

2020 SWS - Multifamily Housing - All Specifications

The National Renewable Energy Laboratory

Disclaimer

This field guide contains all of the Specifications for the Multifamily Housing housing type

Table Of Contents

2.0101.1 Hardwired (interconnected) Smoke Alarms	39
2.0101.1a Selection	39
2.0101.1b Location	39
2.0101.1c Installation	39
2.0101.1d Occupant notification	40
2.0101.2 Battery-Operated Smoke Alarms	40
2.0101.2a Selection	40
2.0101.2b Location	40
2.0101.2c Installation	41
2.0101.2d Occupant notification	41
2.0102.1 CO Detection and Warning Equipment	41
2.0102.1a Selection	41
2.0102.1b Location	42
2.0102.1c Installation	42
2.0102.1d Occupant notification	42
2.0103.1 Temperature and pressure relief valve	43
2.0103.1a Selection	43
2.0103.1b Installation	43
2.0103.1c Discharge	43
2.0201.1 Gutters	44
2.0201.1a Selection	44
2.0201.1b Attachment	44
2.0201.1c Slope	45
2.0201.1d Sealing	45
2.0201.2 Downspouts	45
2.0201.2a Selection	45
2.0201.2b Attachment	46
2.0201.2c Drainage	46
2.0201.3 Grading	46
2.0201.3a Slope	47
2.0201.3b Vegetation removal	47
2.0201.4 Sump Pumps	47
2.0201.4a Selection	47
2.0201.4b Installation	48
2.0201.4c Discharge	48
2.0201.4d Commissioning	48
2.0201.4e Occupant notification	49
2.0202.1 Un-Vented Subspaces - Ground Cover	49
2.0202.1a Preparation	49
2.0202.1b Material selection	49
2.0202.1c Coverage	50
2.0202.1d Drainage	50

2.0202.1e Seams/connections	50
2.0202.1f Fastening	51
2.0202.1g Air sealing	51
2.0202.1h Signage	51
2.0202.2 Vented Subspaces - Ground Cover	52
2.0202.2a Preparation	52
2.0202.2b Material selection	52
2.0202.2c Coverage	53
2.0202.2d Drainage	53
2.0202.2e Seams	53
2.0202.2f Fastening	53
2.0202.2g Air Sealing	54
2.0202.2h Signage	54
2.0203.1 Stand-Alone Dehumidifier Installation	54
2.0203.1a Selection	55
2.0203.1b Installation	55
2.0203.1c Commissioning	56
2.0203.1d Disposal	56
2.0203.1e Client education	56
2.0301.1 Junctions/Splices Enclosed	57
2.0301.1a Junction box covers	57
2.0301.1b Wiring Splices	57
2.0301.2 Knob and Tube Wiring - Isolation	58
2.0301.2a Clearance	58
2.0301.2b Marking	58
2.0401.1 Soil-Gas Retarder	58
2.0401.1a Applicable Spaces	59
2.0401.1b Preparation	59
2.0401.1c Material Selection	59
2.0401.1d Coverage	60
2.0401.1e Termite Inspection Gap	60
2.0401.1f Seams	60
2.0401.1g Foundation Connections	61
2.0401.1h Penetrations	61
2.0401.1i Fastening	62
2.0401.1j Drainage	62
2.0401.2 Sump Well/Pit Covers	62
2.0401.2a Sump Covers	62
2.0401.2b Drainage	63
2.0401.3 Drain Fittings	63
2.0401.3a Sealing Penetrations	63
2.0401.3b Airtight Drains	64
2.0402.1 New Systems	64
2.0402.1a Standard for Installation	64
3.0101.1 Air Sealing Holes	64

3.0101.1a Sealant selection	65
3.0101.1b Material selection	65
3.0101.1c Backing, infill, and support	66
3.0101.1d Surface preparation	66
3.0101.1e Sealant application	67
3.0101.1f High-temperature application	67
3.0102.1 Sealing Non-Insulation Contact (IC) Recessed Light	67
3.0102.1a Sealant selection	67
3.0102.1b Material selection	68
3.0102.1c Clearance	68
3.0102.1d Enclosure top	69
3.0102.1e Structural soundness	69
3.0102.1f Surface preparation	69
3.0102.1g Sealant application	69
3.0102.1h Marking	70
3.0102.2 Sealing High-Temperature Devices	70
3.0102.2a Sealant selection	70
3.0102.2b Material selection	71
3.0102.2c Clearance and isolation	71
3.0102.2d Backing and infill	72
3.0102.2e Surface preparation	72
3.0102.2f Sealant application	72
3.0102.3 Sealing Tongue and Groove Surfaces	72
3.0102.3a Sealant selection	73
3.0102.3b Material selection	73
3.0102.3c Backing	74
3.0102.3d Surface preparation	74
3.0102.3e Sealant application	74
3.0102.4 Sealing Firewalls	74
3.0102.4a Sealant selection	75
3.0102.4b Material selection	75
3.0102.4c Backing and infill	76
3.0102.4d Surface preparation	76
3.0102.4e Sealant application	76
3.0102.9 Sealing Dropped Soffits/Bulkheads	77
3.0102.9a Sealant selection	77
3.0102.9b Material selection	77
3.0102.9c Support	78
3.0102.9d Surface preparation	78
3.0102.9e Install air barrier	78
3.0102.9f Attachment	79
3.0102.9g Sealant application	79
3.0102.9h High-temperature application	79
3.0102.10 Sealing Dropped Ceilings	79
3.0102.10a Sealant selection	80

3.0102.10b Material selection	80
3.0102.10c Support	81
3.0102.10d Surface preparation	81
3.0102.10e Install air barrier	81
3.0102.10f Sealant application	81
3.0102.10g High-temperature application	82
3.0102.11 Sealing Roof/Wall Connections	82
3.0102.11a Sealant selection	82
3.0102.11b Material selection	83
3.0102.11c Surface preparation	83
3.0102.11d Support	83
3.0102.11e Install air barrier	84
3.0102.11f Attachment	84
3.0102.11g Sealant application	84
3.0102.11h High-temperature application	85
3.0103.1 Access Doors and Hatches	85
3.0103.1a Sealant selection	85
3.0103.1b Material selection	86
3.0103.1c Surface preparation	86
3.0103.1d Seal framing	86
3.0103.1e Seal access panel	87
3.0103.1f Damming	87
3.0103.1g Insulate opening	87
3.0103.1h Durability	87
3.0103.2 Exterior Roof Access Panels and Hatches	88
3.0103.2a Sealant selection	88
3.0103.2b Material selection	88
3.0103.2c Roof access operation and fit	89
3.0103.2d Surface preparation	89
3.0103.2e Frame/curb sealing	89
3.0103.2f Insulation	90
3.0103.2g Fire safety	90
3.0103.4 Tenting of Wet Sprinkler Systems	90
3.0103.4a Sealant selection	91
3.0103.4b Material selection	91
3.0103.4c Enclosure construction	91
3.0103.4d Insulation	92
3.0103.4e Air sealing	92
3.0103.4f Fire safety	92
3.0104.1 Closed Crawlspace Air Sealing	93
3.0104.1a Pre-work qualifications	93
3.0104.1b Sealant selection	93
3.0104.1c Material selection	94
3.0104.1d Backing and infill	94
3.0104.1e Support	94

3.0104.1f Surface preparation	95
3.0104.1g Existing vent openings	95
3.0104.1h Air sealing	95
3.0104.1i Adjacent spaces	96
3.0104.1j Fire safety	96
3.0104.2 Installing New Crawlspace Access	96
3.0104.2a Sealant selection	97
3.0104.2b Material selection	97
3.0104.2c Backing and infill	97
3.0104.2d Surface preparation	98
3.0104.2e Access construction	98
3.0104.2f Appliance access	98
3.0104.2g Air sealing	99
3.0104.2h Security	99
3.0104.3 Slab Foundation Sealing	99
3.0104.3a Sealant selection	100
3.0104.3b Material selection	100
3.0104.3c Backing and infill	101
3.0104.3d Surface preparation	101
3.0104.3e Air sealing	101
3.0104.3f High-temperature application	101
3.0104.4 Covers for Intentional Slab Penetrations	102
3.0104.4a Sealant selection	102
3.0104.4b Material selection	102
3.0104.4c Surface preparation	103
3.0104.4d Sealing sump pump wells	103
3.0104.4e Covering other water containing pits	104
3.0105.1 Isolating Garage From Living Space	104
3.0105.1a Sealant selection	104
3.0105.1b Material selection	105
3.0105.1c Surface preparation	105
3.0105.1d Backing and infill	105
3.0105.1e General air sealing	106
3.0105.1f Ductwork	106
3.0105.1g Doors adjacent to conditioned spaces	106
3.0105.1h Glass doors or windows	107
3.0105.1i High-temperature application	107
3.0201.1 Window Air Sealing	107
3.0201.1a Sealant selection	107
3.0201.1b Material selection	108
3.0201.1c Surface preparation	108
3.0201.1d Operation and fit	109
3.0201.1e Sash stops	109
3.0201.1f Weather stripping	109
3.0201.1g Sash locks	110

3.0201.1h Exterior weatherproofing	110
3.0201.1i Safety	110
3.0201.2 Window Sash Replacement	111
3.0201.2a Sealant selection	111
3.0201.2b Material selection	111
3.0201.2c Surface preparation	112
3.0201.2d Sash replacement	112
3.0201.2e Weatherproofing	112
3.0201.2f Sash stops	113
3.0201.2g Weather stripping	113
3.0201.2h Sash locks	113
3.0201.2i Disposal	113
3.0201.2j Safety	114
3.0201.3 Window Sill Replacement	114
3.0201.3a Sealant selection	114
3.0201.3b Material selection	115
3.0201.3c Surface preparation	115
3.0201.3d Sill replacement	115
3.0201.3e Weatherproofing	116
3.0201.3f Disposal	116
3.0201.3g Safety	116
3.0201.4 Glass Replacement	117
3.0201.4a Sealant selection	117
3.0201.4b Material selection	117
3.0201.4c Surface preparation	118
3.0201.4d New glazing selection	118
3.0201.4e New glazing installation	118
3.0201.4f Safety	119
3.0201.5 Interior Fixed Storm Window Installation	119
3.0201.5a Sealant selection	119
3.0201.5b Material selection	120
3.0201.5c Surface preparation	120
3.0201.5d Installation	121
3.0201.5e Safety	121
3.0201.6 Interior Operable Storm Window Installation	121
3.0201.6a Sealant selection	121
3.0201.6b Material selection	122
3.0201.6c Surface preparation	122
3.0201.6d Installation	123
3.0201.6e Safety	123
3.0201.7 Exterior Fixed Storm Window Installation	123
3.0201.7a Sealant selection	123
3.0201.7b Material selection	124
3.0201.7c Surface preparation	124
3.0201.7d Installation	125

