum 75 flame spread and 450 smoke-development index when tested to ASTM E84 or UL 723

Objective

Continuous and contiguous thermal boundary that prevents excessive vapor intrusion

4.0302.7f Rigid protective barrier

Specification

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

Objective

Insulation protected from weather, pests, and moisture

4.0302.7g Sealing and rodent proofing

Specification

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

Objective

Airtight, pest resistant exterior

4.0302.7h Weather-resistant barrier

Specification

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing

system and spray-on roof waterproofing over foam)

Objective

Protect insulation from weather, light and impact

4.0302.7i Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0302.7j Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0302.8 Non-Joisted Floors SPF Insulation

Section:Insulation
Topic:Floors
Sub-Topic:Exposed Floors

Desired Outcome

Continuous, contiguous, safe, pest and weather resistant thermal boundary that prevents air movement @ 50 Pascals

4.0302.8a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0302.8b Material selection

Specification

Select insulation that has a flame spread and smoke development index of 75/450 or less and backing material that has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Select rigid backing material that:

is a permanent air barrier

will support installed insulation without failure

Objective

Select fire safe materials

4.0302.8c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Objective

Select safe and effective sealants

4.0302.8d General preparation

Specification

Remove existing insulation and vapor retarders from installation area

Install durable backing material over any escape holes in the air barrier

Install flags that can be seen below the floor joists at all utility junctions for future identification and ensure utility junctions remain accessible per local code requirements

Objective

Prevent condensation and SPF leakage

4.0302.8e Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Objective

Properly bonded SPF installation

4.0302.8f Installation

Specification

Apply SPF to prescribed R-value to bottom side of floor deck and top of support beams using a pass thickness maximum as indicated by manufacturer specifications

Install to a thickness of a class I vapor retarder or have a class I vapor retarder coating or covering in direct contact with the underside of the SPF

Objective

Continuous pressure and thermal boundary that prevents moisture vapor movement

4.0302.8g Rigid protective barrier

Specification

Mechanically fasten a continuous rigid barrier to underside of floor assembly that is suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly

Objective

Insulation protected from weather, pests, and moisture

4.0302.8h Sealing and rodent proofing

Specification

Seal all seams, joints, connections, penetrations, etc. in the rigid protective barrier with compatible sealant

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Cover exposed corners of the rigid protective barrier with reinforced hardware cloth or metal board bead

Objective

Airtight, pest resistant exterior

4.0302.8i Weather-resistant barrier

Specification

Apply a weather-resistant barrier to the exposed side of the insulation (e.g., exterior insulated finishing system and spray-on roof waterproofing over foam)

Objective

Protect insulation from weather, light and impact

4.0302.8j Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0302.8k Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0388.1 Foundation Skirting

Section:Insulation
Topic:Floors
Sub-Topic:Unique Installations

Desired Outcome

Reduce pest, wind, and water intrusion while reducing conductive heat loss in floor assembly

4.0388.1a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

Verify that installation area is intact and structurally sound

Verify that all plumbing is within the thermal boundary, or insulated appropriately

Verify an appropriate class I vapor retarder is installed between the ground and the floor assembly

Objective

Space safe and prepared for insulation

4.0388.1b Material selection

Specification

Select materials that are corrosion and rot resistant, compatible with existing surfaces, and pest resistant

Select materials that are rated for ground contact if they touch the ground

Objective

Select durable and pest-resistant materials

4.0388.1c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Objective

Select durable, safe, and pest-resistant sealants

4.0388.1d General preparation

Specification

Remove any existing skirting materials

Remove any vegetation from installation area

Objective

Installation area free of obstructions

4.0388.1e Coverage

Specification

Install skirting continuously around the entire perimeter of the conditioned space

Objective

Minimize pests, wind and water intrusion, and freezing of plumbing under dwelling

4.0388.1f Support

Specification

Install support material as needed to adequately support new skirting to prevent failure under wind or snow loads but that allows for expansion, contraction, and frost heaving

Objective

Adequate yet flexible support

4.0388.1g Fastening

Specification

Mechanically fasten all skirting in accordance with manufacturer's specifications using corrosion resistant materials

Objective

Durable installation

4.0388.1h Flashing

Specification

Install flashing that directs bulk water away from the dwelling and to outside skirting

Seal flashing to dwelling with compatible sealant

Objective

Prevent water from entering foundation space

4.0388.1i Insulation

Specification

Install skirting that meets the prescribed R-value

Objective

Reduce conductive heat loss through floor assembly

4.0388.1j Sealing and rodent proofing

Specification

Seal all seams, joints, connections, penetrations, etc. in the skirting with compatible sealant

Seal all exposed wood (e.g., paint, sealed, treated)

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

Objective

Airtight, pest resistant exterior

4.0388.1k Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0401.1 SPF Insulation

Section:Insulation
Topic:Conditioned Subspaces
Sub-Topic:Rim/Band Joist

Desired Outcome

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0401.1a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact and able to support insulation weight

Objective

Ensure insulation can be safely installed

4.0401.1b Material selection

Specification

Select SPF that is between 0.5 and 2.0 lb/ft3 in density and has a flame spread/smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Meet fire safety requirements

4.0401.1c General preparation

Specification

Remove existing insulation and vapor retarders from installation area

Install durable backing material over any escape holes in the air barrier

Ensure utility junctions remain accessible per local code requirements

Objective

Prevent condensation, prevent SPF escape

4.0401.1d Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Objective

Properly bonded SPF installation

4.0401.1e Installation

Specification

Apply SPF to prescribed R-value in a continuous layer from subfloor surface, over band/rim joist and sill/wall plate, and in contact with foundation or ceiling below using a pass thickness maximum as indicated by manufacturer specifications

Install to a thickness of least a class II vapor retarder or have at least a class II vapor retarder coating or covering in direct contact with the interior (or warm) side of the SPF

Objective

Continuous pressure and thermal boundary that prevents moisture vapor movement

4.0401.1f Ignition and thermal barriers

Specification

If foam is no more than 3 1/4" thick, is between 0.5 and 2.0 lb/ft3 in density, and has a flame spread/smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723, no thermal barrier is required

If foam is thicker than 3 1/4", does not meet the flame and smoke index, or is not between 0.5 and 2.0 lb/ft3 density, separate foam from the subspace with a suitable thermal barrier covering or coating as indicated in manufacturer's specifications and applicable building code

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0401.1g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, installed R-value, manufacturer product name, manufacturer supplied material density, and flame spread and smoke development index as tested per ASTME E84 or UL 723

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0401.2 Batt Insulation

Section:Insulation

Topic:Conditioned Subspaces
Sub-Topic:Rim/Band Joist

Desired Outcome

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0401.2a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0401.2b Material selection

Specification

Select batt insulation that has a class II vapor retarder facing and that has a flame spread and smoke development index of 25/450 or less

Select encapsulation material that is a permanent air barrier, a class II vapor retarder, and has a smoke development index of 450 or less when tested in accordance with ASTM E84 or UL 723

Objective

Select materials that are fire safe and meet class II vapor retarder requirement

4.0401.2c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Objective

Select safe and effective sealants

4.0401.2d General preparation

Specification

Remove any existing insulation or vapor barrier materials from installation area

Objective

Prevent condensation, align thermal and pressure boundary

4.0401.2e Batt installation

Specification

Install batt insulation to prescribed R-value in every joist bay in full contact with the rim/band joist air barrier and all sides of the cavity without gaps, voids, compressions, or misalignments

If batt contains a facing material install it toward the conditioned space

Objective

Continuous and contiguous thermal boundary

4.0401.2f Sealing

Specification

Seal each cavity airtight around the perimeter of faced batts or around the perimeter of the encapsulation material

Objective

Prevent air and moisture movement in cavity

4.0401.2g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0401.3 Rigid Insulation

Section:Insulation
Topic:Conditioned Subspaces
Sub-Topic:Rim/Band Joist

Desired Outcome

Continuous, contiguous, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0401.3a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area is:

intact, able to support insulation weight, and air sealed

Objective

Ensure space can be safely insulated

4.0401.3b Material selection

Specification

Select rigid insulation that:

is a class II vapor retarder

is between 0.5 and 2.0 lb/ft3 in density and has a flame spread/smoke development index equal to or less than 25/450 when tested in accordance with ASTM E84 or UL 723

Objective

Prevent condensation and provide fire safe assembly

4.0401.3c General preparation

Specification

Remove any existing insulation or vapor barrier materials and protrusions from installation area

Objective

Prevent condensation, uninterrupted installation area

4.0401.3d Batt installation

Specification

Install rigid insulation to prescribed R-value in every joist bay in full contact with the rim/band joist air barrier and all sides of the cavity without gaps, voids, or misalignments

Objective

Continuous and contiguous thermal boundary

4.0401.3e Sealing

Specification

Seal each cavity airtight around the perimeter of the rigid insulation

Objective

Prevent air and moisture movement in cavity

4.0401.3f Ignition and thermal barriers

Specification

If foam is no more than 3 1/4" thick and the space is not permanently habitable no thermal barrier is required

If foam is thicker than 3 1/4", doesn't meet the flame and smoke index, or is of less than 0.5 lb/ft3 density, or the space is permanently habitable, separate foam from the subspace with a suitable thermal

barrier covering or coating as indicated in manufacturer's specifications and applicable building code

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0401.3g Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0402.1 Closed Crawlspace - Non-Foam Insulation

Section:Insulation
Topic:Conditioned Subspaces
Sub-Topic:Walls

Desired Outcome

Continuous, contiguous, pest and moisture resistant, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0402.1a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

has a sealed class I vapor retarder installed over all bare earth

has all bulk sources of moisture directed away from the subspace walls (i.e. gutters, flashing, grading, drainage)

Objective

Ensure space can be safely insulated

4.0402.1b Material selection

Specification

Select insulation that:

has a flame spread/smoke development index of 25/450 or less when tested in accordance with ASTM E 84 or UL 723

is, or include a facing that is, a class II vapor retarder

is non-absorbent

Objective

Select fire safe and moisture resistant materials

4.0402.1c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective sealants

4.0402.1d General preparation

Specification

Ensure wall vapor retarder will lap underneath the ground vapor retarder connection to the foundation wall

Remove any incomplete or unsealed vapor barrier from the foundation wall

Objective

Keep bulk water below vapor retarder and prevent condensation

4.0402.1e Installation

Specification

Install insulation to prescribed R-value in full contact with the foundation wall from ceiling to floor with vapor retarder facing the conditioned space

Objective

Contiguous and continuous thermal barrier

4.0402.1f Attachment

Specification

Mechanically attach insulation to foundation wall

Objective

Insulation remains in place

4.0402.1g Sealing

Specification

Seal all seams, joints, connections, etc. of insulation and vapor retarder layer with compatible sealant (i.e., tape, mastic, adhesive)

Seal ground vapor retarder to the insulation vapor retarder with the foundation vapor retarder lapped under the ground vapor retarder

Objective

Airtight insulation

4.0402.1h Termite inspection gap

Specification

If termite pressure exists, maintain a 3" inspection gap from the top of the insulation to the bottom of any wood

Objective

Allow for termite detection

4.0402.1i Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage

area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0402.2 Closed Crawlspace - Rigid Foam Insulation

Section:Insulation
Topic:Conditioned Subspaces
Sub-Topic:Walls

Desired Outcome

Continuous, contiguous, pest and moisture resistant, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0402.2a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

has a sealed class I vapor retarder installed over all bare earth

has all bulk sources of moisture directed away from the subspace walls (i.e. gutters, flashing, grading, drainage)

Objective

Ensure space can be safely insulated

4.0402.2b Material selection

Specification

Select foam insulation that:

has a flame spread/smoke development index of 75/450 or less when tested in accordance with ASTM E 84 or UL 723

is, or include a facing that is, a class II vapor retarder

is non-absorbent

Objective

Select fire safe and moisture resistant materials

4.0402.2c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective sealants

4.0402.2d General preparation

Specification

Ensure wall vapor retarder will lap underneath the ground vapor retarder connection to the foundation wall

Remove any incomplete or unsealed vapor barrier from the foundation wall

Objective

Keep bulk water below vapor retarder and prevent condensation

4.0402.2e Surface preparation

Specification

Remove any protrusions or impediments from the installation area that prevent full contact of insulation with foundation wall surface

Objective

Properly bonded rigid foam installation

4.0402.2f Installation

Specification

Install insulation to prescribed R-value in a continuous layer in full contact with the foundation wall from ceiling to floor

If installing multiple layers, offset seams by a minimum of 12" and seal the seams and joints of each layer before installing the next layer

Objective

Contiguous and continuous thermal barrier

4.0402.2g Attachment

Specification

Attach insulation with mechanical fasteners

Objective

Insulation remains in place

4.0402.2h Sealing

Specification

Seal all seams, joints, connections, etc. of insulation and vapor retarder layer with compatible sealant (i.e., tape, mastic, adhesive)

Seal ground vapor retarder to the insulation vapor retarder with the foundation vapor retarder lapped under the ground vapor retarder

Objective

Airtight and vapor controlled installation

4.0402.2i Termite inspection gap

Specification

If termite pressure exists, maintain a 3" inspection gap from the top of the insulation to the bottom of any wood

Objective

Allow for termite detection

4.0402.2j Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum

wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications and the applicable building code

If space is used for storage or occupancy, foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0402.2k Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0402.3 Closed Crawlspace - SPF Insulation

Section:Insulation
Topic:Conditioned Subspaces
Sub-Topic:Walls

Desired Outcome

Continuous, contiguous, pest and moisture resistant, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0402.3a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

has a sealed class I vapor retarder installed over all bare earth

has all bulk sources of moisture directed away from the subspace walls (i.e., gutters, flashing, grading, drainage)

Objective

Ensure space can be safely insulated

4.0402.3b Material selection

Specification

Select SPF insulation that:

has a flame spread/smoke development index of 75/450 or less when tested in accordance with ASTM E 84 or UL 723

is at least a class II vapor retarder

is closed cell

Objective

Select fire safe and moisture resistant materials

4.0402.3c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective sealants

4.0402.3d General preparation

Specification

Ensure wall vapor retarder will lap underneath the ground vapor retarder connection to the foundation wall

Remove any incomplete or unsealed vapor barrier from the foundation wall

Objective

Keep bulk water below vapor retarder and prevent condensation

4.0402.3e Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause

degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Objective

Properly bonded SPF installation

4.0402.3f Installation

Specification

Install insulation to prescribed R-value in a continuous layer in full contact with the foundation wall from ceiling to floor using a pass thickness maximum in accordance with manufacturer specifications

Install SPF to a thickness of at least a class II vapor retarder

Objective

Continuous thermal barrier which prevents air and moisture vapor movement

4.0402.3g Sealing

Specification

Seal ground vapor retarder to the insulation vapor retarder with the foundation vapor retarder lapped under the ground vapor retarder

Objective

Airtight insulation

4.0402.3h Termite inspection gap

Specification

If termite pressure exists, maintain a 3" inspection gap from the top of the insulation to the bottom of any wood

Objective

Allow for termite detection

4.0402.3i Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0402.3j Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0402.4 Basements - Without Groundwater Leakage

Section:Insulation
Topic:Conditioned Subspaces
Sub-Topic:Walls

Desired Outcome

Continuous, contiguous, moisture resistant, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0402.4a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

has a sealed class I vapor retarder installed over all bare earth

has all bulk sources of moisture directed away from the subspace walls (i.e., gutters, flashing, grading, drainage)

Objective

Ensure space can be safely insulated

4.0402.4b Material selection

Specification

Select insulation that has a flame spread/smoke development index of 25/450 or less when tested in accordance with ASTM E 84 or UL 723 and is not water absorbent

Objective

Fire safe and hydrophobic insulation selected

4.0402.4c Sealant selection

Specification

Select sealants that:

- are compatible with their intended surfaces
- allow for differential expansion and contraction between dissimilar materials
- meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)
- are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective sealants

4.0402.4d General preparation

Specification

Remove any incomplete or unsealed vapor barrier from the foundation wall

Objective

Prevent condensation

4.0402.4e Installation

Specification

Install insulation to prescribed R-value in full contact with the entire perimeter of foundation wall from ceiling to floor

If insulation has a vapor retarder on only one side install it facing the conditioned space

Objective

Contiguous and continuous thermal barrier

4.0402.4f Attachment

Specification

Attach rigid or batt insulation with mechanical fasteners

Objective

Insulation remains in place

4.0402.4g Sealing

Specification

Seal all seams, joints, connections, etc. of insulation on the conditioned side of the assembly, or install a sealed air barrier on the conditioned side of the insulation (e.g., drywall, luan)

Objective

Continuous air barrier on heated side of assembly

4.0402.4h Termite inspection gap

Specification

If termite pressure exists, maintain a 3" inspection gap from the top of the insulation to the bottom of any wood

Objective

Allow for termite detection

4.0402.4i Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0402.4j Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0402.5 Basements - With Groundwater Leakage

Section:Insulation
Topic:Conditioned Subspaces
Sub-Topic:Walls

Desired Outcome

Continuous, contiguous, moisture resistant, and safe thermal boundary that prevents air movement @ 50 Pascals

4.0402.5a Pre-work qualifications

Specification

Verify that installation area is free of:

active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions

energized or undammed knob and tube wiring

uncovered electrical junctions

improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)

unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices

insulation escape openings

Verify that installation area:

is intact, able to support insulation weight, and air sealed

has a sealed class I vapor retarder installed over all bare earth

has all bulk sources of moisture directed away from the subspace walls (i.e., gutters, flashing, grading, drainage)

Objective

Ensure space can be safely insulated

4.0402.5b Material selection

Specification

Select insulation that has a flame spread/smoke development index of 25/450 or less when tested in accordance with ASTM E 84 or UL 723 and is not water absorbent

Objective

Fire safe and hydrophobic insulation selected

4.0402.5c Drainage

Specification

Install a continuous drainage plane at the interior surface of the exterior basement wall or leave an airspace of at least 1/2" between insulated wall assembly and foundation wall from the top of the wall to a drainage field at the bottom of the wall or sub-slab that drains to outdoors

If foundation is rough (i.e., rubble, stone), install a waterproof membrane to which insulation will adhere

Objective

Remove bulk moisture from interior surface of basement wall

4.0402.5d Installation

Specification

Install insulation to prescribed R-value in a continuous boundary around the entire perimeter of foundation wall from top of band joist to floor, in contact with any waterproof membrane that exists at the foundation wall

Objective

Contiguous and continuous thermal barrier

4.0402.5e Termite inspection gap

Specification

If termite pressure exists, maintain a 3" inspection gap from the top of the insulation to the bottom of any wood and if subslab drainage is installed, termite treatment will be performed

Objective

Allow for termite detection

4.0402.5f Attachment

Specification

Attach rigid or batt insulation with mechanical fasteners or other means that has a minimum service life of 20 years

Objective

Insulation remains in place

4.0402.5g Sealing

Specification

Install a continuous air barrier between the foundation and the interior of the basement that spans from the slab to the subfloor above

Seal all seams, joints, connections, etc. of insulation on the conditioned side or create an airtight wall assembly on the conditioned side of the insulation

Objective

Continuous air barrier on heated side of assembly

4.0402.5h Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, spray foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

4.0402.5i Vapor retarders

Specification

Do not install a vapor retarder layer on either side of the wall (e.g., vinyl wallpaper, polyethylene, latex paint)

Objective

Allow wall to dry to the interior

4.0402.5j Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

4.0403.1 Raised and On-Grade Slab Edge Insulation

Section:Insulation
Topic:Conditioned Subspaces
Sub-Topic:Slabs

Desired Outcome

Durable, pest-resistant, thermal break between the slab edge and outdoors

4.0403.1a Pre-work qualifications

Specification

Verify all bulk sources of moisture have been directed away from the slab (i.e., gutters, flashing, grading, drainage)

Wall sill plate and slab edge penetration air sealing is completed

No active pest intrusions exist

Objective

Ensure space can be safely insulated

4.0403.1b Material selection

Specification

Select insulation that is rated for ground contact and is a class I vapor retarder

Objective

Durable insulation selected

4.0403.1c Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

are low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select safe and effective sealants

4.0403.1d General preparation

Specification

Prepare slab edge to receive insulation and/or sealing materials per manufacturer specifications

Objective

Surface ready for insulation and sealant

4.0403.1e Excavation

Specification

Excavate slab edge to prescribed depth and width for installation while avoiding undermining slab footing or damaging underground utilities or drainage

Protect excavation from weather until restored to original condition (e.g., density, drainage function)

Objective

Provide installation access and protect slab and utilities from damage

4.0403.1f Installation

Specification

Install insulation to prescribed R-value in contact with the slab edge, without voids, compressions, or misalignments and tight to any utilities penetrating the slab edge insulation

Objective

Continuous and contiguous thermal boundary

4.0403.1g Flashing

Specification

Install continuous and permanent flashing to direct water away from the foundation and slab edge insulation

Objective

Direct bulk moisture away from slab insulation

4.0403.1h Protective covering

Specification

Cover exposed insulation with a durable, rigid, and pest-resistant material

Objective

Protect insulation from weather and impact

4.0403.1i Sealing and pest protection

Specification

Seal all slab edge penetrations using a compatible sealant

Stuff any gaps 1/4" or greater with copper or stainless steel mesh prior to sealant application

Objective

Airtight and pest-resistant slab edge

4.0403.1j Termites

Specification

Preserve existing termite treatment and inspection gaps as required by applicable codes

Objective

Prevent pest entry and maintain applicable warranties

4.0403.1k Back fill

Specification

Restore excavated earth and grade to drain bulk moisture away from foundation

Objective

Preserve the drainage plane of the slab edge

4.0403.1l Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

5.0101.1 Thermostat Replacement

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Controls

Desired Outcome

Properly functioning and more efficient system

5.0101.1a Pre-Work qualifications

Specification

Verify that sufficient number of thermostat wires is available to meet the needs of the replacement unit and the existing system

Objective

Sufficient wiring exists

5.0101.1b Thermostat selection

Specification

Select a double-setback programmable thermostat that allows for full functionality of the installed system (supplementary heat, emergency heat, fan only, ventilation control, etc.)

