

# **2020 SWS - Manufactured Housing - All Specifications**

**The National Renewable Energy Laboratory**

## **Disclaimer**

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

# Table Of Contents

<b>2.0101.1 Hardwired (interconnected) Smoke Alarms</b> .....	31
2.0101.1a Selection .....	31
2.0101.1b Location .....	31
2.0101.1c Installation .....	31
2.0101.1d Occupant notification .....	32
<b>2.0101.2 Battery-Operated Smoke Alarms</b> .....	32
2.0101.2a Selection .....	32
2.0101.2b Location .....	32
2.0101.2c Installation .....	33
2.0101.2d Occupant notification .....	33
<b>2.0102.1 CO Detection and Warning Equipment</b> .....	33
2.0102.1a Selection .....	33
2.0102.1b Location .....	34
2.0102.1c Installation .....	34
2.0102.1d Occupant notification .....	34
<b>2.0103.1 Temperature and pressure relief valve</b> .....	35
2.0103.1a Selection .....	35
2.0103.1b Installation .....	35
2.0103.1c Discharge .....	35
<b>2.0201.1 Gutters</b> .....	36
2.0201.1a Selection .....	36
2.0201.1b Attachment .....	36
2.0201.1c Slope .....	37
2.0201.1d Sealing .....	37
<b>2.0201.2 Downspouts</b> .....	37
2.0201.2a Selection .....	37
2.0201.2b Attachment .....	38
2.0201.2c Drainage .....	38
<b>2.0201.3 Grading</b> .....	38
2.0201.3a Slope .....	39
2.0201.3b Vegetation removal .....	39
<b>2.0202.1 Un-Vented Subspaces - Ground Cover</b> .....	39
2.0202.1a Preparation .....	39
2.0202.1b Material selection .....	40
2.0202.1c Coverage .....	40
2.0202.1d Drainage .....	40
2.0202.1e Seams/connections .....	41
2.0202.1f Fastening .....	41
2.0202.1g Air sealing .....	41
2.0202.1h Signage .....	42
<b>2.0202.2 Vented Subspaces - Ground Cover</b> .....	42
2.0202.2a Preparation .....	42

2.0202.2b Material selection	43
2.0202.2c Coverage	43
2.0202.2d Drainage	43
2.0202.2e Seams	43
2.0202.2f Fastening	44
2.0202.2g Air Sealing	44
2.0202.2h Signage	44
<b>2.0202.3 Pier and Skirting Foundations - Ground Cover</b>	<b>45</b>
2.0202.3a Preparation	45
2.0202.3b Coverage	45
2.0202.3c Material selection	46
2.0202.3d Seams	46
2.0202.3e Fastening	46
<b>2.0203.1 Stand-Alone Dehumidifier Installation</b>	<b>46</b>
2.0203.1a Selection	47
2.0203.1b Installation	47
2.0203.1c Commissioning	48
2.0203.1d Disposal	48
2.0203.1e Client education	48
<b>2.0301.1 Junctions/Splices Enclosed</b>	<b>49</b>
2.0301.1a Junction box covers	49
2.0301.1b Wiring Splices	49
<b>3.0101.1 Air Sealing Holes</b>	<b>50</b>
3.0101.1a Sealant selection	50
3.0101.1b Material selection	50
3.0101.1c Backing, infill, and support	51
3.0101.1d Surface preparation	51
3.0101.1e Sealant application	52
3.0101.1f High-temperature application	52
<b>3.0102.1 Sealing Non-Insulation Contact (IC) Recessed Light</b>	<b>52</b>
3.0102.1a Sealant selection	53
3.0102.1b Material selection	53
3.0102.1c Clearance	53
3.0102.1d Enclosure top	54
3.0102.1e Structural soundness	54
3.0102.1f Surface preparation	54
3.0102.1g Sealant application	54
3.0102.1h Marking	55
<b>3.0102.2 Sealing High-Temperature Devices</b>	<b>55</b>
3.0102.2a Sealant selection	55
3.0102.2b Material selection	56
3.0102.2c Clearance and isolation	56
3.0102.2d Backing and infill	57
3.0102.2e Surface preparation	57
3.0102.2f Sealant application	57

<b>3.0102.3 Sealing Tongue and Groove Surfaces</b>	58
3.0102.3a Sealant selection	58
3.0102.3b Material selection	58
3.0102.3c Backing	59
3.0102.3d Surface preparation	59
3.0102.3e Sealant application	59
<b>3.0102.5 MH Belly Repair - Soft Bottom Patching</b>	60
3.0102.5a Sealant selection	60
3.0102.5b Material selection	60
3.0102.5c Surface preparation	61
3.0102.5d Patch installation	61
3.0102.5e Attachment	61
3.0102.5f High-temperature application	61
<b>3.0102.6 MH Belly Repair - Soft Bottom Replacement</b>	62
3.0102.6a Sealant selection	62
3.0102.6b Material selection	62
3.0102.6c Coverage	63
3.0102.6d Seams	63
3.0102.6e Attachment	63
3.0102.6f Sealant Application	64
3.0102.6g High-temperature application	64
<b>3.0102.7 MH Belly Repair - Rigid Bottom Patching</b>	64
3.0102.7a Sealant selection	65
3.0102.7b Material selection	65
3.0102.7c Surface preparation	65
3.0102.7d Support	66
3.0102.7e Patch installation	66
3.0102.7f Attachment	66
3.0102.7g High-temperature application	67
<b>3.0102.8 MH Belly Repair - Rigid Bottom Replacement</b>	67
3.0102.8a Sealant selection	67
3.0102.8b Material selection	68
3.0102.8c Support	68
3.0102.8d Coverage	68
3.0102.8e Attachment	69
3.0102.8f Sealing	69
3.0102.8g High-temperature application	69
<b>3.0102.9 Sealing Dropped Soffits/Bulkheads</b>	70
3.0102.9a Sealant selection	70
3.0102.9b Material selection	70
3.0102.9c Support	71
3.0102.9d Surface preparation	71
3.0102.9e Install air barrier	71
3.0102.9f Attachment	72
3.0102.9g Sealant application	72

3.0102.9h High-temperature application	72
<b>3.0102.10 Sealing Dropped Ceilings</b>	<b>72</b>
3.0102.10a Sealant selection	73
3.0102.10b Material selection	73
3.0102.10c Support	74
3.0102.10d Surface preparation	74
3.0102.10e Install air barrier	74
3.0102.10f Sealant application	74
3.0102.10g High-temperature application	75
<b>3.0102.11 Sealing Roof/Wall Connections</b>	<b>75</b>
3.0102.11a Sealant selection	75
3.0102.11b Material selection	76
3.0102.11c Surface preparation	76
3.0102.11d Support	76
3.0102.11e Install air barrier	77
3.0102.11f Attachment	77
3.0102.11g Sealant application	77
3.0102.11h High-temperature application	78
<b>3.0103.1 Access Doors and Hatches</b>	<b>78</b>
3.0103.1a Sealant selection	78
3.0103.1b Material selection	79
3.0103.1c Surface preparation	79
3.0103.1d Seal framing	79
3.0103.1e Seal access panel	80
3.0103.1f Damming	80
3.0103.1g Insulate opening	80
3.0103.1h Durability	80
<b>3.0103.3 Whole-House Fan - Operable</b>	<b>81</b>
3.0103.3a Sealant selection	81
3.0103.3b Material selection	81
3.0103.3c Surface preparation	82
3.0103.3d Enclosure construction	82
3.0103.3e Operable cover	82
3.0103.3f Insulation	83
3.0103.3g Air sealing	83
3.0103.3h Durability	83
<b>3.0201.1 Window Air Sealing</b>	<b>84</b>
3.0201.1a Sealant selection	84
3.0201.1b Material selection	84
3.0201.1c Surface preparation	85
3.0201.1d Operation and fit	85
3.0201.1e Sash stops	85
3.0201.1f Weather stripping	86
3.0201.1g Sash locks	86
3.0201.1h Exterior weatherproofing	86

3.0201.1i Safety	87
<b>3.0201.2 Window Sash Replacement</b>	<b>87</b>
3.0201.2a Sealant selection	87
3.0201.2b Material selection	88
3.0201.2c Surface preparation	88
3.0201.2d Sash replacement	88
3.0201.2e Weatherproofing	89
3.0201.2f Sash stops	89
3.0201.2g Weather stripping	89
3.0201.2h Sash locks	90
3.0201.2i Disposal	90
3.0201.2j Safety	90
<b>3.0201.3 Window Sill Replacement</b>	<b>91</b>
3.0201.3a Sealant selection	91
3.0201.3b Material selection	91
3.0201.3c Surface preparation	92
3.0201.3d Sill replacement	92
3.0201.3e Weatherproofing	92
3.0201.3f Disposal	93
3.0201.3g Safety	93
<b>3.0201.4 Glass Replacement</b>	<b>93</b>
3.0201.4a Sealant selection	93
3.0201.4b Material selection	94
3.0201.4c Surface preparation	94
3.0201.4d New glazing selection	95
3.0201.4e New glazing installation	95
3.0201.4f Safety	95
<b>3.0201.5 Interior Fixed Storm Window Installation</b>	<b>96</b>
3.0201.5a Sealant selection	96
3.0201.5b Material selection	96
3.0201.5c Surface preparation	97
3.0201.5d Installation	97
3.0201.5e Safety	97
<b>3.0201.6 Interior Operable Storm Window Installation</b>	<b>98</b>
3.0201.6a Sealant selection	98
3.0201.6b Material selection	98
3.0201.6c Surface preparation	99
3.0201.6d Installation	99
3.0201.6e Safety	99
<b>3.0201.7 Exterior Fixed Storm Window Installation</b>	<b>100</b>
3.0201.7a Sealant selection	100
3.0201.7b Material selection	100
3.0201.7c Surface preparation	101
3.0201.7d Installation	101
3.0201.7e Sealing	101

3.0201.7f Safety	102
<b>3.0201.8 Exterior Operable Storm Window Installation</b>	<b>102</b>
3.0201.8a Sealant selection	102
3.0201.8b Material selection	103
3.0201.8c Surface preparation	103
3.0201.8d Installation	103
3.0201.8e Sealing	104
3.0201.8f Safety	104
<b>3.0201.9 Window Replacement</b>	<b>104</b>
3.0201.9a Sealant selection	104
3.0201.9b Material selection	105
3.0201.9c Window selection	105
3.0201.9d Opening preparation	106
3.0201.9e Installation	106
3.0201.9f Safety	107
<b>3.0202.1 Door Air Sealing</b>	<b>107</b>
3.0202.1a Sealant selection	107
3.0202.1b Material selection	108
3.0202.1c Surface preparation	108
3.0202.1d Operation and fit	108
3.0202.1e Handle/lockset	109
3.0202.1f Weather stripping	109
3.0202.1g Door stop	109
3.0202.1h Exterior weatherproofing	110
3.0202.1i Safety	110
<b>3.0202.2 Door Replacement</b>	<b>110</b>
3.0202.2a Sealant selection	111
3.0202.2b Material selection	111
3.0202.2c Door selection	112
3.0202.2d Opening preparation	112
3.0202.2e Installation	112
3.0202.2f Safety	113
<b>3.0202.3 Exterior Door Handle/Lockset Installation</b>	<b>113</b>
3.0202.3a Hardware selection	113
3.0202.3b Installation	114
3.0202.3c Safety	114
<b>4.0101.1 Roof Deck Insulation</b>	<b>114</b>
4.0101.1a Pre-work qualifications	115
4.0101.1b General preparation	115
4.0101.1c Material selection	115
4.0101.1d Sealant selection	116
4.0101.1e Installation	116
4.0101.1f Air sealing	116
4.0101.1g Water management	117
4.0101.1h Replacement roof covering	117