3.0201.7e Sealing	125
3.0201.7f Safety	125
3.0201.8 Exterior Operable Storm Window Installation	125
3.0201.8a Sealant selection	126
3.0201.8b Material selection	126
3.0201.8c Surface preparation	127
3.0201.8d Installation	127
3.0201.8e Sealing	127
3.0201.8f Safety	127
3.0201.9 Window Replacement	128
3.0201.9a Sealant selection	128
3.0201.9b Material selection	128
3.0201.9c Window selection	129
3.0201.9d Opening preparation	129
3.0201.9e Installation	130
3.0201.9f Safety	130
3.0202.1 Door Air Sealing	130
3.0202.1a Sealant selection	131
3.0202.1b Material selection	131
3.0202.1c Surface preparation	132
3.0202.1d Operation and fit	132
3.0202.1e Handle/lockset	132
3.0202.1f Weather stripping	132
3.0202.1g Door stop	133
3.0202.1h Exterior weatherproofing	133
3.0202.1i Safety	134
3.0202.2 Door Replacement	134
3.0202.2a Sealant selection	134
3.0202.2b Material selection	135
3.0202.2c Door selection	135
3.0202.2d Opening preparation	135
3.0202.2e Installation	136
3.0202.2f Safety	136
3.0202.3 Exterior Door Handle/Lockset Installation	137
3.0202.3a Hardware selection	137
3.0202.3b Installation	137
3.0202.3c Safety	138
4.0101.1 Roof Deck Insulation	138
4.0101.1a Pre-work qualifications	138
4.0101.1b General preparation	138
4.0101.1c Material selection	139
4.0101.1d Sealant selection	139
4.0101.1e Installation	139
4.0101.1f Air sealing	140
4.0101.1g Water management	140

4.0101.1h Replacement roof covering	140
4.0101.1i Insulation - onsite documentation	141
4.0102.1 SPF Roof Insulation - Unvented Roof Deck	141
4.0102.1a Pre-work qualifications	141
4.0102.1b General preparation	142
4.0102.1c Material selection	142
4.0102.1d Surface preparation	143
4.0102.1e Installation	143
4.0102.1f Ignition and thermal barriers	143
4.0102.1g Insulation - onsite documentation	144
4.0102.2 SPF Roof Insulation - Vented Roof Deck	144
4.0102.2a Pre-work qualifications	144
4.0102.2b General preparation	145
4.0102.2c Material selection	145
4.0102.2d Roof deck venting	146
4.0102.2e Surface preparation	146
4.0102.2f Installation	146
4.0102.2g Ignition and thermal barriers	147
4.0102.2h Insulation - onsite documentation	147
4.0102.3 Inaccessible Ceilings - Dense Pack	147
4.0102.3a Pre-work qualifications	148
4.0102.3b General preparation	148
4.0102.3c Material selection	149
4.0102.3d Installation	149
4.0102.3e Close access hole	149
4.0102.3f Insulation - onsite documentation	150
4.0103.1 Accessible Attic - Batt Installation	150
4.0103.1a Pre-work qualifications	150
4.0103.1b Material selection	151
4.0103.1c General preparation	151
4.0103.1d Installation	151
4.0103.1e Insulation - onsite documentation	152
4.0103.2 Accessible Attic - Loose Fill Installation	152
4.0103.2a Pre-work qualifications	152
4.0103.2b Material selection	153
4.0103.2c General preparation	153
4.0103.2d Installation	154
4.0103.2e Insulation - onsite documentation	154
4.0103.3 Accessible Attic - Batt Insulation Over Existing Insulation	154
4.0103.3a Pre-work qualifications	154
4.0103.3b General preparation	155
4.0103.3c Material selection	155
4.0103.3d Installation	156
4.0103.3e Insulation - onsite documentation	156
4.0103.4 Accessible Attic - Loose Fill Over Existing Insulation	156

4.0103.4a Pre-work qualifications	157
4.0103.4b Material selection	157
4.0103.4c General preparation	158
4.0103.4d Installation	158
4.0103.4e Insulation - onsite documentation	158
4.0103.5 Accessible Attic - SPF on Attic Floor	158
4.0103.5a Pre-work qualifications	159
4.0103.5b Material selection	159
4.0103.5c General preparation	160
4.0103.5d Surface preparation	160
4.0103.5e Installation	161
4.0103.5f Ignition and thermal barriers	161
4.0103.5g Insulation - onsite documentation	161
4.0103.6 Accessible Attic - Dense Pack Insulation	162
4.0103.6a Pre-work qualifications	162
4.0103.6b Material selection	163
4.0103.6c General preparation	163
4.0103.6d Installation	163
4.0103.6e Close access hole	163
4.0103.6f Insulation - onsite documentation	164
4.0103.7 Accessible Pitched/Vaulted/Cathedralized Ceilings - Loose Fill Over	164
4.0103.7a Pre-work qualifications	164
4.0103.7b Material selection	165
4.0103.7c General preparation	165
4.0103.7d Cellulose installation	166
4.0103.7e Fiberglass installation	166
4.0103.7f Insulation - onsite documentation	166
4.0103.8 Loose Fill to Capacity	167
4.0103.8a Pre-work qualifications	167
4.0103.8b General preparation	167
4.0103.8c Material selection	168
4.0103.8d Installation	168
4.0103.8e Close access hole	168
4.0103.8f Insulation - onsite documentation	169
4.0104.1 Knee Wall - Dense Packing	169
4.0104.1a Pre-work qualifications	169
4.0104.1b Material selection	170
4.0104.1c General preparation	170
4.0104.1d Install backing	170
4.0104.1e Installation	171
4.0104.1f Close access hole	171
4.0104.1g Ignition and thermal barriers	171
4.0104.1h Insulation - onsite documentation	172
4.0104.2 Knee Wall - Batt Insulation	172
4.0104.2a Pre-work qualifications	172

4.0104.2b Material selection	173
4.0104.2c General preparation	173
4.0104.2d Batt installation	173
4.0104.2e Install backing	174
4.0104.2f Ignition and thermal barriers	174
4.0104.2g Insulation - onsite documentation	175
4.0104.3 Knee Wall - Existing Batt Insulation Repair	175
4.0104.3a Pre-work qualifications	175
4.0104.3b Material selection	176
4.0104.3c General preparation	176
4.0104.3d Install backing	176
4.0104.3e Ignition and thermal barriers	177
4.0104.3f Insulation - onsite documentation	177
4.0104.4 Knee Wall - Rigid Insulation	177
4.0104.4a Pre-work qualifications	178
4.0104.4b Material selection	178
4.0104.4c General preparation	179
4.0104.4d Installation	179
4.0104.4e Ignition and thermal barriers	179
4.0104.4f Insulation - onsite documentation	180
4.0104.5 Knee Wall - SPF With No Existing Insulation	180
4.0104.5a Pre-work qualifications	180
4.0104.5b Material selection	181
4.0104.5c General preparation	181
4.0104.5d Surface preparation	182
4.0104.5e Installation	182
4.0104.5f Ignition and thermal barriers	182
4.0104.5g Insulation - onsite documentation	183
4.0104.6 Knee Wall - SPF With Existing Insulation	183
4.0104.6a Pre-work qualifications	183
4.0104.6b Material selection	184
4.0104.6c General preparation	184
4.0104.6d Surface preparation	185
4.0104.6e Installation	185
4.0104.6f Ignition and thermal barriers	185
4.0104.6g Insulation - onsite documentation	186
4.0188.1 Radiant Barriers	186
4.0188.1a Pre-work qualifications	186
4.0188.1b Material selection	187
4.0188.1c Installation	187
4.0188.1d Air space	188
4.0188.1e Sealing	188
4.0188.1f Ventilation	188
4.0188.1g Insulation - onsite documentation	188
4.0188.2 Unconditioned Attic Ventilation	189

4.0188.2a Pre-work qualifications	189
4.0188.2b Vent selection	189
4.0188.2c Vent openings	189
4.0188.2d Vent location	190
4.0188.2e Ventilation screens	190
4.0188.2f Ventilation baffles	190
4.0201.1 SPF Insulation	191
4.0201.1a Pre-work qualifications	191
4.0201.1b Material selection	192
4.0201.1c General preparation	192
4.0201.1d Surface preparation	192
4.0201.1e Installation	193
4.0201.1f Ignition and thermal barriers	193
4.0201.1g Insulation - onsite documentation	193
4.0201.2 Batt Insulation	194
4.0201.2a Pre-work qualifications	194
4.0201.2b Material selection	195
4.0201.2c General preparation	195
4.0201.2d Batt installation	195
4.0201.2e Install backing	196
4.0201.2f Ignition and thermal barriers	196
4.0201.2g Insulation - onsite documentation	196
4.0201.3 Dense Pack Insulation	196
4.0201.3a Pre-work qualifications	197
4.0201.3b Material selection	197
4.0201.3c General preparation for dense packed insulation	198
4.0201.3d Install backing	198
4.0201.3e Installation	198
4.0201.3f Close access hole	199
4.0201.3g Ignition and thermal barriers	199
4.0201.3h Insulation - onsite documentation	199
4.0202.1 Dense Pack Insulation	199
4.0202.1a Pre-work qualifications	200
4.0202.1b Material selection	200
4.0202.1c General preparation	201
4.0202.1d Sealant selection	201
4.0202.1e Access cavity	201
4.0202.1f Installation	202
4.0202.1g Close access hole	202
4.0202.1h Insulation - onsite documentation	203
4.0202.2 Exterior Rigid Insulation	203
4.0202.2a Pre-work qualifications	203
4.0202.2b Sealant selection	204
4.0202.2c General preparation	204
4.0202.2d Water management system	205

4.0202.2e Installation	205
4.0202.2f Exterior cladding replacement	205
4.0202.2g Fire Safety	206
4.0202.2h Insulation - onsite documentation	206
4.0301.1 Batt Insulation in Joisted Cavities	206
4.0301.1a Pre-work qualifications	206
4.0301.1b Material selection	207
4.0301.1c General preparation	207
4.0301.1e Secure Batts	208
4.0301.1f Insulation - onsite documentation	208
4.0301.2 Loose Fill With Netting/Fabric in Joisted Cavities	208
4.0301.2a Pre-work qualifications	208
4.0301.2b Material selection	209
4.0301.2c General preparation	209
4.0301.2d Install netting/fabric	210
4.0301.2e Installation	210
4.0301.2f Close access hole	210
4.0301.2g Insulation - onsite documentation	211
4.0301.3 Loose Fill in Joisted Cavities With Rigid Barrier	211
4.0301.3a Pre-work qualifications	211
4.0301.3b Material selection	212
4.0301.3c Sealant selection	212
4.0301.3d General preparation	213
4.0301.3e Install rigid barrier	213
4.0301.3f Installation	213
4.0301.3g Close access hole	214
4.0301.3h Ignition and thermal barriers	214
4.0301.3i Insulation - onsite documentation	214
4.0301.4 Dense Pack in Joisted Cavities With Rigid Barrier	215
4.0301.4a Pre-work qualifications	215
4.0301.4b Material selection	215
4.0301.4c Sealant selection	216
4.0301.4d General preparation	216
4.0301.4e Install rigid barrier	217
4.0301.4f Installation	217
4.0301.4g Close access hole	217
4.0301.4h Ignition and thermal barriers	218
4.0301.4i Insulation - onsite documentation	218
4.0301.5 SPF in Open Joisted Cavities	218
4.0301.5a Pre-work qualifications	219
4.0301.5b Material selection	219
4.0301.5c General preparation	220
4.0301.5d Surface preparation	220
4.0301.5e Installation	220
4.0301.5f Ignition and thermal barriers	221