Objective

Versatile programmable thermostat that correctly matches system

5.0101.1c Thermostat location

Specification

Install thermostat where it accurately reflects the temperature and humidity of the zone which it controls (i.e., not exposed to extreme temperatures, radiant heat sources, warm/cold walls, or drafts)

Objective

Temperature and humidity measurements accurate for space controlled

5.0101.1d Heat pump considerations

Specification

Connect supplementary heat to second-stage heating terminal in accordance with manufacturer specifications

Install and connect outdoor temperature sensor that is compatible with the thermostat in accordance with manufacturer specifications

Calculate and select an optimum thermal balance point for supplementary heat operation in accordance with ANSI/ACCA Manual S and manufacturer specifications

Objective

Prevent supplementary heat operation when heat pump can meet heating load

5.0101.1e Installer programming

Specification

Program the thermostat to match the equipment and control board settings per manufacturer specifications

Set time delay for fan start in accordance with manufacturer specifications and as appropriate for the climate zone (e.g., no time delay for hot humid climates, longer time delay for cold climates)

Program the thermostat setbacks to a schedule that accommodates the occupant and reduces overall run time

Objective

Thermostat setup to operate existing system correctly

5.0101.1f Penetrations

Specification

Seal penetrations for control wiring with a durable sealant (e.g., caulk, silicone) that complies with applicable fire safety code

Objective

Minimize air leakage, prevent pest intrusion, increase temperature measurement accuracy

5.0101.1g Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions and installer contact information

Objective

Control instructions available for occupant and installer

5.0102.1 Condensate Removal

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Condensate

Desired Outcome

Remove appliance condensation from building and prevent damage to structure

5.0102.1a Condensate disposal

Specification

Convey all condensate from all cooling coils, condensing furnaces, etc. to the exterior of the building

Condensate from condensing furnaces must first pass through a neutralizer if using waste lines for disposal

Objective

Condensate safely drained to exterior

5.0102.1b Connections

Specification

Seal all piping that conveys condensate

Objective

Leak free condensate piping

5.0102.1c Slope

Specification

Install condensate piping with not less than 1/8" per foot (1% slope) towards the termination point

Objective

Condensate drains toward termination

5.0102.1d Vents and traps

Specification

Install vents and traps on condensate drain lines in accordance with manufacturer specifications and applicable building code and in a manner that allows for cleaning of condensate lines without cutting the existing pipe

Objective

Condensate drain operates as intended

5.0102.1e Secondary drain pan

Specification

Install a secondary drain pan under all condensing appliances installed in or above conditioned space and where water damage may occur to the structure

Install an independent condensate drain for the secondary drain pan that drains to a visible termination location

Slope drain pan towards the condensate drain

Objective

Prevent water damage to dwelling

5.0102.1f Float switches

Specification

Install a float switch in the primary and secondary drain pan that is interlocked with the system power circuit and will break the circuit when drainage fails to remove condensate

Objective

Stop system operation if condensate is not draining

5.0102.1g Insulation

Specification

When there is potential for condensation or freezing of the drain line, insulate condensate drain lines to a minimum of R-4 with insulation that contains a Class II or greater vapor retarder

Objective

Prevent freezing and condensation on pipes

5.0102.1h Pumps

Specification

Install condensate drain pumps when condensate cannot be drained by gravity

Objective

Convey condensate to exterior without gravity assistance

5.0102.1i Exterior termination

Specification

If termination of condensate drain is to the outdoors, direct it downwards with an elbow fitting at the end of the exterior termination

Objective

Condensate drains to exterior and away from building

5.0103.1 Refrigerant Lines

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Refrigerant Loop

Desired Outcome

Leak free, safe, efficient, effective, and compliant refrigerant line installation

5.0103.1a Material selection

Specification

Select only manufacturer and code approved (e.g., IRC, IMC) refrigerant lines, fittings, etc.

Objective

Choose safe and compliant materials

5.0103.1b Sizing

Specification

Size refrigerant lines in accordance with manufacturer specifications for the installed equipment

Objective

Piping moves appropriate volume of refrigerant without increasing compressor load

5.0103.1c Installation

Specification

Install refrigerant lines without kinks, crimps, or excessive bends

Route lines in a manner that protects it from damage by workers and occupants

Join lines using manufacturer-approved method(s)

Install proper filter dryer(s) on all systems

Install P-traps on suction line risers that are greater than 10' in height

Use manufacturer specifications to determine appropriate lengths and elevations of refrigerant lines between condensing units and indoor coils

Objective

Durable, safe piping that moves appropriate volume of refrigerant and protects compressor functionality

5.0103.1d Insulation

Specification

Insulate all suction lines to a minimum of R-4 with an insulation that is a class II or better vapor retarder

Insulate all high pressure lines that pass through spaces where condensation may occur to a minimum of R-4 with an insulation that is a class II or better vapor retarder

Seal all seams, joints, etc. of insulation using compatible material (e.g., tape)

Install UV-resistant insulation on exterior lines or protected insulation from UV degradation

Objective

Prevent excessive heat gain, condensation and UV degradation

5.0103.1e Support

Specification

Secure and support refrigerant lines according to applicable code and in a manner that protects the line from damage by workers or occupants

Objective

Prevent excessive line movement

5.0103.1f Protection

Specification

If refrigerant lines are installed where they may be contacted by vehicles, people, tree limbs, etc., install a rigid sleeve or pipe duct over them that provides adequate impact protection

Objective

Lines protected from impact damage

5.0103.1g Locking refrigerant caps

Specification

Install locking refrigerant caps on all refrigerant access ports

Objective

Protect occupants and the environment from unintentional refrigerant discharge or theft

5.0103.2 Refrigerant Charge

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Refrigerant Loop

Desired Outcome

Properly charged system

5.0103.2a Pre-work qualifications

Specification

Before adjusting refrigerant to system verify that:

system is leak free

air flow of system is correct

indoor and outdoor temperatures are within allowable range for refrigerant charge testing

Objective

Prevent inaccurate refrigerant charging

5.0103.2b Charge

Specification

Base refrigerant charge on manufacturer specifications for the equipment being serviced

Weigh in calculated refrigerant charge if outdoor conditions prevent accurate pressure measurements according to manufacturer specifications

Objective

Accurate refrigerant charge

5.0103.2c Documentation

Specification

Provide occupant/owner with refrigerant charge documentation according to ANSI/ACCA Standard 5 (HVAC Quality Installation)

Objective

Provide occupant and service technicians with previous refrigerant charge information

5.0103.3 Thermostatic Expansion Valve (TXV)

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Refrigerant Loop

Desired Outcome

Ensure thermostatic expansion valve (TXV) operates as designed

5.0103.3a Material selection

Specification

Select properly sized and configured TXV based on manufacturer specifications

Objective

Select efficient and compatible components

5.0103.3b Replacement

Specification

Install in compliance with manufacturer specifications

Objective

Safe and efficient system operation

5.0104.1 New Duct Components

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Duct Installation

Desired Outcome

Efficient, quiet, and optimal air flow, provided through safe, durable, and sealed ducts that do not have visible air leakage @ 25 pascals

5.0104.1a Material selection

Specification

Select insulation:

with a flame spread and smoke development index of 25/50 when tested in accordance with ASTM E84 or UL 723 and that includes an exterior vapor retarder layer

Select duct materials:

with a flame spread of no more than 25 when tested in accordance with ASTM E84 or UL 723 and that are UL 181, SMACNA, NAIMA approved or conform to ASTM A653

Objective

Select durable and safe materials

5.0104.1b General preparation

Specification

Remove all old ductwork and duct insulation from the premises

Objective

Old duct materials disposed of off premises

5.0104.1c Duct design

Specification

Design residential duct systems using friction charts and ANSI/ACCA Manual D (Residential Duct Systems) or equivalents

Do not use building cavities as ductwork under any situation

Route ducts so that standard service and repair to the building and its systems does not damage the ducts

Objective

Maximize air flow

5.0104.1d Termination design

Specification

Design supply terminations to be capable of delivering air with the proper speed and throw to cover the entire space they serve and that do not produce noticeable flow noise when system is operating at full speed

Design return grille gross area to be equal to or larger than return box

Objective

Appropriate level of air mixing, air flow, and occupant comfort

5.0104.1e Protection

Specification

During renovation or construction, block registers, grilles, and diffusers with a durable material

Do not use duct system until construction is finished

Objective

Protect equipment and ducts from damage and debris collection

5.0104.1f Exterior duct construction

Specification

For exterior ducts (i.e., exposed to outdoors), use duct material that meets the following criteria:

insulation level of R-12 or greater

includes a weatherproof barrier that is resistant to ultraviolet light damage

will not be damaged by weather

Objective

Prevent condensation, reduce thermal loss or gain, protected from elements

5.0104.1g Plenums

Specification

When a 90 degree turn is required in the plenum, use radius elbow fittings or square fittings with turning vanes

Supply plenum must be the same size or larger than the air handler supply opening

If equipment is installed on top of the return plenum, plenum platform must independently support the weight of the equipment

Objective

Minimize static pressure and maximize air flow

5.0104.1h Reducers

Specification

Install reducers between sections of different size ducts in accordance with existing standards based on duct material (e.g., SMACNA, NAIMA)

Objective

Minimize static pressure and maximize air flow

5.0104.1i Supply branches

Specification

Install runs as short as possible

Objective

Minimize static pressure and maximize air flow

5.0104.1j Take-offs

Specification

Install take-offs onto the trunk in accordance with duct construction standards (SMACNA)

Install take-offs using mechanical fasteners for all applications

Take-offs that create high turbulence will not be used (e.g., elbows with integrated dampers, scoops)

Objective

Minimize static pressure and maximize air flow

5.0104.1k Flexible ducts

Specification

Install flexible duct as straight as possible and fully stretched without unnecessary sagging, crimping, or bends

Do not bend flexible duct more than 45 degrees without using a rigid elbow

Use a rigid connector when joining two pieces of flexible duct together

Objective

Minimize static pressure and maximize air flow

5.0104.1l Boots

Specification

Use boots with a directional collar (e.g., 45 degree elbow) whenever ducting turns directly after the boot connection

If using straight boots, connect an elbow to the boot before connecting the duct

Do not connect flexible duct directly to a straight boot if it turns more than 15 degrees within 6' of boot connection

Objective

Minimize static pressure and maximize air flow

5.0104.1m Fire protection

Specification

Install fire dampers and ductwork in accordance with applicable fire code

Install smoke alarms inside duct plenums that convey more than 2500 cfm

Seal ductwork penetrations through fire rated surfaces according to applicable code requirements for the surface

Objective

Meet applicable fire code and provide functional smoke detection

5.0104.1n Air filtration

Specification

Install accessible filter grills that have no air bypass around the filters

Install filter slot covers to prevent return air leakage

Avoid filters with high static pressure drop unless system is designed for them

Objective

Protect equipment from dirt and debris and allow proper airflow

5.0104.1o Room pressure balancing

Specification

Room-to-room pressure differences shall not exceed 3 pascals with the air handler running

Install appropriate means of pressure balancing if necessary (e.g., transfer grilles, jumper ducts, individual room returns)

Objective

Unrestricted air flow, minimize shell leakage caused by duct system, prevent interference with combustion appliance function

5.0104.1p Sealing

Specification

Seal all ducts in accordance with SWS Subtopic "Duct Sealing"

Seal ductwork penetrations through interior walls with a durable and compatible sealant (e.g., caulk, silicone)

Objective

Visibly sealed ducts and penetrations

5.0104.1q Fastening

Specification

Fasten duct connections in accordance with SWS detail "Duct Repair: Mechanical Fastening"

Objective

Durable duct connection

5.0104.1r Support

Specification

Support ducts in accordance with SWS detail "Duct Repair: Duct Support"

Objective

Durably supported ducts

5.0104.1s Insulation

Specification

Insulated ducts in accordance with SWS Detail "General Duct Insulation"

Objective

Properly insulated and condensation resistant ducts

5.0104.1t Manual volume dampers

Specification

Install dampers as close to the trunk as possible and in accessible locations to the fullest extent possible

Objective

Volume dampers are accessible after interior finishes are installed

5.0105.1 Mechanical Fastening

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Duct Repair

Desired Outcome

Ducts securely fastened

5.0105.1a Metal to metal

Specification

Fasten ducts with a minimum of three equally spaced galvanized or stainless steel mechanical fasteners

Objective

Durable joints

5.0105.1b Flex to metal

Specification

Fasten ducts with UL 181 approved tie bands using a tie band tensioning tool

Objective

Durable and sealed joints

5.0105.1c Flex to flex

Specification

Install a rigid metal coupling of the same size as the flex duct between the two sections

Fasten both joints with UL 181 approved tie bands using a tie band tensioning tool

Objective

Durable flex duct connections

5.0105.1d Duct board to duct board

Specification

Cut duct board edges to create an overlapping joint on all contact surfaces

Fasten joints with outward clinching (stitch) staples spaced every 2"

Cover joint with UL 181 rated mastic embedded fiber tape and additional mastic that laps at least 1" past the edges of the tape on all sides

Objective

Durable and sealed joints

5.0105.1e Duct board to flexible duct

Specification

Install a metal take-off collar on the duct board specifically designed for the thickness of the duct board

Bend all finger tabs down securely so collar shank is firmly seated against the exterior surface

Attach flexible duct to collar with UL 181 approved tie bands using a tie band tensioning tool

Objective

Durable take-off duct attachment

5.0105.1f Duct board to metal

Specification

Fasten duct board to metal duct using metal channel and mechanical fasteners spaced evenly on all sides

Cover connection joint with UL 181 rated mastic embedded fiber tape and additional mastic that laps at least 1" past the edges of the tape on all sides

Objective

Durable and sealed duct connection

5.0105.1g Duct board plenum to air handler cabinet

Specification

Fasten duct board to air handler cabinet using metal channel fastened with screws spaced a maximum of 6" with the duct board sandwiched between the channel flanges

In upflow air handler connections, install a flexible connection between supply plenum and unit that does not reduce the inside dimensions of the duct

Objective

Durable connection that reduce duct vibration and optimize airflow

5.0105.1h Duct boot to subfloor

Specification

Fasten boot to wood using a minimum of 1 stainless steel or galvanized fastener per side

Objective

Durable boot to subfloor connection

5.0105.1i Duct boot to gypsum

Specification

If accessible, fasten a boot hanger to adjacent framing with mechanical fasteners

Connect boot to hanger with mechanical fasteners

If inaccessible, fasten boot to gypsum with UL 181 rated fiber tape and mastic

Objective

Durable boot to gypsum connection

5.0105.1j Metal plenum to air handler cabinet

Specification

Install a flexible connection between plenum and unit that does not reduce the inside dimensions of the duct

Fasten plenum on all sides with mechanical fasteners spaces no more than every 6"

Objective

Durable joints that reduce duct vibration and optimize airflow

5.0105.2 Duct Support

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Duct Repair

Desired Outcome

Ducts properly and durably supported

5.0105.2a Flex duct and duct board support

Specification

Support flexible and duct board ducts and plenums with 1-1/2" wide or greater material, installed every 4' or less, without crimping or pinching the ductwork or reducing the interior dimensions

Ducts must never contact the ground

Objective

Ducts securely supported without causing interior dimensions to be reduced or allowing moisture damage

5.0105.2b Metal duct support

Specification

Support metal ducts with 1/2" wide or greater eighteen gauge metal straps, 12-gauge galvanized wire, or metal rods every 10' or less

Ducts must never contact the ground

Objective

Ducts securely supported and protected from corrosion

5.0105.2c Plenum support

Specification

Support upflow supply plenums or downflow return plenums independently from the air handler attachment

Objective

Prevent plenum sagging or excessive movement

5.0106.1 General Duct Sealing

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Duct Sealing

Desired Outcome

Ducts sealed to prevent air leakage without interfering with volume or fire damper operation

5.0106.1a Sealant selection

Specification

Select only UL 181 approved materials that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)

Select low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols

Objective

Select durable and safe duct sealant

5.0106.1b Access ducts

Specification

Clear surrounding insulation to expose joints being sealed, salvage for reuse if possible

If duct must be cut open to gain access, position the hole to make repair with appropriate materials feasible

Objective

Gain access while maintaining insulation value

5.0106.1c Surface preparation

Specification

Remove loose debris using a vacuum

Remove any substance that will prevent sealant adhesion (tape, oil, etc.) using appropriate solvent.

Objective

Sealant adheres to surface

5.0106.1d Securely fasten ducts

Specification

Securely fasten all duct connections using appropriate mechanical fasteners according to the SWS detail "Ducts: Mechanical Fastening"

Objective

Prevent catastrophic duct sealing failure

5.0106.1e General sealing

Specification

Seal all accessible seams, cracks, joints, holes, and penetrations of duct system

Select method according to physical leak size

Objective

Eliminate duct leakage

5.0106.1f Seal leaks less than 1/4"

Specification

Seal leaks less than 1/4" using fiberglass mesh and mastic

Mastic alone is acceptable for holes less than 1/8" in size that are more than 10' from air handler if static operating pressure is less than 1" of Water Column

Objective

Eliminate minor duct leakage

5.0106.1g Seal leaks between 1/4" and 3/4"

Specification

Seal leaks between 1/4" and 3/4" using a two stage process:

Install temporary tape as a backing material

Seal with fiberglass mesh and mastic that extends at least 1" past the temporary tape on all sides

Objective

Eliminate major duct leakage

5.0106.1h Seal leaks greater than 3/4"

Specification

Repair leaks larger than 3/4" using a rigid duct patch

Mechanically fasten patch before applying mastic

Install fiberglass mesh and mastic over the seam, overlapping repair joint by at least 1" on all sides

Objective

Eliminate catastrophic duct leakage

5.0106.1i Duct boots

Specification

Seal gaps between boot and surface connections using fiberglass mesh tape and mastic or appropriate flexible caulking

Ensure sealant is dry before reinstalling the register

Ensure the register can be removed and reinstalled by the dwelling occupant

Objective

Eliminate duct leakage around duct boot connections, but maintain boot access

5.0106.1j Air handler jacket

Specification

Seal any joints, cracks, and holes that are not gasketed or weatherstripped and are not needed for proper function or service of the unit using removable sealant (e.g., foil tape, gaskets, etc.)