4.0101.1i Insulation - onsite documentation . . . . .	117
<b>4.0102.1 SPF Roof Insulation - Unvented Roof Deck . . . . .</b>	<b>117</b>
4.0102.1a Pre-work qualifications . . . . .	118
4.0102.1b General preparation . . . . .	118
4.0102.1c Material selection . . . . .	119
4.0102.1d Surface preparation . . . . .	119
4.0102.1e Installation . . . . .	119
4.0102.1f Ignition and thermal barriers . . . . .	120
4.0102.1g Insulation - onsite documentation . . . . .	120
<b>4.0102.2 SPF Roof Insulation - Vented Roof Deck . . . . .</b>	<b>121</b>
4.0102.2a Pre-work qualifications . . . . .	121
4.0102.2b General preparation . . . . .	122
4.0102.2c Material selection . . . . .	122
4.0102.2d Roof deck venting . . . . .	122
4.0102.2e Surface preparation . . . . .	122
4.0102.2f Installation . . . . .	123
4.0102.2g Ignition and thermal barriers . . . . .	123
4.0102.2h Insulation - onsite documentation . . . . .	124
<b>4.0102.3 Inaccessible Ceilings - Dense Pack . . . . .</b>	<b>124</b>
4.0102.3a Pre-work qualifications . . . . .	124
4.0102.3b General preparation . . . . .	125
4.0102.3c Material selection . . . . .	125
4.0102.3d Installation . . . . .	125
4.0102.3e Close access hole . . . . .	126
4.0102.3f Insulation - onsite documentation . . . . .	126
<b>4.0103.8 Loose Fill to Capacity . . . . .</b>	<b>126</b>
4.0103.8a Pre-work qualifications . . . . .	127
4.0103.8b General preparation . . . . .	127
4.0103.8c Material selection . . . . .	127
4.0103.8d Installation . . . . .	128
4.0103.8e Close access hole . . . . .	128
4.0103.8f Insulation - onsite documentation . . . . .	128
<b>4.0103.9 MH - Blown Insulation for Flat, Bowed, or Vaulted Ceilings (via Gable End Access) . . . . .</b>	<b>129</b>
4.0103.9a Pre-work qualifications . . . . .	129
4.0103.9b Material selection . . . . .	129
4.0103.9c Access . . . . .	130
4.0103.9d Installation . . . . .	130
4.0103.9e Close access . . . . .	130
4.0103.9f Insulation - onsite documentation . . . . .	131
<b>4.0103.10 MH - Blown Insulation for Flat, Bowed, or Vaulted Ceilings (via Roof Side Lift) . .</b>	<b>131</b>
4.0103.10a Pre-work qualifications . . . . .	131
4.0103.10b Material selection . . . . .	132
4.0103.10c Access . . . . .	132
4.0103.10d Installation . . . . .	133

4.0103.10e Close access	133
4.0103.10f Insulation - onsite documentation	133
<b>4.0103.11 MH - Blown Insulation for Flat, Bowed, or Vaulted Ceilings (via Roof Top Access)</b>	<b>134</b>
4.0103.11a Pre-work qualifications	134
4.0103.11b Material selection	135
4.0103.11c Sealant selection	135
4.0103.11d Access	135
4.0103.11e Installation	136
4.0103.11f Close access	136
4.0103.11g Insulation - onsite documentation	137
<b>4.0103.12 MH - Blown Insulation for Flat, Bowed, or Vaulted Ceilings (via Interior Access Through the Ceiling)</b>	<b>137</b>
4.0103.12a Pre-work qualifications	138
4.0103.12b Material selection	138
4.0103.12c Sealant selection	138
4.0103.12d General preparation	139
4.0103.12e Access	139
4.0103.12f Installation	140
4.0103.12g Close access	140
4.0103.12h Insulation - onsite documentation	140
<b>4.0103.13 MH - Blown Insulation in Roof-Over Construction</b>	<b>141</b>
4.0103.13a Pre-work qualifications	141
4.0103.13b Material selection	142
4.0103.13c Sealant selection	142
4.0103.13d General preparation	142
4.0103.13e Access	143
4.0103.13f Installation	143
4.0103.13g Close access	143
4.0103.13h Insulation - onsite documentation	144
<b>4.0104.1 Knee Wall - Dense Packing</b>	<b>144</b>
4.0104.1a Pre-work qualifications	144
4.0104.1b Material selection	145
4.0104.1c General preparation	145
4.0104.1d Install backing	146
4.0104.1e Installation	146
4.0104.1f Close access hole	146
4.0104.1g Ignition and thermal barriers	146
4.0104.1h Insulation - onsite documentation	147
<b>4.0104.2 Knee Wall - Batt Insulation</b>	<b>147</b>
4.0104.2a Pre-work qualifications	147
4.0104.2b Material selection	148
4.0104.2c General preparation	148
4.0104.2d Batt installation	149
4.0104.2e Install backing	149

4.0104.2f Ignition and thermal barriers . . . . .	149
4.0104.2g Insulation - onsite documentation . . . . .	150
<b>4.0104.3 Knee Wall - Existing Batt Insulation Repair . . . . .</b>	<b>150</b>
4.0104.3a Pre-work qualifications . . . . .	150
4.0104.3b Material selection . . . . .	151
4.0104.3c General preparation . . . . .	151
4.0104.3d Install backing . . . . .	152
4.0104.3e Ignition and thermal barriers . . . . .	152
4.0104.3f Insulation - onsite documentation . . . . .	152
<b>4.0104.4 Knee Wall - Rigid Insulation . . . . .</b>	<b>153</b>
4.0104.4a Pre-work qualifications . . . . .	153
4.0104.4b Material selection . . . . .	154
4.0104.4c General preparation . . . . .	154
4.0104.4d Installation . . . . .	154
4.0104.4e Ignition and thermal barriers . . . . .	154
4.0104.4f Insulation - onsite documentation . . . . .	155
<b>4.0104.5 Knee Wall - SPF With No Existing Insulation . . . . .</b>	<b>155</b>
4.0104.5a Pre-work qualifications . . . . .	155
4.0104.5b Material selection . . . . .	156
4.0104.5c General preparation . . . . .	156
4.0104.5d Surface preparation . . . . .	157
4.0104.5e Installation . . . . .	157
4.0104.5f Ignition and thermal barriers . . . . .	157
4.0104.5g Insulation - onsite documentation . . . . .	158
<b>4.0104.6 Knee Wall - SPF With Existing Insulation . . . . .</b>	<b>158</b>
4.0104.6a Pre-work qualifications . . . . .	158
4.0104.6b Material selection . . . . .	159
4.0104.6c General preparation . . . . .	159
4.0104.6d Surface preparation . . . . .	160
4.0104.6e Installation . . . . .	160
4.0104.6f Ignition and thermal barriers . . . . .	160
4.0104.6g Insulation - onsite documentation . . . . .	161
<b>4.0188.1 Radiant Barriers . . . . .</b>	<b>161</b>
4.0188.1a Pre-work qualifications . . . . .	161
4.0188.1b Material selection . . . . .	162
4.0188.1c Installation . . . . .	162
4.0188.1d Air space . . . . .	163
4.0188.1e Sealing . . . . .	163
4.0188.1f Ventilation . . . . .	163
4.0188.1g Insulation - onsite documentation . . . . .	163
<b>4.0188.2 Unconditioned Attic Ventilation . . . . .</b>	<b>164</b>
4.0188.2a Pre-work qualifications . . . . .	164
4.0188.2b Vent selection . . . . .	164
4.0188.2c Vent openings . . . . .	164
4.0188.2d Vent location . . . . .	165

4.0188.2e Ventilation screens	165
4.0188.2f Ventilation baffles	165
<b>4.0201.1 SPF Insulation</b>	<b>166</b>
4.0201.1a Pre-work qualifications	166
4.0201.1b Material selection	167
4.0201.1c General preparation	167
4.0201.1d Surface preparation	167
4.0201.1e Installation	168
4.0201.1f Ignition and thermal barriers	168
4.0201.1g Insulation - onsite documentation	168
<b>4.0201.2 Batt Insulation</b>	<b>169</b>
4.0201.2a Pre-work qualifications	169
4.0201.2b Material selection	170
4.0201.2c General preparation	170
4.0201.2d Batt installation	170
4.0201.2e Install backing	171
4.0201.2f Ignition and thermal barriers	171
4.0201.2g Insulation - onsite documentation	171
<b>4.0201.3 Dense Pack Insulation</b>	<b>171</b>
4.0201.3a Pre-work qualifications	172
4.0201.3b Material selection	172
4.0201.3c General preparation for dense packed insulation	173
4.0201.3d Install backing	173
4.0201.3e Installation	173
4.0201.3f Close access hole	174
4.0201.3g Ignition and thermal barriers	174
4.0201.3h Insulation - onsite documentation	174
<b>4.0202.1 Dense Pack Insulation</b>	<b>174</b>
4.0202.1a Pre-work qualifications	175
4.0202.1b Material selection	175
4.0202.1c General preparation	176
4.0202.1d Sealant selection	176
4.0202.1e Access cavity	176
4.0202.1f Installation	177
4.0202.1g Close access hole	177
4.0202.1h Insulation - onsite documentation	178
<b>4.0202.2 Exterior Rigid Insulation</b>	<b>178</b>
4.0202.2a Pre-work qualifications	178
4.0202.2b Sealant selection	179
4.0202.2c General preparation	179
4.0202.2d Water management system	180
4.0202.2e Installation	180
4.0202.2f Exterior cladding replacement	180
4.0202.2g Fire Safety	181
4.0202.2h Insulation - onsite documentation	181

<b>4.0202.3 MH - Fiberglass Batts</b>	181
4.0202.3a Pre-work qualifications	181
4.0202.3b Material selection	182
4.0202.3c General preparation	182
4.0202.3d Access cavities	183
4.0202.3e Installation	183
4.0202.3f Close cavities	183
4.0202.3g Insulation - onsite documentation	184
<b>4.0202.4 MH - Blown Fiberglass</b>	184
4.0202.4a Pre-work qualifications	184
4.0202.4b Material selection	185
4.0202.4c General preparation	185
4.0202.4d Access cavities	185
4.0202.4e Installation	186
4.0202.4f Close cavities	186
4.0202.4g Insulation - onsite documentation	186
<b>4.0202.5 MH - Blown Fiberglass Through Penetrations</b>	187
4.0202.5a Pre-work qualifications	187
4.0202.5b Material selection	187
4.0202.5c Sealant selection	188
4.0202.5d General preparation for blown wall insulation	188
4.0202.5e Access cavity	189
4.0202.5f Blow insulation	189
4.0202.5g Close access hole	189
4.0202.5h Insulation - onsite documentation	190
<b>4.0202.6 SPF Insulation Installation in Closed Cavities</b>	190
4.0202.6a Pre-work qualifications	190
4.0202.6b Material selection	191
4.0202.6c Sealant selection	191
4.0202.6d General preparation	192
4.0202.6e Surface preparation	192
4.0202.6f Access	192
4.0202.6g Installation	193
4.0202.6h Closure	193
4.0202.6i Ignition and thermal barriers	193
4.0202.6j Insulation - onsite documentation	193
<b>4.0301.1 Batt Insulation in Joisted Cavities</b>	194
4.0301.1a Pre-work qualifications	194
4.0301.1b Material selection	195
4.0301.1c General preparation	195
4.0301.1e Secure Batts	195
4.0301.1f Insulation - onsite documentation	195
<b>4.0301.2 Loose Fill With Netting/Fabric in Joisted Cavities</b>	196
4.0301.2a Pre-work qualifications	196
4.0301.2b Material selection	197

4.0301.2c General preparation . . . . .	197
4.0301.2d Install netting/fabric . . . . .	197
4.0301.2e Installation . . . . .	198
4.0301.2f Close access hole . . . . .	198
4.0301.2g Insulation - onsite documentation . . . . .	198
<b>4.0301.3 Loose Fill in Joisted Cavities With Rigid Barrier . . . . .</b>	<b>198</b>
4.0301.3a Pre-work qualifications . . . . .	199
4.0301.3b Material selection . . . . .	199
4.0301.3c Sealant selection . . . . .	200
4.0301.3d General preparation . . . . .	200
4.0301.3e Install rigid barrier . . . . .	200
4.0301.3f Installation . . . . .	201
4.0301.3g Close access hole . . . . .	201
4.0301.3h Ignition and thermal barriers . . . . .	201
4.0301.3i Insulation - onsite documentation . . . . .	202
<b>4.0301.4 Dense Pack in Joisted Cavities With Rigid Barrier . . . . .</b>	<b>202</b>
4.0301.4a Pre-work qualifications . . . . .	202
4.0301.4b Material selection . . . . .	203
4.0301.4c Sealant selection . . . . .	203
4.0301.4d General preparation . . . . .	204
4.0301.4e Install rigid barrier . . . . .	204
4.0301.4f Installation . . . . .	205
4.0301.4g Close access hole . . . . .	205
4.0301.4h Ignition and thermal barriers . . . . .	205
4.0301.4i Insulation - onsite documentation . . . . .	206
<b>4.0301.5 SPF in Open Joisted Cavities . . . . .</b>	<b>206</b>
4.0301.5a Pre-work qualifications . . . . .	206
4.0301.5b Material selection . . . . .	207
4.0301.5c General preparation . . . . .	207
4.0301.5d Surface preparation . . . . .	208
4.0301.5e Installation . . . . .	208
4.0301.5f Ignition and thermal barriers . . . . .	208
4.0301.5g Insulation - onsite documentation . . . . .	209
<b>4.0301.6 Cantilever Floor Joisted Cavities Batt Insulation . . . . .</b>	<b>209</b>
4.0301.6a Pre-work qualifications . . . . .	209
4.0301.6b Material selection . . . . .	210
4.0301.6c General preparation . . . . .	210
4.0301.6d Batt installation . . . . .	210
4.0301.6e Secure Batts . . . . .	211
4.0301.6f Enclose cavity . . . . .	211
4.0301.6g Exterior soffit . . . . .	211
4.0301.6h Insulation - onsite documentation . . . . .	212
<b>4.0302.1 Batt Insulation With Rigid Barrier . . . . .</b>	<b>212</b>
4.0302.1a Pre-work qualifications . . . . .	212
4.0302.1b Material selection . . . . .	213