4.0301.5g Insulation - onsite documentation	221
4.0301.6 Cantilever Floor Joisted Cavities Batt Insulation	221
4.0301.6a Pre-work qualifications	222
4.0301.6b Material selection	222
4.0301.6c General preparation	223
4.0301.6d Batt installation	223
4.0301.6e Secure Batts	223
4.0301.6f Enclose cavity	223
4.0301.6g Exterior soffit	224
4.0301.6h Insulation - onsite documentation	224
4.0301.7 Non-Joisted Floors Batt Insulation	224
4.0301.7a Pre-work qualifications	225
4.0301.7b Material selection	225
4.0301.7c General preparation	226
4.0301.7d Installation	226
4.0301.7e Support	226
4.0301.7f Insulation - onsite documentation	227
4.0301.8 Non-Joisted Floors Rigid Foam	227
4.0301.8a Pre-work qualifications	227
4.0301.8b Material selection	228
4.0301.8c Sealant selection	228
4.0301.8d General preparation	228
4.0301.8e Installation	229
4.0301.8f Sealing	229
4.0301.8g Support	229
4.0301.8h Ignition and thermal barriers	230
4.0301.8i Insulation - onsite documentation	230
4.0301.9 Non-Joisted Floors SPF	231
4.0301.9a Pre-work qualifications	231
4.0301.9b Material selection	231
4.0301.9c General preparation	232
4.0301.9d Surface preparation	232
4.0301.9e Installation	232
4.0301.9f Ignition and thermal barriers	233
4.0301.9g Insulation - onsite documentation	233
4.0302.1 Batt Insulation With Rigid Barrier	234
4.0302.1a Pre-work qualifications	234
4.0302.1b Material selection	235
4.0302.1c Sealant selection	235
4.0302.1d General preparation	235
4.0302.1e Batt installation	236
4.0302.1f Secure batts	236
4.0302.1g Rigid protective barrier	236
4.0302.1h Sealing and rodent proofing	237
4.0302.1i Weather-resistant barrier	237

4.0302.1j Insulation - onsite documentation	237
4.0302.2 Loose Fill With Rigid Barrier	237
4.0302.2a Pre-work qualifications	238
4.0302.2b Material selection	238
4.0302.2c Sealant selection	239
4.0302.2d General preparation	239
4.0302.2e Rigid protective barrier	239
4.0302.2f Installation	240
4.0302.2g Close access hole	240
4.0302.2h Sealing and rodent proofing	240
4.0302.2i Weather-resistant barrier	241
4.0302.2j Insulation - onsite documentation	241
4.0302.3 Dense Pack with Rigid Barrier	241
4.0302.3a Pre-work qualifications	241
4.0302.3b Material selection	242
4.0302.3c Sealant selection	243
4.0302.3d General preparation	243
4.0302.3e Rigid protective barrier	243
4.0302.3f Installation	244
4.0302.3g Close access hole	244
4.0302.3h Sealing and rodent proofing	244
4.0302.3i Weather-resistant barrier	244
4.0302.3j Insulation - onsite documentation	245
4.0302.4 SPF with Rigid Barrier	245
4.0302.4a Pre-work qualifications	245
4.0302.4b Material selection	246
4.0302.4c Sealant selection	246
4.0302.4d General preparation	247
4.0302.4e Surface preparation	247
4.0302.4f Rigid protective barrier	247
4.0302.4g Installation	248
4.0302.4h Sealing and rodent proofing	248
4.0302.4i Weather-resistant barrier	248
4.0302.4j Ignition and thermal barriers	249
4.0302.4k Insulation - onsite documentation	249
4.0302.5 Rigid Insulation on Joists	249
4.0302.5a Pre-work qualifications	250
4.0302.5b Material selection	250
4.0302.5c Sealant selection	251
4.0302.5d General preparation	251
4.0302.5e Installation	251
4.0302.5f Rigid protective barrier	252
4.0302.5g Sealing and rodent proofing	252
4.0302.5h Weather-resistant barrier	252
4.0302.5i Ignition and thermal barriers	253

4.0302.5j Insulation - onsite documentation	253
4.0302.6 Non-Joisted Floors Batt Insulation	253
4.0302.6a Pre-work qualifications	254
4.0302.6b Material selection	254
4.0302.6c Sealant selection	255
4.0302.6d General preparation	255
4.0302.6e Installation	255
4.0302.6f Secure batts	256
4.0302.6g Rigid protective barrier	256
4.0302.6h Sealing and rodent proofing	256
4.0302.6i Weather-resistant barrier	257
4.0302.6j Insulation - onsite documentation	257
4.0302.7 Non-Joisted Floors Rigid Insulation	257
4.0302.7a Pre-work qualifications	257
4.0302.7b Material selection	258
4.0302.7c Sealant selection	259
4.0302.7d General preparation	259
4.0302.7e Installation	259
4.0302.7f Rigid protective barrier	260
4.0302.7g Sealing and rodent proofing	260
4.0302.7h Weather-resistant barrier	260
4.0302.7i Ignition and thermal barriers	261
4.0302.7j Insulation - onsite documentation	261
4.0302.8 Non-Joisted Floors SPF Insulation	261
4.0302.8a Pre-work qualifications	262
4.0302.8b Material selection	262
4.0302.8c Sealant selection	263
4.0302.8d General preparation	263
4.0302.8e Surface preparation	263
4.0302.8f Installation	264
4.0302.8g Rigid protective barrier	264
4.0302.8h Sealing and rodent proofing	264
4.0302.8i Weather-resistant barrier	265
4.0302.8j Ignition and thermal barriers	265
4.0302.8k Insulation - onsite documentation	265
4.0401.1 SPF Insulation	266
4.0401.1a Pre-work qualifications	266
4.0401.1b Material selection	266
4.0401.1c General preparation	267
4.0401.1d Surface preparation	267
4.0401.1e Installation	267
4.0401.1f Ignition and thermal barriers	268
4.0401.1g Insulation - onsite documentation	268
4.0401.2 Batt Insulation	269
4.0401.2a Pre-work qualifications	269

4.0401.2b Material selection	269
4.0401.2c Sealant selection	270
4.0401.2d General preparation	270
4.0401.2e Batt installation	270
4.0401.2f Sealing	271
4.0401.2g Insulation - onsite documentation	271
4.0401.3 Rigid Insulation	271
4.0401.3a Pre-work qualifications	272
4.0401.3b Material selection	272
4.0401.3c General preparation	273
4.0401.3d Batt installation	273
4.0401.3e Sealing	273
4.0401.3f Ignition and thermal barriers	273
4.0401.3g Insulation - onsite documentation	274
4.0402.1 Closed Crawlspace - Non-Foam Insulation	274
4.0402.1a Pre-work qualifications	274
4.0402.1b Material selection	275
4.0402.1c Sealant selection	276
4.0402.1d General preparation	276
4.0402.1e Installation	276
4.0402.1f Attachment	277
4.0402.1g Sealing	277
4.0402.1h Termite inspection gap	277
4.0402.1i Insulation - onsite documentation	277
4.0402.2 Closed Crawlspace - Rigid Foam Insulation	278
4.0402.2a Pre-work qualifications	278
4.0402.2b Material selection	279
4.0402.2c Sealant selection	279
4.0402.2d General preparation	280
4.0402.2e Surface preparation	280
4.0402.2f Installation	280
4.0402.2g Attachment	281
4.0402.2h Sealing	281
4.0402.2i Termite inspection gap	281
4.0402.2j Ignition and thermal barriers	281
4.0402.2k Insulation - onsite documentation	282
4.0402.3 Closed Crawlspace - SPF Insulation	282
4.0402.3a Pre-work qualifications	282
4.0402.3b Material selection	283
4.0402.3c Sealant selection	284
4.0402.3d General preparation	284
4.0402.3e Surface preparation	284
4.0402.3f Installation	285
4.0402.3g Sealing	285
4.0402.3h Termite inspection gap	285

4.0402.3i Ignition and thermal barriers	286
4.0402.3j Insulation - onsite documentation	286
4.0402.4 Basements - Without Groundwater Leakage	286
4.0402.4a Pre-work qualifications	287
4.0402.4b Material selection	287
4.0402.4c Sealant selection	288
4.0402.4d General preparation	288
4.0402.4e Installation	288
4.0402.4f Attachment	289
4.0402.4g Sealing	289
4.0402.4h Termite inspection gap	289
4.0402.4i Ignition and thermal barriers	290
4.0402.4j Insulation - onsite documentation	290
4.0402.5 Basements - With Groundwater Leakage	290
4.0402.5a Pre-work qualifications	291
4.0402.5b Material selection	291
4.0402.5c Drainage	292
4.0402.5d Installation	292
4.0402.5e Termite inspection gap	292
4.0402.5f Attachment	293
4.0402.5g Sealing	293
4.0402.5h Ignition and thermal barriers	293
4.0402.5i Vapor retarders	294
4.0402.5j Insulation - onsite documentation	294
4.0403.1 Raised and On-Grade Slab Edge Insulation	294
4.0403.1a Pre-work qualifications	295
4.0403.1b Material selection	295
4.0403.1c Sealant selection	295
4.0403.1d General preparation	296
4.0403.1e Excavation	296
4.0403.1f Installation	296
4.0403.1g Flashing	296
4.0403.1h Protective covering	297
4.0403.1i Sealing and pest protection	297
4.0403.1j Termites	297
4.0403.1k Back fill	298
4.0403.1l Insulation - onsite documentation	298
5.0101.1 Thermostat Replacement	298
5.0101.1a Pre-Work qualifications	298
5.0101.1b Thermostat selection	299
5.0101.1c Thermostat location	299
5.0101.1d Heat pump considerations	299
5.0101.1e Installer programming	300
5.0101.1f Penetrations	300
5.0101.1g Documentation	300

5.0102.1 Condensate Removal	301
5.0102.1a Condensate disposal	301
5.0102.1b Connections	301
5.0102.1c Slope	301
5.0102.1d Vents and traps	302
5.0102.1e Secondary drain pan	302
5.0102.1f Float switches	302
5.0102.1g Insulation	303
5.0102.1h Pumps	303
5.0102.1i Exterior termination	303
5.0103.1 Refrigerant Lines	303
5.0103.1a Material selection	304
5.0103.1b Sizing	304
5.0103.1c Installation	304
5.0103.1d Insulation	305
5.0103.1e Support	305
5.0103.1f Protection	305
5.0103.1g Locking refrigerant caps	306
5.0103.2 Refrigerant Charge	306
5.0103.2a Pre-work qualifications	306
5.0103.2b Charge	307
5.0103.2c Documentation	307
5.0103.3 Thermostatic Expansion Valve (TXV)	307
5.0103.3a Material selection	307
5.0103.3b Replacement	308
5.0103.4 Compressors	308
5.0103.4a Sizing	308
5.0103.4b Location	309
5.0103.4c Refrigerant piping	309
5.0103.4d Electrical	309
5.0104.1 New Duct Components	310
5.0104.1a Material selection	310
5.0104.1b General preparation	310
5.0104.1c Duct design	311
5.0104.1d Termination design	311
5.0104.1e Protection	311
5.0104.1f Exterior duct construction	312
5.0104.1g Plenums	312
5.0104.1h Reducers	312
5.0104.1i Supply branches	313
5.0104.1j Take-offs	313
5.0104.1k Flexible ducts	313
5.0104.1l Boots	314
5.0104.1m Fire protection	314
5.0104.1n Air filtration	314