Objective

Eliminate air handler leakage

5.0106.1k Filter slot

Specification

Seal the filter slot with a durable, client removable filter slot cover (e.g., magnetic strip)

Objective

Eliminate duct leakage at air filter location without inhibiting access to filter

5.0106.2 Duct Sealing - Spray Polyurethane Foam (SPF)

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Duct Sealing

Desired Outcome

Ducts safely sealed to prevent air leakage

5.0106.2a Material selection

Specification

Select SPF that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723 at its installed thickness

Objective

Select fire safe insulation

5.0106.2b Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Cover all holes, cracks, gaps, etc. where SPF may enter the interior of the duct with a temporary backing material (e.g., foil tape)

Objective

Properly bonded SPF only on the exterior of ducts

5.0106.2c Installation

Specification

Apply SPF to the prescribed R-value in a continuous layer over entire exterior duct surface using a pass thickness maximum in accordance with manufacturer specifications

No SPF may be installed on ducts inside the thermal boundary

Objective

Airtight ducts that do not threaten indoor air quality

5.0106.2d Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, spray foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

5.0106.3 Duct Sealing - Proprietary Spray Application

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Duct Sealing

Desired Outcome

Ducts safely sealed to prevent air leakage

5.0106.3a Material selection

Specification

Select sealant that is UL 181 approved

Objective

Select safe and effective sealant

5.0106.3b Surface preparation

Specification

Prepare the installation surface in accordance with manufacturer specifications

Objective

Sealant fully bonded with installation surface

5.0106.3c Installation

Specification

Install sealant in accordance with manufacturer specifications and UL 181, NFPA 90A, and NFPA 90B

Objective

Airtight and compliant duct seal

5.0107.1 General Duct Insulation

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Duct Insulation

Desired Outcome

Properly insulated and condensation resistant ducts

5.0107.1a Material selection

Specification

Select insulation with a flame spread and smoke development index of 25/50 when tested in accordance with ASTM E84 or UL 723

Select insulation that includes an exterior vapor retarder layer

Objective

Select durable and safe materials that prevent condensation

5.0107.1b General preparation

Specification

Remove damaged or wet duct insulation from premises

Verify ductwork is sealed before insulating

Objective

Damaged materials properly disposed and ductwork sealed before insulating

5.0107.1c Insulation value

Specification

Insulate all ducts outside the thermal boundary to a minimum of R-8

Insulate all ducts exposed to the exterior to a minimum of R-12

Objective

Location appropriate insulation value

5.0107.1d Attachment

Specification

Secure blanket insulation in full contact with the duct surface using mechanical fasteners (e.g., stick pins, metal wire)

Secure reflective insulation to duct in compliance with manufacturer specifications including required air spaces

Objective

Insulation durably fastened

5.0107.1e Sealing

Specification

Seal all seams and connections of the duct insulation using UL 181 approved tape so that no gaps exist in the vapor retarder

Objective

Prevent condensation

5.0107.1f Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

If reflective exterior insulation is used the documentation must include the number and width of included air spaces

Objective

Comply with 16 CFR 460.17 and document contract compliance

5.0107.2 Duct Insulation - Spray Polyurethane Foam (SPF)

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Duct Insulation

Desired Outcome

Safe and durable SPF duct insulation

5.0107.2a Material selection

Specification

Select SPF that has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723 at its installed thickness

Objective

Select fire safe insulation

5.0107.2b Surface preparation

Specification

Remove contaminants from all SPF application surfaces that will prevent full adhesion or cause degradation

Verify all SPF application surfaces are in accordance with manufacturer specifications for moisture content and temperature

Cover all holes, cracks, gaps, etc. where SPF may enter the interior of the duct with a temporary backing material (e.g., foil tape)

Objective

Properly bonded SPF only on the exterior of ducts

5.0107.2c Installation

Specification

Apply SPF to the prescribed R-value in a continuous layer over entire exterior duct surface using a pass thickness maximum in accordance with manufacturer specifications

No SPF may be installed on ducts inside the thermal boundary

Objective

Airtight and properly insulated ducts that do not threaten indoor air quality

5.0107.2d Ignition and thermal barriers

Specification

Separate all foam products from living space with a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code

If space is used only for the service of utilities, foam will be separated from the space using a suitable ignition barrier covering or coating according to manufacturer's specifications

If space is used for storage or occupancy, spray foam will be separated from the space using a thermal barrier material (e.g., 1/2" gypsum wallboard) as specified by applicable building code and manufacturer

specifications

If code requirements are unclear, consult local code officials for clarification

Objective

Minimize ignition and combustion potential

5.0107.2e Insulation - onsite documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

5.0108.1 Air-to-Air Split System

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Equipment Installation

Desired Outcome

Safe, compliant, efficient, and effective system installation in which sequence of operation is correct

5.0108.1a Load calculation

Specification

Perform residential load calculation in accordance with the current version of ANSI/ACCA Manual J (Residential Load Calculation) or equivalent using interior design temperatures of 75 degrees for cooling and 70 degrees for heating

Perform commercial load calculation in accordance with the current version of ANSI/ACCA Manual N (Commercial Load Calculation) or equivalent using interior design temperatures of 75 degrees for cooling and 70 degrees for heating

Room by room load calculations will be performed when installing a new duct system or in retro-commissioning projects

Calculated loads based on post-retrofit dwelling characteristics

Objective

Equipment design load calculated correctly for post-retrofit dwelling

5.0108.1b Equipment selection

Specification

Select residential equipment in accordance with the current version of ANSI/ACCA Manual S (Residential Equipment Selection) or equivalent

Select commercial equipment in accordance with the current version of ANSI/ACCA Manual CS (Commercial Applications, Systems and Equipment) or equivalent

Select cooling equipment capable of meeting the sensible and latent load of the building that is not sized more than 115% of total load or next available size

Select heating equipment of the lowest capacity required to meet the design heating load and provide the air volume required by any air conditioning equipment installed

Select system that is ENERGY STAR certified or equivalent

Select outdoor units that are corrosion-protected for marine climate zones

Objective

Select efficient equipment capable of meeting the design loads

5.0108.1c Outdoor unit location

Specification

Locate unit to provide clearance on all sides and top according to manufacturer specifications and service access according to applicable code

Objective

Locate outdoor unit to facilitate air-flow and service access

5.0108.1d Outdoor unit support

Specification

Situate outdoor unit on a non-wicking equipment pad

Ensure unit is level, stable, and elevated a minimum of 6" above the ground

Objective

Stable outdoor unit that is protected from corrosion

5.0108.1e Outdoor unit installation

Specification

Install outdoor unit according to manufacturer specifications and applicable building code (e.g., IRC, IMC, IBC) and ANSI/ACCA Standard 5 (HVAC Quality Installation Standard)

Objective

Safe and compliant installation

5.0108.1f Indoor unit location

Specification

Locate unit in a dry location and within conditioned space (when feasible) that provides adequate service access according to manufacturer specifications and applicable code

Objective

Protect unit from corrosion and thermal loss and facilitate service access

5.0108.1g Indoor unit installation

Specification

Install outdoor unit according to manufacturer specifications and applicable building code (e.g., IRC, IMC, IBC) and ANSI/ACCA Standard 5 (HVAC Quality Installation Standard)

Install fuel delivery to the unit according to SWS Subtopic "Fuel Delivery"

Objective

Safe, accessible, stable, and properly installed indoor unit with safe and durable fuel supply

5.0108.1h Support - all installations

Specification

Ensure unit is level, stable, secured to ductwork, properly braced to prevent movement (seismic bracing), and elevated as required by applicable building code

Objective

Safe, stable, and durably supported indoor unit

5.0108.1i Support - horizontal air flow in attic

Specification

Support equipment on a fireproof platform that is elevated above the insulation level or suspend with threaded rod in accordance with local codes and manufacturer specifications

Install vibration pads/isolators according to manufacturer specifications

Objective

Equipment is safe, stable, level, and does not transmit vibration or reduce attic insulation level

5.0108.1j Support - horizontal air flow in subspace

Specification

Support equipment on a nonwicking, fireproof material or suspend with threaded rod in accordance with local codes and manufacturer specifications

Install vibration pads/isolators according to manufacturer specifications

Objective

Equipment is safe, stable, level, and does not transmit vibration or corrode

5.0108.1k Support - upflow on a platform

Specification

Support equipment on a durable, fireproof platform capable of supporting the weight of the equipment

Install vibration pads/isolators according to manufacturer specifications

Objective

Equipment is safe, stable, level, and does not transmit vibration or corrode

5.0108.1l Support - downflow

Specification

Support equipment on ductwork capable of supporting the weight of the equipment

Objective

Equipment is safe, stable, and level

5.0108.1m Connections

Specification

Install equipment connections (e.g., electrical service, condensate drains, ductwork, fuel, venting, refrigerant lines) to allow for necessary service and repair access to all portions of the equipment

Objective

Connections do not interfere with operation and service of equipment

5.0108.1n Intakes/terminations

Specification

Locate all intakes/terminations in compliance with manufacturer specifications and applicable building code

Objective

System intakes/terminations that are operational, safe, and compliant

5.0108.1o Condensate drainage

Specification

Install a secondary drain pan with a float switch interlocked to the cooling system power under all units that exist in or above conditioned space

Pipe condensate to a properly sized sanitary drain or the outdoors and provide with traps as specified by the manufacturer and applicable building code

When there is potential for condensation or freezing of the drain line, insulate condensate drain lines to a minimum of R-4 with insulation that contains a Class II or greater vapor retarder

Objective

Prevent water damage and drain condensate through functional drains to an approved location

5.0108.1p Electrical wiring

Specification

Install electrical wiring according to NFPA 70, and

Provide an electrical disconnect within site of the unit

Install all high voltage wiring inside of protective conduit and approved junction boxes, no wiring connections (high or low voltage) will occur outside of appropriate junction box

Objective

Safe and compliant electrical wiring installation

5.0108.1q Refrigerant lines and charge

Specification

Install refrigerant piping according to SWS detail "Refrigerant Lines"

Install refrigerant charge according to SWS detail "Refrigerant Charge"

Objective

Safe, and effective refrigerant installation

5.0108.1r Fire protection

Specification

Install smoke detectors inside the supply duct plenum of systems that move more than 2,500 cubic feet per minute (CFM) in accordance with the applicable building code

Objective

Operational fire warning system in place

5.0108.1s Air handler sealing

Specification

Seal air handler and adjoining ductwork in accordance with SWS Subtopic "Duct Sealing"

If air handler is installed in a building cavity (i.e., closet), seal the cavity to eliminate any return air leaks from adjoining chases

Objective

Air handler leakage less than 1% of system airflow

5.0108.1t Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Provide occupants and service technicians with instructions

5.0108.2 Air-to-Air Package Unit

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Equipment Installation

Desired Outcome

Safe, compliant, efficient, and effective system installation in which sequence of operation is correct

5.0108.2a Load calculation

Specification

Perform residential load calculation in accordance with the current version of ANSI/ACCA Manual J (Residential Load Calculation) or equivalent using interior design temperatures of 75 degrees for cooling and 70 degrees for heating

Perform commercial load calculation in accordance with the current version of ANSI/ACCA Manual N (Commercial Load Calculation) or equivalent using interior design temperatures of 75 degrees for cooling and 70 degrees for heating

Room by room load calculations will be performed when installing a new duct system or in retro-commissioning projects

Calculated loads based on post-retrofit dwelling characteristics

Objective

Equipment design load calculated correctly for post-retrofit dwelling

5.0108.2b Equipment selection

Specification

Select residential equipment in accordance with the current version of ANSI/ACCA Manual S (Residential Equipment Selection) or equivalent

Select commercial equipment in accordance with the current version of ANSI/ACCA Manual CS (Commercial Applications, Systems and Equipment) or equivalent

Select cooling equipment capable of meeting the sensible and latent load of the building that is not sized more than 115% of total load or next available size

Select heating equipment of the lowest capacity required to meet the design heating load and provide the air movement required by any air conditioning equipment installed

Select system that is ENERGY STAR certified or equivalent

Select outdoor units that are corrosion-protected for marine climate zones

Objective

Select equipment capable of meeting the design loads

5.0108.2c Unit location

Specification

Locate unit to provide clearance on all sides and top according to manufacturer specifications and service access according to applicable code

Objective

Locate outdoor unit to facilitate air-flow and service access

5.0108.2d Unit support

Specification

Situate outdoor unit on a non-wicking equipment pad

Ensure unit is level, stable, and secured to ductwork

Objective

Stable unit that is protected from corrosion

5.0108.2e Unit installation

Specification

Install outdoor unit according to manufacturer specifications and applicable building code (e.g., IRC, IMC, IBC) and ANSI/ACCA Standard 5 (HVAC Quality Installation Standard)

Install fuel delivery to the unit according to SWS Subtopic "Fuel Delivery"

Objective

Safe and compliant installation with safe and durable fuel supply

5.0108.2f Electrical wiring

Specification

Install electrical wiring according to NFPA 70, and

Provide an electrical disconnect within site of the unit

Install all high voltage wiring inside of protective conduit and approved junction boxes, no wiring connections (high or low voltage) will occur outside of appropriate junction box

Objective

Safe and compliant electrical wiring installation

5.0108.2g Refrigerant lines and charge

Specification

Install refrigerant piping according to SWS detail "Refrigerant Lines"

Install refrigerant charge according to SWS detail "Refrigerant Charge"

Objective

Safe, and effective refrigerant installation

5.0108.2h Connections

Specification

Install equipment connections (e.g., electrical service, condensate drains, ductwork, fuel, venting, refrigerant lines) to allow for necessary service and repair access to all portions of the equipment

Objective

Connections do not interfere with operation and service of equipment

5.0108.2i Outdoor ductwork

Specification

Install exterior ductwork using rigid, corrosion-resistant metal insulated to a minimum of R-12

Objective

Durable, pest-resistant, and insulated exterior ductwork

5.0108.2j Intakes/terminations

Specification

Locate all intakes/terminations in compliance with manufacturer specifications and applicable building code

Objective

System intakes/terminations that are operational, safe, and compliant

5.0108.2k Condensate drainage

Specification

Pipe condensate to a safe outdoor location where it is drained without contacting the outdoor unit and provide the condensate piping with traps as specified by the manufacturer and applicable building code

When there is potential for freezing of the drain line, insulate condensate drain lines to a minimum of R-4 with insulation that contains a Class II or greater vapor retarder

Objective

Drain condensate away from unit and prevent damage

5.0108.2l Fire protection

Specification

Install smoke detectors inside the supply duct plenum of systems that move more than 2,500 cubic feet per minute (CFM) in accordance with the applicable building code

Objective

Operational fire warning system in place

5.0108.2m Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Provide occupants and service technicians with instructions

5.0108.3 Mini-Split System

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Equipment Installation

Desired Outcome

Safe, compliant, efficient, and effective system installation in which sequence of operation is correct

5.0108.3a Load calculation

Specification

Perform residential load calculation in accordance with the current version of ANSI/ACCA Manual J (Residential Load Calculation) or equivalent using interior design temperatures of 75 degrees for cooling and 70 degrees for heating

Perform commercial load calculation in accordance with the current version of ANSI/ACCA Manual N (Commercial Load Calculation) or equivalent using interior design temperatures of 75 degrees for cooling and 70 degrees for heating

Room by room load calculations will be performed when installing multiple indoor units

Calculated loads based on post-retrofit dwelling characteristics

Objective

Equipment design load calculated correctly for post-retrofit dwelling

5.0108.3b Equipment selection

Specification

Select residential equipment in accordance with the current version of ANSI/ACCA Manual S (Residential Equipment Selection) or equivalent

Select commercial equipment in accordance with the current version of ANSI/ACCA Manual CS (Commercial Applications, Systems and Equipment) or equivalent

Select system that is ENERGY STAR certified or equivalent

Select outdoor units that are corrosion-protected for marine climate zones

When applicable, supply multiple indoor units with a single outdoor unit using manufacturer specifications to determine allowable overage of indoor unit capacity in relation to the outdoor unit and derated capacity of indoor units based on outdoor design temperature

When applicable, select units that offer ducting options (e.g., ceiling cassette units have a knock out for a 5" or 6" duct) and/or have an outdoor air intake

Objective

Select equipment capable of meeting the design loads

Equipment operates at optimal efficiency and reduced cost

5.0108.3c Outdoor unit location

Specification

Locate unit with manufacturer recommended clearance on all sides and to allow service access according to applicable code

Objective

Outdoor unit located to facilitate air-flow and service access

5.0108.3d Outdoor unit support

Specification

Situate outdoor unit on a non-wicking equipment pad

Ensure unit is level, plumb, stable, and elevated a minimum of 6" above snow line

Objective

Stable outdoor unit that is protected from corrosion

5.0108.3e Outdoor unit installation

Specification

Install outdoor unit according to manufacturer specifications and applicable building code (e.g., IRC, IMC, IBC) and ANSI/ACCA Standard 5 (HVAC Quality Installation Standard)

Objective

Safe and compliant installation

5.0108.3f Indoor unit location

Specification

Locate indoor unit(s) to provide effective airflow to desired locations without exceeding the manufacturer specifications for refrigerant line total length

Maintain clearances in accordance with manufacturer specifications

Objective

Effective location selected for indoor unit(s)

5.0108.3g Indoor unit(s) installation

Specification

Install indoor unit(s) according to manufacturer specifications and applicable building code (e.g., IRC, IMC, IBC) and ANSI/ACCA Standard 5 (HVAC Quality Installation Standard)

Objective

Safe, effective, and compliant installation

5.0108.3h Ceiling cassette insulation

Specification

Insulate concealed ceiling cassette unit(s) to a minimum of R-6 when contained inside a building cavity, (even when inside the thermal boundary) without hindering access to serviceable parts

Insulation must include a sealed vapor retarder layer

Objective

Prevent water damage to structure

5.0108.3i Indoor unit(s) support

Specification

Securely mount indoor unit(s) according to manufacturer specifications ensuring condensate drainage is correctly sloped

Objective

Securely mounted with properly functioning drain pan

5.0108.3j Electrical wiring

Specification

Install electrical wiring according to NFPA 70, and

Provide an electrical disconnect within site of the outdoor unit

Install all high voltage wiring inside of protective conduit and approved junction boxes, no wiring connections (high or low voltage) will occur outside of appropriate junction box

Objective

Safe and compliant electrical wiring installation

5.0108.3k Intakes/terminations

Specification

Locate all intakes/terminations in compliance with manufacturer specifications and applicable building code

Objective

System intakes/terminations that are operational, safe, and compliant

5.0108.3l Connections

Specification

Install equipment connections (e.g., electrical service, condensate drains, ductwork, refrigerant lines) to

allow for necessary service and repair access to all portions of the equipment

Objective

Equipment connections do not interfere with operation and service of equipment

5.0108.3m Ducting

Specification

When applicable, install ducting per the manufacturer specifications in runs that do not exceed 6' per run

Insulate all ducts, including those inside the thermal boundary, to a minimum of R-6 with insulation that includes a sealed vapor barrier

Objective

Low static pressure ducts that are condensation-resistant

5.0108.3n Refrigerant piping

Specification

Total equivalent length of refrigerant piping will not exceed system manufacturer specifications

Install refrigerant piping according to SWS detail "Refrigerant Piping"

Install refrigerant charge according to SWS detail "Refrigerant Charge"

Objective

Safe and effective refrigerant piping

5.0108.3o Controls

Specification

Install wall mounted thermostats that are not within the direct airflow of the indoor unit

Objective

Independent system controls that are not affected by supply air

5.0108.3p Condensate

Specification

Install an independent condensate drain for each indoor unit according to SWS for "Condensate Disposal"

Install a float switch in the drain pan that interlocks with the cooling system power to turn unit off when pan is not draining

Pipe condensate to a properly sized sanitary drain or the outdoors

When there is potential for condensation or freezing of the drain line, insulate condensate drain lines to a minimum of R-4 with insulation that contains a Class II or greater vapor retarder

Objective

Independent and functional condensate drainage that prevents water damage

5.0108.3q Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Provide occupants and service technicians with instructions

5.0108.4 Furnaces

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Equipment Installation

Desired Outcome

Safe, compliant, efficient, and effective system installation in which sequence of operation is correct

5.0108.4a Load calculation

Specification

Perform residential load calculation in accordance with the current version of ANSI/ACCA Manual J (Residential Load Calculation) or equivalent using interior design temperatures of 70 degrees for heating

Perform commercial load calculation in accordance with the current version of ANSI/ACCA Manual N (Commercial Load Calculation) or equivalent using interior design temperatures of 70 degrees for heating

Room by room load calculations will be performed when installing a new duct system or in retro-commissioning projects

Calculated loads based on post-retrofit dwelling characteristics

Objective

Equipment design load calculated correctly for post-retrofit dwelling

5.0108.4b Equipment selection

Specification

Select residential equipment in accordance with the current version of ANSI/ACCA Manual S (Residential Equipment Selection) or equivalent

Select commercial equipment in accordance with the current version of ANSI/ACCA Manual CS (Commercial Applications, Systems and Equipment) or equivalent

Select heating equipment of the lowest capacity required to meet the design heating load and provide the air movement required by any air conditioning equipment installed

Select system that is ENERGY STAR certified or equivalent

Objective

Select efficient equipment capable of meeting the design loads

5.0108.4c Indoor unit location

Specification

Locate unit in a dry location and within conditioned space (when feasible) that provides adequate service access according to manufacturer specifications and applicable code

Objective

Protect unit from corrosion and thermal loss and facilitate service access

5.0108.4d Indoor unit installation

Specification

Install indoor unit according to manufacturer specifications and applicable building code (e.g., IRC, IMC, IBC) and ANSI/ACCA Standard 5 (HVAC Quality Installation Standard)

Install fuel delivery to the unit according to SWS Subtopic "Fuel Delivery"

Objective

Safe, accessible, stable, and properly installed indoor unit with safe and durable fuel supply

5.0108.4e Support - all installations

Specification

Ensure unit is level, stable, secured to ductwork, properly braced to prevent movement (seismic bracing), and elevated as required by applicable building code

Objective

Safe, stable, and durably supported indoor unit

5.0108.4f Support - horizontal air flow in attic

Specification

Support equipment on a fireproof platform that is elevated above the insulation level or suspend with

threaded rod in accordance with local codes and manufacturer specifications

Install vibration pads/isolators according to manufacturer specifications

Objective

Equipment is safe, stable, level, and does not transmit vibration or reduce attic insulation level

5.0108.4g Support - horizontal air flow in subspace

Specification

Support equipment on a nonwicking, fireproof material or suspend with threaded rod in accordance with local codes and manufacturer specifications

Install vibration pads/isolators according to manufacturer specifications

Objective

Equipment is safe, stable, level, and does not transmit vibration or corrode

5.0108.4h Support - upflow on a platform

Specification

Support equipment on a durable, fireproof platform capable of supporting the weight of the equipment

Install vibration pads/isolators according to manufacturer specifications

Objective

Equipment is safe, stable, level, and does not transmit vibration or corrode

5.0108.4i Support - downflow

Specification

Support equipment on ductwork capable of supporting the weight of the equipment

Objective

Equipment is safe, stable, and level

5.0108.4j Connections

Specification

Install equipment connections (e.g., electrical service, condensate drains, ductwork, fuel, venting, refrigerant lines) to allow for necessary service and repair access to all portions of the equipment

Objective

Equipment connections do not interfere with operation and service of equipment

5.0108.4k Intakes/terminations

Specification

Locate all intakes/terminations in compliance with manufacturer specifications and applicable building code

Objective

System intakes/terminations that are safe, functional, and compliant

5.0108.4l Condensate drainage

Specification

Install a secondary drain pan with a float switch interlocked to the system power under all condensing units that exist in or above conditioned space

Pipe condensate to a properly sized sanitary drain or the outdoors and provide with traps as specified by the manufacturer and applicable building code

When there is potential for condensation or freezing of the drain line, insulate condensate drain lines to a minimum of R-4 with insulation that contains a Class II or greater vapor retarder

Objective

Prevent water damage and drain condensate through functional drains to an approved location

5.0108.4m Electrical wiring

Specification

Install electrical wiring according to NFPA 70, and

Provide an electrical disconnect within site of the unit

Install all high voltage wiring inside of protective conduit and approved junction boxes, no wiring connections (high or low voltage) will occur outside of appropriate junction box

Objective

Safe and compliant electrical wiring installation

5.0108.4n Fire protection

Specification

Install combustion venting in compliance with manufacturer specifications and applicable building code (e.g., IRC, IMC, IBC)