4.0302.1c Sealant selection . . . . .	213
4.0302.1d General preparation . . . . .	214
4.0302.1e Batt installation . . . . .	214
4.0302.1f Secure batts . . . . .	214
4.0302.1g Rigid protective barrier . . . . .	214
4.0302.1h Sealing and rodent proofing . . . . .	215
4.0302.1i Weather-resistant barrier . . . . .	215
4.0302.1j Insulation - onsite documentation . . . . .	215
<b>4.0302.2 Loose Fill With Rigid Barrier . . . . .</b>	<b>216</b>
4.0302.2a Pre-work qualifications . . . . .	216
4.0302.2b Material selection . . . . .	217
4.0302.2c Sealant selection . . . . .	217
4.0302.2d General preparation . . . . .	217
4.0302.2e Rigid protective barrier . . . . .	218
4.0302.2f Installation . . . . .	218
4.0302.2g Close access hole . . . . .	218
4.0302.2h Sealing and rodent proofing . . . . .	219
4.0302.2i Weather-resistant barrier . . . . .	219
4.0302.2j Insulation - onsite documentation . . . . .	219
<b>4.0302.3 Dense Pack with Rigid Barrier . . . . .</b>	<b>220</b>
4.0302.3a Pre-work qualifications . . . . .	220
4.0302.3b Material selection . . . . .	220
4.0302.3c Sealant selection . . . . .	221
4.0302.3d General preparation . . . . .	221
4.0302.3e Rigid protective barrier . . . . .	222
4.0302.3f Installation . . . . .	222
4.0302.3g Close access hole . . . . .	222
4.0302.3h Sealing and rodent proofing . . . . .	222
4.0302.3i Weather-resistant barrier . . . . .	223
4.0302.3j Insulation - onsite documentation . . . . .	223
<b>4.0302.4 SPF with Rigid Barrier . . . . .</b>	<b>223</b>
4.0302.4a Pre-work qualifications . . . . .	224
4.0302.4b Material selection . . . . .	224
4.0302.4c Sealant selection . . . . .	225
4.0302.4d General preparation . . . . .	225
4.0302.4e Surface preparation . . . . .	225
4.0302.4f Rigid protective barrier . . . . .	226
4.0302.4g Installation . . . . .	226
4.0302.4h Sealing and rodent proofing . . . . .	226
4.0302.4i Weather-resistant barrier . . . . .	227
4.0302.4j Ignition and thermal barriers . . . . .	227
4.0302.4k Insulation - onsite documentation . . . . .	227
<b>4.0302.5 Rigid Insulation on Joists . . . . .</b>	<b>228</b>
4.0302.5a Pre-work qualifications . . . . .	228
4.0302.5b Material selection . . . . .	229

4.0302.5c Sealant selection . . . . .	229
4.0302.5d General preparation . . . . .	229
4.0302.5e Installation . . . . .	230
4.0302.5f Rigid protective barrier . . . . .	230
4.0302.5g Sealing and rodent proofing . . . . .	230
4.0302.5h Weather-resistant barrier . . . . .	231
4.0302.5i Ignition and thermal barriers . . . . .	231
4.0302.5j Insulation - onsite documentation . . . . .	231
<b>4.0302.9 MH - Blown Belly Insulation . . . . .</b>	<b>232</b>
4.0302.9a Pre-work qualifications . . . . .	232
4.0302.9b Material selection . . . . .	233
4.0302.9c Sealant selection . . . . .	233
4.0302.9d Installation . . . . .	233
4.0302.9e Close access hole . . . . .	234
4.0302.9f Insulation - onsite documentation . . . . .	234
<b>4.0388.1 Foundation Skirting . . . . .</b>	<b>234</b>
4.0388.1a Pre-work qualifications . . . . .	235
4.0388.1b Material selection . . . . .	235
4.0388.1c Sealant selection . . . . .	235
4.0388.1d General preparation . . . . .	236
4.0388.1e Coverage . . . . .	236
4.0388.1f Support . . . . .	236
4.0388.1g Fastening . . . . .	237
4.0388.1h Flashing . . . . .	237
4.0388.1i Insulation . . . . .	237
4.0388.1j Sealing and rodent proofing . . . . .	237
4.0388.1k Insulation - onsite documentation . . . . .	238
<b>5.0101.1 Thermostat Replacement . . . . .</b>	<b>238</b>
5.0101.1a Pre-Work qualifications . . . . .	238
5.0101.1b Thermostat selection . . . . .	239
5.0101.1c Thermostat location . . . . .	239
5.0101.1d Heat pump considerations . . . . .	239
5.0101.1e Installer programming . . . . .	240
5.0101.1f Penetrations . . . . .	240
5.0101.1g Documentation . . . . .	240
<b>5.0102.1 Condensate Removal . . . . .</b>	<b>241</b>
5.0102.1a Condensate disposal . . . . .	241
5.0102.1b Connections . . . . .	241
5.0102.1c Slope . . . . .	241
5.0102.1d Vents and traps . . . . .	242
5.0102.1e Secondary drain pan . . . . .	242
5.0102.1f Float switches . . . . .	242
5.0102.1g Insulation . . . . .	243
5.0102.1h Pumps . . . . .	243
5.0102.1i Exterior termination . . . . .	243

<b>5.0103.1 Refrigerant Lines</b>	243
5.0103.1a Material selection	244
5.0103.1b Sizing	244
5.0103.1c Installation	244
5.0103.1d Insulation	245
5.0103.1e Support	245
5.0103.1f Protection	245
5.0103.1g Locking refrigerant caps	246
<b>5.0103.2 Refrigerant Charge</b>	246
5.0103.2a Pre-work qualifications	246
5.0103.2b Charge	247
5.0103.2c Documentation	247
<b>5.0103.3 Thermostatic Expansion Valve (TXV)</b>	247
5.0103.3a Material selection	247
5.0103.3b Replacement	248
<b>5.0105.1 Mechanical Fastening</b>	248
5.0105.1a Metal to metal	248
5.0105.1b Flex to metal	248
5.0105.1c Flex to flex	249
5.0105.1d Duct board to duct board	249
5.0105.1e Duct board to flexible duct	249
5.0105.1f Duct board to metal	250
5.0105.1g Duct board plenum to air handler cabinet	250
5.0105.1h Duct boot to subfloor	250
5.0105.1i Duct boot to gypsum	251
5.0105.1j Metal plenum to air handler cabinet	251
<b>5.0105.2 Duct Support</b>	251
5.0105.2a Flex duct and duct board support	252
5.0105.2b Metal duct support	252
5.0105.2c Plenum support	252
<b>5.0105.3 Crossover Duct Repair or Replacement</b>	252
5.0105.3a General preparation	253
5.0105.3b Duct materials	253
5.0105.3c Rigid transition	253
5.0105.3d Duct connections	254
5.0105.3e Duct support	254
5.0105.3f Insulation	254
5.0105.3g Sealing	254
<b>5.0105.4 Replace Return Air Systems That Use Building Cavities</b>	255
5.0105.4a Material selection	255
5.0105.4b Close existing return air openings	255
5.0105.4c Alternate return air path	256
5.0105.4d Sealing	256
5.0105.4e Filtration	256
<b>5.0105.5 Replace MH Duct Boots</b>	256

5.0105.5a Material selection	257
5.0105.5b Boot construction	257
5.0105.5c Boot installation	257
5.0105.5d Mechanical fastening	258
5.0105.5e Sealing	258
5.0105.5f Registers	258
<b>5.0106.1 General Duct Sealing</b>	<b>259</b>
5.0106.1a Sealant selection	259
5.0106.1b Access ducts	259
5.0106.1c Surface preparation	260
5.0106.1d Securely fasten ducts	260
5.0106.1e General sealing	260
5.0106.1f Seal leaks less than 1/4"	260
5.0106.1g Seal leaks between 1/4" and 3/4"	261
5.0106.1h Seal leaks greater than 3/4"	261
5.0106.1i Duct boots	261
5.0106.1j Air handler jacket	262
5.0106.1k Filter slot	262
<b>5.0106.2 Duct Sealing - Spray Polyurethane Foam (SPF)</b>	<b>262</b>
5.0106.2a Material selection	263
5.0106.2b Surface preparation	263
5.0106.2c Installation	263
5.0106.2d Ignition and thermal barriers	264
<b>5.0106.3 Duct Sealing - Proprietary Spray Application</b>	<b>264</b>
5.0106.3a Material selection	264
5.0106.3b Surface preparation	265
5.0106.3c Installation	265
<b>5.0107.1 General Duct Insulation</b>	<b>265</b>
5.0107.1a Material selection	265
5.0107.1b General preparation	266
5.0107.1c Insulation value	266
5.0107.1d Attachment	266
5.0107.1e Sealing	267
5.0107.1f Insulation - onsite documentation	267
<b>5.0107.2 Duct Insulation - Spray Polyurethane Foam (SPF)</b>	<b>267</b>
5.0107.2a Material selection	268
5.0107.2b Surface preparation	268
5.0107.2c Installation	268
5.0107.2d Ignition and thermal barriers	269
5.0107.2e Insulation - onsite documentation	269
<b>5.0108.1 Air-to-Air Split System</b>	<b>269</b>
5.0108.1a Load calculation	270
5.0108.1b Equipment selection	270
5.0108.1c Outdoor unit location	271
5.0108.1d Outdoor unit support	271

5.0108.1e Outdoor unit installation	271
5.0108.1f Indoor unit location	272
5.0108.1g Indoor unit installation	272
5.0108.1h Support - all installations	272
5.0108.1i Support - horizontal air flow in attic	272
5.0108.1j Support - horizontal air flow in subspace	273
5.0108.1k Support - upflow on a platform	273
5.0108.1l Support - downflow	273
5.0108.1m Connections	274
5.0108.1n Intakes/terminations	274
5.0108.1o Condensate drainage	274
5.0108.1p Electrical wiring	275
5.0108.1q Refrigerant lines and charge	275
5.0108.1r Fire protection	275
5.0108.1s Air handler sealing	275
5.0108.1t Documentation	276
<b>5.0108.2 Air-to-Air Package Unit</b>	<b>276</b>
5.0108.2a Load calculation	276
5.0108.2b Equipment selection	277
5.0108.2c Unit location	277
5.0108.2d Unit support	278
5.0108.2e Unit installation	278
5.0108.2f Electrical wiring	278
5.0108.2g Refrigerant lines and charge	279
5.0108.2h Connections	279
5.0108.2i Outdoor ductwork	279
5.0108.2j Intakes/terminations	280
5.0108.2k Condensate drainage	280
5.0108.2l Fire protection	280
5.0108.2m Documentation	280
<b>5.0108.3 Mini-Split System</b>	<b>281</b>
5.0108.3a Load calculation	281
5.0108.3b Equipment selection	281
5.0108.3c Outdoor unit location	282
5.0108.3d Outdoor unit support	282
5.0108.3e Outdoor unit installation	283
5.0108.3f Indoor unit location	283
5.0108.3g Indoor unit(s) installation	283
5.0108.3h Ceiling cassette insulation	283
5.0108.3i Indoor unit(s) support	284
5.0108.3j Electrical wiring	284
5.0108.3k Intakes/terminations	284
5.0108.3l Connections	285
5.0108.3m Ducting	285
5.0108.3n Refrigerant piping	285

5.0108.3o Controls	286
5.0108.3p Condensate	286
5.0108.3q Documentation	286
<b>5.0108.4 Furnaces</b>	<b>287</b>
5.0108.4a Load calculation	287
5.0108.4b Equipment selection	287
5.0108.4c Indoor unit location	288
5.0108.4d Indoor unit installation	288
5.0108.4e Support - all installations	288
5.0108.4f Support - horizontal air flow in attic	289
5.0108.4g Support - horizontal air flow in subspace	289
5.0108.4h Support - upflow on a platform	289
5.0108.4i Support - downflow	290
5.0108.4j Connections	290
5.0108.4k Intakes/terminations	290
5.0108.4l Condensate drainage	291
5.0108.4m Electrical wiring	291
5.0108.4n Fire protection	291
5.0108.4o Air handler sealing	292
5.0108.4p Documentation	292
<b>5.0108.5 Evaporative Coolers</b>	<b>292</b>
5.0108.5a Equipment selection	293
5.0108.5b Installation location	293
5.0108.5c Installation	293
5.0108.5d Support	293
5.0108.5e Connections	294
5.0108.5f Electrical wiring	294
5.0108.5g Water management	294
5.0108.5h Intakes	295
5.0108.5i Documentation	295
<b>5.0109.1 Condensers</b>	<b>295</b>
5.0109.1a Repair diagnosis	296
5.0109.1b Service	296
5.0109.1c Documentation	296
<b>5.0109.2 Air Handlers</b>	<b>297</b>
5.0109.2a Repair diagnosis	297
5.0109.2b Service	297
5.0109.2c Documentation	298
<b>5.0109.3 Evaporators</b>	<b>298</b>
5.0109.3a Repair diagnosis	298
5.0109.3b Service	299
5.0109.3c Documentation	299
<b>5.0109.4 Combustion</b>	
<b>Furnaces</b>	<b>299</b>
5.0109.4a Repair diagnosis	299