5.0104.1o Room pressure balancing	315
5.0104.1p Sealing	315
5.0104.1q Fastening	315
5.0104.1r Support	316
5.0104.1s Insulation	316
5.0104.1t Manual volume dampers	316
5.0105.1 Mechanical Fastening	316
5.0105.1a Metal to metal	317
5.0105.1b Flex to metal	317
5.0105.1c Flex to flex	317
5.0105.1d Duct board to duct board	317
5.0105.1e Duct board to flexible duct	318
5.0105.1f Duct board to metal	318
5.0105.1g Duct board plenum to air handler cabinet	319
5.0105.1h Duct boot to subfloor	319
5.0105.1i Duct boot to gypsum	319
5.0105.1j Metal plenum to air handler cabinet	319
5.0105.2 Duct Support	320
5.0105.2a Flex duct and duct board support	320
5.0105.2b Metal duct support	320
5.0105.2c Plenum support	321
5.0106.1 General Duct Sealing	321
5.0106.1a Sealant selection	321
5.0106.1b Access ducts	322
5.0106.1c Surface preparation	322
5.0106.1d Securely fasten ducts	322
5.0106.1e General sealing	323
5.0106.1f Seal leaks less than 1/4"	323
5.0106.1g Seal leaks between 1/4" and 3/4"	323
5.0106.1h Seal leaks greater than 3/4"	324
5.0106.1i Duct boots	324
5.0106.1j Air handler jacket	324
5.0106.1k Filter slot	325
5.0106.2 Duct Sealing - Spray Polyurethane Foam (SPF)	325
5.0106.2a Material selection	325
5.0106.2b Surface preparation	325
5.0106.2c Installation	326
5.0106.2d Ignition and thermal barriers	326
5.0106.3 Duct Sealing - Proprietary Spray Application	327
5.0106.3a Material selection	327
5.0106.3b Surface preparation	327
5.0106.3c Installation	327
5.0107.1 General Duct Insulation	328
5.0107.1a Material selection	328
5.0107.1b General preparation	328

5.0107.1c Insulation value	328
5.0107.1d Attachment	329
5.0107.1e Sealing	329
5.0107.1f Insulation - onsite documentation	329
5.0107.2 Duct Insulation - Spray Polyurethane Foam (SPF)	330
5.0107.2a Material selection	330
5.0107.2b Surface preparation	330
5.0107.2c Installation	331
5.0107.2d Ignition and thermal barriers	331
5.0107.2e Insulation - onsite documentation	331
5.0108.1 Air-to-Air Split System	332
5.0108.1a Load calculation	332
5.0108.1b Equipment selection	333
5.0108.1c Outdoor unit location	333
5.0108.1d Outdoor unit support	333
5.0108.1e Outdoor unit installation	334
5.0108.1f Indoor unit location	334
5.0108.1g Indoor unit installation	334
5.0108.1h Support - all installations	335
5.0108.1i Support - horizontal air flow in attic	335
5.0108.1j Support - horizontal air flow in subspace	335
5.0108.1k Support - upflow on a platform	335
5.0108.1l Support - downflow	336
5.0108.1m Connections	336
5.0108.1n Intakes/terminations	336
5.0108.1o Condensate drainage	337
5.0108.1p Electrical wiring	337
5.0108.1q Refrigerant lines and charge	337
5.0108.1r Fire protection	338
5.0108.1s Air handler sealing	338
5.0108.1t Documentation	338
5.0108.2 Air-to-Air Package Unit	339
5.0108.2a Load calculation	339
5.0108.2b Equipment selection	339
5.0108.2c Unit location	340
5.0108.2d Unit support	340
5.0108.2e Unit installation	340
5.0108.2f Electrical wiring	341
5.0108.2g Refrigerant lines and charge	341
5.0108.2h Connections	341
5.0108.2i Outdoor ductwork	342
5.0108.2j Intakes/terminations	342
5.0108.2k Condensate drainage	342
5.0108.2l Fire protection	343
5.0108.2m Documentation	343

5.0108.3 Mini-Split System	343
5.0108.3a Load calculation	343
5.0108.3b Equipment selection	344
5.0108.3c Outdoor unit location	344
5.0108.3d Outdoor unit support	345
5.0108.3e Outdoor unit installation	345
5.0108.3f Indoor unit location	345
5.0108.3g Indoor unit(s) installation	346
5.0108.3h Ceiling cassette insulation	346
5.0108.3i Indoor unit(s) support	346
5.0108.3j Electrical wiring	347
5.0108.3k Intakes/terminations	347
5.0108.3l Connections	347
5.0108.3m Ducting	347
5.0108.3n Refrigerant piping	348
5.0108.3o Controls	348
5.0108.3p Condensate	348
5.0108.3q Documentation	349
5.0108.4 Furnaces	349
5.0108.4a Load calculation	349
5.0108.4b Equipment selection	350
5.0108.4c Indoor unit location	350
5.0108.4d Indoor unit installation	351
5.0108.4e Support - all installations	351
5.0108.4f Support - horizontal air flow in attic	351
5.0108.4g Support - horizontal air flow in subspace	351
5.0108.4h Support - upflow on a platform	352
5.0108.4i Support - downflow	352
5.0108.4j Connections	352
5.0108.4k Intakes/terminations	353
5.0108.4l Condensate drainage	353
5.0108.4m Electrical wiring	353
5.0108.4n Fire protection	354
5.0108.4o Air handler sealing	354
5.0108.4p Documentation	354
5.0108.5 Evaporative Coolers	355
5.0108.5a Equipment selection	355
5.0108.5b Installation location	355
5.0108.5c Installation	356
5.0108.5d Support	356
5.0108.5e Connections	356
5.0108.5f Electrical wiring	356
5.0108.5g Water management	357
5.0108.5h Intakes	357
5.0108.5i Documentation	357

5.0109.1 Condensers	358
5.0109.1a Repair diagnosis	358
5.0109.1b Service	358
5.0109.1c Documentation	359
5.0109.2 Air Handlers	359
5.0109.2a Repair diagnosis	359
5.0109.2b Service	360
5.0109.2c Documentation	360
5.0109.3 Evaporators	360
5.0109.3a Repair diagnosis	361
5.0109.3b Service	361
5.0109.3c Documentation	361
5.0109.4 Combustion Furnaces	362
5.0109.4a Repair diagnosis	362
5.0109.4b Service	362
5.0109.4c Documentation	363
5.0109.5 Evaporative Coolers	363
5.0109.5a Repair diagnosis	363
5.0109.5b Service	364
5.0109.5c Documentation	364
5.0188.1 Economizers	364
5.0188.1a Design	365
5.0188.1b Installation	365
5.0201.1 Thermostat Replacement	365
5.0201.1a Pre-work qualifications	365
5.0201.1b Thermostat selection	366
5.0201.1c Thermostat location	366
5.0201.1d Installation	366
5.0201.1e Installer programming	367
5.0201.1f Penetrations	367
5.0201.1g Documentation	367
5.0202.1 Radiator Reflector	368
5.0202.1a Reflector installation	368
5.0202.1b Insulation	368
5.0202.2 Distribution Insulation	368
5.0202.2a Insulation selection	369
5.0202.2b Installation	369
5.0202.2c Documentation	369
5.0203.1 Boilers	370
5.0203.1a Load calculation	370
5.0203.1b Equipment selection	370
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	372
5.0204.1 Fuel-Fired Boilers	373
5.0204.1a Repair diagnosis	373
5.0204.1b Service	373
5.0204.1c Documentation	374
5.0288.1 Boiler Room Water Drainage	374
5.0288.1a Blow-down piping	374
5.0288.1b Drain condition	375
5.0288.1c Blow-down pit	375
5.0288.1d Sump pump/sump pit	375
5.0301.1 Through-Wall and Window Units	376
5.0301.1a Pre-work qualifications	376
5.0301.1b Equipment selection	376
5.0301.1c Installation	377
5.0301.1d Support	377
5.0301.1e Sealing	377
5.0301.1f Disposal	378
5.0301.1g Documentation	378
5.0301.2 PTAC/PTHP Units	378
5.0301.2a Load calculation	378
5.0301.2b Equipment selection	379
5.0301.2c Installation	379
5.0301.2d Condensate disposal	380
5.0301.2e Sealing	380
5.0301.2f Insulation	380
5.0301.2g Disposal	380
5.0301.2h Documentation	381
5.0301.3 Wall Furnace	381
5.0301.3a Load calculation	381
5.0301.3b Equipment selection	382
5.0301.3c Installation	382
5.0301.3d Controls	382
5.0301.3e Condensate disposal	383
5.0301.3f Sealing	383
5.0301.3g Disposal	383
5.0301.3h Documentation	384
5.0401.1 Indigenous Shading	384
5.0401.1a Plant selection	384
5.0401.1b Plant size	385
5.0402.1 Reflective Roof Coatings	385
5.0402.1a Material selection	385
5.0402.1b Preparation	385
5.0402.1c Application	386
5.0501.1 Isolate CAZ	386

5.0501.1a Air sealing	386
5.0501.1b Ductwork	387
5.0501.1c Plumbing	387
5.0501.1d Walls/floors/ceilings	387
5.0501.1e Combustion air	388
5.0502.1 Combustion Air - Fuel-Fired Appliances	388
5.0502.1a Design	388
5.0502.1b Installation	389
5.0503.1 Fuel-Fired Appliance Venting	389
5.0503.1a Design	389
5.0503.1b Materials	389
5.0503.1c Installation	390
5.0503.1d Terminations	390
5.0503.1e Chimney liners	390
5.0504.1 Natural Gas/Propane Fuel Piping	391
5.0504.1a Material selection	391
5.0504.1b Gas piping size	391
5.0504.1c Piping location	392
5.0504.1d Support	392
5.0504.1e Required components	392
5.0504.1f Gas pressure regulator venting	392
5.0504.1g Sealing	393
5.0504.1h Safety devices for propane	393
5.0504.1i Gas boosters	393
5.0504.2 Oil Piping	394
5.0504.2a Material selection	394
5.0504.2b Piping location	394
5.0504.2c Support	394
5.0504.2d Required components	395
5.0504.2e Pumps	395
5.0504.2f Line connections	395
5.8801.1 Decommissioning	396
5.8801.1a Utility disconnect	396
5.8801.1b Refrigerant recovery	396
5.8801.1c Equipment disconnection	396
5.8801.1d Equipment removal	397
5.8801.1e Disposal	397
6.0101.1 Ventilation Ducts	397
6.0101.1a Material selection	398
6.0101.1b Design and configuration	398
6.0101.1c Combining air streams	398
6.0101.1d Mechanical fastening	399
6.0101.1e Sealing	399
6.0101.1f Insulation	399
6.0101.1g Support	400