Install smoke detectors inside the supply duct plenum of systems that move more than 2,500 cubic feet per minute (CFM) in accordance with the applicable building code

Objective

Safely vented appliances

Operational fire warning system in place

5.0108.4o Air handler sealing

Specification

Seal air handler and adjoining ductwork in accordance with SWS Subtopic "Duct Sealing"

If air handler is installed in a building cavity (i.e., closet), seal the cavity to eliminate any return air leaks from adjoining chases

Objective

Air handler leakage less than 1% of system airflow installed in an air sealed cavity

5.0108.4p Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Provide occupants and service technicians with instructions

5.0108.5 Evaporative Coolers

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Equipment Installation

Desired Outcome

Safe, compliant, efficient, and effective system installation in which sequence of operation is correct

5.0108.5a Equipment selection

Specification

Select system that is ENERGY STAR certified or equivalent and complies with UL 1995 or UL/CSA/ANCE 60335-2-40

Objective

Select safe and efficient equipment

5.0108.5b Installation location

Specification

Select installation location based on service and utility access, occupant safety, and area to be cooled

Objective

Safe, accessible, and effective location

5.0108.5c Installation

Specification

Install indoor unit according to manufacturer specifications and applicable building code (e.g., IRC, IMC, IBC) and ANSI/ACCA Standard 5 (HVAC Quality Installation Standard) in a manner that provides ease of access for routine maintenance/service

Objective

Safe, secure, and accessible installation

5.0108.5d Support

Specification

Install unit a minimum of 3" above the ground on a solid durable pad (e.g., concrete slab) or

Suspended a minimum of 6" above the ground using secure and durable supports

Secure unit per applicable seismic restraint needs

Ensure unit is level, stable, and mechanically secured to any ductwork

Objective

Safely supported and level installation

5.0108.5e Connections

Specification

Install equipment connections (e.g., electrical service, condensate drains, ductwork, fuel, venting, refrigerant lines) to allow for necessary service and repair access to all portions of the equipment

Objective

Connections do not interfere with operation and service of equipment

5.0108.5f Electrical wiring

Specification

Install electrical wiring according to NFPA 70, and

Provide an electrical disconnect within site of the unit

Install all high voltage wiring inside of protective conduit and approved junction boxes, no wiring connections (high or low voltage) will occur outside of appropriate junction box

Objective

Safe and compliant electrical wiring installation

5.0108.5g Water management

Specification

Install a float switch in the pan that is interlocked to the system power to prevent unit from overflowing

Pipe overflow tube to a properly sized sanitary drain or the outdoors and provided with traps as specified by the manufacturer and applicable building code

Install a back-flow preventor on the potable water supply

Objective

Prevent water damage, and potable water contamination

5.0108.5h Intakes

Specification

Locate intakes no closer than 10' to pollutant sources or a minimum of 3' below the source

Objective

Protect occupant health

5.0108.5i Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Provide occupants and service technicians with instructions

5.0109.1 Condensers

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Clean and Tune

Desired Outcome

Outdoor units serviced as needed

5.0109.1a Repair diagnosis

Specification

Verify proper function and safety of the following system elements:

Fan motor, compressor, outdoor temperature sensors, bearings, safety devices, electrical disconnect, electrical wiring, contactors, capacitors, fan blades, refrigerant access ports

Objective

Ensure all components function properly, safely, efficiently, and are durable

5.0109.1b Service

Specification

Clean outdoor condenser coil and straighten bent fins

Level outdoor unit

Remove debris from inside unit (e.g., leaves, twigs, insects, spiderwebs)

Clear debris, foliage, grass, etc. from within 3' of the unit

Verify refrigerant charge is correct per manufacturer specifications

Replace damaged refrigerant line insulation

Repair or replace additional elements as needed

Objective

Replace/clean necessary parts

5.0109.1c Documentation

Specification

Post on equipment, or in a conspicuous location, a list of all systems and components inspected, results, and services performed that includes legible service personnel name, contact information, and date of service

Objective

Verify contract completion

5.0109.2 Air Handlers

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Clean and Tune

Desired Outcome

Air handler serviced as needed

5.0109.2a Repair diagnosis

Specification

Verify proper function and safety of the following system elements:

Blower motor, bearings, safety devices, electrical disconnect, electrical wiring, contactors, capacitors, thermostat

Objective

Ensure all components function properly, safely, efficiently, and are durable

5.0109.2b Service

Specification

Clean the following elements: Furnace cabinet interior, blower fan and motor

Lubricate all moving parts according to manufacturer specifications

Replace return air and fresh air supply filters

Repair or replace additional elements as needed

Objective

Replace/clean necessary parts

5.0109.2c Documentation

Specification

Post on equipment, or in a conspicuous location, a list of all systems and components inspected, results, and services performed that includes legible service personnel name, contact information, and date of service

Objective

Verify contract completion

5.0109.3 Evaporators

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Clean and Tune

Desired Outcome

Evaporators serviced as needed

5.0109.3a Repair diagnosis

Specification

Verify proper function and safety of the following system elements:

Drain pan floats, condensate drain line and condensate pump, TXV, temperature sensing bulbs

Objective

Ensure all components function properly, safely, efficiently, and are durable

5.0109.3b Service

Specification

Clear condensate lines and clean drain pans

Verify condensate termination is free of debris and directs water away from the home

Clean evaporator coil

Repair or replace additional elements as needed

Objective

Replace/clean necessary parts

5.0109.3c Documentation

Specification

Post on equipment, or in a conspicuous location, a list of all systems and components inspected, results, and services performed that includes legible service personnel name, contact information, and date of service

Objective

Verify contract completion

5.0109.4 Combustion Furnaces

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Clean and Tune

Desired Outcome

Combustion furnaces serviced as needed

5.0109.4a Repair diagnosis

Specification

Verify proper function and safety of the following system elements:

Thermostat, ignition system, gas valves, venting system, safety devices, blower motor, electrical wiring, gas piping, condensate disposal

Objective

Ensure all components function properly, safely, efficiently, and are durable

5.0109.4b Service

Specification

Perform combustion testing that includes the following: Carbon monoxide, combustion efficiency, gas pressure testing, temperature rise, stack temperature

Adjust combustion as needed to meet BPI 1200 standards for carbon monoxide

Clean the following elements: Furnace cabinet interior, blower fan and motor, heat exchangers, burners

Lubricate all moving parts according to manufacturer specifications

Replace return air and fresh air supply filters

Remove combustible/flammable materials from furnace area

Repair or replace additional elements as needed

Objective

Replace/clean necessary parts

5.0109.4c Documentation

Specification

Post on equipment, or in a conspicuous location, a list of all systems and components inspected, results, and services performed that includes legible service personnel name, contact information, and date of service

Objective

Verify contract completion

5.0109.5 Evaporative Coolers

Section:Heating and Cooling
Topic:Forced Air
Sub-Topic:Clean and Tune

Desired Outcome

Evaporative cooler maintained as needed

5.0109.5a Repair diagnosis

Specification

Verify proper function and safety of the following system elements:

Pump, pan, spider, float, damper, roof jack/support mechanism, water line, water valve, electrical wiring, evaporator pads, motor, fan, bearings, pulleys, belts

Objective

Ensure all components function properly, safely, efficiently, and are durable

5.0109.5b Service

Specification

Replace pads and remove calcium/mineral deposits from cabinet

Repair or replace additional elements as needed

Objective

Replace/clean necessary parts

5.0109.5c Documentation

Specification

Post on equipment, or in a conspicuous location, a list of all systems and components inspected, results, and services performed that includes legible service personnel name, contact information, and date of service

Objective

Verify contract completion

5.0201.1 Thermostat Replacement

Section:Heating and Cooling
Topic:Hydronic
Sub-Topic:Controls

Desired Outcome

Increased system efficiency

5.0201.1a Pre-work qualifications

Specification

Verify that sufficient number of thermostat wires is available to meet the needs of the replacement thermostat and the existing system

Objective

Sufficient wiring exists

5.0201.1b Thermostat selection

Specification

Select a programmable thermostat with a double-setback option that allows for full functionality of the installed system

Objective

Fully functioning system with multiple programming options

5.0201.1c Thermostat location

Specification

Install thermostat where it accurately reflects the temperature of the zone which it controls (i.e., not exposed to extreme temperatures, radiant heat sources, warm/cold walls, or drafts) and meets ADA accessibility requirements when applicable

Objective

Controls operate as designed and are accessible

5.0201.1d Installation

Specification

Install thermostat according to manufacturer specifications and applicable building code

Deenergize the heating system before removing the existing thermostat

Secure the thermostat with mechanical fasteners so that it is level

Objective

Durably, safely, and correctly installed thermostat

5.0201.1e Installer programming

Specification

Program the thermostat to match the equipment and control board settings

Program the thermostat setbacks to a schedule that accommodates the occupant and reduces overall operating time

Objective

Thermostat setup to operate existing system correctly and efficiently

5.0201.1f Penetrations

Specification

Seal penetrations for control wiring with a durable sealant (e.g., caulk, silicone) that complies with applicable fire safety code

Objective

Minimize air leakage, prevent pest intrusion, and prevent in accurate temperature measurements

5.0201.1g Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Control instructions available for occupant and installer

5.0202.1 Radiator Reflector

Section:Heating and Cooling
Topic:Hydronic
Sub-Topic:Distribution

Desired Outcome

Minimized heat loss and enhanced terminal unit effectiveness

5.0202.1a Reflector installation

Specification

Install reflector between the heating element and the wall so that it does not contact the element

Maintain a continuous and consistent air space between the heating element and the reflector

Secure the reflector with mechanical fasteners

Objective

Effectively direct radiant heat towards living space with a securely installed reflector

5.0202.1b Insulation

Specification

If insulation is installed, install it behind the reflector and must meet applicable fire safety code

Objective

Provide a thermal break between the reflector and the exterior

5.0202.2 Distribution Insulation

Section:Heating and Cooling
Topic:Hydronic
Sub-Topic:Distribution

Desired Outcome

Reduce thermal loss through distribution system safely and durably

5.0202.2a Insulation selection

Specification

Select insulation that:

- is rated for the maximum operating temperature of the system
- meets applicable fire safety code
- is R-3 or greater

Objective

Select effective and safe insulation materials

5.0202.2b Installation

Specification

Install insulation over all distribution system components that allow insulation in a continuous manner without gaps

Seal all seams, joints, and connections of insulation with a durable sealant or mechanical fasteners (e.g., zip ties)

Install removable/reusable insulation over components that require regular maintenance

Objective

Continuous insulation that does not interfere with maintenance

5.0202.2c Documentation

Specification

Post a dated receipt signed by the installer that minimally includes: Installed insulation type, coverage area, installed thickness, and installed R-value

Objective

Comply with 16 CFR 460.17 and document contract compliance

5.0203.1 Boilers

Section:Heating and Cooling
Topic:Hydronic
Sub-Topic:Equipment Installation

Desired Outcome

Safe, compliant, and effective system installation in which sequence of operation is correct

5.0203.1a Load calculation

Specification

Perform residential load calculation in accordance with the current version of ANSI/ACCA Manual J (Residential Load Calculation) or equivalent using interior design temperatures of 70 degrees for heating

Perform commercial load calculation in accordance with the current version of ANSI/ACCA Manual N (Commercial Load Calculation) or equivalent using interior design temperatures of 70 degrees for heating

Room by room load calculations will be performed when installing new distribution system components or in retro-commissioning projects

Calculated loads based on post-retrofit dwelling characteristics including distribution system

Objective

Equipment design load calculated correctly for post-retrofit dwelling

5.0203.1b Equipment selection

Specification

Select residential equipment in accordance with the current version of ANSI/ACCA Manual S (Residential Equipment Selection) or equivalent

Select commercial equipment in accordance with the current version of ANSI/ACCA Manual CS (Commercial Applications, Systems and Equipment) or equivalent

Select heating equipment of the lowest capacity required to meet the design heating load and provide sufficient volume for components of existing distribution system that will not be replaced

Select system that is ENERGY STAR certified or equivalent

Objective

Select efficient equipment capable of meeting the design load

5.0203.1c Installation location

Specification

Install unit in a dry location and within conditioned space (when feasible)

Install equipment in a location and manner to provide ease of access for routine maintenance/service

Objective

Safe, accessible, and corrosion-resistant location

5.0203.1d Equipment installation

Specification

Install boiler according to manufacturer specifications and applicable building code (e.g., IRC, IMC, IBC)

Install fuel delivery to the unit according to SWS Subtopic "Fuel Delivery"

Objective

Safe and compliant installation with safe and durable fuel supply

5.0203.1e Equipment support

Specification

Situate equipment on a stable, non-wicking, and fireproof material

Ensure unit is level, stable and supported independently of the distribution system

Objective

Safe, stable, and durable equipment installation

5.0203.1f Electrical wiring

Specification

Install electrical wiring according to NFPA 70, and

Provide an electrical disconnect within site of the unit

Install all high voltage wiring inside of protective conduit and approved junction boxes, no wiring connections (high or low voltage) will occur outside of appropriate junction box

Objective

Safe and compliant electrical wiring installation

5.0203.1g Connections

Specification

Install equipment connections (e.g., electrical service, drains, fuel, venting) to allow for necessary service and repair access to all portions of the equipment

Objective

Connections do not interfere with operation and service of equipment

5.0203.1h Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Provide occupants and service technicians with instructions

5.0204.1 Fuel-Fired Boilers

Section:Heating and Cooling
Topic:Hydronic
Sub-Topic:Clean and Tune

Desired Outcome

Fuel-fired boiler serviced as needed

5.0204.1a Repair diagnosis

Specification

Verify proper function and safety of the following system elements:

Thermostat, ignition system, gas valves, venting system, safety devices, electrical wiring, gas piping, burners, low water cutoff, blow-down systems, fuel delivery, distribution system, insulation, gauge glass, temperature and pressure measurement devices, expansion tanks, automatic fill valves, circulator pumps,

zone valves, condensate drainage, air vents, combustion air

Objective

Ensure all components function properly, safely, efficiently, and are durable

5.0204.1b Service

Specification

Perform combustion testing that includes the following: Carbon monoxide, combustion efficiency, gas pressure testing, temperature rise, stack temperature

Adjust combustion as needed to meet BPI 1200 standards for carbon monoxide

Clean the following elements: heat exchangers, burners

Remove combustible/flammable materials from area

Repair or replace additional elements as needed

Purge, verify system pressure, and flush or skim steam boiler

Objective

Replace/clean necessary parts

5.0204.1c Documentation

Specification

Post on equipment, or in a conspicuous location, a list of all systems and components inspected, results, and services performed that includes legible service personnel name, contact information, and date of service

Objective

Verify contract completion

5.0301.1 Through-Wall and Window Units

Section:Heating and Cooling
Topic:Non-Distributed
Sub-Topic:Room Conditioning

Desired Outcome

Efficient, safe, and compliant room conditioning

5.0301.1a Pre-work qualifications

Specification

Verify unit meets physical size of through-wall or window opening

Verify electrical receptacle meets requirements of NFPA 70 (Article 440)

Objective

Verify appropriate device, location, and electrical service

5.0301.1b Equipment selection

Specification

Select new unit that:

matches available voltage and does not exceed available amperage of existing circuit

is sized based on manufacturer specifications for the space conditioned

is ENERGY STAR qualified with Energy Saver Mode or better

does not use electric resistance heat as the primary heat source (i.e., select Heat Pump units)

Objective

Safe, effective, and efficient room conditioner selected

5.0301.1c Installation

Specification

Install unit per manufacturer specifications and in accord with applicable codes (e.g., no extension cord used)

Where applicable, unit controls and thermostat must comply with the operable parts provisions of ICC A117.1 when the dwelling unit is required to be accessible per ADA

Where required, maintain egress requirements in accordance with ANSI/NFPA 101 and local laws

Objective

Safe, compliant, and accessible installation that maintains egress requirements

5.0301.1d Support

Specification

Install unit according to manufacturer specifications so that it is stable, secure, and will not pose a risk to occupant safety

Objective

Safe, secure, and compliant installation

5.0301.1e Sealing

Specification

Before installing through-wall unit, seal all adjacent framing and provide a sealed and sleeved opening

After installation, seal the perimeter with suitable materials (e.g., ASTM C1193)

Objective

Reduce air movement around installed unit

5.0301.1f Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

5.0301.1g Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions and installer contact information

Objective

Provide occupants and service technicians with instructions

5.0301.2 PTAC/PTHP Units

Section:Heating and Cooling
Topic:Non-Distributed
Sub-Topic:Room Conditioning

Desired Outcome

Efficient, safe, and compliant dwelling conditioning that functions as designed

5.0301.2a Load calculation

Specification

Perform residential load calculation in accordance with the current version of ANSI/ACCA Manual J (Residential Load Calculation) or equivalent using interior design temperatures of 75 degrees for cooling and 70 degrees for heating

Calculated loads based on post-retrofit dwelling characteristics

Objective

Equipment design load calculated correctly for post-retrofit dwelling

5.0301.2b Equipment selection

Specification

Select new unit that:

is ENERGY STAR qualified or equivalent

does not use electric resistance heat as the primary heat source (i.e., select Heat Pump units)

is corrosion-resistant in marine climates

is ducted if conditioning multiple rooms

Objective

Select efficient, corrosion-resistant system that conditions intended area

5.0301.2c Installation

Specification

Install unit per manufacturer specifications and in accord with applicable building code

Where applicable, unit controls and thermostat must comply with the operable parts provisions of ICC A117.1 when the dwelling unit is required to be accessible per ADA

Where required, maintain egress requirements in accordance with ANSI/NFPA 101 and local laws

Objective

Safe, compliant, and accessible installation that meets egress requirements

5.0301.2d Condensate disposal

Specification

Pipe condensate away from the building or to a sanitary drain

Insulate condensate drain to a minimum of R-3 if danger of freezing or condensation exists

Objective

Functional condensate drain

5.0301.2e Sealing

Specification

Before installing through-wall unit, seal all adjacent framing and provide a sealed and sleeved opening

After installation, seal the perimeter with suitable materials (e.g., ASTM C1193)

Objective

Reduce air movement around installed unit

5.0301.2f Insulation

Specification

If unit is ducted, insulate all cooling ducts (including those inside the thermal boundary) in accordance with SWS Detail "General Duct Insulation"

Objective

Prevent water damage from condensation

5.0301.2g Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

5.0301.2h Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions and installer contact information

Objective

Provide occupants and service technicians with instructions

5.0301.3 Wall Furnace

Section:Heating and Cooling
Topic:Non-Distributed
Sub-Topic:Room Conditioning

Desired Outcome

Efficient, safe, and compliant dwelling conditioning that functions as designed

5.0301.3a Load calculation

Specification

Perform residential load calculation in accordance with the current version of ANSI/ACCA Manual J (Residential Load Calculation) or equivalent using interior design temperatures of 70 degrees for heating

Calculated loads based on post-retrofit dwelling characteristics

Objective

Equipment design load calculated correctly for post-retrofit dwelling

5.0301.3b Equipment selection

Specification

Select new unit that:

is ENERGY STAR qualified or equivalent

is ducted if conditioning multiple rooms

Objective

Select efficient, corrosion-resistant system that conditions intended area

5.0301.3c Installation

Specification

Install unit per manufacturer specifications and in accord with applicable building code

Supply air temperature and gas pressure will be within the manufacturer specifications

Objective

Safe and compliant installation

5.0301.3d Controls

Specification

Install a wall mounted thermostat that is not directly affected by supply air flow

Objective

Effective and accessible controls

5.0301.3e Condensate disposal

Specification

Pipe condensate away from the building or to a sanitary drain

Insulate condensate drain to a minimum of R-3 if danger of freezing or condensation exists

Objective

Functional condensate drain

5.0301.3f Sealing

Specification

Before installing unit, seal adjacent framing or cavity if recessed into wall

After installation, seal the perimeter with suitable materials

Seal all penetrations through the thermal boundary

Objective

Reduce air movement around installed unit or in wall cavity

5.0301.3g Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

5.0301.3h Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions and installer contact information

Objective

Provide occupants and service technicians with instructions

5.0401.1 Indigenous Shading

Section:Heating and Cooling
Topic:Solar Gain Reduction
Sub-Topic:Landscaping

Desired Outcome

Heat gain reduced in cooling season

5.0401.1a Plant selection

Specification

Select plantings that are:

- indigenous and drought resistant
- evergreen, in cooling dominated climates
- deciduous, in heating dominated climates

Objective

Plantings survive in local conditions using minimum amount of water and provide seasonally correct shading

5.0401.1b Plant size

Specification

Select plants that will not grow to a height that would cause damage to the home if it or any part of it fell on the home

Objective

Reduce possibility of building damage

5.0402.1 Reflective Roof Coatings

Section:Heating and Cooling
Topic:Solar Gain Reduction
Sub-Topic:Reflective Roofs

Desired Outcome

Reduced solar heat gain

5.0402.1a Material selection

Specification

Material will be:

approved by manufacturer for application to existing roof material/coating

an ENERGY STAR qualified reflective coating

durable, flexible, reflective, and meet ASTM D412, ASTM D1737, and UL 790 Class A or LEED New Construction Reflective Roof standard

Objective

Durable, compatible, and effective roof coating

5.0402.1b Preparation

Specification

Strip roof of all debris, algae, and peeled and loose coatings

Make roof repairs and seal all penetrations before application

Verify roof is clean, dry, and structurally sound

Objective

Fully bonded roof coating

5.0402.1c Application

Specification

Apply roof-coating in accordance with manufacturer specifications

Objective

Properly applied coating

5.0501.1 Isolate CAZ

Section:Heating and Cooling
Topic:Combustion Safety
Sub-Topic:Combustion Appliance Zones