5.0109.4b Service	300
5.0109.4c Documentation	300
<b>5.0109.5 Evaporative Coolers</b>	<b>301</b>
5.0109.5a Repair diagnosis	301
5.0109.5b Service	301
5.0109.5c Documentation	301
<b>5.0301.1 Through-Wall and Window Units</b>	<b>302</b>
5.0301.1a Pre-work qualifications	302
5.0301.1b Equipment selection	302
5.0301.1c Installation	303
5.0301.1d Support	303
5.0301.1e Sealing	303
5.0301.1f Disposal	304
5.0301.1g Documentation	304
<b>5.0401.1 Indigenous Shading</b>	<b>304</b>
5.0401.1a Plant selection	305
5.0401.1b Plant size	305
<b>5.0402.1 Reflective Roof Coatings</b>	<b>305</b>
5.0402.1a Material selection	306
5.0402.1b Preparation	306
5.0402.1c Application	306
<b>5.0501.1 Isolate CAZ</b>	<b>307</b>
5.0501.1a Air sealing	307
5.0501.1b Ductwork	307
5.0501.1c Plumbing	308
5.0501.1d Walls/floors/ceilings	308
5.0501.1e Combustion air	308
<b>5.0502.1 Combustion Air - Fuel-Fired Appliances</b>	<b>308</b>
5.0502.1a Design	309
5.0502.1b Installation	309
<b>5.0503.1 Fuel-Fired Appliance Venting</b>	<b>309</b>
5.0503.1a Design	310
5.0503.1b Materials	310
5.0503.1c Installation	310
5.0503.1d Terminations	311
5.0503.1e Chimney liners	311
<b>5.0504.1 Natural Gas/Propane Fuel Piping</b>	<b>311</b>
5.0504.1a Material selection	312
5.0504.1b Gas piping size	312
5.0504.1c Piping location	312
5.0504.1d Support	312
5.0504.1e Required components	313
5.0504.1f Gas pressure regulator venting	313
5.0504.1g Sealing	313
5.0504.1h Safety devices for propane	314

5.0504.1i Gas boosters	314
<b>5.0504.2 Oil Piping</b>	<b>314</b>
5.0504.2a Material selection	314
5.0504.2b Piping location	315
5.0504.2c Support	315
5.0504.2d Required components	315
5.0504.2e Pumps	315
5.0504.2f Line connections	316
<b>5.8801.1 Decommissioning</b>	<b>316</b>
5.8801.1a Utility disconnect	316
5.8801.1b Refrigerant recovery	317
5.8801.1c Equipment disconnection	317
5.8801.1d Equipment removal	317
5.8801.1e Disposal	317
<b>6.0101.1 Ventilation Ducts</b>	<b>318</b>
6.0101.1a Material selection	318
6.0101.1b Design and configuration	318
6.0101.1c Combining air streams	319
6.0101.1d Mechanical fastening	319
6.0101.1e Sealing	320
6.0101.1f Insulation	320
6.0101.1g Support	320
<b>6.0101.2 Exhaust Terminations</b>	<b>321</b>
6.0101.2a Selection	321
6.0101.2b Damper (if applicable)	321
6.0101.2c Location	322
6.0101.2d Installation	322
6.0101.2e Duct to termination connection	323
6.0101.2f Sealing	323
<b>6.0101.3 Exterior Intakes</b>	<b>323</b>
6.0101.3a Selection	324
6.0101.3b Damper (if applicable)	324
6.0101.3c Location	324
6.0101.3d Installation	325
6.0101.3e Duct to termination connection	325
6.0101.3f Labeling	325
6.0101.3g Sealing	326
<b>6.0101.4 Fan Controls</b>	<b>326</b>
6.0101.4a Intermittent/continuous operation	326
6.0101.4b Optional sensors	327
6.0101.4c Manual override	327
6.0101.4d Labeling, if applicable	327
<b>6.0201.1 Surface Mounted</b>	<b>328</b>
6.0201.1a Fan selection	328
6.0201.1b Sealant selection	328

6.0201.1c Damper	329
6.0201.1d Location	329
6.0201.1e Opening preparation	329
6.0201.1f Fan orientation	330
6.0201.1g Fan mounting	330
6.0201.1h Wiring	330
6.0201.1i Sealing	330
6.0201.1j Insulate housing	331
6.0201.1k Fan access	331
6.0201.1l Venting	331
<b>6.0201.2 Kitchen Range Hoods</b>	<b>332</b>
6.0201.2a Fan selection	332
6.0201.2b Sealant selection	332
6.0201.2c Location	333
6.0201.2d Damper	333
6.0201.2e Installation	333
6.0201.2f Wiring	334
6.0201.2g Sealing	334
6.0201.2h Fan access	334
6.0201.2i Venting	334
6.0201.2j Make-up air	335
<b>6.0201.3 Inline and Multiport Fans</b>	<b>335</b>
6.0201.3a Fan selection	335
6.0201.3b Sealant selection	336
6.0201.3c Wiring	336
6.0201.3d Fan orientation	336
6.0201.3e Fan mounting	337
6.0201.3f Damper	337
6.0201.3g Intake grill openings	337
6.0201.3h Air sealing	338
6.0201.3i Fan Access	338
6.0201.3j Venting	338
<b>6.0201.4 Garage Exhaust Fans</b>	<b>338</b>
6.0201.4a Fan selection	339
6.0201.4b Sealant selection	339
6.0201.4c Wiring	339
6.0201.4d Fan orientation	340
6.0201.4e Fan mounting	340
6.0201.4f Damper	340
6.0201.4g Controls	341
6.0201.4h Exhaust system openings	341
6.0201.4i Air sealing	341
6.0201.4j Fan access	341
6.0201.4k Outdoor termination location	342
6.0201.4l Venting	342

<b>6.0202.1 Clothes Dryer</b> .....	342
6.0202.1a Duct selection .....	343
6.0202.1b Venting installation .....	343
6.0202.1c Lint collection devices .....	343
6.0202.1d Mechanical fasteners .....	344
6.0202.1e Make-up air .....	344
6.0202.1f Duct insulation .....	344
6.0202.1g Termination fitting .....	345
6.0202.1h Sealing .....	345
6.0202.1i Condensing dryers .....	345
<b>6.0301.1 Fresh Air Intake In Forced Air System</b> .....	345
6.0301.1a Pre-work qualifications .....	346
6.0301.1b Intake location .....	346
6.0301.1c Labeling .....	346
6.0301.1d Pest exclusion .....	347
6.0301.1e Motorized damper .....	347
6.0301.1f System control .....	347
6.0301.1g Wiring .....	348
6.0301.1h Fresh air filtration .....	348
6.0301.1i Filter accessibility and fit .....	348
6.0301.1j Access .....	349
6.0301.1k Ducting .....	349
6.0301.1l Fire dampers .....	349
6.0301.1m System balancing .....	350
<b>6.0302.1 Individual Exhaust Fan Serving Entire Dwelling</b> .....	350
6.0302.1a Fan selection .....	350
6.0302.1b Sealant selection .....	350
6.0302.1c Termination location .....	351
6.0302.1d Pest exclusion .....	351
6.0302.1e Damper .....	352
6.0302.1f Interior intake location .....	352
6.0302.1g Opening preparation .....	352
6.0302.1h Fan orientation .....	352
6.0302.1i Fan mounting .....	353
6.0302.1j Wiring .....	353
6.0302.1k Sealing .....	353
6.0302.1l Insulate housing .....	354
6.0302.1m Fan access .....	354
6.0302.1n Venting .....	354
6.0302.1o System balancing .....	354
<b>6.0303.1 HRV/ERV Installation</b> .....	355
6.0303.1a Fan selection .....	355
6.0303.1b Wiring .....	355
6.0303.1c Exterior exhaust termination location .....	355
6.0303.1d Exterior intake location .....	356

6.0303.1e Pest exclusion	356
6.0303.1f Interior intake location	357
6.0303.1g Interior supply location	357
6.0303.1h Combining air streams	357
6.0303.1i Backdraft prevention	358
6.0303.1j Fresh air filtration	358
6.0303.1k Fan mounting	358
6.0303.1l Sealing	359
6.0303.1m Condensate drain	359
6.0303.1n Access	359
6.0303.1o Fire dampers	359
6.0303.1p System balancing	360
6.0303.1q Very cold climate considerations	360
6.0303.1r Hot-humid climate considerations	360
<b>6.0306.1 Decommissioning Ventilation Systems</b>	<b>361</b>
6.0306.1a Power supply	361
6.0306.1b Fan and component removal	361
6.0306.1c Sealing holes and openings	362
6.0306.1d Disposal	362
<b>7.0101.1 Refrigerator and Freezer Replacement</b>	<b>362</b>
7.0101.1a Pre-work qualifications	362
7.0101.1b Selection	363
7.0101.1c Installation	363
7.0101.1d Accessibility	363
7.0101.1e Disposal	364
7.0101.1f Documentation	364
<b>7.0101.2 Refrigerator/Freezer Clean and Tune</b>	<b>364</b>
7.0101.2a Clearances and location	365
7.0101.2b Coil cleaning	365
7.0101.2c Condensation settings	365
7.0101.2d Temperature settings	366
<b>7.0102.1 Consumer Electronics Replacement</b>	<b>366</b>
7.0102.1a Pre-work qualifications	366
7.0102.1b Selection	366
7.0102.1c Installation	367
7.0102.1d Disconnecting means	367
7.0102.1e Disposal	367
7.0102.1f Documentation	368
<b>7.0103.1 Lighting Replacement</b>	<b>368</b>
7.0103.1a Selection	368
7.0103.1b Installation	369
7.0103.1c Electrical installation	369
7.0103.1d Disposal	369
7.0103.1e Documentation	370
<b>7.0103.2 Lighting Reduction</b>	<b>370</b>

7.0103.2a Design	370
7.0103.2b Removal	371
7.0103.2c Reuse	371
7.0103.2d Disposal	371
<b>7.0103.3 Ballast Replacement</b>	<b>372</b>
7.0103.3a Selection	372
7.0103.3b Removal and installation	372
7.0103.3c Disposal	373
7.0103.3d Documentation	373
<b>7.0103.6 Security Lighting</b>	<b>373</b>
7.0103.6a Selection	374
7.0103.6b Installation	374
7.0103.6c Controls	374
7.0103.6d Disposal	375
7.0103.6e Documentation	375
<b>7.0103.7 Daylighting</b>	<b>375</b>
7.0103.7a Daylighting	376
<b>7.0104.1 Occupancy Sensors</b>	<b>376</b>
7.0104.1a Selection	376
7.0104.1b Installation	376
7.0104.1c Documentation	377
<b>7.0104.2 Stand-Alone Timers</b>	<b>377</b>
7.0104.2a Selection	377
7.0104.2b Installation	378
7.0104.2c Timer settings	378
7.0104.2d Documentation	378
<b>7.0104.3 Motion Control Sensors</b>	<b>379</b>
7.0104.3a Selection	379
7.0104.3b Location	379
7.0104.3c Installation	380
7.0104.3d Settings	380
7.0104.3e Documentation	380
<b>7.0104.4 Outdoor Photo Sensors</b>	<b>381</b>
7.0104.4a Selection	381
7.0104.4b Installation	381
7.0104.4c Documentation	382
<b>7.0105.1 Washing Machine</b>	<b>382</b>
7.0105.1a Pre-work qualifications	382
7.0105.1b Selection	382
7.0105.1c Installation	383
7.0105.1d Water management	383
7.0105.1e Accessibility	383
7.0105.1f Disposal	384
7.0105.1g Documentation	384
<b>7.0105.2 Clothes Dryer</b>	<b>384</b>