6.0101.2 Exhaust Terminations	400
6.0101.2a Selection	400
6.0101.2b Damper (if applicable)	401
6.0101.2c Location	401
6.0101.2d Installation	402
6.0101.2e Duct to termination connection	402
6.0101.2f Sealing	403
6.0101.3 Exterior Intakes	403
6.0101.3a Selection	403
6.0101.3b Damper (if applicable)	403
6.0101.3c Location	404
6.0101.3d Installation	404
6.0101.3e Duct to termination connection	405
6.0101.3f Labeling	405
6.0101.3g Sealing	405
6.0101.4 Fan Controls	406
6.0101.4a Intermittent/continuous operation	406
6.0101.4b Optional sensors	406
6.0101.4c Manual override	407
6.0101.4d Labeling, if applicable	407
6.0101.5 Airflow Control Devices	407
6.0101.5a Pre-Work Qualifications	407
6.0101.5b Material selection	408
6.0101.5c Installation	408
6.0101.5d Sealing	408
6.0101.5e Fire Safety	409
6.0101.6 Variable Frequency Drives and Electrically Commutated Motors	409
6.0101.6a Pre-work qualifications	409
6.0101.6b Installation	410
6.0101.6c Feedback sensors	410
6.0101.6d Manual controls	410
6.0101.6e Initial setup	410
6.0201.1 Surface Mounted	411
6.0201.1a Fan selection	411
6.0201.1b Sealant selection	411
6.0201.1c Damper	412
6.0201.1d Location	412
6.0201.1e Opening preparation	412
6.0201.1f Fan orientation	413
6.0201.1g Fan mounting	413
6.0201.1h Wiring	413
6.0201.1i Sealing	413
6.0201.1j Insulate housing	414
6.0201.1k Fan access	414
6.0201.1l Venting	414

6.0201.2 Kitchen Range Hoods	415
6.0201.2a Fan selection	415
6.0201.2b Sealant selection	415
6.0201.2c Location	416
6.0201.2d Damper	416
6.0201.2e Installation	416
6.0201.2f Wiring	417
6.0201.2g Sealing	417
6.0201.2h Fan access	417
6.0201.2i Venting	417
6.0201.2j Make-up air	418
6.0201.3 Inline and Multiport Fans	418
6.0201.3a Fan selection	418
6.0201.3b Sealant selection	419
6.0201.3c Wiring	419
6.0201.3d Fan orientation	419
6.0201.3e Fan mounting	420
6.0201.3f Damper	420
6.0201.3g Intake grill openings	420
6.0201.3h Air sealing	421
6.0201.3i Fan Access	421
6.0201.3j Venting	421
6.0201.4 Garage Exhaust Fans	421
6.0201.4a Fan selection	422
6.0201.4b Sealant selection	422
6.0201.4c Wiring	423
6.0201.4d Fan orientation	423
6.0201.4e Fan mounting	423
6.0201.4f Damper	423
6.0201.4g Controls	424
6.0201.4h Exhaust system openings	424
6.0201.4i Air sealing	424
6.0201.4j Fan access	425
6.0201.4k Outdoor termination location	425
6.0201.4l Venting	425
6.0202.1 Clothes Dryer	425
6.0202.1a Duct selection	426
6.0202.1b Venting installation	426
6.0202.1c Lint collection devices	426
6.0202.1d Mechanical fasteners	427
6.0202.1e Make-up air	427
6.0202.1f Duct insulation	427
6.0202.1g Termination fitting	428
6.0202.1h Sealing	428
6.0202.1i Condensing dryers	428

6.0301.1 Fresh Air Intake In Forced Air System	429
6.0301.1a Pre-work qualifications	429
6.0301.1b Intake location	429
6.0301.1c Labeling	430
6.0301.1d Pest exclusion	430
6.0301.1e Motorized damper	430
6.0301.1f System control	430
6.0301.1g Wiring	431
6.0301.1h Fresh air filtration	431
6.0301.1i Filter accessibility and fit	431
6.0301.1j Access	432
6.0301.1k Ducting	432
6.0301.1l Fire dampers	432
6.0301.1m System balancing	433
6.0301.2 Dedicated Air Handler for Multiple Dwellings	433
6.0301.2a Fan selection	433
6.0301.2b Intake location	434
6.0301.2c Labeling	434
6.0301.2d Pest exclusion	434
6.0301.2e Motorized damper	435
6.0301.2f Backdraft prevention	435
6.0301.2g Wiring	435
6.0301.2h Fresh air filtration	436
6.0301.2i Filter accessibility and fit	436
6.0301.2j Air handler mounting	436
6.0301.2k Air handler duct plenum connection	437
6.0301.2l Sealing	437
6.0301.2m System control	437
6.0301.2n Access	438
6.0301.2o Fire dampers	438
6.0301.2p System balancing	438
6.0302.1 Individual Exhaust Fan Serving Entire Dwelling	438
6.0302.1a Fan selection	439
6.0302.1b Sealant selection	439
6.0302.1c Termination location	440
6.0302.1d Pest exclusion	440
6.0302.1e Damper	440
6.0302.1f Interior intake location	441
6.0302.1g Opening preparation	441
6.0302.1h Fan orientation	441
6.0302.1i Fan mounting	441
6.0302.1j Wiring	442
6.0302.1k Sealing	442
6.0302.1l Insulate housing	442
6.0302.1m Fan access	442

6.0302.1n Venting	443
6.0302.1o System balancing	443
6.0302.1p Hot-humid climates	443
6.0302.2 Multiport Exhaust Fan Serving Multiple Dwellings	444
6.0302.2a Fan selection	444
6.0302.2b Termination location	444
6.0302.2c Pest exclusion	445
6.0302.2d Backdraft prevention	445
6.0302.2e Wiring	445
6.0302.2f Fan mounting	445
6.0302.2g Combining air streams	446
6.0302.2h Sealing	446
6.0302.2i Access	446
6.0302.2j Fire dampers	447
6.0302.2k System balancing	447
6.0303.1 HRV/ERV Installation	447
6.0303.1a Fan selection	448
6.0303.1b Wiring	448
6.0303.1c Exterior exhaust termination location	448
6.0303.1d Exterior intake location	448
6.0303.1e Pest exclusion	449
6.0303.1f Interior intake location	449
6.0303.1g Interior supply location	450
6.0303.1h Combining air streams	450
6.0303.1i Backdraft prevention	450
6.0303.1j Fresh air filtration	450
6.0303.1k Fan mounting	451
6.0303.1l Sealing	451
6.0303.1m Condensate drain	451
6.0303.1n Access	452
6.0303.1o Fire dampers	452
6.0303.1p System balancing	452
6.0303.1q Very cold climate considerations	453
6.0303.1r Hot-humid climate considerations	453
6.0304.1 Multi-Story Passive System	453
6.0304.1a Exterior intake location	454
6.0304.1b Pest exclusion	454
6.0304.1c Backdraft prevention	454
6.0304.1d Interior intake/supply location	455
6.0305.1 Ventilator Dehumidifiers	455
6.0305.1a Equipment selection	455
6.0305.1b Sizing	456
6.0305.1c Equipment location	456
6.0305.1d Mounting	456
6.0305.1e Installation	457

6.0305.1f Wiring	457
6.0305.1g Controls	457
6.0305.1h Sealing	457
6.0305.1i Condensate drain	458
6.0305.1j Access	458
6.0305.1k Fire dampers	458
6.0306.1 Decommissioning Ventilation Systems	459
6.0306.1a Power supply	459
6.0306.1b Fan and component removal	459
6.0306.1c Sealing holes and openings	459
6.0306.1d Disposal	460
7.0101.1 Refrigerator and Freezer Replacement	460
7.0101.1a Pre-work qualifications	460
7.0101.1b Selection	461
7.0101.1c Installation	461
7.0101.1d Accessibility	461
7.0101.1e Disposal	462
7.0101.1f Documentation	462
7.0101.2 Refrigerator/Freezer Clean and Tune	462
7.0101.2a Clearances and location	462
7.0101.2b Coil cleaning	463
7.0101.2c Condensation settings	463
7.0101.2d Temperature settings	463
7.0102.1 Consumer Electronics Replacement	464
7.0102.1a Pre-work qualifications	464
7.0102.1b Selection	464
7.0102.1c Installation	465
7.0102.1d Disconnecting means	465
7.0102.1e Disposal	465
7.0102.1f Documentation	466
7.0103.1 Lighting Replacement	466
7.0103.1a Selection	466
7.0103.1b Installation	467
7.0103.1c Electrical installation	467
7.0103.1d Disposal	467
7.0103.1e Documentation	468
7.0103.2 Lighting Reduction	468
7.0103.2a Design	468
7.0103.2b Removal	469
7.0103.2c Reuse	469
7.0103.2d Disposal	469
7.0103.3 Ballast Replacement	470
7.0103.3a Selection	470
7.0103.3b Removal and installation	470
7.0103.3c Disposal	470

7.0103.3d Documentation	471
7.0103.4 Exit Sign Replacement	471
7.0103.4a Selection	471
7.0103.4b Installation	472
7.0103.4c Disposal	472
7.0103.4d Documentation	473
7.0103.5 Emergency Lighting Replacement	473
7.0103.5a Selection	473
7.0103.5b Installation	473
7.0103.5c Disposal	474
7.0103.5d Documentation	474
7.0103.6 Security Lighting	474
7.0103.6a Selection	475
7.0103.6b Installation	475
7.0103.6c Controls	475
7.0103.6d Disposal	476
7.0103.6e Documentation	476
7.0103.7 Daylighting	476
7.0103.7a Daylighting	477
7.0104.1 Occupancy Sensors	477
7.0104.1a Selection	477
7.0104.1b Installation	478
7.0104.1c Documentation	478
7.0104.2 Stand-Alone Timers	478
7.0104.2a Selection	478
7.0104.2b Installation	479
7.0104.2c Timer settings	479
7.0104.2d Documentation	480
7.0104.3 Motion Control Sensors	480
7.0104.3a Selection	480
7.0104.3b Location	480
7.0104.3c Installation	481
7.0104.3d Settings	481
7.0104.3e Documentation	481
7.0104.4 Outdoor Photo Sensors	482
7.0104.4a Selection	482
7.0104.4b Installation	482
7.0104.4c Documentation	483
7.0104.5 Bi-Level Controls	483
7.0104.5a Selection	483
7.0104.5b Installation	484
7.0104.5c Labeling	484
7.0104.5d Documentation	484
7.0105.1 Washing Machine	484
7.0105.1a Pre-work qualifications	485