Desired Outcome

Combustion appliances unaffected by pressure changes in conditioned area Isolated room is outside the thermal and pressure boundary

5.0501.1a Air sealing

Specification

Air Seal in accordance with SWS Subtopic "General Air Sealing"

Apply a continuous seal at all penetrations, gaps, cracks, etc. of the pressure boundary between the isolated room and conditioned space using sufficient pressure to push sealant into any gaps or cracks and contact any backing or infill material required

Objective

Establish new pressure boundary that is durable

5.0501.1b Ductwork

Specification

Remove and seal register/grill openings of any return or supply ducting in the isolated room

Seal all ductwork existing inside the isolated room according to SWS detail for "Duct Sealing"

Insulate all ductwork existing inside the isolated room according to SWS detail "General Duct Insulation"

Objective

Sealed, insulated, and condensation free ducts that do not affect CAZ pressure

5.0501.1c Plumbing

Specification

Insulate all plumbing pipes according to SWS detail for "Distribution Insulation"

Objective

Freeze-proof plumbing

5.0501.1d Walls/floors/ceilings

Specification

Insulate all surfaces of the isolated room between the room and conditioned space to the applicable code minimum for the climate zone according to the IECC and applicable SWS

Objective

Continuous thermal boundary

5.0501.1e Combustion air

Specification

Provide outdoor combustion air to the isolated room according to SWS detail for "Combustion Air-Fuel-

Fired Appliances"

Objective

Appliances have sufficient combustion air

5.0502.1 Combustion Air - Fuel-Fired Appliances

Section:Heating and Cooling
Topic:Combustion Safety
Sub-Topic:Combustion Air

Desired Outcome

Sufficient combustion air provided to appliances

5.0502.1a Design

Specification

Calculate combustion air needs in conformance with the applicable code (i.e., NFPA 54, IFGC, or NFPA 31) and manufacturer requirements

In instances where conflicts occur between the code and the manufacturer's installation instructions, the more restrictive provisions shall apply (i.e., more air rather than less)

The minimum required volume is 50 cubic feet per 1,000 BTU/h, except that where the air infiltration rate is known to be less than 0.40 air changes per hour (ACH), then use alternate calculation from IFGC

Objective

Compliant and safe amount of combustion air for appliance

5.0502.1b Installation

Specification

Provide combustion air in conformance with the applicable code (i.e., NFPA 54, IFGC, or NFPA 31) and manufacturer specifications

In instances where conflicts occur between the code and the manufacturer's installation instructions, the more restrictive provisions shall apply (i.e., more air rather than less)

Objective

Compliant combustion air supply

5.0503.1 Fuel-Fired Appliance Venting

Section:Heating and Cooling
Topic:Combustion Safety
Sub-Topic:Appliance Venting

Desired Outcome

Combustion by-products safely vented to the outdoors

5.0503.1a Design

Specification

Design combustion appliance venting in accordance with applicable code (i.e., NFPA 54, NFPA 31, IFGC) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe and compliant combustion venting design

5.0503.1b Materials

Specification

Select combustion appliance vent materials in accordance with applicable code (i.e., NFPA 54, NFPA 31, IFGC) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe and compliant combustion venting materials

5.0503.1c Installation

Specification

Install combustion appliance venting in accordance with applicable code (i.e., NFPA 54, NFPA 31, IFGC) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe and compliant combustion venting installation

5.0503.1d Terminations

Specification

Install combustion appliance terminations in accordance with applicable code (i.e., NFPA 54, NFPA 31, IFGC) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe and compliant combustion venting termination

5.0503.1e Chimney liners

Specification

Select and install chimney liners for combustion appliances in accordance with applicable code (i.e., NFPA 54, NFPA 31, IFGC) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe and compliant chimney liner installation

5.0504.1 Natural Gas/Propane Fuel Piping

Section:Heating and Cooling
Topic:Combustion Safety
Sub-Topic:Fuel Delivery

Desired Outcome

Safe, leak free, and optimal gas supply to all gas-fired equipment

5.0504.1a Material selection

Specification

Select approved pipe type in accordance with applicable code (e.g., NFPA 54/ANSI/AGA Z223.1)

Objective

Select compliant materials

5.0504.1b Gas piping size

Specification

Install gas piping capable of supporting the total connected load of all appliances in accordance with applicable code (e.g., NFPA 54/ANSI/AGA Z223.1)

Objective

Ensure safe and proper gas supply to equipment

5.0504.1c Piping location

Specification

Locate/route gas piping/train so as to not create a trip hazard, not be damaged by water, and to create the least pressure drop possible

Objective

Durable, safe, and effective installation

5.0504.1d Support

Specification

Support gas piping in compliance with applicable code (e.g., NFPA 54/ANSI/AGA Z223.1)

Objective

Adequate and compliant pipe support

5.0504.1e Required components

Specification

All piping installations must contain at a minimum a manual gas shut off valve, union joint, and a sediment trap at each appliance

Objective

Safely allow service, replacement, and emergency shutoff of individual appliances

Protect appliance from moisture and debris in gas

5.0504.1f Gas pressure regulator venting

Specification

If installed, vent all gas pressure regulators requiring venting to outside the building with code approved rigid pipe

Terminate pipe in a safe location without any thread, coupling, fitting, etc. that would allow a plug to be easily fitted

Objective

Vent flammable gasses outside the building

5.0504.1g Sealing

Specification

Seal all gas piping in accordance with manufacturer specifications

Objective

Leak free gas piping

5.0504.1h Safety devices for propane

Specification

Install a secondary LP safety detector system (e.g., valve, exhaust fan, alarm light) for propane piping installed below grade

Objective

Detect accumulation of dangerous levels of propane in areas that are below grade

5.0504.1i Gas boosters

Specification

If a gas pressure booster is necessary, confirm compatibility with the gas-fired equipment and check low and high gas pressure switches for proper operation

Objective

Gas pressure booster is compatible and safe

5.0504.2 Oil Piping

Section:Heating and Cooling
Topic:Combustion Safety
Sub-Topic:Fuel Delivery

Desired Outcome

Safe, leak free, and optimal oil supply to all oil-fired equipment

5.0504.2a Material selection

Specification

Select approved pipe type in accordance with applicable code (e.g., NFPA 31, IMC)

Objective

Select compliant materials

5.0504.2b Piping location

Specification

Locate/route oil piping so as to not create a trip hazard and not be damaged by water

Objective

Durable, safe, and effective installation

5.0504.2c Support

Specification

Support oil piping in compliance with applicable code (e.g., NFPA 31, IMC)

Objective

Adequate and compliant pipe support

5.0504.2d Required components

Specification

All piping installations must contain at a minimum: a fire valve, a manual oil shut off valve, union joint, and filter fitting for each appliance

Objective

Safely allow service, replacement, and emergency shutoff of individual appliances

Protect equipment from debris in fuel

5.0504.2e Pumps

Specification

If a fuel pump is required, design it in accordance with manufacturer specifications based on fuel type, distance from tank, and equipment size

Install a serviceable strainer in the pump supply side

Pump must be interlocked with appliance to cut off when appliance is not functioning

Objective

Provide adequate and clean fuel supply while protecting installed equipment

5.0504.2f Line connections

Specification

Use connectors and filter fittings that are approved by applicable code (e.g., NFPA 31, IMC)

Objective

Compliant oil line installation

5.8801.1 Decommissioning

Section:Heating and Cooling
Topic:Special Considerations
Sub-Topic:Equipment Removal

Desired Outcome

Protect workers, occupants, and environment during equipment removal

5.8801.1a Utility disconnect

Specification

Turn off and lock out electricity and fuel prior to beginning removal of old appliance

Objective

Protect workers and occupants from injury

5.8801.1b Refrigerant recovery

Specification

Recover and recycle all refrigerants in accordance with local and federal law (i.e., 40 CFR 608)

Objective

Protect environment and comply with regulation

5.8801.1c Equipment disconnection

Specification

Disconnect all attachments to the equipment and terminate in accordance with applicable code and industry practice (e.g., refrigerant lines, plumbing, ducts, wiring, vents, fuel supply)

Objective

Equipment ready for physical removal

5.8801.1d Equipment removal

Specification

Remove existing equipment (e.g., furnace, air handler, boiler, evaporator, condensing unit) from premises without damaging or disturbing property or existing insulation

Old equipment may not be left on client's property

Objective

Equipment removed without physical damage to property

5.8801.1e Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

6.0101.1 Ventilation Ducts

Section:Ventilation
Topic:Infrastructure
Sub-Topic:Components

Desired Outcome

Durable, safe, airtight, and effective ventilation ducts that move the required air volume

6.0101.1a Material selection

Specification

Select duct materials that have a flame spread no greater than 25

Select flexible ducts that are UL 181 listed or Air Diffusion Council approved

Select rigid ducts of 28 gauge or thicker

Select duct insulation with a flame spread/smoke development index of 25/50 or less when tested according to ASTM E84 or UL 723

Objective

Select durable, safe, and effective duct materials

6.0101.1b Design and configuration

Specification

Install ventilation ducts as short, straight, smooth and fully extended as possible considering the following: Vent termination location; Amount of space for duct run; Roof condition, type, and access (e.g., metal, shingle, bowstring, flat)

Choose duct diameter that is equal to or greater than the exhaust fan outlet

Slope duct downwards towards the termination when possible

Install flexible duct so the radius at the centerline of any turn is no less than one duct diameter

Objective

Smooth and direct air movement

6.0101.1c Combining air streams

Specification

If combining ducts, combine them on the upstream side of fan using "Y"-fittings or collection boxes

Do not combine dryer, kitchen, or garage exhausts streams with any other exhaust stream

Objective

Effective, safe exhaust of air from multiport systems

6.0101.1d Mechanical fastening

Specification

Fasten all ducts as follows:

Round metal-to-metal or metal-to-PVC with a minimum of three equally spaced screws

For other metal-to-metal or metal-to-PVC with welds, gaskets, mastics (adhesives), mastic-embedded-fabric systems, or tapes

Flexible duct-to-metal or flexible duct-to-PVC with tie bands using a tie band tensioning tool

PVC-to-PVC materials with approved PVC primer and cement

Fasten other specialized duct fittings in accordance with manufacturer specifications

Objective

Durable duct connections

6.0101.1e Sealing

Specification

Seal all duct connections with UL 181B or 181B-M listed materials (e.g., mastic, tape)

Objective

Airtight duct connections

6.0101.1f Insulation

Specification

Insulate all ducts installed outside of the thermal boundary to a minimum of R-8

Insulate all ductwork exposed to the exterior of the building to a minimum of R-12

Objective

Prevent condensation

6.0101.1g Support

Specification

Support flexible and duct board ducts every 4' or less using a minimum of 1-1/2" wide material

Install support materials in a way that does not crimp ductwork or cause the interior dimensions of the ductwork to be less than specified

Support metal ducts every 10' or less using 1/2" or wider material, using 18 gauge or greater strapping or 12 gauge or greater galvanized wire

Objective

Ducts secured to prevent damage

6.0101.2 Exhaust Terminations

Section:Ventilation
Topic:Infrastructure
Sub-Topic:Components

Desired Outcome

Appropriate, safe, weather-tight, pest-resistant, and effective termination fittings with unrestricted air flow

6.0101.2a Selection

Specification

Select termination fitting:

- that is appropriate for regional weather conditions and installation location
- with an integrated collar at least the same diameter as the exhaust duct outlet
- with an integrated pest screen with holes no less than 1/4" and no greater than 1/2", except for dryer terminations which will have no pest screen
- for kitchen exhaust: made from galvanized steel, stainless steel, or copper

for dryer exhaust: that is designed for dryers exhaust and does not include a pest screen

in very cold climates: that have no backflow dampers or use backflow dampers that resist freezing

Objective

Appropriate, safe, and weather resistant termination

6.0101.2b Damper (if applicable)

Specification

Damper must open in the direction of the desired flow

Damper will close when system is off

No damper is required if the system operates continuously

Objective

Prevent unwanted air movement while not restricting desired air flow

6.0101.2c Location

Specification

Install termination to exhaust to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Install terminations:

A minimum of 3' away from any property line;

A minimum of 3' away from operable opening to houses;

A minimum of 10' away from mechanical intake;

Above the snow-line.

If the termination is at the soffit, seal all soffit vents within 6' of the termination

Objective

Prevent exhaust from reentering the structure

6.0101.2d Installation

Specification

Cut hole no larger than a 1/4" greater than the termination fitting

Weather seal and flash the exterior fitting

Mechanically fasten termination in place following manufacturer specifications

Do not inhibit damper operation if included in termination

Objective

Weather-resistant, durable, and effective installation

6.0101.2e Duct to termination connection

Specification

If termination collar is larger than exhaust duct install a rigid metal transition

Objective

Effective termination connection

6.0101.2f Sealing

Specification

Seal all duct connections with UL 181B or 181B-M listed materials (e.g., mastic, tape)

Objective

Airtight duct connections

6.0101.3 Exterior Intakes

Section:Ventilation
Topic:Infrastructure
Sub-Topic:Components

Desired Outcome

Appropriate, safe, weather-tight, pest-resistant and effective intake fittings with unrestricted air flow

6.0101.3a Selection

Specification

Select intake fitting:

that is appropriate for regional weather conditions and installation location

with an integrated collar at least the same diameter as the exhaust duct outlet

with an integrated pest screen with holes no less than 1/4" and no greater than 1/2"

in very cold climates that have no backflow dampers or use backflow dampers that resist freezing

Objective

Appropriate, safe, and weather resistant termination

6.0101.3b Damper (if applicable)

Specification

Damper must open in the direction of the desired flow

Damper will close when system is off

No damper is required if the system operates continuously

Objective

Prevent unwanted air movement while not restricting desired air flow

6.0101.3c Location

Specification

Install intake to pull air from the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Install intake:

A minimum of 6" from grade;

A minimum of 10' from contaminant sources or exhaust outlets;

Above local snow or flood line;

A minimum of 18" above an asphalt based roof;

Never on a flat roof

Objective

Unrestricted entry of contaminant-free air

6.0101.3d Installation

Specification

Cut hole no larger than a 1/4" greater than the termination fitting

Weather seal and flash the exterior fitting

Mechanically fasten termination in place following manufacturer specifications

Do not inhibit damper operation if included in termination

Objective

Weather-resistant, durable, and effective installation

6.0101.3e Duct to termination connection

Specification

If termination collar is larger than intake duct install a rigid metal transition

Objective

Effective termination connection

6.0101.3f Labeling

Specification

Label intake fitting: "ventilation air intake"

Objective

Prevent fitting restriction

6.0101.3g Sealing

Specification

Seal all duct connections with UL 181B or 181B-M listed materials (e.g., mastic, tape)

Objective

Airtight duct connections

6.0101.4 Fan Controls

Section:Ventilation
Topic:Infrastructure
Sub-Topic:Components

Desired Outcome

Safe and effective fan control that supports the ventilation strategy

6.0101.4a Intermittent/continuous operation

Specification

Install controls that are either internal to the fan or external

For intermittent ventilation strategies: Install a controller that can operate the fan intermittently to produce the intended flow

For continuous ventilation strategies: Install an automatic controller that can operate the fan continuously to meet the intended flow rate

Only use continuous operation controls on fans containing ECM motors rated for continuous operation

Objective

Meet intended ventilation strategy

6.0101.4b Optional sensors

Specification

Install a manual override control to activate the fan as necessary

Occupancy sensors/humidistat:

Install an occupancy sensor and/or humidistat designed to function with the chosen fan and in accordance with manufacturer specifications

Carbon dioxide sensors (demand control):

Only use CO2 sensors with VFD or multispeed fans

Objective

Provide ventilation on an as-needed basis

6.0101.4c Manual override

Specification

Install a clearly labeled manual service disconnect for all ventilation fan controls

Objective

Service disconnect available

6.0101.4d Labeling, if applicable

Specification

Clearly label all whole-house ventilation system controls "Whole-House Ventilation Control"

Objective

Fan control operation made clear

6.0101.5 Airflow Control Devices

Section:Ventilation
Topic:Infrastructure
Sub-Topic:Components

Desired Outcome

Safe, balanced, and effective airflow control

6.0101.5a Pre-Work Qualifications

Specification

Verify:

air flow regulator specifications are appropriate to site conditions(e.g., duct size, type, shape, register type, duct static pressure)

presence and type of fire dampers and smoke control devices

Objective

Verify safety and appropriate regulator design

6.0101.5b Material selection

Specification

Select appropriate air flow regulator or orifice for the opening and desired airflow that will not interfere with the operation of smoke and fire dampers

Objective

Moderate air flow safely and efficiently

6.0101.5c Installation

Specification

Securely fasten transition or adapter according to manufacturer specifications

Install flow control device in the proper orientation for the desired flow direction

Set adjustable devices to preliminary balancing position per the design specifications

Objective

Secure and properly oriented device

6.0101.5d Sealing

Specification

Seal all connections with UL 181B or 181B-M listed materials (e.g., mastic, tape)

Objective

Airtight installation

6.0101.5e Fire Safety

Specification

Verify installed air flow device will not interfere with proper operation of smoke and fire dampers

Objective

Proper function of fire safety systems

6.0201.1 Surface Mounted

Section:Ventilation
Topic:Local Ventilation
Sub-Topic:Exhaust Systems

Desired Outcome

Efficient, safe, quiet, and effective removal of air contaminants from area

6.0201.1a Fan selection

Specification

Select a fan that:

produces no more than 2.0 sones at maximum speed

has an efficacy of 4 cfm/watt or more

moves at least 50 cfm after installation, ducting, and termination is complete

Objective

Select efficient and quiet equipment

6.0201.1b Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealant

6.0201.1c Damper

Specification

If the fan does not contain an integrated damper, install a damper that:

opens in the direction of the desired flow

closes when the system is off

Objective

Prevent unwanted air movement while not restricting desired air flow

6.0201.1d Location

Specification

Install fan near the center of the space where odor, moisture, or other contaminants are generated but not inside a shower unless fan is rated for wet location installation

Objective

Effective location for removal of contaminants

6.0201.1e Opening preparation

Specification

Cut hole for fan leaving no more than a 1/4" gap on each side of the fan assembly

Objective

Properly sized opening

6.0201.1f Fan orientation

Specification

Orient the fan outlet toward the final termination location and so the equivalent length of the duct run is as short as possible

Objective

Short, effective fan venting

6.0201.1g Fan mounting

Specification

Mount fan using mechanical fasteners and per manufacturer's specifications so that fan housing does not shake, rattle, or vibrate when operating

Objective

Securely mounted fan

6.0201.1h Wiring

Specification

Install all electrical wiring according to manufacturer specifications and applicable code

Objective

Prevent an electrical hazard

6.0201.1i Sealing

Specification

Seal gap around fan housing and enclose fan housing when possible

Objective

Airtight fan installation

6.0201.1j Insulate housing

Specification

If fan housing is installed in unconditioned space, insulate fan housing to a minimum of R-8 or cover with insulation of more than R-8

Objective

Prevent condensation

6.0201.1k Fan access

Specification

Ensure fan and service disconnect switch are accessible for maintenance according to NEC, or applicable building code

Objective

Accessible for service

6.0201.1l Venting

Specification

Duct and terminate fan to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors, in accordance with SWS detail for "Ventilation Ducts"

Objective

Exhausted to outdoors

6.0201.2 Kitchen Range Hoods

Section:Ventilation
Topic:Local Ventilation
Sub-Topic:Exhaust Systems

Desired Outcome

Efficient, safe, quiet, and effective removal of air contaminants from kitchens

6.0201.2a Fan selection

Specification

Select a fan that:

is rated a maximum of 3 sones at one or more airflow settings greater than or equal to 100 cfm

has a minimum efficacy of 2.8 cfm/watt

moves at least 100 cfm intermittently or 5 kitchen air changes per hour (ACH) continuously after installation, ducting, and termination is complete

Objective

Select efficient and quiet equipment that moves the specified amount of air.