7.0105.2a Pre-work qualifications	385
7.0105.2b Selection	385
7.0105.2c Installation	386
7.0105.2d Dryer venting	386
7.0105.2e Accessibility	386
7.0105.2f Disposal	386
7.0105.2g Documentation	387
<b>7.0188.1 Ceiling Fan Replacement</b>	<b>387</b>
7.0188.1a Pre-work qualifications	387
7.0188.1b Selection	388
7.0188.1c Installation	388
7.0188.1d Lighting	388
7.0188.1e Disposal	389
7.0188.1f Documentation	389
<b>7.0201.1 Low-Flow Devices</b>	<b>389</b>
7.0201.1a Pre-work qualifications	390
7.0201.1b Selection	390
7.0201.1c Installation	390
7.0201.1d Disposal	390
7.0201.1e Documentation	391
<b>7.0201.2 Dishwasher</b>	<b>391</b>
7.0201.2a Pre-work qualifications	391
7.0201.2b Selection	392
7.0201.2c Installation	392
7.0201.2d Disposal	392
7.0201.2e Documentation	393
<b>7.0301.1 Pipe Insulation</b>	<b>393</b>
7.0301.1a Pre-work qualifications	393
7.0301.1b Insulation selection	393
7.0301.1c Installation	394
7.0301.1d Clearance	394
<b>7.0301.2 Tank Insulation</b>	<b>395</b>
7.0301.2a Pre-work qualifications	395
7.0301.2b Insulation selection	395
7.0301.2c Insulation installation	396
7.0301.2d Clearance	396
7.0301.2e Service access	396
<b>7.0302.1 Electric Storage Tank Water Heater</b>	<b>396</b>
7.0302.1a Pre-work qualifications	397
7.0302.1b Equipment selection	397
7.0302.1c Location	397
7.0302.1d Installation	398
7.0302.1e Equipment accessibility	398
7.0302.1f TandP valve and piping	398
7.0302.1g Emergency drain pan	399

7.0302.1h Shut-off valves	399
7.0302.1i Expansion tank	399
7.0302.1j Dielectric unions	400
7.0302.1k Heat traps	400
7.0302.1l Discharge temperature settings	400
7.0302.1n Disposal	401
7.0302.1o Documentation	401
<b>7.0302.2 Fuel-Fired Storage Tank Water Heater</b>	<b>401</b>
7.0302.2a Pre-work qualifications	401
7.0302.2b Equipment selection	402
7.0302.2c Location	402
7.0302.2d Installation	402
7.0302.2e Equipment accessibility	403
7.0302.2f Fuel supply	403
7.0302.2g Emergency drain pan	404
7.0302.2h Shut-off valves	404
7.0302.2i Expansion tank	404
7.0302.2j TandP valve and piping	405
7.0302.2k Dielectric unions	405
7.0302.2l Heat traps	405
7.0302.2m Discharge temperature settings	405
7.0302.2o Disposal	406
7.0302.2p Documentation	406
<b>7.0302.3 Heat Pump Storage Tank Water Heater</b>	<b>406</b>
7.0302.3a Pre-work qualifications	407
7.0302.3b Equipment selection	407
7.0302.3c Location	407
7.0302.3d Installation	408
7.0302.3e Equipment accessibility	408
7.0302.3f TandP valve and piping	408
7.0302.3g Emergency drain pan	409
7.0302.3h Shut-off valves	409
7.0302.3i Expansion tank	409
7.0302.3j Dielectric unions	410
7.0302.3k Heat traps	410
7.0302.3l Discharge temperature settings	410
7.0302.3m Disposal	411
7.0302.3n Documentation	411
<b>7.0302.5 Tankless On-Demand/Point-Of-Use Appliances</b>	<b>411</b>
7.0302.5a Pre-work qualifications	411
7.0302.5b Equipment selection	412
7.0302.5c Location	412
7.0302.5d Installation	413
7.0302.5e Equipment accessibility	413
7.0302.5f Shut-off valves	413

7.0302.5g TandP valve and piping	413
7.0302.5h Fuel supply	414
7.0302.5i Dielectric unions	414
7.0302.5j Discharge temperature settings	414
7.0302.5k Disposal	415
7.0302.5l Documentation	415
<b>7.0302.6 Solar Water Heater</b>	<b>415</b>
7.0302.6a Pre-work qualifications	416
7.0302.6b Storage tank selection	416
7.0302.6c Solar collector location	416
7.0302.6d Installation	417
7.0302.6e Accessibility	417
7.0302.6f Freeze protection	417
7.0302.6g Emergency drain pan	418
7.0302.6h TandP valve and piping	418
7.0302.6i Dielectric unions	418
7.0302.6j Heat traps	419
7.0302.6k Isolation valves	419
7.0302.6l Expansion tank	419
7.0302.6m Insulate piping	420
7.0302.6n Discharge temperature settings	420
7.0302.6p Disposal	420
7.0302.6q Documentation	421
<b>7.0303.1 Mixing Valves</b>	<b>421</b>
7.0303.1a Pre-work qualifications	421
7.0303.1b Location	421
7.0303.1c Installation	422
7.0303.1d Equipment accessibility	422
7.0303.1e Isolation valves	422
7.0303.1f Check valves	422
7.0303.1g Heat traps	423
7.0303.1h Temperature gauges	423
7.0303.1i Wiring	423
7.0303.1j Dielectric unions	424
7.0303.1k Discharge temperature settings	424
7.0303.1l Documentation	424
<b>7.0303.2 Piping</b>	<b>424</b>
7.0303.2a Pre-work qualifications	425
7.0303.2b Material selection	425
7.0303.2c Decommissioning existing piping	425
7.0303.2d Piping location	425
7.0303.2e New pipe installation	426
7.0303.2f Insulate piping	426
7.0303.2g Friction loss	426
7.0303.2h Dielectric unions	427

7.0303.2i Stray voltage protection	427
7.0303.2j Disposal	427
<b>7.0303.5 Expansion Tank (Potable Water)</b>	<b>428</b>
7.0303.5a Expansion tank selection	428
7.0303.5b Location	428
7.0303.5c Installation	429
7.0303.5d Support	429
7.0303.5e Air pressure	429
7.0303.5f Documentation	430
<b>7.8802.1 Motor Replacement</b>	<b>430</b>
7.8802.1a Pre-work qualifications	430
7.8802.1b Equipment Selection	430
7.8802.1c Installation	431
7.8802.1d Disposal or reuse	431
7.8802.1e Documentation	431
<b>7.8802.2 Control Replacement</b>	<b>432</b>
7.8802.2a Pre-work qualifications	432
7.8802.2b Equipment selection	432
7.8802.2c Installation	433
7.8802.2d Disposal or reuse	433
7.8802.2e Documentation	433
<b>7.8803.1 Water Softening System Installation</b>	<b>434</b>
7.8803.1a Pre-work qualifications	434
7.8803.1b Equipment selection	434
7.8803.1c Location	434
7.8803.1d Equipment accessibility	435
7.8803.1e Installation	435
7.8803.1f Electrical wiring	435
7.8803.1g Isolation and bypass valves	436
7.8803.1h Salt storage	436
7.8803.1i Documentation	436

## **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

## **2.0202.1 Un-Vented Subspaces - Ground Cover**

Section:Health and Safety

Topic:Moisture

Sub-Topic:Ground Vapor Retarders

#### **Desired Outcome**

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

### **2.0202.1a Preparation**

## **Specification**

Remove all vegetation and organic material from area to be covered

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

## **Objective**

Minimize punctures

### **2.0202.1b Material selection**

## **Specification**

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

## **Objective**

Durable material selected

### **2.0202.1c Coverage**

## **Specification**

Cover all exposed soil

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

## **Objective**

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

### **2.0202.1d Drainage**

## **Specification**

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

## **Objective**

Ensure proper drainage

### **2.0202.1e Seams/connections**

#### **Specification**

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

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

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

Mechanically attach ground vapor retarder to foundation and piers where practical

## **Objective**

Provide airtight seal for ground vapor retarder

### **2.0202.1f Fastening**

#### **Specification**

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

## **Objective**

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

### **2.0202.1g Air sealing**

#### **Specification**

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

## **Objective**

Ensure ground vapor retarder is air tight

### **2.0202.1h Signage**

#### **Specification**

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

Sign shall minimally include the following items:

Warning to prohibit storage of hazardous and flammable materials

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

Immediate repairs are needed in the case of damage

#### **Objective**

Provide essential safety and maintenance information

### **2.0202.2 Vented Subspaces - Ground Cover**

Section:Health and Safety

Topic:Moisture

Sub-Topic:Ground Vapor Retarders

#### **Desired Outcome**

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

### **2.0202.2a Preparation**

#### **Specification**

Remove all vegetation from area to be covered

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

## **Objective**

Minimize punctures

### **2.0202.2b Material selection**

## **Specification**

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

## **Objective**

Durable material selected

### **2.0202.2c Coverage**

## **Specification**

Cover all exposed soil

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

## **Objective**

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

### **2.0202.2d Drainage**

## **Specification**

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

## **Objective**

Ensure proper drainage

### **2.0202.2e Seams**

## **Specification**

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

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

## **Objective**

Keep bulk moisture under ground cover

### **2.0202.2f Fastening**

## **Specification**

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

## **Objective**

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

### **2.0202.2g Air Sealing**

## **Specification**

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

## **Objective**

Ensure ground vapor retarder is air tight

### **2.0202.2h Signage**

## **Specification**

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

Sign shall minimally include the following items:

Warning to prohibit storage of hazardous and flammable materials

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

Immediate repairs are needed in the case of damage

### **Objective**

Provide essential safety and maintenance information

## **2.0202.3 Pier and Skirting Foundations - Ground Cover**

Section:Health and Safety

Topic:Moisture

Sub-Topic:Ground Vapor Retarders

### **Desired Outcome**

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

### **2.0202.3a Preparation**

#### **Specification**

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

#### **Objective**

Minimize punctures

### **2.0202.3b Coverage**

#### **Specification**

Cover all exposed soil

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

## **Objective**

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

### **2.0202.3c Material selection**

#### **Specification**

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

## **Objective**

Durable material selected

### **2.0202.3d Seams**

#### **Specification**

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

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

## **Objective**

Keep bulk moisture under ground cover

### **2.0202.3e Fastening**

#### **Specification**

Fasten ground vapor retarder to ground with durable fasteners

## **Objective**

Prevent movement of the ground moisture barrier

## **2.0203.1 Stand-Alone Dehumidifier Installation**

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

### **Desired Outcome**

Minimize energy used for humidity control

### **2.0203.1a Selection**

#### **Specification**

Appliance will have:

An efficiency level of ENERGY STAR or better

A fan-off option

Ability to retain settings after power-off

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

Standby losses of 1 watt or less

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

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

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

#### **Objective**

Provide durable, efficient, and appropriate appliance

### **2.0203.1b Installation**

#### **Specification**

Install appliance according to manufacturer specifications

Install appliance to permit adequate air flow

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

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

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

### **Objective**

Properly installed new appliance

### **2.0203.1c Commissioning**

#### **Specification**

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

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

### **Objective**

Verify proper operation

### **2.0203.1d Disposal**

#### **Specification**

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

Permanently decommission old appliance

### **Objective**

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

### **2.0203.1e Client education**

#### **Specification**

Provide the occupant with:

Manufacturer specific appliance maintenance information

Warranty information, operation manuals, and installer contact information

A user guide for dehumidifier settings in different climate conditions

### **Objective**

Ensure proper operation and maintenance

## **2.0301.1 Junctions/Splices Enclosed**

Section:Health and Safety

Topic:Electrical

Sub-Topic:High Voltage (50 volts or more)

### **Desired Outcome**

Prevent electrocution

### **2.0301.1a Junction box covers**

#### **Specification**

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

#### **Objective**

Junction boxes are securely covered with appropriate, durable covers

### **2.0301.1b Wiring Splices**

#### **Specification**

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

#### **Objective**

Wiring splices are safely enclosed in appropriate enclosure

### **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)

Install a rigid, fixed dam higher than the insulation while that maintains a minimum 3" 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

### **3.0102.5 MH Belly Repair - Soft Bottom Patching**

Section: Air Sealing

Topic: General Pressure Boundary

Sub-Topic: Specific Air Sealing

#### **Desired Outcome**

Minimize air leakage and keep insulation in place

#### **3.0102.5a 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 effective sealants

#### **3.0102.5b Material selection**

##### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers, and

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

### **Objective**

Select effective materials

### **3.0102.5c Surface preparation**

#### **Specification**

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

### **Objective**

Surface is clean and ready to accept sealant

### **3.0102.5d Patch installation**

#### **Specification**

Install patching material over all holes lapping a minimum of 3" over the surrounding material

Apply a continuous bead of sealant under the patch that creates an airtight seal

### **Objective**

Airtight and durable seal

### **3.0102.5e Attachment**

#### **Specification**

Attach patches using outward clinch staples ("cinch staples") spaced no more than 2" apart

### **Objective**

Durable repair

### **3.0102.5f 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

### **3.0102.6 MH Belly Repair - Soft Bottom Replacement**

Section: Air Sealing

Topic: General Pressure Boundary

Sub-Topic: Specific Air Sealing

#### **Desired Outcome**

Minimize air leakage and keep insulation in place

### **3.0102.6a 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 effective sealants

### **3.0102.6b Material selection**

#### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers, and  
meet the requirements of the applicable fire safety code (e.g. thermal or ignition barriers).