7.0105.1b Selection	485
7.0105.1c Installation	485
7.0105.1d Water management	486
7.0105.1e Accessibility	486
7.0105.1f Disposal	486
7.0105.1g Documentation	487
7.0105.2 Clothes Dryer	487
7.0105.2a Pre-work qualifications	487
7.0105.2b Selection	487
7.0105.2c Installation	488
7.0105.2d Dryer venting	488
7.0105.2e Accessibility	489
7.0105.2f Disposal	489
7.0105.2g Documentation	489
7.0106.1 Vending Machines	490
7.0106.1a Pre-work qualifications	490
7.0106.1b Selection	490
7.0106.1c Installation	490
7.0106.1d Motion controls	491
7.0106.1e Accessibility	491
7.0106.1f Disposal	491
7.0106.1g Documentation	492
7.0106.2 Freestanding Water Coolers	492
7.0106.2a Pre-work qualifications	492
7.0106.2b Selection	492
7.0106.2c Installation	493
7.0106.2d Accessibility	493
7.0106.2e Disposal	493
7.0106.2f Documentation	494
7.0188.1 Ceiling Fan Replacement	494
7.0188.1a Pre-work qualifications	494
7.0188.1b Selection	494
7.0188.1c Installation	495
7.0188.1d Lighting	495
7.0188.1e Disposal	495
7.0188.1f Documentation	496
7.0201.1 Low-Flow Devices	496
7.0201.1a Pre-work qualifications	496
7.0201.1b Selection	497
7.0201.1c Installation	497
7.0201.1d Disposal	497
7.0201.1e Documentation	498
7.0201.2 Dishwasher	498
7.0201.2a Pre-work qualifications	498
7.0201.2b Selection	498

7.0201.2c Installation	499
7.0201.2d Disposal	499
7.0201.2e Documentation	500
7.0301.1 Pipe Insulation	500
7.0301.1a Pre-work qualifications	500
7.0301.1b Insulation selection	500
7.0301.1c Installation	501
7.0301.1d Clearance	501
7.0301.2 Tank Insulation	501
7.0301.2a Pre-work qualifications	502
7.0301.2b Insulation selection	502
7.0301.2c Insulation installation	502
7.0301.2d Clearance	503
7.0301.2e Service access	503
7.0301.3 Drain Heat Recovery	503
7.0301.3a Pre-work qualifications	504
7.0301.3b Location	504
7.0301.3c Installation	504
7.0301.3d Cold/tempered water supply	504
7.0301.3e Documentation	505
7.0302.1 Electric Storage Tank Water Heater	505
7.0302.1a Pre-work qualifications	505
7.0302.1b Equipment selection	506
7.0302.1c Location	506
7.0302.1d Installation	506
7.0302.1e Equipment accessibility	507
7.0302.1f TandP valve and piping	507
7.0302.1g Emergency drain pan	507
7.0302.1h Shut-off valves	508
7.0302.1i Expansion tank	508
7.0302.1j Dielectric unions	508
7.0302.1k Heat traps	509
7.0302.1l Discharge temperature settings	509
7.0302.1m Multitank systems	509
7.0302.1n Disposal	509
7.0302.1o Documentation	510
7.0302.2 Fuel-Fired Storage Tank Water Heater	510
7.0302.2a Pre-work qualifications	510
7.0302.2b Equipment selection	511
7.0302.2c Location	511
7.0302.2d Installation	511
7.0302.2e Equipment accessibility	512
7.0302.2f Fuel supply	512
7.0302.2g Emergency drain pan	512
7.0302.2h Shut-off valves	513

7.0302.2i Expansion tank	513
7.0302.2j TandP valve and piping	513
7.0302.2k Dielectric unions	514
7.0302.2l Heat traps	514
7.0302.2m Discharge temperature settings	514
7.0302.2n Multitank systems	514
7.0302.2o Disposal	515
7.0302.2p Documentation	515
7.0302.3 Heat Pump Storage Tank Water Heater	515
7.0302.3a Pre-work qualifications	516
7.0302.3b Equipment selection	516
7.0302.3c Location	516
7.0302.3d Installation	517
7.0302.3e Equipment accessibility	517
7.0302.3f TandP valve and piping	517
7.0302.3g Emergency drain pan	518
7.0302.3h Shut-off valves	518
7.0302.3i Expansion tank	518
7.0302.3j Dielectric unions	519
7.0302.3k Heat traps	519
7.0302.3l Discharge temperature settings	519
7.0302.3m Disposal	520
7.0302.3n Documentation	520
7.0302.4 Non Heated Storage Tank	520
7.0302.4a Pre-work qualifications	521
7.0302.4b Equipment selection	521
7.0302.4c Location	521
7.0302.4d Installation	522
7.0302.4e Equipment accessibility	522
7.0302.4f TandP valve and piping	522
7.0302.4g Emergency drain pan	523
7.0302.4h Isolation and bypass valves	523
7.0302.4i Dielectric unions	523
7.0302.4j Heat traps	524
7.0302.4k Gauges	524
7.0302.4l Disposal	524
7.0302.4m Documentation	524
7.0302.5 Tankless On-Demand/Point-Of-Use Appliances	525
7.0302.5a Pre-work qualifications	525
7.0302.5b Equipment selection	525
7.0302.5c Location	526
7.0302.5d Installation	526
7.0302.5e Equipment accessibility	526
7.0302.5f Shut-off valves	527
7.0302.5g TandP valve and piping	527

7.0302.5h Fuel supply	527
7.0302.5i Dielectric unions	528
7.0302.5j Discharge temperature settings	528
7.0302.5k Disposal	528
7.0302.5l Documentation	529
7.0302.6 Solar Water Heater	529
7.0302.6a Pre-work qualifications	529
7.0302.6b Storage tank selection	529
7.0302.6c Solar collector location	530
7.0302.6d Installation	530
7.0302.6e Accessibility	531
7.0302.6f Freeze protection	531
7.0302.6g Emergency drain pan	531
7.0302.6h TandP valve and piping	531
7.0302.6i Dielectric unions	532
7.0302.6j Heat traps	532
7.0302.6k Isolation valves	532
7.0302.6l Expansion tank	533
7.0302.6m Insulate piping	533
7.0302.6n Discharge temperature settings	533
7.0302.6o Multitank systems	534
7.0302.6p Disposal	534
7.0302.6q Documentation	534
7.0303.1 Mixing Valves	535
7.0303.1a Pre-work qualifications	535
7.0303.1b Location	535
7.0303.1c Installation	535
7.0303.1d Equipment accessibility	536
7.0303.1e Isolation valves	536
7.0303.1f Check valves	536
7.0303.1g Heat traps	537
7.0303.1h Temperature gauges	537
7.0303.1i Wiring	537
7.0303.1j Dielectric unions	537
7.0303.1k Discharge temperature settings	538
7.0303.1l Documentation	538
7.0303.2 Piping	538
7.0303.2a Pre-work qualifications	538
7.0303.2b Material selection	539
7.0303.2c Decommissioning existing piping	539
7.0303.2d Piping location	539
7.0303.2e New pipe installation	540
7.0303.2f Insulate piping	540
7.0303.2g Friction loss	540
7.0303.2h Dielectric unions	541

7.0303.2i Stray voltage protection	541
7.0303.2j Disposal	541
7.0303.3 Pumps	542
7.0303.3a Pre-work qualifications	542
7.0303.3b Pump selection	542
7.0303.3c Installation	542
7.0303.3d Accessibility	543
7.0303.3e Laminar flow	543
7.0303.3f Isolation valves	543
7.0303.3g Drain/purge valve	543
7.0303.3h Gauges	544
7.0303.3i Dielectric unions	544
7.0303.3j Insulation	544
7.0303.3k Controls and sensors	545
7.0303.3l Electrical wiring	545
7.0303.3m Stray voltage protection	545
7.0303.3n Disposal	545
7.0303.3o Documentation	546
7.0303.4 Gauges	546
7.0303.4a Pre-work qualifications	546
7.0303.4b Gauge selection	547
7.0303.4c Location	547
7.0303.4d Installation	547
7.0303.4e Isolation valves	548
7.0303.4f Dielectric unions	548
7.0303.4g Documentation	548
7.0303.5 Expansion Tank (Potable Water)	549
7.0303.5a Expansion tank selection	549
7.0303.5b Location	549
7.0303.5c Installation	549
7.0303.5d Support	550
7.0303.5e Air pressure	550
7.0303.5f Documentation	550
7.0303.6 Recirculation System Temperature Modulation Controls	551
7.0303.6a Pre-work qualifications	551
7.0303.6b Installation	551
7.0303.6c Integration with other system controls	551
7.0303.6d Disposal	552
7.0303.6e Documentation	552
7.8801.1 Component Replacement	552
7.8801.1a Equipment selection	553
7.8801.1b Equipment Installation	553
7.8801.1c Documentation	553
7.8802.1 Motor Replacement	554
7.8802.1a Pre-work qualifications	554

7.8802.1b Equipment Selection	554
7.8802.1c Installation	555
7.8802.1d Disposal or reuse	555
7.8802.1e Documentation	555
7.8802.2 Control Replacement	555
7.8802.2a Pre-work qualifications	556
7.8802.2b Equipment selection	556
7.8802.2c Installation	556
7.8802.2d Disposal or reuse	557
7.8802.2e Documentation	557
7.8803.1 Water Softening System Installation	557
7.8803.1a Pre-work qualifications	558
7.8803.1b Equipment selection	558
7.8803.1c Location	558
7.8803.1d Equipment accessibility	558
7.8803.1e Installation	559
7.8803.1f Electrical wiring	559
7.8803.1g Isolation and bypass valves	559
7.8803.1h Salt storage	560
7.8803.1i Documentation	560

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

2.0203.1 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

3.0103.2 Exterior Roof Access Panels and Hatches

Section: Air Sealing

Topic: General Pressure Boundary

Sub-Topic: Intentional Attic Openings

Desired Outcome

Operable, safe, weathertight and insulated roof access

3.0103.2a 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

3.0103.2b 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

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

3.0103.2c Roof access operation and fit

Specification

Repair or adjust roof access to properly fit the curb/jamb and allow for ease of operation (e.g., hardware adjustment and/or replacement)

Objective

Proper operation of roof access system

3.0103.2d 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

3.0103.2e Frame/curb sealing

Specification

Seal access frame/curb to both the exterior and interior side of the roof/wall

Seal roof access stop to frame/curb

Seal abandoned penetrations in the existing frame/curb

Objective

Weathertight roof access frame/curb

3.0103.2f Insulation

Specification

Insulate access with non-compressible insulation to an R-value sufficient to prevent condensation on either the conditioned or unconditioned side, based on local climate conditions

Hatch curb will be durably insulated where feasible

Objective

Achieve uniform R-value on the roof access sufficient to prevent condensation

3.0103.2g Fire safety

Specification

When access hatches are part of a fire-resistance-rated assembly or are used for smoke or heat removal, added materials are not permitted

Objective

Maintain fire rating/performance

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

Weather-tight 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

4.0401.1 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 ASTM 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

5.0103.4 Compressors

Section:Heating and Cooling

Topic:Forced Air

Sub-Topic:Refrigerant Loop

Desired Outcome

Safe, efficient, and durable compressor operation

5.0103.4a Sizing

Specification

Size compressor based on equipment manufacturer specifications and ASNI/ACCA Standard 5 QI (HVAC Quality Installation Specification)

Objective

Properly sized compressor

5.0103.4b Location

Specification

Locate new compressor on a stable and level surface with adequate ventilation as required by manufacturer specifications

Objective

Durable, stable, and effective location selected

5.0103.4c Refrigerant piping

Specification

Size refrigerant lines to match compressor manufacturer specifications and desired return velocities

Install new filter dryers when installing new compressors

Install P-type oil traps at the base of suction line risers and inverted P-type oil traps at the top of risers