6.0201.2b Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealant

6.0201.2c Location

Specification

Install fan within at least 5' of the primary cooking surface (e.g., range, oven, stove)

Objective

Effective location for removal of contaminants

6.0201.2d Damper

Specification

If the fan does not contain an integrated damper, install a damper that:

opens in the direction of the desired flow

closes when the system is off

Objective

Prevent unwanted air movement while not restricting desired air flow

6.0201.2e Installation

Specification

Mount fan using mechanical fasteners and per manufacturer specifications so that fan housing does not shake, rattle, or vibrate when operating

Ensure internal components are correctly oriented to exhaust air through the duct system

Objective

Securely mounted and vent ready fan

6.0201.2f Wiring

Specification

Install all electrical wiring according to manufacturer specifications and applicable code

Objective

Prevent an electrical hazard

6.0201.2g Sealing

Specification

Seal any gap around fan housing where air can leak to outside the pressure boundary

Objective

Reduce infiltration

6.0201.2h Fan access

Specification

Ensure fan and service disconnect switch are accessible for maintenance according to NEC, or applicable building code

Objective

Accessible for service

6.0201.2i Venting

Specification

Duct fan flow through smooth wall metal duct and terminated to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors, in accordance with SWS detail for "Ventilation Ducts"

Objective

Safely exhausted to outdoors

6.0201.2j Make-up air

Specification

Provide make-up air if the range hood operation interferes with combustion appliance operation

Objective

Prevent excessive depressurization from fan

6.0201.3 Inline and Multiport Fans

Section:Ventilation
Topic:Local Ventilation
Sub-Topic:Exhaust Systems

Desired Outcome

Efficient, safe, durable, and airtight fan installation that maximizes air flow

6.0201.3a Fan selection

Specification

Select a fan that:

has an electrically commutated motor (ECM)

has an efficacy of 3.8 cfm/watt or more

Objective

Efficient fan selection

6.0201.3b Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealant

6.0201.3c Wiring

Specification

Install all electrical wiring according to manufacturer specifications and applicable code

Objective

Prevent an electrical hazard

6.0201.3d Fan orientation

Specification

Orient the fan outlet toward the final termination location and so the equivalent length of the duct run is as short as possible

Objective

Short, effective fan venting

6.0201.3e Fan mounting

Specification

Mount fan using mechanical fasteners and per manufacturer's specifications so that fan housing does not shake, rattle, or vibrate when operating

Objective

Securely mounted fan

6.0201.3f Damper

Specification

If the fan does not contain an integrated damper, install a damper that:

opens in the direction of the desired flow

closes when the system is off

Objective

Prevent unwanted air movement while not restricting desired air flow

6.0201.3g Intake grill openings

Specification

Cut hole for intakes leaving no more than a 1/8" gap on each side

Install register boots using mechanical fasteners sufficient to prevent movement

Objective

Durable intake boots with properly sized opening

6.0201.3h Air sealing

Specification

Seal gaps around intake register boots with compatible sealant

Objective

Airtight fan installation

6.0201.3i Fan Access

Specification

Ensure fan and service disconnect switch are accessible for maintenance according to NEC, or applicable building code

Objective

Accessible for service

6.0201.3j Venting

Specification

Duct and terminate fan to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors, in accordance with SWS detail for "Ventilation Ducts"

Objective

Exhausted to outdoors

6.0201.4 Garage Exhaust Fans

Section:Ventilation
Topic:Local Ventilation
Sub-Topic:Exhaust Systems

Desired Outcome

Safely and efficiently remove pollutants from garage space

6.0201.4a Fan selection

Specification

Select a fan that:

has an electrically commutated motor (ECM)

has an efficacy of 3.8 cfm/watt or more

exhausts 100 cfm per garage bay after installation

Objective

Efficient fan selection

6.0201.4b Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealant

6.0201.4c Wiring

Specification

Install all electrical wiring according to manufacturer specifications and applicable code

Objective

Prevent an electrical hazard

6.0201.4d Fan orientation

Specification

Orient the fan outlet toward the final termination location and so the equivalent length of the duct run is as short as possible

Objective

Short, effective fan venting

6.0201.4e Fan mounting

Specification

Mount fan using mechanical fasteners and per manufacturer's specifications so that fan housing does not shake, rattle, or vibrate when operating

Objective

Securely mounted fan

6.0201.4f Damper

Specification

If the fan does not contain an integrated damper, install a damper that:

opens in the direction of the desired flow

closes when the system is off

Objective

Prevent unwanted air movement while not restricting desired air flow

6.0201.4g Controls

Specification

Fan must operate continuously or have automatic controls that activate the fan whenever the garage is occupied and for 15 minutes after the garage is vacated

Objective

Correct exhaust strategy

6.0201.4h Exhaust system openings

Specification

Cut hole for intakes or surface mounted fans leaving no more than a 1/4" gap on each side

Install register boots using mechanical fasteners sufficient to prevent movement

Objective

Durable intake boots with properly sized opening

6.0201.4i Air sealing

Specification

Seal gaps around intake register boots or fan housing with compatible sealant

Seal leakage locations between living space and garage

Remove or cap and seal supply and/or return registers in garage that are connected to the same duct system as living space

Objective

Minimize air exchange between garage and dwelling

6.0201.4j Fan access

Specification

Ensure fan and service disconnect switch are accessible for maintenance according to NEC, or applicable building code

Objective

Accessible for service

6.0201.4k Outdoor termination location

Specification

Terminate exhaust venting a minimum of 15' from any doors, windows, or outside air intakes

Objective

Prevent reentry of exhausted pollutants

6.0201.4l Venting

Specification

Duct and terminate fan to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors, in accordance with SWS detail for "Ventilation Ducts"

Objective

Exhausted to outdoors

6.0202.1 Clothes Dryer

Section:Ventilation
Topic:Local Ventilation
Sub-Topic:Appliance Exhaust

Desired Outcome

Dryer vented to outdoors safely and effectively

6.0202.1a Duct selection

Specification

Select dryer transition ducting materials that are UL 2158A approved and less than 8 feet in total length with no joints

Select primary dryer ducting material that is 28 gauge metal with a smooth interior

Objective

Smooth airflow that does not collect lint

6.0202.1b Venting installation

Specification

Vent all clothes dryers to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Choose the shortest practical installation path

Install a dryer booster fan that is listed and labeled to UL 705 for dryer ducts exceeding 35' in equivalent length

Install ducts according to SWS detail for "Ventilation Ducts"

Objective

Dryer ducted to outdoors durably and effectively

6.0202.1c Lint collection devices

Specification

If a lint collection device is installed, it must:

be UL approved for dryers

be installed according to manufacturer specifications

be airtight when dryer is operating

Objective

Safe and airtight lint collection

6.0202.1d Mechanical fasteners

Specification

Fasten all duct connections with mechanical fasteners that do not penetrate the interior of the duct (e.g., clamps, gasketed fitting)

No fastener may penetrate the interior of the duct

Objective

Securely fastened without obstructing flow

6.0202.1e Make-up air

Specification

If the dryer operation interferes with combustion appliance operation, make-up air must be provided according to applicable code

Objective

Safe operation of combustion appliances

6.0202.1f Duct insulation

Specification

Insulate dryer ducts installed outside of the thermal boundary to a minimum of R-8

Objective

Prevent condensation

6.0202.1g Termination fitting

Specification

Vent dryer through a termination manufactured for use with dryers that includes a backdraft damper

Termination may not contain a pest screen

Objective

Dryer termination that is effective, safe and does not inhibit flow

6.0202.1h Sealing

Specification

Seal all duct connections with 181B or 181B-M listed material

Objective

Airtight ducts

6.0202.1i Condensing dryers

Specification

Plumb condensing dryers to a drain

Objective

Condensate properly disposed

6.0301.1 Fresh Air Intake In Forced Air System

Section:Ventilation
Topic:Whole-Building Ventilation
Sub-Topic:Supply Ventilation

Desired Outcome

Efficiently supply adequate, clean ventilation air

6.0301.1a Pre-work qualifications

Specification

Existing forced air system duct leakage to outside will be less than 10% of the air handler flow when measured at 25 pascals with reference to outside

Any portion of the return located inside a combustion appliance zone will be sealed

Objective

Prevent contamination through duct leakage

6.0301.1b Intake location

Specification

Install intake to pull air from the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Install intake:

A minimum of 6" from grade;

A minimum of 10' from contaminant sources or exhaust outlets;

Above local snow or flood line;

A minimum of 18" above an asphalt based roof;

Never on a flat roof

Objective

Unrestricted entry of contaminant-free air

6.0301.1c Labeling

Specification

Intake fitting will be labeled "ventilation air intake"

Objective

Prevent fitting restriction

6.0301.1d Pest exclusion

Specification

Install corrosion resistant screen, louver, or grille material over exterior intake with a hole size of no less than 1/4" and no greater than 1/2" in any direction

Objective

Prevent pest entry while allowing proper air flow.

6.0301.1e Motorized damper

Specification

Install a motorized damper or equivalent between the intake fitting and the return side duct connection

Damper will be open only when the air handler fan is operating

Objective

Prevent unwanted air flow

6.0301.1f System control

Specification

Provide air flow by sequenced or scheduled operation of the damper or equivalent technology

Control system must operate both the air handler and the motorized damper or be interlocked to prevent damper operation when air handler is not on

Objective

Sufficient controlled ventilation rate

6.0301.1g Wiring

Specification

Install all electrical wiring according to manufacturer specifications and applicable code

Objective

Prevent an electrical hazard

6.0301.1h Fresh air filtration

Specification

All mechanically-supplied outdoor air must pass through a filter before combining with conditioned air

Filtration must meet a minimum efficiency of MERV 8

Filter or air cleaning systems that intentionally produce ozone are not allowed

Objective

Outdoor air filtered for particles

6.0301.1i Filter accessibility and fit

Specification

Install filtration in a readily accessible location for service

Filter opening must allow filter to be fully removed and inserted without bending or damaging the filter

Filter access panel must include gasket or comparable sealing mechanism and fit snugly against exposed edge of filter when closed

Filter plenum must be airtight and mechanically fastened to adjoining ductwork

Objective

Filter accessible for service and prevents air bypass

6.0301.1j Access

Specification

Ensure motorized dampers and service disconnect switches are accessible for maintenance according to NEC, or applicable building code

Objective

Serviceable parts are readily accessible

6.0301.1k Ducting

Specification

Install all ducting in accordance with SWS detail for "Ventilation Ducts"

Objective

Unrestricted ventilation air flow

6.0301.1l Fire dampers

Specification

If fire dampers are required in the fresh air supply duct, install them according to applicable building code

Fire dampers must be accessible for inspection and/or testing

Sealing activities must not interfere with the operation of fire dampers, balancing dampers, or backdraft dampers

Objective

Fire dampers function effectively and are accessible

6.0301.1m System balancing

Specification

Adjust fan speed, dampers, and registers until design specifications are met

Objective

Ensure complete dwelling ventilation

6.0302.1 Individual Exhaust Fan Serving Entire Dwelling

Section:Ventilation
Topic:Whole-Building Ventilation
Sub-Topic:Exhaust Ventilation

Desired Outcome

Safe, efficient, and adequate whole dwelling exhaust ventilation

6.0302.1a Fan selection

Specification

Select a fan that:

uses an ECM motor designed for continuous operation

produces no more than 1.0 sones at maximum speed

has an efficacy of 2.8 cfm/watt or more

Objective

Select efficient and quiet equipment

6.0302.1b Sealant selection

Specification

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers), and

for use inside the pressure boundary select low volatile organic compound (VOC) sealants that meet independent testing and verification protocols

Objective

Select safe and effective sealant

6.0302.1c Termination location

Specification

Terminate exhaust system to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Install terminations: A minimum of 3' away from any property line; A minimum of 3' away from operable opening to houses; A minimum of 10' away from mechanical intake; Above the snow-line

If the termination is at the soffit, seal soffit vents within 6' of the termination

Objective

Prevent exhaust from reentering the structure

6.0302.1d Pest exclusion

Specification

Install corrosion resistant screen, louver, or grille material over exterior termination with a hole size of no less than 1/4" and no greater than 1/2" in any direction

Objective

Prevent pest entry while allowing proper air flow.

6.0302.1e Damper

Specification

If the fan does not contain an integrated damper, install a damper that:

opens in the direction of the desired flow

closes when the system is off

Objective

Prevent unwanted air movement while not restricting desired air flow

6.0302.1f Interior intake location

Specification

Install exhaust intake in a central location within the main body of the dwelling

Objective

Effective location for removal of contaminants

6.0302.1g Opening preparation

Specification

Cut hole for exhaust intake leaving no more than a 1/4" gap on each side of the fan assembly

Objective

Properly sized opening

6.0302.1h Fan orientation

Specification

Orient the fan outlet toward the final termination location and so the effective length of the duct run is as

short as possible

Objective

Short, effective fan venting

6.0302.1i Fan mounting

Specification

Mount fan using mechanical fasteners and per manufacturer's specifications so that fan housing does not shake, rattle, or vibrate when operating

Objective

Securely mounted fan

6.0302.1j Wiring

Specification

Install all electrical wiring according to manufacturer specifications and applicable code

Objective

Prevent an electrical hazard

6.0302.1k Sealing

Specification

Seal gap between the fan housing and interior surface

Seal fan housing to be substantially airtight

Objective

Fan housing sealed to prevent air movement (except through the designed outlet) at 50PA of pressure

6.0302.1l Insulate housing

Specification

Insulate fan housing located outside the thermal boundary to a minimum of R-8 or cover with insulation of more than R-8

Objective

Prevent condensation

6.0302.1m Fan access

Specification

Ensure fan and service disconnect switch are accessible for maintenance according to NEC, or applicable building code

Objective

Accessible for service

6.0302.1n Venting

Specification

Duct and terminate fan to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors, in accordance with SWS detail for "Ventilation Ducts"

Objective

Exhausted to outdoors

6.0302.1o System balancing

Specification

Adjust fan speed, dampers, and registers until design specifications are met

Objective

Ensure complete dwelling ventilation

6.0303.1 HRV/ERV Installation

Section:Ventilation
Topic:Whole-Building Ventilation
Sub-Topic:Balanced Ventilation

Desired Outcome

Efficient, effective, safe, and adequate ventilation air

6.0303.1a Fan selection

Specification

Select Energy or Heat Recovery Ventilators (ERV/HRV) that are ENERGY STAR, equivalent, or better

Objective

Select efficient equipment

6.0303.1b Wiring

Specification

Install all electrical wiring according to manufacturer specifications and applicable code

Objective

Prevent an electrical hazard

6.0303.1c Exterior exhaust termination location

Specification

Terminate exhaust system to the outdoors, which does not include unconditioned spaces such as attics and

crawl spaces that are ventilated with the outdoors

Install terminations: A minimum of 3' away from any property line; A minimum of 3' away from operable opening to houses; A minimum of 10' away from mechanical intake; Above the snow-line

If the termination is at the soffit, seal soffit vents within 6' of the termination

Objective

Prevent exhaust from reentering the structure

6.0303.1d Exterior intake location

Specification

Install intake to pull air from the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Install intake:

A minimum of 6" from grade;

A minimum of 10' from contaminant sources or exhaust outlets;

Above local snow or flood line;

A minimum of 18" above an asphalt based roof;

Never on a flat roof

Objective

Unrestricted entry of contaminant-free air

6.0303.1e Pest exclusion

Specification

Install corrosion resistant screen, louver, or grille material over exterior terminations with a hole size of no less than 1/4" and no greater than 1/2" in any direction

Objective

Prevent pest entry while allowing proper air flow.

6.0303.1f Interior intake location

Specification

Install interior intakes a minimum of 10' from interior fresh air supplies, cooking surfaces, or combustion appliances

Objective

Remove pollutants without damaging fan or interfering with fresh air supply

6.0303.1g Interior supply location

Specification

Install interior fresh air supply:

near high traffic areas and occupied spaces (e.g., living rooms, hallways, bedrooms)

not within 10' of interior exhaust intakes

Objective

Supply fresh air where needed

6.0303.1h Combining air streams

Specification

If combining ducts, combine them on the upstream side of fan using "Y"-fittings or collection boxes

Do not combine/connect dryer, kitchen, or garage exhaust streams with any other exhaust stream

Objective

Effective, safe exhaust of air from multiport systems

6.0303.1i Backdraft prevention

Specification

Ensure system contains a backdraft damper between the ventilator and all exterior terminations/intakes that only allows air flow in the desired direction

Equip outdoor air intakes and exhausts with automatic or gravity dampers that close when the ventilation system is not operating

Objective

Prevent unwanted air movement

6.0303.1j Fresh air filtration

Specification

All mechanically-supplied outdoor air must pass through a filter before combining with conditioned air

Filtration must meet a minimum efficiency of MERV 8

Filter or air cleaning systems that intentionally produce ozone are not allowed.

Objective

Outdoor air filtered for particles

6.0303.1k Fan mounting

Specification

Mount ventilator using mechanical fasteners per manufacturer's specifications and applicable code (e.g., seismic restraints)

Isolate unit from the building framing unless specifically designed to be directly attached

Objective

Secure, vibration-isolated ventilator

6.0303.1l Sealing

Specification

Seal all air moving portions of the system using UL 181 products without interfering with the function of dampers

Objective

Airtight ventilation system with freely operating dampers

6.0303.1m Condensate drain

Specification

If unit has a condensate drain, connect drain according to manufacturer specifications to a drain location approved by applicable code

Insulate all condensate lines outside the thermal boundary to a minimum of R-4

Objective

Safe and reliable condensate drainage

6.0303.1n Access

Specification

Ensure fan, service disconnect switch, filters, and drains are accessible for maintenance according to NEC, or applicable building code

Objective

Serviceable parts are readily accessible

6.0303.1o Fire dampers

Specification

If fire dampers are required in the fresh air supply duct, install them according to applicable building code

Fire dampers must be accessible for inspection and/or testing

Sealing activities must not interfere with the operation of fire dampers, balancing dampers, or backdraft dampers

Objective

Fire dampers function effectively and are accessible

6.0303.1p System balancing

Specification

Adjust fan speed, dampers, and registers until the incoming air volume is equal to the outgoing air volume

If the HRV/ERV is ducted to the air handler, balance it with the air handler running

Objective

Ensure complete dwelling ventilation

6.0303.1q Very cold climate considerations

Specification

In climate zones 6B, 7, and 8 (as defined by ASHRAE 62.2) do not install ERVs unless they are equipped with frost controls

Objective

Prevent freezing of ventilators and condensation

6.0303.1r Hot-humid climate considerations

Specification

In climate zones 0A, 1A, 2A (as defined by ASHRAE 62.2) it is preferential to install an ERV rather than

an HRV

Do not terminate ventilation air intake at the roof

Determine whether net latent load from ventilation (both natural and mechanical) requires dehumidification; if so, install dehumidification

Objective

Prevent excessive heat and moisture from entering the ventilation air.

6.0305.1 Ventilator Dehumidifiers

Section:Ventilation
Topic:Whole-Building Ventilation
Sub-Topic:Dehumidification

Desired Outcome

Provide adequate fresh air and maintain desired indoor humidity

6.0305.1a Equipment selection

Specification

Equipment must be ENERGY STAR rated and must have an auto-restart to maintain settings through power failures

Dehumidification ventilator will be a ducted unit and will provide outside air to the home or space

Objective

Ensure efficient dehumidification and fresh air

6.0305.1b Sizing

Specification

Size the system with enough capacity to handle humidity from outside air ventilation and internal gains

Maintain humidity levels inside the home at less than 60% relative humidity

For residential applications, follow ASHRAE 62.2 and local code requirements to identify design airflow rates within dwelling units

For commercial applications, follow local code requirements and/or ASHRAE 62.1 requirements

Objective

Ensure system ability to maintain the desired humidity

6.0305.1c Equipment location

Specification

Locate equipment in an area with access to HVAC supply trunk line or plenum, and orient outside air intake so the effective length of the duct run is as short as possible

Objective

Easy access to existing ductwork and fresh air source

6.0305.1d Mounting

Specification

Mount ventilator using mechanical fasteners per manufacturer's specifications and applicable code (e.g., seismic restraints)

Isolate unit from the building framing unless specifically designed to be directly attached

Objective

Secure, vibration-isolated dehumidifier

6.0305.1e Installation

Specification

Install ventilator according to manufacturer specifications and applicable code

Objective

Correct installation

6.0305.1f Wiring

Specification

Install all electrical wiring according to manufacturer specifications and applicable code

Objective

Prevent an electrical hazard

6.0305.1g Controls

Specification

Install dehumidistat in accordance with manufacturer specifications

Operation of the dehumidifier will be based upon humidity/temperature in the return air, or will provide supply air at a specified temperature and humidity

Objective

Controls support dehumidification strategy

6.0305.1h Sealing

Specification

Seal all air moving portions of the system using UL 181 products without interfering with the function of dampers

Objective

Airtight ventilation system with freely operating dampers

6.0305.1i Condensate drain

Specification

Connect condensate drain according to manufacturer specifications to a drain location approved by applicable code

Insulate all condensate lines outside the thermal boundary to a minimum of R-4

Objective

Safe and reliable condensate drainage

6.0305.1j Access

Specification

Ensure fan, service disconnect switch, filters, and drains are accessible for maintenance according to NEC, or applicable building code

Objective

Serviceable parts are readily accessible

6.0305.1k Fire dampers

Specification

If fire dampers are required in the fresh air supply duct, install them according to applicable building code

Fire dampers must be accessible for inspection and/or testing

Sealing activities must not interfere with the operation of fire dampers, balancing dampers, or backdraft dampers

Objective

Fire dampers function effectively and are accessible

6.0306.1 Decommissioning Ventilation Systems

Section:Ventilation
Topic:Whole-Building Ventilation
Sub-Topic:Decommissioning

Desired Outcome

Safe and proper elimination of ventilation components

6.0306.1a Power supply

Specification

Disconnect power supply and terminate it in a visible junction box per applicable code

Objective

Safely disconnect and terminate power supplies

6.0306.1b Fan and component removal

Specification

Remove all ventilation components (i.e., fans, ducts, terminations) from dwelling

Objective

Preserve aesthetics and thermal and pressure boundary

6.0306.1c Sealing holes and openings

Specification

Seal and insulate all openings and voids left by the removal of the ventilation system including exterior terminations

Objective

Preserve the thermal/pressure boundary

6.0306.1d Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0101.1 Refrigerator and Freezer Replacement

Section:Baseload
Topic:Plug Load
Sub-Topic:Refrigeration

Desired Outcome

Safe, efficient, compliant, and accessible appliance installation

7.0101.1a Pre-work qualifications

Specification

Electrical receptacle meets the requirements of NFPA 70 (Article 440)

Objective

Safe electrical connection

7.0101.1b Selection

Specification

Select an ENERGY STAR qualified appliance, equivalent, or better

Select appliance with a minimum one-year warranty that provides a replacement appliance if repeated issues relating to health, safety, or performance occur

Ensure new appliance will not block access to light switches, cabinets, etc. and will fit through the smallest opening between the outside and installation location

Objective

Select safe, efficient, and durable appliance

7.0101.1c Installation

Specification

Install appliance according to manufacturer specifications and applicable code

Objective

Safe and proper installation

7.0101.1d Accessibility

Specification

Where applicable, ensure appliance is accessible as required by the Federal Fair Housing Act and ICC A117.1