#### **Objective**

Select effective materials

### **3.0102.6c Coverage**

#### **Specification**

Span each belly section with an uninterrupted section of belly material creating as few seams as possible

#### **Objective**

Complete and durable coverage

### **3.0102.6d Seams**

#### **Specification**

Lap any seams in the belly material a minimum of 6", seal with a continuous bead of sealant, and mechanically fastened every 2"

#### **Objective**

Airtight seams that prevent insulation loss

### **3.0102.6e Attachment**

#### **Specification**

Attach belly material at opposite ends of spanned section using rigid support material (i.e., wooden

furring strips)

Attach belly material to rigid support material by wrapping it around the rigid support material a minimum of 2 times and mechanically fastening every 6"

Attach rigid support material to belly at every joist or at a maximum of every 2' with mechanical fasteners that penetrate the substrate a minimum of 1-1/2"

### **Objective**

Durable repair

### **3.0102.6f Sealant Application**

#### **Specification**

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

### **Objective**

Airtight belly repair

### **3.0102.6g 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

### **3.0102.7 MH Belly Repair - Rigid Bottom Patching**

Section: Air Sealing

Topic: General Pressure Boundary

Sub-Topic: Specific Air Sealing

## **Desired Outcome**

Minimize air leakage and keep insulation in place

### **3.0102.7a 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 effective sealants

### **3.0102.7b Material selection**

#### **Specification**

Select materials that:

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

create a continuous insulation layer when possible (i.e., rigid insulation board), and

rigid materials that adequately support applied load and are permanent air barriers

#### **Objective**

Select effective materials

### **3.0102.7c Surface preparation**

## **Specification**

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

## **Objective**

Surface is clean and ready to accept sealant

### **3.0102.7d Support**

## **Specification**

Patch any hole larger than 1 square foot with patch material that laps over the sub-framing on at least two edges

## **Objective**

Sealing materials remain in place and support applied loads

### **3.0102.7e Patch installation**

## **Specification**

Install rigid patching material over all holes lapping a minimum of 3" over the surrounding material

Apply a continuous bead of sealant under the patch that creates an airtight seal

## **Objective**

Airtight permanent repairs

### **3.0102.7f Attachment**

## **Specification**

Attach patches using mechanical fasteners spaced no more than 6" apart

Use mechanical fasteners that incorporate washers/caps that prevent fasteners from being pulled through

belly material

## **Objective**

Durable repair

### **3.0102.7g 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

### **3.0102.8 MH Belly Repair - Rigid Bottom Replacement**

Section: Air Sealing

Topic: General Pressure Boundary

Sub-Topic: Specific Air Sealing

## **Desired Outcome**

Minimize air leakage and keep insulation in place

### **3.0102.8a 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 effective sealants

### **3.0102.8b Material selection**

#### **Specification**

Select materials that:

- meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers),
- create a continuous insulation layer when possible (i.e., rigid insulation board), and
- rigid materials that adequately support applied load and are permanent air barriers

### **Objective**

Select effective materials

### **3.0102.8c 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 will support applied loads without sagging, bending, or failure

### **Objective**

Ensure sealing materials remain in place and support applied loads

### **3.0102.8d Coverage**

#### **Specification**

Cover entire area with as few pieces of rigid material as possible

## **Objective**

Avoid unnecessary seams

### **3.0102.8e Attachment**

#### **Specification**

Attach rigid belly material to sub-framing every 6" where possible with mechanical fasteners that penetrate sub-framing a minimum of 1-1/2"

Use mechanical fasteners that incorporate washers/caps that prevent fasteners from being pulled through belly material

## **Objective**

Durable attachment

### **3.0102.8f Sealing**

#### **Specification**

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

## **Objective**

Airtight belly repair

### **3.0102.8g 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

### **3.0102.9 Sealing Dropped Soffits/Bulkheads**

Section: Air Sealing

Topic: General Pressure Boundary

Sub-Topic: Specific Air Sealing

#### **Desired Outcome**

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

#### **3.0102.9a Sealant selection**

##### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

##### **Objective**

Select safe and effective sealants

#### **3.0102.9b Material selection**

##### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

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

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

### **Objective**

Select safe and effective materials

### **3.0102.9c Support**

#### **Specification**

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

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

### **Objective**

Ensure sealing materials remain in place and support applied loads

### **3.0102.9d Surface preparation**

#### **Specification**

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

### **Objective**

Surface is clean and ready to accept sealant

### **3.0102.9e Install air barrier**

#### **Specification**

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

### **Objective**

Pressure boundary aligned

### **3.0102.9f Attachment**

#### **Specification**

Mechanically fasten air barrier material to prevent movement

#### **Objective**

Durable attachment

### **3.0102.9g Sealant application**

#### **Specification**

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

#### **Objective**

Fully adhered, airtight, and durable seal

### **3.0102.9h High-temperature application**

#### **Specification**

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

#### **Objective**

Prevent a fire hazard

### **3.0102.10 Sealing Dropped Ceilings**

Section: Air Sealing

Topic: General Pressure Boundary

Sub-Topic: Specific Air Sealing

**Desired Outcome**

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

**3.0102.10a Sealant selection**

**Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

**Objective**

Select safe and effective sealants

**3.0102.10b Material selection**

**Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

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

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

**Objective**

Select safe and effective materials

### **3.0102.10c Support**

#### **Specification**

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

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

#### **Objective**

Ensure sealing materials remain in place and support applied loads

### **3.0102.10d Surface preparation**

#### **Specification**

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

#### **Objective**

Surface is clean and ready to accept sealant

### **3.0102.10e Install air barrier**

#### **Specification**

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

#### **Objective**

Align pressure boundary

### **3.0102.10f Sealant application**

## **Specification**

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

## **Objective**

Fully adhered, airtight, and durable seal

### **3.0102.10g High-temperature application**

## **Specification**

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

## **Objective**

Prevent a fire hazard

### **3.0102.11 Sealing Roof/Wall Connections**

Section: Air Sealing

Topic: General Pressure Boundary

Sub-Topic: Specific Air Sealing

## **Desired Outcome**

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

### **3.0102.11a Sealant selection**

## **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

### **Objective**

Select safe and effective sealants

### **3.0102.11b Material selection**

#### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

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

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

### **Objective**

Select safe and effective materials

### **3.0102.11c Surface preparation**

#### **Specification**

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

### **Objective**

Surface is clean and ready to accept sealant

### **3.0102.11d Support**

## **Specification**

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

Install support materials that will support all applied loads

## **Objective**

Ensure sealing materials remain in place and support applied loads

### **3.0102.11e Install air barrier**

## **Specification**

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

## **Objective**

Align pressure boundary

### **3.0102.11f Attachment**

## **Specification**

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

## **Objective**

Durable attachment

### **3.0102.11g Sealant application**

## **Specification**

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

## **Objective**

Fully adhered, airtight, and durable seal

### **3.0102.11h High-temperature application**

#### **Specification**

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

## **Objective**

Prevent a fire hazard

### **3.0103.1 Access Doors and Hatches**

Section:Air Sealing

Topic:General Pressure Boundary

Sub-Topic:Intentional Attic Openings

#### **Desired Outcome**

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

### **3.0103.1a Sealant selection**

#### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

## **Objective**

Select safe and effective sealants

### **3.0103.1b Material selection**

## **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

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

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

## **Objective**

Select safe and effective materials

### **3.0103.1c Surface preparation**

## **Specification**

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

## **Objective**

Surface is clean and ready to accept sealant

### **3.0103.1d Seal framing**

## **Specification**

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

## **Objective**

Prevent air and moisture movement

### **3.0103.1e Seal access panel**

#### **Specification**

Seal access using gaskets, weather stripping or equivalent method

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

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

#### **Objective**

Prevent air and moisture movement

### **3.0103.1f Damming**

#### **Specification**

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

#### **Objective**

Prevent insulation movement

### **3.0103.1g Insulate opening**

#### **Specification**

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

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

#### **Objective**

Align thermal barrier

### **3.0103.1h Durability**

#### **Specification**

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

#### **Objective**

Ensure minimum service life

### **3.0103.3 Whole-House Fan - Operable**

Section:Air Sealing

Topic:General Pressure Boundary

Sub-Topic:Intentional Attic Openings

#### **Desired Outcome**

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

### **3.0103.3a Sealant selection**

#### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

#### **Objective**

Select safe and effective sealants

### **3.0103.3b Material selection**

#### **Specification**

Select materials that:

adequately support applied load and are permanent air barriers,

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

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

#### **Objective**

Select safe and effective materials

### **3.0103.3c Surface preparation**

#### **Specification**

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

#### **Objective**

Surface is clean and ready to accept sealant

### **3.0103.3d Enclosure construction**

#### **Specification**

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

#### **Objective**

Keep insulation out of fan components

### **3.0103.3e Operable cover**

## **Specification**

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

Operable lid must have an airtight seal when closed

## **Objective**

Align pressure and thermal boundary and maintain fan operation

### **3.0103.3f Insulation**

## **Specification**

Insulate fan enclosure to a minimum of R-20

Install insulation in full contact with the enclosure

Mechanically fasten insulation to fan cover

## **Objective**

Uniform pressure and thermal boundary

### **3.0103.3g Air sealing**

## **Specification**

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

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

## **Objective**

Prevent air and moisture movement

### **3.0103.3h Durability**

## **Specification**

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

## **Objective**

Ensure a minimum expected service life

### **3.0201.1 Window Air Sealing**

Section:Air Sealing

Topic:Shell Components

Sub-Topic:Windows

#### **Desired Outcome**

Weathertight window repairs

#### **3.0201.1a Sealant selection**

##### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

##### **Objective**

Select safe and effective sealants

#### **3.0201.1b Material selection**

## **Specification**

Select:

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

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

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

## **Objective**

Select safe and effective materials

### **3.0201.1c Surface preparation**

## **Specification**

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

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

## **Objective**

Surface is clean and ready to accept sealant

### **3.0201.1d Operation and fit**

## **Specification**

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

Verify intentional drainage is functioning correctly

## **Objective**

Proper window sash operation and drainage

### **3.0201.1e Sash stops**

#### **Specification**

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

#### **Objective**

Operable, weathertight sash

### **3.0201.1f Weather stripping**

#### **Specification**

Remove existing weather stripping or sealing strips that are damaged

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

Mechanically installed weather stripping will be sealed to surface

#### **Objective**

Complete seal of window sash

### **3.0201.1g Sash locks**

#### **Specification**

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

#### **Objective**

Securely fastened sash

### **3.0201.1h Exterior weatherproofing**

## **Specification**

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

Seal any holes in frame left by abandoned hardware

Do not seal weep holes or intentional drainage locations

## **Objective**

Prevent water intrusion

### **3.0201.1i Safety**

## **Specification**

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

## **Objective**

Safe egress maintained

### **3.0201.2 Window Sash Replacement**

Section: Air Sealing

Topic: Shell Components

Sub-Topic: Windows

## **Desired Outcome**

Weathertight window repairs

### **3.0201.2a Sealant selection**

## **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

### **Objective**

Select safe and effective sealants

### **3.0201.2b Material selection**

#### **Specification**

Select:

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

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

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

### **Objective**

Select safe and effective materials

### **3.0201.2c Surface preparation**

#### **Specification**

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

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

### **Objective**

Surface is clean and ready to accept sealant

### **3.0201.2d Sash replacement**

#### **Specification**

Install new sash per manufacturer's instructions

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

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

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

#### **Objective**

Weatherproof sash installation

### **3.0201.2e Weatherproofing**

#### **Specification**

Water-seal and prime new sash if water permeable

#### **Objective**

Prevent water damage

### **3.0201.2f Sash stops**

#### **Specification**

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

#### **Objective**

Operable, weathertight sash

### **3.0201.2g Weather stripping**

#### **Specification**

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

**Objective**

Complete seal of window sash

**3.0201.2h Sash locks**

**Specification**

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

**Objective**

Securely fastened sash

**3.0201.2i Disposal**

**Specification**

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

**Objective**

Prevent reuse of old components and protect health and the environment

**3.0201.2j Safety**

**Specification**

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

**Objective**

Safe egress maintained

### **3.0201.3 Window Sill Replacement**

Section: Air Sealing

Topic: Shell Components

Sub-Topic: Windows

#### **Desired Outcome**

Weathertight, fully operational window repairs

#### **3.0201.3a Sealant selection**

##### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

##### **Objective**

Select safe and effective sealants

#### **3.0201.3b Material selection**

##### **Specification**

Select:

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

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

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

independent testing and verification protocols

### **Objective**

Select safe and effective materials

### **3.0201.3c Surface preparation**

#### **Specification**

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

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

### **Objective**

Surface is clean and ready to accept sealant

### **3.0201.3d Sill replacement**

#### **Specification**

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

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

### **Objective**

Weatherproof sill

### **3.0201.3e Weatherproofing**

#### **Specification**

Water-seal and prime new sill if water permeable

### **Objective**

Prevent water damage

### **3.0201.3f Disposal**

#### **Specification**

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

#### **Objective**

Prevent reuse of old components and protect health and the environment

### **3.0201.3g Safety**

#### **Specification**

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

#### **Objective**

Safe egress maintained

## **3.0201.4 Glass Replacement**

Section:Air Sealing

Topic:Shell Components

Sub-Topic:Windows

#### **Desired Outcome**

Weathertight glazing repairs

### **3.0201.4a Sealant selection**

#### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

### **Objective**

Select safe and effective sealants

### **3.0201.4b Material selection**

#### **Specification**

Select:

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

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

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

### **Objective**

Select safe and effective materials

### **3.0201.4c Surface preparation**

#### **Specification**

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

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

Remove push point or stops from replacement area

## **Objective**

Surface is clean and ready to accept sealant

### **3.0201.4d New glazing selection**

#### **Specification**

Select tempered safety glass as required by applicable codes

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

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

## **Objective**

Properly select and size replacement glazing

### **3.0201.4e New glazing installation**

#### **Specification**

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

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

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

## **Objective**

Secure and seal glazing

### **3.0201.4f Safety**

#### **Specification**

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

## **Objective**

Safe egress maintained

### **3.0201.5 Interior Fixed Storm Window Installation**

Section: Air Sealing

Topic: Shell Components

Sub-Topic: Windows

#### **Desired Outcome**

Airtight and safe fixed storm window installation

#### **3.0201.5a Sealant selection**

##### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

##### **Objective**

Select safe and effective sealants

#### **3.0201.5b Material selection**

##### **Specification**

Select:

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

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

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

### **Objective**

Select safe and effective materials

### **3.0201.5c Surface preparation**

#### **Specification**

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

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

### **Objective**

Surface is clean and ready to accept sealant

### **3.0201.5d Installation**

#### **Specification**

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

Storm window installation must be substantially airtight

### **Objective**

Airtight and proper installation

### **3.0201.5e Safety**

#### **Specification**

Do not install fixed storm windows in required egress locations

## **Objective**

Safe egress maintained

### **3.0201.6 Interior Operable Storm Window Installation**

Section: Air Sealing

Topic: Shell Components

Sub-Topic: Windows

#### **Desired Outcome**

Airtight and safe operable storm window installation

#### **3.0201.6a Sealant selection**

##### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

##### **Objective**

Select safe and effective sealants

#### **3.0201.6b Material selection**

##### **Specification**

Select:

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

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

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

### **Objective**

Select safe and effective materials

### **3.0201.6c Surface preparation**

#### **Specification**

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

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

### **Objective**

Surface is clean and ready to accept sealant

### **3.0201.6d Installation**

#### **Specification**

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

Installation must be substantially airtight when closed

### **Objective**

Airtight and proper installation

### **3.0201.6e Safety**

#### **Specification**

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

## **Objective**

Safe egress maintained

### **3.0201.7 Exterior Fixed Storm Window Installation**

Section: Air Sealing

Topic: Shell Components

Sub-Topic: Windows

#### **Desired Outcome**

Weathertight and safe fixed storm window installation

#### **3.0201.7a Sealant selection**

##### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

##### **Objective**

Select safe and effective sealants

#### **3.0201.7b Material selection**

##### **Specification**

Select:

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

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

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

### **Objective**

Select safe and effective materials

### **3.0201.7c Surface preparation**

#### **Specification**

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

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

### **Objective**

Surface is clean and ready to accept sealant

### **3.0201.7d Installation**

#### **Specification**

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

Installation must be substantially airtight

### **Objective**

Weather-tight 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

#### **4.0103.8 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

#### **4.0103.9 MH - Blown Insulation for Flat, Bowed, or Vaulted Ceilings (via Gable End Access)**

Section:Insulation

Topic:Attics

Sub-Topic:Attic Floors - Unconditioned Attics

##### **Desired Outcome**

Continuous, contiguous, safe, compliant, and pest-resistant thermal barrier

##### **4.0103.9a Pre-work qualifications**

##### **Specification**

Verify that installation area is free of:

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

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

##### **4.0103.9b Material selection**

## **Specification**

Select loose fill fiberglass 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

### **4.0103.9c Access**

## **Specification**

Create access to attic by removing existing gable vents or installing new gable vents on each gable of the home that are large enough for access to install insulation correctly

## **Objective**

Access entire cavity through gable vents

### **4.0103.9d Installation**

## **Specification**

Fill entire attic to prescribed R-value

If existing insulation is roof-mounted, insulation will be blown below

If existing insulation is ceiling-mounted, insulation will be blown above

If existing insulation is mounted at both locations, insulation will be blown in between

## **Objective**

Continuous thermal barrier of consistent R-value

### **4.0103.9e Close access**

## **Specification**

Install gable vents using mechanical fasteners ensuring vents are oriented per the manufacturer's specifications

Install gable vents with a pest intrusion screening with a maximum hole size of 1/2"

### **Objective**

Weatherproof and pest-resistant gable access closure

### **4.0103.9f 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

### **4.0103.10 MH - Blown Insulation for Flat, Bowed, or Vaulted Ceilings (via Roof Side Lift)**

Section:Insulation

Topic:Attics

Sub-Topic:Attic Floors - Unconditioned Attics

### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal barrier installation that protects integrity of roof

### **4.0103.10a Pre-work qualifications**

### **Specification**

Verify that installation area is free of:

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

uncovered electrical junctions

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

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

insulation escape openings

Verify that installation area:

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

### **Objective**

Ensure space can be safely insulated

### **4.0103.10b Material selection**

#### **Specification**

Select loose fill fiberglass 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

### **4.0103.10c Access**

#### **Specification**

Remove a small section (no more than 10') of fasteners at a time from the J channel and the roof edge on the most easily accessible side of the dwelling and separate roof from the heel plate and siding

Prop roof open no more than necessary to accommodate fill tube access to entire cavity

Avoid performing this method when high winds are expected

### **Objective**

Create safe access to entire cavity

#### **4.0103.10d Installation**

##### **Specification**

Fill entire attic to prescribed R-value

If existing insulation is roof-mounted, insulation will be blown below

If existing insulation is ceiling-mounted, insulation will be blown above

If existing insulation is mounted at both locations, insulation will be blown in between

##### **Objective**

Continuous thermal barrier of consistent R-value

#### **4.0103.10e Close access**

##### **Specification**

Remove existing sealant from the roof edge and J channel

Install new sealant at the original location

Install new J channel if existing J channel is damaged

Fasten roof and J channel to the original location with new screws

Seal all seams, edges, and penetrations of roof/wall connection

##### **Objective**

Weathertight roof closure

#### **4.0103.10f 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

## **4.0103.11 MH - Blown Insulation for Flat, Bowed, or Vaulted Ceilings (via Roof Top Access)**

Section:Insulation

Topic:Attics

Sub-Topic:Attic Floors - Unconditioned Attics

## **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal barrier installation that protects integrity of roof

### **4.0103.11a Pre-work qualifications**

## **Specification**

Verify that installation area is free of:

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

uncovered electrical junctions

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

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

insulation escape openings

Verify that installation area:

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

## **Objective**

Ensure space can be safely insulated

#### **4.0103.11b Material selection**

##### **Specification**

Select loose fill fiberglass 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

#### **4.0103.11c 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

#### **4.0103.11d Access**

##### **Specification**

Create a horizontal opening the full length of the attic by slicing the roof open at the peak allowing no more room than is necessary for access to the entire attic cavity using a fill tube, OR

Drill or cut uniform holes in the roof adequately spaced to access the entire roof cavity to be insulated

##### **Objective**

Create safe access to entire cavity

#### **4.0103.11e Installation**

##### **Specification**

Fill entire attic to prescribed R-value

If existing insulation is roof-mounted, insulation will be blown below

If existing insulation is ceiling-mounted, insulation will be blown above

If existing insulation is mounted at both locations, insulation will be blown in between

##### **Objective**

Continuous thermal barrier of consistent R-value

#### **4.0103.11f Close access**

##### **Specification**

If the roof is sliced open:

Install a solid metal ridge cap centered over the slice that overlaps each side of the roof by a minimum of 2"

Install a continuous, permanently flexible and durable sealant between the roof and the entire perimeter of the ridge cap

Install mechanical fasteners along the perimeter of the ridge cap every 6" or less that do not enter any framing material, prevent wrinkles and create a permanent seal

Apply a durable and flexible final roof coating over the screws and edge of the ridge cap to create a continuous seal between the roof and the perimeter of the ridge cap

For holes that are drilled or cut:

Prepare at least 6" of surface surrounding the opening by removing any material that will interfere with sealant adhesion

Install a durable metal patch of equal or greater gauge than the roof material that overlaps the opening by a minimum of 2" on all sides

Install a continuous bead of flexible and durable all-weather adhesive between the roof patch and the roof

Mechanically fasten patch along the perimeter every 2" without entering any framing material to prevent wrinkles and create a permanent seal

Install a durable and flexible 45 mil minimum adhesive roof patch in accordance with manufacturer specifications over the initial patch that overlaps the initial patch by a minimum of 2" on all sides ensuring surface temperatures are within manufacturer's guidelines for installation

Adhesive patch must meet the following minimum standards: Tensile strength of 640g, elongation of 380%, service temperature between -25 and 150 degrees F.

Apply a durable and flexible final coating (e.g., elastomeric paint) over the adhesive patch that laps at least 6" over the patch on all sides to create a continuous seal between the roof and the perimeter of the patch

### **Objective**

Durable and weathertight roof closure

### **4.0103.11g 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

### **4.0103.12 MH - Blown Insulation for Flat, Bowed, or Vaulted Ceilings (via Interior Access Through the Ceiling)**

Section:Insulation

Topic:Attics

Sub-Topic:Attic Floors - Unconditioned Attics

### **Desired Outcome**

Continuous, contiguous, safe, and compliant thermal barrier installation that protects integrity of interior surfaces and client health

#### **4.0103.12a Pre-work qualifications**

##### **Specification**

Verify that installation area is free of:

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

uncovered electrical junctions

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

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

insulation escape openings

Verify that installation area:

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

##### **Objective**

Ensure space can be safely insulated

#### **4.0103.12b Material selection**

##### **Specification**

Select loose fill fiberglass 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

#### **4.0103.12c 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, durable, and effective sealants

#### **4.0103.12d 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

#### **4.0103.12e Access**

##### **Specification**

Drill equidistant holes in a straight row parallel to the longitudinal exterior wall of the ceiling

If a longitudinal ceiling trim piece exists, remove trim piece and drill behind the trim

Choose access hole locations that allow for consistent and uniform coverage of installed insulation; at a minimum there will be one hole between each roof truss

Drill holes that are large enough to accommodate the chosen fill tube without damaging the ceiling

material during installation

If a vapor barrier or ceiling-mounted insulation is present, gain access through them

### **Objective**

Create safe access to entire cavity

### **4.0103.12f Installation**

#### **Specification**

Fill entire attic to prescribed R-value

If existing insulation is roof-mounted, insulation will be blown below

If existing insulation is ceiling-mounted, insulation will be blown above

If existing insulation is mounted at both locations, insulation will be blown in between

### **Objective**

Continuous thermal barrier of consistent R-value

### **4.0103.12g Close access**

#### **Specification**

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

If existing trim was removed, reinstall it as originally installed

### **Objective**

Airtight, durable, and aesthetic access closure

### **4.0103.12h 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

## **4.0103.13 MH - Blown Insulation in Roof-Over Construction**

Section:Insulation

Topic:Attics

Sub-Topic:Attic Floors - Unconditioned Attics

### **Desired Outcome**

Continuous, safe, and compliant thermal barrier installation that protects integrity of interior surfaces, client health, and roof-over weather protection

### **4.0103.13a Pre-work qualifications**

#### **Specification**

Verify that installation area is free of:

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

uncovered electrical junctions

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

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

insulation escape openings

Verify that installation area:

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

## **Objective**

Ensure space can be safely insulated

#### **4.0103.13b Material selection**

##### **Specification**

Select loose fill fiberglass 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