Slope horizontal runs 1" per 20' toward the compressor

Install vibration absorbers in accordance with manufacturer specifications

Route refrigerant piping so as not to inhibit service access to compressor or associated equipment

Objective

Piping installed to ensure proper oil return, proper operation, and not interfere with normal maintenance or service procedures

5.0103.4d Electrical

Specification

Install field wiring in accordance with applicable codes (i.e., NFPA 70) ensuring proper voltage, frequency, and phase coincide with the nameplate

Objective

Equipment operates safely and as designed

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, ANSI/ACCA Manual D (Residential Duct Systems), or ASHRAE equivalents

Design commercial duct systems using ANSI/ACCA Manual Q (Low Pressure, Low Velocity Duct System Design), or ASHRAE 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 and safeguard indoor air quality

5.0104.1d Termination design

Specification

Design terminations using ANSI/ACCA Manual T (Air Distribution Basics)

Terminations must be capable of delivering air with proper speed and throw of 80-120% of the farthest wall, floor, or ceiling they serve, and must have a noise level less than 30 decibels

Return grille gross area will 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

5.0188.1 Economizers

Section:Heating and Cooling

Topic:Forced Air

Sub-Topic:Special Considerations

Desired Outcome

Operationally safe economizer installed

5.0188.1a Design

Specification

Design economizer outdoor air dampers in accordance with ASHRAE 90.1 minimum requirements or applicable code

Objective

Correctly determine needs

5.0188.1b Installation

Specification

Install economizer intake as far from pollutant sources as possible, but no less than 20 feet

Install economizer controls with carbon dioxide (CO₂) control in high occupancy spaces (demand control ventilation)

Objective

Durable, safe, compliant and operational economizer

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

5.0288.1 Boiler Room Water Drainage

Section:Heating and Cooling

Topic:Hydronic

Sub-Topic:Special Considerations

Desired Outcome

No standing water in boiler room

5.0288.1a Blow-down piping

Specification

Route maintenance blow-down piping to the nearest drain

Objective

No standing water on the mechanical room floor

5.0288.1b Drain condition

Specification

Remove debris from drainage system and flush system removing any blockages

Verify that drainage system is capable of handling maximum volume of water

Objective

Functioning drainage system that is capable of handling drainage load

5.0288.1c Blow-down pit

Specification

Clean blow-down pit out to handle the volume of water required to sufficiently reduce blow-down temperature for safe discharge

Clear blow-down pit connection to the drain system

Objective

Blow-down temperature is within acceptable temperatures and pit drains correctly

5.0288.1d Sump pump/sump pit

Specification

Size sump pit to handle the volume of water required to sufficiently reduce water temperature for safe discharge

Verify that sump pump is rated for high-temperature application, operates correctly, and contains a check valve

Objective

Collect and properly discharge water

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 multipoint 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

6.0101.6 Variable Frequency Drives and Electrically Commutated Motors

Section: Ventilation

Topic: Infrastructure

Sub-Topic: Components

Desired Outcome

Improve fan efficiency and control systems

6.0101.6a Pre-work qualifications

Specification

Evaluate motors for compatibility with variable frequency drive (VFD)

Analyze load profile and source equipment for use of VFD to provide variable ventilation rates

Objective

Ensure existing system is compatible with VFD use

6.0101.6b Installation

Specification

Replace motor and/or starter per the manufacturer's specifications and in compliance with applicable codes

Objective

Ensure that VFD or ECM installed safely and effectively

6.0101.6c Feedback sensors

Specification

If using a sensor-controlled strategy, install feedback sensors in accordance with manufacturer specifications at locations that will optimize the chosen control strategy

Objective

Optimize VFD or ECM operation

6.0101.6d Manual controls

Specification

Install manual controls in accordance with manufacturer specifications at a location easy to access for continued operation

Objective

Safe and effective manual operation

6.0101.6e Initial setup

Specification

Set VFD and/or ECM parameters to accept feedback from sensors dependent upon chosen control strategy

Optimize system to meet design ventilation rates at the lowest possible speed setting.

Objective

Minimal fan speed for ventilation rate

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 or if the fan exhausts more than 200 CFM

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 0.75cfm/ft² of garage area after installation

motors 1 horsepower or larger will meet NEMA premium efficiency standards

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

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

6.0301.2 Dedicated Air Handler for Multiple Dwellings

Section: Ventilation

Topic: Whole-Building Ventilation

Sub-Topic: Supply Ventilation

Desired Outcome

Efficiently supply adequate, clean ventilation air

6.0301.2a Fan selection

Specification

Select a fan that:

has an electrically commutated motor (ECM) and/or utilizes (VFD) controllers

is capable of maintaining a minimum operating static pressure of .25 inches of water column or greater

motors 1 horsepower or larger must meet NEMA premium efficiency standards

motors less than 1 HP must be rated by the Home Ventilation Institute to satisfy these requirements

Objective

Adequate and efficient fan motor

6.0301.2b 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

6.0301.2c Labeling

Specification

Label exterior intake fitting with the words "Ventilation Air Intake"

Objective

Prevent fitting restriction

6.0301.2d 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.

6.0301.2e 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

6.0301.2f Backdraft prevention

Specification

Design one or more supply fans located upstream of all the supply outlets to run continuously, or

install a system of one or more backdraft dampers to isolate each dwelling unit from the common duct when the fan is not running.

Objective

Prevent air movement between dwelling units

6.0301.2g Wiring

Specification

Install all electrical wiring according to manufacturer specifications and applicable code

Objective

Prevent an electrical hazard

6.0301.2h 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

6.0301.2i 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

6.0301.2j Air handler mounting

Specification

Mount fan using mechanical fasteners per manufacturer's specifications and applicable code (e.g., seismic

restraints)

Isolate air handling unit from the building framing unless specifically designed to be directly attached

Objective

Secure, vibration-isolated air handler

6.0301.2k Air handler duct plenum connection

Specification

Attach ductwork to air handler via a flexible connection and that maintains the intended fan opening

Objective

Efficient, vibration-resistant plenum connections

6.0301.2l Sealing

Specification

Seal all air moving portions of the system using UL 181 products

Objective

Airtight ventilation system

6.0301.2m 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

6.0301.2n Access

Specification

Ensure motorized damper, service disconnect switch, fan, filter, and conditioning coils are accessible for maintenance according to NEC and applicable building code

Objective

Serviceable parts are readily accessible

6.0301.2o 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

6.0301.2p 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

6.0302.1p Hot-humid climates

Specification

Exhaust ventilation will not rely on make-up air from common corridors

Objective

Ensure building durability and occupant health in humid conditions

6.0302.2 Multiport Exhaust Fan Serving Multiple Dwellings

Section: Ventilation

Topic: Whole-Building Ventilation

Sub-Topic: Exhaust Ventilation

Desired Outcome

Efficiently and safely exhaust adequate ventilation air

6.0302.2a Fan selection

Specification

Select a fan that:

has an electrically commutated motor (ECM) and/or utilizes (VFD) controllers

is capable of maintaining a minimum operating static pressure of .25 inches of water column or greater

motors 1 horsepower or larger must meet NEMA premium efficiency standards

motors less than 1 HP must be rated by the Home Ventilation Institute to satisfy these requirements

Objective

Adequate and efficient fan motor

6.0302.2b 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

6.0302.2c 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.

6.0302.2d Backdraft prevention

Specification

Design one or more exhaust fans located upstream of all the exhaust inlets to run continuously, or install a system of one or more backdraft dampers to isolate each dwelling unit from the common duct when the fan is not running

Objective

Prevent air movement between dwelling units

6.0302.2e Wiring

Specification

Install all electrical wiring according to manufacturer specifications and applicable code

Objective

Prevent an electrical hazard

6.0302.2f Fan mounting

Specification

Mount fan 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 air handler

6.0302.2g 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

6.0302.2h 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

6.0302.2i Access

Specification

Ensure fan and service disconnect switch are accessible for maintenance according to NEC, or applicable

building code

Objective

Serviceable parts are readily accessible

6.0302.2j 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

6.0302.2k 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

Design one or more ventilation fans located upstream of all the exhaust inlets to run continuously, or install a system of one or more backdraft dampers to isolate each dwelling unit from the common duct when the fan is not running

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.

6.0304.1 Multi-Story Passive System

Section: Ventilation

Topic: Whole-Building Ventilation

Sub-Topic:Passive Ventilation

Desired Outcome

Efficient and effective passive ventilation system

6.0304.1a 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

6.0304.1b 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.

6.0304.1c Backdraft prevention

Specification

System must contain a backdraft damper between all exterior terminations/intakes that only allows air flow in the desired direction

A system of one or more backdraft dampers shall be installed to isolate each dwelling unit from the common duct when the system is not operating

Objective

Prevent unwanted air movement

6.0304.1d Interior intake/supply location

Specification

Intakes/supplies in dwelling units must minimize potential occupant discomfort and/or drafts

Objective

Minimize client discomfort

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

7.0103.4 Exit Sign Replacement

Section:Baseload

Topic:Plug Load

Sub-Topic:Lighting

Desired Outcome

Safe, efficient, and compliant exit lighting replacement

7.0103.4a Selection

Specification

Select exit signs:

from the NEMA Premium Exit Sign List and that meet all applicable codes (UL 924, NFPA 70, and/or IBC and IFC, as appropriate)

that include battery-backups that can maintain the total load for a minimum period of 1-1/2 hours and indicate system failure with visual and audible alarm

that are able to be attached to the existing outlet box

that are rated for a maximum of 5 watts per illuminated side

with at least a 1-year warranty

Objective

Select efficient, reliable, and safe lighting improvements

7.0103.4b Installation

Specification

De-energize circuit and lock out power before work begins

Locate and install fixture in accordance with NFPA 101 and NFPA 70

Objective

Safe, proper, and functioning installation

7.0103.4c 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

7.0103.4d Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0103.5 Emergency Lighting Replacement

Section:Baseload

Topic:Plug Load

Sub-Topic:Lighting

Desired Outcome

Safe, efficient, and compliant emergency lighting replacement

7.0103.5a Selection

Specification

Select emergency light fixtures that:

are UL approved for location installed (i.e., indoor, outdoor, wet location)

have battery-backup that can maintain the total load for a minimum period of 1-1/2 hours, in accordance with section 700.12 of the NEC

Objective

Select efficient, reliable, and safe lighting improvements

7.0103.5b Installation

Specification

De-energize circuit and lock out power before work begins

Locate and install fixture in accordance with NFPA 101 and NFPA 70 and as specified by NECA/IESNA 500

Objective

Safe, proper, and functioning installation

7.0103.5c 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

7.0103.5d 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

7.0104.5 Bi-Level Controls

Section:Baseload

Topic:Plug Load

Sub-Topic:Lighting Controls

Desired Outcome

Reduce lighting electrical usage without compromising required lighting levels, or safety

7.0104.5a Selection

Specification

Select control that:

is compatible with existing wiring and lighting

is UL approved and listed

has an appropriate manual override

Objective

Appropriate and safe control selected

7.0104.5b Installation

Specification

Install switches in accordance with NFPA 70 and manufacturer specifications, in a secure location, and protected from physical damage

Objective

Safe, secure, and proper installation

7.0104.5c Labeling

Specification

Affix permanent labels near the switch location to indicate light level and fixture control