The appliance shall not reduce required maneuvering clearances in the kitchen to less than that permitted by local, state, or federal guidelines

Objective

Accessible kitchen

7.0101.1e Disposal

Specification

Permanently remove old appliance from job site and recycle or dispose of removed appliance and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old appliance

Objective

Old appliance is permanently removed from service, protect the environment, and comply with regulation

7.0101.1f Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0101.2 Refrigerator/Freezer Clean and Tune

Section:Baseload
Topic:Plug Load
Sub-Topic:Refrigeration

Desired Outcome

Improve refrigeration efficiency without effecting performance

7.0101.2a Clearances and location

Specification

If possible, position the appliance to allow sufficient air flow over coils according to manufacturer specifications (i.e., move away from wall in back, remove excessive clutter from top)

Provide shading of windows or doors that allow direct sunlight to affect appliance function

Direct heating supply register air flow away from appliance

Objective

Sufficient airflow to allow refrigerant heat transfer to occur effectively

7.0101.2b Coil cleaning

Specification

Gently vacuum all debris from exterior coils

Using warm water, clean the coils and exterior surfaces until critical air flow surfaces are clean

Vacuum out all compressor and control areas and underneath the appliance and all air venting openings

Objective

Improved air flow through refrigerant coils and increased compressor heat removal

7.0101.2c Condensation settings

Specification

Set condensation controls in the appropriate position, based on moisture load in the house

Objective

Reduce unnecessary energy use

7.0101.2d Temperature settings

Specification

Set and verify interior appliance temperatures at 0 degrees F for freezer, and 35-40 degrees F for refrigerator

Objective

Food safely preserved

7.0102.1 Consumer Electronics Replacement

Section:Baseload
Topic:Plug Load
Sub-Topic:Electronics

Desired Outcome

Decreased electricity consumption without reducing performance

7.0102.1a Pre-work qualifications

Specification

Verify electrical receptacle meets the requirements of NFPA 70 (Article 440)

Objective

Safe electrical connection

7.0102.1b Selection

Specification

Select equipment:

that is ENERGY STAR qualified, equivalent, or better

that does not have to be left on during non-use periods for updates (e.g., gaming systems, set-top boxes)

with system standby losses of one watt or less

Objective

Select efficient appliances

7.0102.1c Installation

Specification

Install equipment according to manufacturer specifications (e.g., for air circulation) and applicable code

Enable all energy saving features unless specifically directed otherwise by the occupant

Objective

Safe and compliant installation

7.0102.1d Disconnecting means

Specification

Provide a readily accessible means of disconnection (e.g., power strip, timer) for equipment that must be disconnected from the power source to avoid standby losses and whose performance will not be damaged by being disconnected

Objective

Reduce standby energy use

7.0102.1e Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0102.1f Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0103.1 Lighting Replacement

Section:Baseload
Topic:Plug Load
Sub-Topic:Lighting

Desired Outcome

Improved lighting efficacy without performance loss

7.0103.1a Selection

Specification

Select lighting that:

is appropriate for the intended application (e.g., enclosed, dimmable, potential for breakage, indoor, and outdoor)

provide lighting level quality required for the intended application (e.g., task lighting, hazards lighting, nightlights)

is the highest level of efficiency within a technology (e.g., LED bulbs)

are ENERGY STAR qualified, equivalent or better, and UL approved

facilitate upgrade to future lighting technologies

is rated no more than the rated wattage of fixture

Objective

Select efficient, reliable, and safe lighting improvements

7.0103.1b Installation

Specification

Install lighting in accordance with manufacturer specifications and applicable code (i.e., NFPA 70, NFPA 101, NECA/IESNA 500)

If applicable, clean lens and reflector before installing new bulb

Objective

Safe and proper installation

7.0103.1c Electrical installation

Specification

Install all electrical wiring according to applicable code (i.e., NFPA 70)

Objective

Safe electrical installation

7.0103.1d Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0103.1e Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0103.2 Lighting Reduction

Section:Baseload
Topic:Plug Load
Sub-Topic:Lighting

Desired Outcome

Reduce lighting density without compromising life safety

7.0103.2a Design

Specification

Follow IESNA protocols for appropriate light levels for certain tasks when designing delamping procedure

Ensure final lighting levels are in accordance with ASHRAE 90.1 or 90.2

Ensure final egress lighting levels are in accordance with NFPA 70 and 101

Ensure that delamping does not impact required egress lighting, as required by ANSI/NFPA 101

Objective

Determine appropriate strategy

7.0103.2b Removal

Specification

De-energize circuit and lock out power before work begins

Remove bulbs or fixtures per plan ensuring that no open connections will remain after work is finished

Terminate all unused electrical connections in appropriate covered junction box per NFPA 70

Seal any penetrations created by removal as per ANSI/NFPA /ICC Fire Code

Objective

Safe and proper removal of fixtures and bulbs

7.0103.2c Reuse

Specification

If removed bulbs or fixtures meet retrofit standards and are operational, store them in a dry location for reuse

Objective

Store appropriate lighting equipment for future use

7.0103.2d Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0103.3 Ballast Replacement

Section:Baseload
Topic:Plug Load
Sub-Topic:Lighting

Desired Outcome

Improved lighting efficacy without performance loss

7.0103.3a Selection

Specification

Select pulse start, high-efficiency, electronic ballasts that meet the appropriate nationally recognized product standards (ANSI C82.1, ANSI C82.4, UL 924, UL 1029, NEMA) and have a ballast factor of 0.85 or greater

Select ballasts that match the input and output voltage of the existing fixture, that fit within the existing enclosure, and will support the necessary wattage of the bulbs

Objective

Select safe, efficient, and effective ballasts

7.0103.3b Removal and installation

Specification

De-energize circuit and lock out power before work begins

Install ballasts in accordance with manufacturer specifications

Clean the lens and reflector once installation is complete

Objective

Safe and effective installation

7.0103.3c Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0103.3d Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0103.6 Security Lighting

Section:Baseload
Topic:Plug Load
Sub-Topic:Lighting

Desired Outcome

Efficient, effective security lighting that minimizes disturbances of occupant and light pollution

7.0103.6a Selection

Specification

Select security light fixtures that:

- are UL approved for location installed (i.e., indoor, outdoor, wet location)
- provide the required lighting conditions with the lowest possible energy-use
- are vandal-proof
- are dark sky approved
- are ENERGY STAR qualified, equivalent, or better

Objective

Select efficient, reliable, and safe lighting improvements

7.0103.6b Installation

Specification

De-energize circuit and lock out power before work begins

Install lighting in accordance with manufacturer specifications and applicable code (e.g., NFPA 70)

Aim light fixtures to minimize light emitted above the horizontal, beyond the perimeter of the property, and not directly into any window of a residence

Clean the lens and reflector once installation is complete

Objective

Safe, effective, and efficient installation that does not disturb occupants

7.0103.6c Controls

Specification

Install both photo and motion sensors and configure to only activate when sun is down and to switch off within 5 minutes if no motion is detected

Objective

Energy saving control strategy

7.0103.6d Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0103.6e Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0103.7 Daylighting

Section:Baseload
Topic:Plug Load
Sub-Topic:Lighting

Desired Outcome

Reduce need for artificial lighting

7.0103.7a Daylighting

Specification

Replace or maneuver window coverings (e.g., blinds, shades, movable insulation) to maximize useful daylight where appropriate

Objective

Improve use of daylight for interior lighting

7.0104.1 Occupancy Sensors

Section:Baseload
Topic:Plug Load
Sub-Topic:Lighting Controls

Desired Outcome

Lighting only on when needed without compromising required lighting levels, or safety

7.0104.1a Selection

Specification

Select sensors that:

- are compatible with the existing wiring and lighting fixture
- is UL approved and listed for the installed location

Objective

Select efficient, reliable, and safe lighting control

7.0104.1b Installation

Specification

Install sensor in accordance with NFPA 70 and manufacturer specifications

- Do not install occupancy sensors in areas accessed for electrical and mechanical maintenance
- Set controls to match the intended use of the space (i.e., time off setting not too short or too long)

Objective

Safe installation that doesn't compromise service access

7.0104.1c Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0104.2 Stand-Alone Timers

Section:Baseload
Topic:Plug Load
Sub-Topic:Lighting Controls

Desired Outcome

Reduce lighting run time without compromising required lighting levels, or safety

7.0104.2a Selection

Specification

Select timer that:

- is compatible with existing wiring and lighting
- is UL approved and listed for the installed location
- has at least 10 hours of battery backup time
- has at least two programmable schedules
- has an appropriate manual override

Objective

Safe, effective, and reliable timer selection

7.0104.2b Installation

Specification

Install timer in accordance with NFPA 70 and manufacturer specifications, in a secure location, and in location appropriate enclosure (e.g., weatherproof)

Do not install timers for egress lighting required by NFPA 101

Objective

Safe, secure, and proper installation

7.0104.2c Timer settings

Specification

Set timer to turn off exterior fixtures when there is sufficient daylight (civil twilight) or when lighting is no longer needed at night per ASHRAE 90.1 or 90.2

Set timer to turn off interior fixtures when light is no longer needed in the space

Objective

Lights on when required

7.0104.2d Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0104.3 Motion Control Sensors

Section:Baseload
Topic:Plug Load
Sub-Topic:Lighting Controls

Desired Outcome

Reduce lighting run time without compromising required lighting levels, or safety

7.0104.3a Selection

Specification

Select sensor that:

- is compatible with existing wiring and lighting
- is UL approved and listed for the installed location
- is location and climate appropriate (e.g., outdoor weatherproof fixture)

Objective

Safe, effective, and reliable sensor selection

7.0104.3b Location

Specification

Locate sensor where it will minimize false starts

Objective

Reduce unnecessary operation of lighting

7.0104.3c Installation

Specification

Install timer in accordance with NFPA 70 and manufacturer specifications, in a secure location, and protected from physical damage

Objective

Safe, secure, and proper installation

7.0104.3d Settings

Specification

Set controls of motion sensor based on anticipated occupant usage or security needs

Set control to turn off lighting if no motion is detected for a maximum of 15 minutes

Objective

Meet lighting needs for area

7.0104.3e Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0104.4 Outdoor Photo Sensors

Section:Baseload
Topic:Plug Load
Sub-Topic:Lighting Controls

Desired Outcome

Lights only on when needed without compromising required lighting levels, or safety

7.0104.4a Selection

Specification

Select sensor that:

is compatible with existing wiring and lighting

is UL approved for installation location (e.g., UL 60730-1)

is location and climate appropriate (e.g., outdoor weatherproof fixture)

Select fixture that allows for replacement of photo sensor independently

Objective

Safe, effective, serviceable, and reliable sensor selection

7.0104.4b Installation

Specification

Install timer in accordance with NFPA 70 and manufacturer specifications, in a secure location, and protected from physical damage

Position sensor to properly sense natural light, but shielded from artificial light sources (e.g., other outdoor lighting)

Objective

Safe and secure installation that operates lighting when needed without interruption

7.0104.4c Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0105.1 Washing Machine

Section:Baseload
Topic:Plug Load
Sub-Topic:Laundry

Desired Outcome

Reduce energy and water usage with a fully functioning washing machine that does not inhibit accessibility

7.0105.1a Pre-work qualifications

Specification

Verify electrical receptacle meets the requirements of NFPA 70 (Article 422)

Objective

Safe electrical connection

7.0105.1b Selection

Specification

Select appliance that:

is an ENERGY STAR and WaterSense appliance, equivalent, or better

has a minimum one-year warranty that provides a replacement appliance if repeated issues relating to health, safety, or performance occur

will fit in location with manufacturer required clearance without blocking access to cabinets and light switches

fits through the smallest opening between outdoors and the installation location

that has standby losses of one watt or less

Objective

Efficient, safe, and reliable appliance selected

7.0105.1c Installation

Specification

Install appliance according to manufacturer specifications and applicable code

Objective

Safe, secure, and proper installation

7.0105.1d Water management

Specification

Install shut-off valves if not already present

Install hoses that can withstand the local water pressure

If located in or above conditioned area, install an overflow pan and drain to a code approved location

Objective

Provide service shutoffs, durable hoses, and prevent water damage to structure

7.0105.1e Accessibility

Specification

Where applicable, ensure appliance is accessible as required by the Federal Fair Housing Act and ICC A117.1

The appliance shall not reduce required maneuvering clearances to less than that permitted by local, state, or federal guidelines

Objective

Accessible home

7.0105.1f Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0105.1g Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0105.2 Clothes Dryer

Section:Baseload
Topic:Plug Load
Sub-Topic:Laundry

Desired Outcome

Safely reduce energy use for drying clothes

7.0105.2a Pre-work qualifications

Specification

Verify electrical receptacle meets the requirements of NFPA 70 (Article 422)

Objective

Safe electrical connection

7.0105.2b Selection

Specification

Select dryer that:

- is equipped with moisture sensor
- has energy features that reduce both peak electric demand and absolute energy use
- has a standby losses of one watt or less
- best matches the venting options (e.g., central location, length of vent, cost of venting)
- has a minimum one-year warranty that provides a replacement appliance if repeated issues relating to health, safety, or performance occur
- will fit in location with manufacturer required clearance without blocking access to cabinets and light switches
- fits through the smallest opening between outdoors and the installation location

Objective

Efficient, safe, and reliable appliance selected

7.0105.2c Installation

Specification

Install appliance according to manufacturer specifications and applicable code

Objective

Safe, secure, and proper installation

7.0105.2d Dryer venting

Specification

Vent dryer to outdoors according to SWS detail 6.0202.1 (Ventilation: Local Ventilation: Appliance Exhaust: Clothes Dryer)

Objective

Dryer vented to outdoors safely and effectively

7.0105.2e Accessibility

Specification

Where applicable, ensure appliance is accessible as required by the Federal Fair Housing Act and ICC A117.1

The appliance shall not reduce required maneuvering clearances to less than that permitted by local, state, or federal guidelines

Objective

Accessible home

7.0105.2f Disposal

Specification

Permanently remove old appliance from job site and recycle or dispose of removed appliance and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old appliance

Objective

Old appliance is permanently removed from service, protect the environment, and comply with regulation

7.0105.2g Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0188.1 Ceiling Fan Replacement

Section:Baseload
Topic:Plug Load
Sub-Topic:Special Considerations

Desired Outcome

Reduce energy use by installing an efficient, safe, compliant, and operable ceiling fan without reducing performance

7.0188.1a Pre-work qualifications

Specification

Verify electrical outlet box meets the requirements of NFPA 70 (Section 314.27(C)) for ceiling fan mounting

Objective

Safe and secure mechanical attachment

7.0188.1b Selection

Specification

Select ceiling fan and lighting that:

- is ENERGY STAR qualified, equivalent, or better
- is compatible with the existing switching and wiring configuration
- is of similar functionality and size
- carries a minimum of a 1-year warranty

Objective

Select safe, efficient, effective, compatible, and durable fan

7.0188.1c Installation

Specification

Install fixture in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Compliant and safe installation

7.0188.1d Lighting

Specification

Install and select light bulbs for fixture according to SWS detail 7.0103.1 (Lighting Replacement)

Objective

Improved lighting efficacy without performance loss

7.0188.1e Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0188.1f Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0201.1 Low-Flow Devices

Section:Baseload
Topic:Water Conservation
Sub-Topic:Water Preservation Devices

Desired Outcome

Leak-free and safe installation of water saving devices without affecting performance

7.0201.1a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s) and water is free of visible debris that may clog the equipment

Objective

Verify adequacy of plumbing and water source

7.0201.1b Selection

Specification

Select showerheads rated for 2.5 gallons per minute (GPM) or less that include an antiscald valve

If multiple heads are provided in a shower stall, the total flow rate may not exceed 2.5 GPM

Select features that meet any special needs of the occupant (e.g., shut off, swivel, handheld showers)

Select aerators with a flow rate of 2.2 GPM or less

Objective

Select appropriate low-flow devices

7.0201.1c Installation

Specification

Install equipment in accordance with manufacturer specifications and applicable building code

Install low-flow devices using a non-hardening thread sealant (i.e., thread tape)

Objective

Safe and proper installation that is serviceable

7.0201.1d Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0201.1e Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0201.2 Dishwasher

Section:Baseload
Topic:Water Conservation
Sub-Topic:Water Preservation Devices

Desired Outcome

Reduce dishwashing energy use with a leak-free and safe dishwasher installation

7.0201.2a Pre-work qualifications

Specification

Verify electrical receptacle or direct connection circuit meets the requirements of NFPA 70 (Article 422)

Objective

Safe electrical connection

7.0201.2b Selection

Specification

Select an appliance that:

is ENERGY STAR qualified, equivalent, or better

fits in the available space without blocking access to light switches, cabinets, etc.

includes a minimum 1-year warranty

Objective

Select safe, efficient, and reliable appliance

7.0201.2c Installation

Specification

De-energize circuit and lock out power before work begins

Install equipment in accordance with NFPA 70 (Article 422.31), manufacturer specifications, and applicable code

Install plumbing supply lines with the shortest length possible

Objective

Safe and proper installation

7.0201.2d Disposal

Specification

Permanently remove old appliance from job site and recycle or dispose of removed appliance and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old appliance

Objective

Old appliance is permanently removed from service, protect the environment, and comply with regulation

7.0201.2e Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0301.1 Pipe Insulation

Section:Baseload
Topic:Water Heating
Sub-Topic:Thermal Loss Reduction

Desired Outcome

Safely reduce thermal loss and prevent freezing of water distribution piping

7.0301.1a Pre-work qualifications

Specification

Confirm sufficient clearance exists between pipes and heat-producing devices (e.g., combustion venting)

Objective

Verify pipes can be safely insulated

7.0301.1b Insulation selection

Specification

Select insulation that:

- is a minimum of R-3
- is a vapor retarder
- is the correct interior diameter to match pipes
- is UV-protected if installed outside

Objective

Select durable and correctly sized pipe insulation

7.0301.1c Installation

Specification

Install insulation without gaps

Do not install insulation around pumps (i.e., prevent overheating)

Seal all pipe insulation seams, joints, connections with tape, tie straps, or other independent means (i.e., manufactured adhesive seam seal is not sufficient)

Objective

Safe, continuous, and durable installation

7.0301.1d Clearance

Specification

Maintain a minimum clearance of 6" between combustible pipe insulation and fuel-fired water heater draft hood and/or single wall metal vent materials

Objective

Prevent a fire hazard

7.0301.2 Tank Insulation

Section:Baseload
Topic:Water Heating
Sub-Topic:Thermal Loss Reduction

Desired Outcome

Safely reduce standby loss from storage tanks

7.0301.2a Pre-work qualifications

Specification

Verify tank is not labeled as prohibiting insulation

Verify sufficient space exists to wrap tank

Objective

Verify tank can be insulated

7.0301.2b Insulation selection

Specification

Select an insulation that:

is a minimum of R-10

has a flame spread and smoke development index of 25/450 or less when tested in accordance with ASTM E84 or UL 723

is clearly labeled with R-value

Objective

Select safe and effective insulation of the correct R-value

7.0301.2c Insulation installation

Specification

Install insulation according to manufacturer specifications over entire storage tank while ensuring that insulation does not obstruct pressure relief valve, plumbing pipes, gas valves, combustion air intakes, etc.

Permanently secure insulation with minimal compression

Seal all seams and edges airtight using compatible and durable tape

Objective

Safe, effective, and durable installation

7.0301.2d Clearance

Specification

Maintain a minimum clearance of 6" between combustible tank insulation and fuel-fired water heater draft hood and/or single wall metal vent materials

Do not wrap the top of fuel-fired water heaters or cover combustion air intakes

Objective

Prevent a fire hazard

7.0301.2e Service access

Specification

Pre-cut flaps at access plates and label them clearly indicating access purpose

Tape access flaps closed

Objective

Provide easy service access and prevent future damage to insulation

7.0302.1 Electric Storage Tank Water Heater

Section:Baseload
Topic:Water Heating
Sub-Topic:Water Heater Installation

Desired Outcome

Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible water heater

7.0302.1a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s) and is leak-free

Objective

Verify adequacy of plumbing

7.0302.1b Equipment selection

Specification

Select a water heater that:

has an Energy Factor (EF) of 0.93 or better

fits in the installation space with required clearances

provides sufficient hot water for the home and occupants

Objective

Select efficient and properly sized water heater

7.0302.1c Location

Specification

Install appliance where it is protected from freezing and accessible for service

Objective

Select freezeproof, safe, and accessible location

7.0302.1d Installation

Specification

Install water heater in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Compliant and safe installation

7.0302.1e Equipment accessibility

Specification

Provide a level working space not less than 30" in length and 30" in width in front of the control side of the appliance

Install appliance and plumbing to allow for inspection, maintenance, and replacement of the appliance and its components, without disturbing other installed equipment, controls, piping, and components, other than what requires repair/replacement

Ensure that anode rod is accessible for replacement

Objective

Ensure the appliance can be easily maintained and replaced

7.0302.1f TandP valve and piping

Specification

Install a Temperature and Pressure (TandP) relief valve per the IRC and manufacturer specifications

Pipe the valve to within 6" of the floor or drain pan or to the outdoors and must terminate in an observable location

Select piping material based on IRC requirements

Objective

Direct scalding water away from occupants

7.0302.1g Emergency drain pan

Specification

If appliance is installed in or above conditioned space or in a location where water damage could occur, install a drain pan according to the requirements of the IRC

Drain pan to the exterior of the building

Objective

Prevent water damage from leaking water

7.0302.1h Shut-off valves

Specification

Install a separate water cut-off valve for both the hot and cold water lines

Objective

Allow isolation of tank

7.0302.1i Expansion tank

Specification

Install an expansion tank anytime a storage water heater is supplied with cold water that passes through a check valve, pressure reducing valve or backflow preventer

Connect the tank to the cold water supply line at a point that is downstream of all check valves, pressure reducing valves and backflow preventers

Size thermal expansion tanks in accordance with the tank manufacturer's instructions and applicable code (e.g., IRC, IBC)

Objective

Protect tank and connected piping from expansion damage or leaks

7.0302.1j Dielectric unions

Specification

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

Objective

Prevent corrosion between dissimilar metals

7.0302.1k Heat traps

Specification

Install heat traps on the inlet and outlet piping where not provided by manufacturer

Objective

Reduce thermal loss from convection or siphoning

7.0302.1l Discharge temperature settings

Specification

Set discharge temperature to not exceed 120 degrees or as prescribed by local code

Objective

Prevent biological growth in tank but prevent scalding

7.0302.1n Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0302.1o Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0302.2 Fuel-Fired Storage Tank Water Heater

Section:Baseload
Topic:Water Heating
Sub-Topic:Water Heater Installation

Desired Outcome

Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible water heater

7.0302.2a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s) and is leak-free

Objective

Verify adequacy of plumbing

7.0302.2b Equipment selection

Specification

Select a system that:

is ENERGY STAR certified, equivalent, or better

includes a low nitrogen oxide burner

fits in the installation space with required clearances

provides sufficient hot water for the home and occupants

Objective

Select efficient, durable, and properly sized water heater

7.0302.2c Location

Specification

Install appliance where it is protected from freezing and accessible for service

Objective

Select freezeproof, safe, and accessible location

7.0302.2d Installation

Specification

Install water heater in compliance with applicable code (e.g., IRC, NFPA 31, NFPA 54) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Compliant and safe installation

7.0302.2e Equipment accessibility

Specification

Provide a level working space not less than 30" in length and 30" in width in front of the control side of the appliance

Install appliance and plumbing to allow for inspection, maintenance, and replacement of the appliance and its components, without disturbing other installed equipment, controls, piping, and components, other

than what requires repair/replacement

Ensure that anode rod is accessible for replacement

Objective

Ensure the appliance can be easily maintained and replaced

7.0302.2f Fuel supply

Specification

Install fuel supply components per NFPA 31 (for oil) and NFPA 54 (for gas) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Install an emergency fuel cut-off switch within reach of the water heater

Objective

Safe and effective fuel delivery that provides for emergency fuel cut-off

7.0302.2g Emergency drain pan

Specification

If appliance is installed in or above conditioned space or in a location where water damage could occur, install a drain pan according to the requirements of the IRC

Drain pan to the exterior of the building

Objective

Prevent water damage from leaking water

7.0302.2h Shut-off valves

Specification

Install a separate water cut-off valve for both the hot and cold water lines

Objective

Allow isolation of tank

7.0302.2i Expansion tank

Specification

Install an expansion tank anytime a storage water heater is supplied with cold water that passes through a check valve, pressure reducing valve or backflow preventer

Connect the tank to the cold water supply line at a point that is downstream of all check valves, pressure reducing valves and backflow preventers

Size thermal expansion tanks in accordance with the tank manufacturer's instructions and applicable code (e.g., IRC, IBC)

Objective

Protect tank and connected piping from expansion damage or leaks

7.0302.2j TandP valve and piping

Specification

Install a Temperature and Pressure (TandP) relief valve per the IRC and manufacturer specifications

Pipe the valve to within 6" of the floor or drain pan or to the outdoors and must terminate in an observable location

Select piping material based on IRC requirements

Objective

Direct scalding water away from occupants

7.0302.2k Dielectric unions

Specification

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

Objective

Prevent corrosion between dissimilar metals

7.0302.2l Heat traps

Specification

Install heat traps on the inlet and outlet piping where not provided by manufacturer

Objective

Reduce thermal loss from convection or siphoning

7.0302.2m Discharge temperature settings

Specification

Set discharge temperature to not exceed 120 degrees or as prescribed by local code

Objective

Prevent biological growth in tank but prevent scalding

7.0302.2o Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0302.2p Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0302.3 Heat Pump Storage Tank Water Heater

Section:Baseload
Topic:Water Heating
Sub-Topic:Water Heater Installation

Desired Outcome

Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible water heater

7.0302.3a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s) and is leak-free

Objective

Verify adequacy of plumbing

7.0302.3b Equipment selection

Specification

Select a water heater that:

is ENERGY STAR certified, equivalent, or better

fits in the installation space with required clearances

provides sufficient hot water for the home and occupants

Objective

Select efficient and properly sized water heater

7.0302.3c Location

Specification

Install appliance where it:

is in conditioned space

is accessible for service

has sufficient volume of air per manufacturer specifications

will not affect indoor thermostat readings or blow directly on occupants

Objective

Select indoor, safe, and accessible location with sufficient air volume

7.0302.3d Installation

Specification

Install water heater in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Compliant and safe installation

7.0302.3e Equipment accessibility

Specification

Provide a level working space not less than 30" in length and 30" in width in front of the control side of the appliance

Install appliance and plumbing to allow for inspection, maintenance, and replacement of the appliance and its components, without disturbing other installed equipment, controls, piping, and components, other than what requires repair/replacement

Ensure that anode rod is accessible for replacement

Objective

Ensure the appliance can be easily maintained and replaced

7.0302.3f TandP valve and piping

Specification

Install a Temperature and Pressure (TandP) relief valve per the IRC and manufacturer specifications

Pipe the valve to within 6" of the floor or drain pan or to the outdoors and must terminate in an observable location

Select piping material based on IRC requirements

Objective

Direct scalding water away from occupants

7.0302.3g Emergency drain pan

Specification

If appliance is installed in or above conditioned space or in a location where water damage could occur, install a drain pan according to the requirements of the IRC

Drain pan to the exterior of the building

Objective

Prevent water damage from leaking water

7.0302.3h Shut-off valves

Specification

Install a separate water cut-off valve for both the hot and cold water lines

Objective

Allow isolation of tank

7.0302.3i Expansion tank

Specification

Install an expansion tank anytime a storage water heater is supplied with cold water that passes through a check valve, pressure reducing valve or backflow preventer

Connect the tank to the cold water supply line at a point that is downstream of all check valves, pressure reducing valves and backflow preventers

Size thermal expansion tanks in accordance with the tank manufacturer's instructions and applicable code (e.g., IRC, IBC)

Objective

Protect tank and connected piping from expansion damage or leaks

7.0302.3j Dielectric unions

Specification

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

Objective

Prevent corrosion between dissimilar metals

7.0302.3k Heat traps

Specification

Install heat traps on the inlet and outlet piping where not provided by manufacturer

Objective

Reduce thermal loss from convection or siphoning

7.0302.3l Discharge temperature settings

Specification

Set discharge temperature to not exceed 120 degrees or as prescribed by local code

Objective

Prevent biological growth in tank but prevent scalding

7.0302.3m Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0302.3n Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0302.5 Tankless On-Demand/Point-Of-Use Appliances

Section:Baseload
Topic:Water Heating
Sub-Topic:Water Heater Installation

Desired Outcome

Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible water heater

7.0302.5a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s) and is leak-free

Objective

Verify adequacy of plumbing

7.0302.5b Equipment selection

Specification

Select a water heater that:

- is ENERGY STAR certified, equivalent, or better
- fits in the installation space with required clearances
- provides sufficient hot water for the home and occupants

Objective

Select efficient and properly sized water heater

7.0302.5c Location

Specification

Install appliance where it:

is protected from freezing

is accessible for service

will minimize distance between tank and primary hot water outlets

Objective

Select freeze protected, safe, efficient and accessible location

7.0302.5d Installation

Specification

Install water heater in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Compliant and safe installation

7.0302.5e Equipment accessibility

Specification

Provide a level working space not less than 30" in length and 30" in width in front of the control side of the appliance

Install appliance and plumbing to allow for inspection, maintenance, and replacement of the appliance

and its components, without disturbing other installed equipment, controls, piping, and components, other than what requires repair/replacement

Objective

Ensure the appliance can be easily maintained and replaced

7.0302.5f Shut-off valves

Specification

Install a separate water cut-off valve for both the hot and cold water lines

Objective

Allow isolation of tank

7.0302.5g TandP valve and piping

Specification

Install a Temperature and Pressure (TandP) relief valve per the IRC and manufacturer specifications

Pipe the valve to within 6" of the floor or drain pan or to the outdoors and must terminate in an observable location

Select piping material based on IRC requirements

Objective

Direct scalding water away from occupants

7.0302.5h Fuel supply

Specification

Install fuel supply components per NFPA 31 (for oil) and NFPA 54 (for gas) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Install an emergency fuel cut-off switch within reach of the water heater

Objective

Safe and effective fuel delivery that provides for emergency fuel cut-off

7.0302.5i Dielectric unions

Specification

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

Objective

Prevent corrosion between dissimilar metals

7.0302.5j Discharge temperature settings

Specification

Set discharge temperature to not exceed 120 degrees or as prescribed by local code

Objective

Prevent biological growth in tank but prevent scalding

7.0302.5k Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with

regulation

7.0302.5l Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0302.6 Solar Water Heater

Section:Baseload
Topic:Water Heating
Sub-Topic:Water Heater Installation

Desired Outcome

Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible water heater

7.0302.6a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s) and is leak-free

If a roof installation is planned, verify that the roof will support the installation (e.g., dead load, wind load) and that the current roof has more than 10 years of useful life remaining

Objective

Verify adequacy of plumbing

7.0302.6b Storage tank selection

Specification

Select a storage/backup water heaters that:

- is ENERGY STAR certified, equivalent, or better
- fits in the installation space with required clearances
- provides sufficient hot water for the home and occupants
- is insulated to R-12.5 or greater

Objective

Efficient, and appropriate tank selected

7.0302.6c Solar collector location

Specification

Locate solar collectors to minimize shading factor and maximize solar gain, but not interfere with other appliance operation (e.g., chimneys, vents, exhaust terminations)

Objective

Maximize system performance

7.0302.6d Installation

Specification

Install water heater in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications

- If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Compliant and safe installation

7.0302.6e Accessibility

Specification

Install and plumb storage tank and solar collectors to allow for inspection, maintenance, and replacement of the appliance and its components

Ensure that anode rod is accessible for replacement

Provide a path that allows the solar collector to be safely accessed without damaging the roof

Objective

System is safely accessible for service

7.0302.6f Freeze protection

Specification

Incorporate system freeze protection for applicable climates, including, but not limited to, closed glycol loops, drain back systems, supplemental heat, or other methods, as approved by applicable code and manufacturer specifications

Objective

Prevent freezing liquid in pipes in cold weather climates

7.0302.6g Emergency drain pan

Specification

If appliance is installed in or above conditioned space or in a location where water damage could occur, install a drain pan according to the requirements of the IRC

Drain pan to the exterior of the building

Objective

Prevent water damage from leaking water

7.0302.6h TandP valve and piping

Specification

Install a Temperature and Pressure (TandP) relief valve per the IRC and manufacturer specifications

Pipe the valve to within 6" of the floor or drain pan or to the outdoors and must terminate in an observable location

Select piping material based on IRC requirements

Objective

Direct scalding water away from occupants

7.0302.6i Dielectric unions

Specification

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

Objective

Prevent corrosion between dissimilar metals

7.0302.6j Heat traps

Specification

Install heat traps on the inlet and outlet piping where not provided by manufacturer

Objective

Reduce thermal loss from convection or siphoning

7.0302.6k Isolation valves

Specification

Install a separate water cut-off valve for both the hot and cold incoming water lines at the storage tank, and between each additional components of the system (e.g., mixing valves, solar collector, additional

storage tank)

Objective

Allow isolation and service of each system component

7.0302.6l Expansion tank

Specification

Install an expansion tank anytime a storage water heater is supplied with cold water that passes through a check valve, pressure reducing valve or backflow preventer

Connect the tank to the cold water supply line at a point that is downstream of all check valves, pressure reducing valves and backflow preventers

Size thermal expansion tanks in accordance with the tank manufacturer's instructions and applicable code (e.g., IRC, IBC)

Objective

Protect tank and connected piping from expansion damage or leaks

7.0302.6m Insulate piping

Specification

Insulate all accessible pipes carrying hot water to a minimum R-3 per SWS (Water Heating: Thermal Loss Reduction: Pipe Insulation"

Objective

Reduce heat loss through hot water pipes

7.0302.6n Discharge temperature settings

Specification

Install a suitable thermostatic mixing valve and set discharge temperature to not exceed 120 degrees or as prescribed by local code

Install a temperature-indicating device at the discharge outlet of the thermostatic mixing valve

Objective

Prevent biological growth in tank but prevent scalding

7.0302.6p Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0302.6q Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0303.1 Mixing Valves

Section:Baseload
Topic:Water Heating
Sub-Topic:Distribution Components

Desired Outcome

Safe and reliable water temperature control

7.0303.1a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s) and is leak-free

Objective

Verify adequacy of plumbing

7.0303.1b Location

Specification

Install mixing valves at as many locations as necessary to deliver safe and adequate hot water

Objective

Optimal water temperature throughout the system

7.0303.1c Installation

Specification

Install equipment in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Compliant and safe installation

7.0303.1d Equipment accessibility

Specification

Install valve and plumbing to allow for inspection, maintenance, and replacement of the appliance and its

components, without disturbing other installed equipment, controls, piping, and components, other than what requires repair/replacement

Objective

Ensure the valve can be readily maintained and replaced

7.0303.1e Isolation valves

Specification

Install a separate water cut-off valve for both the hot and cold incoming water lines

Objective

Allow isolation and service of mixing valve

7.0303.1f Check valves

Specification

Install check valves on the hot and cold water supply lines upstream of the mixing valve

Objective

Eliminate crossover

7.0303.1g Heat traps

Specification

Install mixing valve with a heat trap or at a distance from heat sources sufficient enough to prevent scaling or damage to the valve

Objective

Prevent scaling and valve damage

7.0303.1h Temperature gauges

Specification

Install temperature gauges on hot, cold, and tempered supply water lines within sight of the mixing valve

Objective

Verification of proper mixing valve operation

7.0303.1i Wiring

Specification

Install controls and sensors in accordance with manufacturer specifications and applicable code (NFPA 70)

When controls are low voltage, separate the low voltage and line voltage wiring

Objective

Safe and compliant mixing valve operation

7.0303.1j Dielectric unions

Specification

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

Objective

Prevent corrosion between dissimilar metals

7.0303.1k Discharge temperature settings

Specification

Set discharge temperature to not exceed 120 degrees or as prescribed by local code

Objective

Prevent biological growth in tank but prevent scalding

7.0303.1l Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0303.2 Piping

Section:Baseload
Topic:Water Heating
Sub-Topic:Distribution Components

Desired Outcome

Safe, compliant, and efficient water distribution

7.0303.2a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s) and is leak-free

Objective

Verify adequacy of plumbing

7.0303.2b Material selection

Specification

Select piping materials according to the applicable code requirements (i.e., IRC, IBC)

Objective

Safe and compliant material selection

7.0303.2c Decommissioning existing piping

Specification

Cap obsolete but inaccessible piping as close as possible to the point of no access

Objective

Prevent reuse of abandoned piping

7.0303.2d Piping location

Specification

Locate piping with the following priority: Within conditioned space; Within the building; Outdoor; Below ground (insulated and sleeved)

Objective

Prevent freezing and reduce thermal loss

7.0303.2e New pipe installation

Specification

Install piping in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications according to the following design:

minimize length of runs

allow for insulation on each individual pipe (e.g., no bundling)

install and label tracer lines when piping is installed below ground or when the pipe is hidden within the building

install piping to protect all occupants from contact with hot water pipes

Objective

Safe, efficient, and durable pipe installation

7.0303.2f Insulate piping

Specification

Insulate all accessible pipes carrying hot water to a minimum R-3 per SWS (Water Heating: Thermal Loss Reduction: Pipe Insulation"

Objective

Reduce heat loss through hot water pipes

7.0303.2g Friction loss

Specification

Minimize friction loss using the following criteria:

Use smooth piping

Use as few joints and fittings as possible

Use sweeps instead of 90o elbows

Use full port valves

Objective

Efficient delivery of water

7.0303.2h Dielectric unions

Specification

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC

and manufacturer specifications

Objective

Prevent corrosion between dissimilar metals

7.0303.2i Stray voltage protection

Specification

Bond and ground piping as required by NEC (NFPA 70)

Objective

Eliminate stray voltage from piping

7.0303.2j Disposal

Specification

Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old equipment

Objective

Old equipment is permanently removed from service, protect the environment, and comply with regulation

7.0303.5 Expansion Tank (Potable Water)

Section:Baseload
Topic:Water Heating
Sub-Topic:Distribution Components

Desired Outcome

Safe, compliant, leak-free, and properly sized expansion tank installation

7.0303.5a Expansion tank selection

Specification

Select a tank that:

is rated for potable water

is sized according to applicable code (i.e., IPC, IRC, IBC) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe and properly sized expansion tank

7.0303.5b Location

Specification

Locate the expansion tank on the cold water inlet to the water heater between the water heating equipment and the required shut off

Objective

Prevent isolation of the expansion tank from the water heater

7.0303.5c Installation

Specification

Install expansion tank in accordance with the manufacturer's installation instructions and applicable code

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe and compliant installation

7.0303.5d Support

Specification

Support expansion tank so that it does not move or sag using rigid support material that is able to support twice the weight of the tank filled with water

Objective

Durable rigid support

7.0303.5e Air pressure

Specification

Set the pressure in the expansion tank to match the incoming water pressure

Objective

Set correct air pressure

7.0303.5f Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.8802.1 Motor Replacement

Section:Baseload
Topic:Special Considerations
Sub-Topic:Spas, Hot Tubs, Saunas

Desired Outcome

Safe, efficient, and compatible motor replacement

7.8802.1a Pre-work qualifications

Specification

Verify that existing plumbing and electrical systems can support the new installation

Objective

Verify adequacy of existing utilities

7.8802.1b Equipment Selection

Specification

Select a motor that:

- is compatible with phase and voltage of existing wiring
- is physically compatible with frame size
- is at least 2-speed
- is UL listed for pool, spa, or hot tub use
- meets or exceeds efficiency standards of APSP-15
- Select controls that are UL listed for the installation location (e.g., wet location)

Objective

Select safe, efficient, and compatible motor

7.8802.1c Installation

Specification

Install motor in accordance with NFPA 70 (Article 680) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe and compliant installation

7.8802.1d Disposal or reuse

Specification

If operational, store replaced motor for temporary backup use and label as such

If nonoperational, recycle or dispose of removed equipment according to local and federal law (e.g., EPA) (i.e., do not leave replaced equipment at the client home)

Objective

Provide backup motor, protect the environment and comply with regulation

7.8802.1e Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.8802.2 Control Replacement

Section:Baseload
Topic:Special Considerations
Sub-Topic:Spas, Hot Tubs, Saunas

Desired Outcome

Safe, efficient, and compatible control replacement

7.8802.2a Pre-work qualifications

Specification

Verify that existing plumbing and electrical systems can support the new installation

Objective

Verify adequacy of existing utilities

7.8802.2b Equipment selection

Specification

Select controls that:

are UL listed for the installation location (e.g., wet location)

provide reduced energy consumption options (i.e., timers, schedules)

Objective

Select safe, efficient, and compatible controls

7.8802.2c Installation

Specification

Install controls in accordance with NFPA 70 (Article 680) and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe and compliant installation

7.8802.2d Disposal or reuse

Specification

If operational, store replaced controls for temporary backup use and label as such

If nonoperational, recycle or dispose of removed equipment according to local and federal law (e.g., EPA) (i.e., do not leave replaced equipment at the client home)

Objective

Provide backup motor, protect the environment and comply with regulation

7.8802.2e Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.8803.1 Water Softening System Installation

Section:Baseload
Topic:Special Considerations
Sub-Topic:Water Conditioning

Desired Outcome

Safe, compliant, and leak-free system installation that meets the needs of the water consumer without damaging the water system

7.8803.1a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s) and is leak-free

Objective

Verify adequacy of plumbing

7.8803.1b Equipment selection

Specification

Select equipment that:

provides the treatment level needed in accordance with the National Association of Corrosion Engineers (NACE TPC 7)

meets the local water standards and requirements

Objective

Prevent damage to water distribution system and protect water consumer

7.8803.1c Location

Specification

Install system on a level surface where it is protected from freezing and accessible for service

Objective

Accessible, freeze-protected installation

7.8803.1d Equipment accessibility

Specification

Provide a level working space not less than 30" in length and 30" in width in front of the control side of the appliance

Install appliance and plumbing to allow for inspection, maintenance, and replacement of the appliance and its components, without disturbing other installed equipment, controls, piping, and components, other than what requires repair/replacement

Objective

Ensure the appliance can be easily maintained and replaced

7.8803.1e Installation

Specification

Install system on the cold water side of any water heating system according to manufacturer specifications and applicable codes

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe, compliant, and durable installation

7.8803.1f Electrical wiring

Specification

Install all electrical wiring in compliance with NFPA 70 and manufacturer specifications

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe and compliant pump installation

7.8803.1g Isolation and bypass valves

Specification

Install a cut-off valve for the incoming water line and install bypass piping and valve

Objective

Allow isolation and bypass of conditioning system

7.8803.1h Salt storage

Specification

Store salts for treating the system in a cool and dry environment, not in contact with the floor, and away from metal solids

Objective

Prevent corrosion

7.8803.1i Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information as well as a copy of the NACE recommendations

Objective

Manufacturer supplied information available to occupant