Objective

Operation made clear to occupants

7.0104.5d 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

7.0106.1 Vending Machines

Section:Baseload

Topic:Plug Load

Sub-Topic:Vending and Beverage

Desired Outcome

Safely reduce energy used by vending machines without interfering with egress or accessibility

7.0106.1a Pre-work qualifications

Specification

Verify electrical receptacle meets the requirements of NFPA 70 (Article 422)

Objective

Safe electrical connection

7.0106.1b Selection

Specification

Select vending machines that:

- are ENERGY STAR qualified, equivalent, or better

- are compliant with ANSI/UL 541 (refrigerated vending machines) or ANSI/UL 751 (non-refrigerated vending machines)

- have a GFCI as an integral part of the attachment plug according to NFPA 70 (Article 422.51)

Objective

Select safe and efficient appliance

7.0106.1c Installation

Specification

Install appliance according to manufacturer specifications and applicable code

Objective

Safe and proper installation

7.0106.1d Motion controls

Specification

Install motion controls for all non-refrigeration functions (e.g., lighting, advertising, sound)

Objective

Reduce energy consumption when not in use

7.0106.1e Accessibility

Specification

Where applicable per ADA, provide clear floor space and unit controls complying with the operable parts provisions of ICC A117.1

Objective

Accessible home

7.0106.1f 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

7.0106.1g Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0106.2 Freestanding Water Coolers

Section:Baseload

Topic:Plug Load

Sub-Topic:Vending and Beverage

Desired Outcome

Safely reduce energy use for freestanding point-of-use water coolers without interfering with egress or accessibility

7.0106.2a Pre-work qualifications

Specification

Verify electrical receptacle meets the requirements of NFPA 70 (Article 422)

Objective

Safe electrical connection

7.0106.2b Selection

Specification

Select water cooler that is ENERGY STAR qualified, equivalent, or better

If unit provides hot water delivery, includes a child-resistant hot water faucet

Objective

Select safe and efficient appliance

7.0106.2c Installation

Specification

Install appliance according to manufacturer specifications and applicable code

Objective

Safe and proper installation

7.0106.2d Accessibility

Specification

Where applicable per ADA, provide clear floor space and unit controls complying with the operable parts provisions of ICC A117.1

Objective

Accessible home

7.0106.2e 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

7.0106.2f 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

7.0301.3 Drain Heat Recovery

Section: Baseload

Topic: Water Heating

Sub-Topic: Thermal Loss Reduction

Desired Outcome

Effectively capture heat from outgoing drain water with leak-free and compliant installation

7.0301.3a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s)

Objective

Verify adequacy of plumbing

7.0301.3b Location

Specification

Choose a location where cold water draw is concurrent with a warm drain

Ensure vertical drop of drain is sufficient to allow installation of the recovery device

Objective

Identify suitable locations

7.0301.3c Installation

Specification

Install drain heat recovery device in accordance with manufacturer specifications (e.g., cold water counter flow)

Objective

Maximize effectiveness of heat exchange

7.0301.3d Cold/tempered water supply

Specification

Plumb the tempered water line (post-drain heat recovery device) as close to the primary fixture as possible (e.g., showerhead); or to fixtures that will have water use concurrent with drain heat recovery (e.g., shower that is supplying the drain water); or to the cold water intake of the water heater

Objective

Minimize heat loss from tempered water

7.0301.3e Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0302.1 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

7.0302.1m Multitank systems

Specification

In multitank systems, install valves to isolate each tank from water heating system and install bypass piping

Objective

Allow removal and maintenance of a single tank without shutting down entire system

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

7.0302.2n Multitank systems

Specification

In multitank systems, install valves to isolate each tank from water heating system and install bypass piping

Objective

Allow removal and maintenance of a single tank without shutting down entire system

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

7.0302.4 Non Heated Storage Tank

Section:Baseload

Topic:Water Heating

Sub-Topic:Water Heater Installation

Desired Outcome

Leak free, safe, durable and efficient hot water storage tank

7.0302.4a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s) and is leak-free

Objective

Verify adequacy of plumbing

7.0302.4b Equipment selection

Specification

Select a water storage tank that:

fits in the installation space with required clearances

has an R-value of 12.5 or greater

Objective

Select efficient and properly sized water heater

7.0302.4c Location

Specification

Install appliance where it:

is protected from freezing

is accessible for service

will maximize efficient operation of the water heating system

will minimize distance between tank and primary hot water outlets

does not obstruct building egress or access, as required by applicable code (e.g., NFPA 101)

Objective

Select freeze protected, safe, and accessible location that maximizes operation of the water heating system

7.0302.4d 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

Install storage tank on a housekeeping pad

Objective

Compliant and safe installation

7.0302.4e 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

7.0302.4f 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

7.0302.4g 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

7.0302.4h Isolation and bypass valves

Specification

Install a separate water cut-off valve for both the hot and cold water lines and install bypass piping

Objective

Allow isolation and bypass of storage tank

7.0302.4i 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

7.0302.4j 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

7.0302.4k Gauges

Specification

Where required, install temperature and pressure gauges on storage tank in an easily visible location

Objective

Easily visible gauges installed

7.0302.4l 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

7.0302.4m 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

7.0302.51 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

7.0302.6o Multitank systems

Specification

In multitank systems, install valves to isolate each tank from water heating system and install bypass piping

Objective

Allow removal and maintenance of a single tank without shutting down entire system

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

7.0303.3 Pumps

Section:Baseload

Topic:Water Heating

Sub-Topic:Distribution Components

Desired Outcome

Safe, compliant, and efficient pump installation

7.0303.3a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s) and is leak-free

Objective

Verify adequacy of plumbing

7.0303.3b Pump selection

Specification

Choose a pump built with materials suitable for potable water (i.e., bronze or stainless steel) and that is certified as lead-free

Objective

Select safe pump materials compatible with potable water source

7.0303.3c Installation

Specification

Install pumps according to manufacturer specifications and applicable code (e.g., IPC, IRC, NFPA 70)

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe, compliant, and effective pump installation

7.0303.3d Accessibility

Specification

Install and plumb pump to allow for inspection, maintenance, and replacement of the pump

Objective

Pump is accessible for service

7.0303.3e Laminar flow

Specification

Install pumps in accordance with manufacturer specifications with sufficient straight line piping before and after the pump

Objective

Minimize pump cavitation

7.0303.3f Isolation valves

Specification

Install a water cut-off valve on both sides of the pump

Objective

Allow isolation and service of mixing valve

7.0303.3g Drain/purge valve

Specification

Install a drain spigot in close proximity of the discharge end of the pump

Objective

Allow the piping to be purged of air

7.0303.3h Gauges

Specification

Install pressure gauges to measure suction, discharge, and pressure differential

Objective

Verify proper operation of the pump

7.0303.3i Dielectric unions

Specification

When connecting non-ferrous metal pump to existing ferrous piping, install a dielectric union or a plastic-lined steel nipple a minimum of 4" long to connect the two piping systems

Objective

Prevent corrosion between dissimilar metals

7.0303.3j Insulation

Specification

Do not insulate pumps

Objective

Prevent pump from overheating

7.0303.3k Controls and sensors

Specification

Install or reconnect controls and sensors in accordance with design specifications

When controls use low voltage, separate the low voltage and line voltage wiring

Objective

Proper operation of the water heating system

7.0303.3l 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

7.0303.3m Stray voltage protection

Specification

Install grounding and bonding for pump as required by NEC (NFPA 70)

Objective

Eliminate stray voltage from pump

7.0303.3n 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

7.0303.3o Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0303.4 Gauges

Section:Baseload

Topic:Water Heating

Sub-Topic:Distribution Components

Desired Outcome

Safe and accurate sensor readings of distribution system

7.0303.4a Pre-work qualifications

Specification

Verify current plumbing infrastructure is sufficient to support the installation(s) and is leak-free

Objective

Verify adequacy of plumbing

7.0303.4b Gauge selection

Specification

Select gauges:

with an appropriate range for the design specifications

that can be easily read in the available light conditions

Objective

Provide accurate and visible measurement

7.0303.4c Location

Specification

Install gauges:

so they can be easily read (e.g., not facing the wall, or so high a ladder or stool is needed to access)

so they are not adversely affected by other equipment through heat conduction

Install surface-mount thermometers so that thermocouple for digital gauges is tight to the pipe and wrapped with insulation to exclude ambient temperature

Install wet-mount thermometers so they are not in an air pocket (e.g., install on side of pipe, not on top of side-plumbed tanks)

Install pressure gauges so they are not adversely affected by turbulent flow and vibration

Objective

Easily accessible gauges that provide accurate measurements

7.0303.4d Installation

Specification

Install gauges according to manufacturer specifications and applicable code (e.g., IPC, IRC, NFPA 70)

If conflict exists between code and manufacturer specifications, apply the more restrictive requirement

Objective

Safe, compliant installation

7.0303.4e Isolation valves

Specification

Install a water cut-off valve on both sides of the gauge

Objective

Allow isolation and service of gauge

7.0303.4f Dielectric unions

Specification

When connecting non-ferrous metal pump to existing ferrous piping, install a dielectric union or a plastic-lined steel nipple a minimum of 4" long to connect the two piping systems

Objective

Minimize corrosion between dissimilar metals

7.0303.4g Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.0303.5 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

7.0303.6 Recirculation System Temperature Modulation Controls

Section:Baseload

Topic:Water Heating

Sub-Topic:Distribution Components

Desired Outcome

Controls work properly and safely to provide water at desired temperature

7.0303.6a Pre-work qualifications

Specification

Verify that existing plumbing and electrical systems are adequate for the new installation

Objective

Verify adequacy of existing utilities

7.0303.6b Installation

Specification

Install sensors and controls in accordance with manufacturer specifications and applicable code (e.g., NFPA 70)

Mount controls on a stable and sturdy surface

When controls are using low voltage, separate the low voltage and line voltage wiring

Install controls, sensors, wiring, and other components in a manner that does not expose occupants to hazardous conditions nor poses any unnecessary risk to the integrity of the installation

Objective

Safe, durable, and compliant controls

7.0303.6c Integration with other system controls

Specification

Clearly identify new controls with labels to identify purpose of control and its associated equipment ("this device controls boiler #2," etc.)

Log existing hot water supply set points

Remove decommissioned controls or label them as abandoned

Objective

Maintain the integrity of the hot water system and components

7.0303.6d 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

7.0303.6e Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, installer contact information and a clear description/plan of the final configuration of sensors and controls

Objective

Manufacturer supplied information available to occupant

7.8801.1 Component Replacement

Section:Baseload

Topic:Special Considerations

Sub-Topic:Elevators

Desired Outcome

Safe, durable and energy efficient elevator operation

7.8801.1a Equipment selection

Specification

Select the most energy efficient components available and within budget (e.g., elevator room heating, ventilation, and air conditioning equipment)

Objective

Select equipment that will optimize energy performance

7.8801.1b Equipment Installation

Specification

Perform installations to comply with ASME A17.1, ICC A117.1, and NFPA 70 (Article 620)

Objective

Safe, compliant, and durable installation

7.8801.1c Documentation

Specification

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Objective

Manufacturer supplied information available to occupant

7.8802.1 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