#### **4.0103.13c 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, durable, and effective sealants

#### **4.0103.13d 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

#### **4.0103.13e Access**

##### **Specification**

If roof-over attic is large enough for safe physical access, perform all work from the exterior of the original attic by means of access through the roof-over roof or gables

If roof-over attic space is not large enough for safe physical access, install insulation in original attic from the interior of the dwelling and install insulation in the roof-over attic from the roof or gable of the roof over attic

At a minimum, access each end cavity of the original attic to install insulation

##### **Objective**

Safely access both attics

#### **4.0103.13f Installation**

##### **Specification**

Fill each end cavity of the original attic to capacity

Add additional insulation to meet prescribed R-value to either the original attic or on top of the original roof if sufficient space is available or both if necessary to meet the prescribed R-value

If additional insulation is installed on top of the original roof follow the applicable Single Family SWS for attic insulation

##### **Objective**

Continuous thermal barrier of appropriate R-value

#### **4.0103.13g Close access**

##### **Specification**

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

Install closure system over all holes in the original roof that is airtight and durable

Install closure system over access holes in the roof-over attic with a durable, weatherproof, and pest resistant closure

### **Objective**

Airtight, durable, and aesthetic interior access closure. Weathertight, durable, and pest-resistant exterior access closure

### **4.0103.13h 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 prevention of 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

#### **4.0202.3 MH - Fiberglass Batts**

Section:Insulation

Topic:Walls

Sub-Topic:Enclosed Walls

##### **Desired Outcome**

Continuous, contiguous, and safe thermal boundary and vapor retarder

#### **4.0202.3a Pre-work qualifications**

##### **Specification**

Verify that installation area is free of:

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

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

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

Verify that installation area is:

intact, able to support insulation weight, and air sealed

### **Objective**

Ensure space can be safely insulated

#### **4.0202.3b 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

Select a poly-encased fiberglass batt or an unfaced fiberglass batt and a flexible class 1 vapor retarder membrane

### **Objective**

Select correct and fire safe materials

#### **4.0202.3c General preparation**

### **Specification**

Remove objects from the interior surfaces of the walls being insulated

Repair or reattach interior paneling as necessary

### **Objective**

Protect occupant belongings and prevent interior paneling failure

#### **4.0202.3d Access cavities**

##### **Specification**

Remove skirting if it overlaps the siding

Remove fasteners from the bottom of the siding, working upward until the siding can be pulled away from the framing approximately 6" without damaging the siding

Install temporary fasteners at the seams near the bottom of the siding panels to prevent separation

Cut access through sheathing if present

##### **Objective**

Access cavities without damaging the siding or compromising the interior wall surface

#### **4.0202.3e Installation**

##### **Specification**

Insert fiberglass batts that fill entire cavity all the way to the top of the cavity without deforming siding or damaging structure

If using a flexible membrane, cut it 2" wider than the cavity and approximately 1' longer than the batt and install together with the batt in the climate correct orientation

##### **Objective**

Fill entire cavity with insulation and vapor retarder

#### **4.0202.3f Close cavities**

##### **Specification**

Patch or repair sub sheathing as necessary

If skirting was removed, reinstall it to shed water to the outside of the skirting

Reattach siding with new fasteners and without bulges or wrinkles

### **Objective**

Weathertight exterior cavity closure

### **4.0202.3g 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

### **4.0202.4 MH - Blown Fiberglass**

Section:Insulation

Topic:Walls

Sub-Topic:Enclosed Walls

### **Desired Outcome**

Continuous, contiguous, and safe thermal boundary

### **4.0202.4a Pre-work qualifications**

### **Specification**

Verify that installation area is free of:

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

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

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

Verify that installation area is:

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

### **Objective**

Ensure space can be safely insulated

### **4.0202.4b Material selection**

#### **Specification**

Select fiberglass 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

### **4.0202.4c General preparation**

#### **Specification**

Remove objects from the interior surfaces of the walls being insulated

Repair or reattach interior paneling as necessary

### **Objective**

Protect occupant belongings and prevent interior paneling failure

### **4.0202.4d Access cavities**

#### **Specification**

Remove skirting if it overlaps the siding

Remove fasteners from the bottom of the siding, working upward until the siding can be pulled away from the framing approximately 6" without damaging the siding

Install temporary fasteners at the seams near the bottom of the siding panels to prevent separation

Cut access through sheathing if present

### **Objective**

Access cavities without damaging the siding or compromising the interior wall surface

### **4.0202.4e Installation**

#### **Specification**

Install insulation in entirety of each cavity to a density of no more than 1.6 pounds per cubic foot between the interior paneling and any existing insulation

Do not overfill any portion of the cavity

### **Objective**

Consistent thermal boundary that does not compromise interior wall

### **4.0202.4f Close cavities**

#### **Specification**

Patch or repair sub sheathing as necessary

If skirting was removed, reinstall it to shed water to the outside of the skirting

Reattach siding with new fasteners and without bulges or wrinkles

### **Objective**

Weathertight exterior cavity closure

### **4.0202.4g 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

## **4.0202.5 MH - Blown Fiberglass Through Penetrations**

Section:Insulation

Topic:Walls

Sub-Topic:Enclosed Walls

## **Desired Outcome**

Continuous, contiguous, and safe thermal boundary

### **4.0202.5a Pre-work qualifications**

#### **Specification**

Verify that installation area is free of:

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

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

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

Verify that installation area is:

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

## **Objective**

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

### **4.0202.5b 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

### **4.0202.5c 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)

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

### **4.0202.5d General preparation for blown wall insulation**

## **Specification**

Remove objects from the interior surfaces of the walls being insulated

Install durable blocking materials at any openings to the cavity

Repair or reattach interior paneling as necessary

Set up dust containment enclosure in installation area for all interior installations

## **Objective**

Protect property and workers

Contain insulation inside cavity where intended

#### **4.0202.5e Access cavity**

##### **Specification**

Exterior access:

Remove the exterior cladding at the insulation access point when feasible

If not feasible, drill holes in the exterior siding around the perimeter of the home, parallel to the bottom plate, an equal distance apart, and located under the lowest window sill when possible

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

##### **Objective**

Access all wall cavities safely and prepare for access closure

#### **4.0202.5f Blow insulation**

##### **Specification**

Install insulation in entirety of each cavity to a density of no more than 1.6 pounds per cubic foot between the interior paneling and any existing insulation

Do not overfill any portion of the cavity

##### **Objective**

Airtight and continuous pressure and thermal boundary

#### **4.0202.5g 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

### **Objective**

Airtight, durable hole closure

### **4.0202.5h 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

### **4.0202.6 SPF Insulation Installation in Closed Cavities**

Section:Insulation

Topic:Walls

Sub-Topic:Enclosed Walls

### **Desired Outcome**

Continuous, contiguous, and safe thermal boundary

### **4.0202.6a 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

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 pressure

## **Objective**

Ensure space can be safely insulated

### **4.0202.6b 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

### **4.0202.6c 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)

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

### **4.0202.6d General preparation**

#### **Specification**

Cover all finished surfaces areas (e.g., windows, doors) in the installation area with appropriate materials (e.g., plastic, masking tape)

Secure all paneling joints and repair any holes

## **Objective**

Protect finished surfaces from overspray and prevent SPF leakage

### **4.0202.6e 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

### **4.0202.6f Access**

#### **Specification**

Drill holes no larger than the spray nozzle from the interior of the house in each cavity, preferably in the paneling groove when possible

## **Objective**

Minimal hole that allows sufficient access for application

#### **4.0202.6g Installation**

##### **Specification**

Insulate 100% of each cavity to a consistent density without bulging of panels or siding

##### **Objective**

Continuous pressure and thermal boundary that prevents vapor intrusion

#### **4.0202.6h Closure**

##### **Specification**

Seal access hole airtight with a color-corresponding sealant

##### **Objective**

Durable, airtight, and aesthetic hole seal

#### **4.0202.6i 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

#### **4.0202.6j 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

### **4.0301.1 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**

Weather-tight, 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

### **4.0302.1 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

## **4.0302.9 MH - Blown Belly Insulation**

Section:Insulation

Topic:Floors

Sub-Topic:Exposed Floors

## **Desired Outcome**

Continuous, contiguous, safe, pest and weather resistant thermal boundary

## **4.0302.9a Pre-work qualifications**

### **Specification**

Verify that installation area is free of:

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

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

Air and duct sealing is complete

Verify that all plumbing is within the thermal boundary, or insulated appropriately

## **Objective**

Space safe and prepared for insulation

### **4.0302.9b 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

are of minimal water absorbency

are noncorrosive

## **Objective**

Select safe materials

### **4.0302.9c 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

### **4.0302.9d Installation**

#### **Specification**

Fill all belly cavities to full capacity and prescribed R-value ensuring that all ductwork and plumbing has sufficient insulation value to prevent condensation or freezing

### **Objective**

Continuous and contiguous thermal boundary

### **4.0302.9e Close access hole**

#### **Specification**

Install closure system over all access holes that is weathertight, patched with like materials that are stitch stapled and adhered to the existing closure system with permanent adhesive, and meets applicable fire safety codes

### **Objective**

Weathertight, durable, and safe access closure

### **4.0302.9f 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

### **4.0388.1 Foundation Skirting**

Section:Insulation

Topic:Floors

Sub-Topic:Unique Installations

#### **Desired Outcome**

Reduce pest, wind, and water intrusion while reducing conductive heat loss in floor assembly

#### **4.0388.1a Pre-work qualifications**

##### **Specification**

Verify that installation area is free of:

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

uncovered electrical junctions

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

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

Verify that installation area is intact and structurally sound

Verify that all plumbing is within the thermal boundary, or insulated appropriately

Verify an appropriate class I vapor retarder is installed between the ground and the floor assembly

##### **Objective**

Space safe and prepared for insulation

#### **4.0388.1b Material selection**

##### **Specification**

Select materials that are corrosion and rot resistant, compatible with existing surfaces, and pest resistant

Select materials that are rated for ground contact if they touch the ground

##### **Objective**

Select durable and pest-resistant materials

#### **4.0388.1c Sealant selection**

##### **Specification**

Select sealants that:

are compatible with their intended surfaces

allow for differential expansion and contraction between dissimilar materials

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

### **Objective**

Select durable, safe, and pest-resistant sealants

### **4.0388.1d General preparation**

#### **Specification**

Remove any existing skirting materials

Remove any vegetation from installation area

### **Objective**

Installation area free of obstructions

### **4.0388.1e Coverage**

#### **Specification**

Install skirting continuously around the entire perimeter of the conditioned space

### **Objective**

Minimize pests, wind and water intrusion, and freezing of plumbing under dwelling

### **4.0388.1f Support**

#### **Specification**

Install support material as needed to adequately support new skirting to prevent failure under wind or snow loads but that allows for expansion, contraction, and frost heaving

## **Objective**

Adequate yet flexible support

### **4.0388.1g Fastening**

## **Specification**

Mechanically fasten all skirting in accordance with manufacturer's specifications using corrosion resistant materials

## **Objective**

Durable installation

### **4.0388.1h Flashing**

## **Specification**

Install flashing that directs bulk water away from the dwelling and to outside skirting

Seal flashing to dwelling with compatible sealant

## **Objective**

Prevent water from entering foundation space

### **4.0388.1i Insulation**

## **Specification**

Install skirting that meets the prescribed R-value

## **Objective**

Reduce conductive heat loss through floor assembly

### **4.0388.1j Sealing and rodent proofing**

## **Specification**

Seal all seams, joints, connections, penetrations, etc. in the skirting with compatible sealant

Seal all exposed wood (e.g., paint, sealed, treated)

Stuff any gaps larger than 1/4" with copper metal mesh or steel wool prior to sealing

## **Objective**

Airtight, pest resistant exterior

### **4.0388.1k Insulation - onsite documentation**

## **Specification**

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

## **Objective**

Comply with 16 CFR 460.17 and document contract compliance

## **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

### **5.0105.1 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

## **5.0105.3 Crossover Duct Repair or Replacement**

Section: Heating and Cooling

Topic: Forced Air

Sub-Topic: Duct Repair

### **Desired Outcome**

Durable and effective crossover duct installation

### **5.0105.3a General preparation**

#### **Specification**

Remove previously existing duct materials from installation area that are damaged or wet

Prepare trunk surface to accept new installation and sealants

#### **Objective**

Prepare installation area and remove damaged materials

### **5.0105.3b Duct materials**

#### **Specification**

Use only rigid ducts of 26 gauge or greater for crossover connections in subspaces (i.e., crawlspaces, belly area)

In attics, if sufficient space is not available for rigid duct installation, UL 181 approved flexible duct may be used

#### **Objective**

Select durable materials that maximize airflow

### **5.0105.3c Rigid transition**

#### **Specification**

Install a rigid metal transition (e.g., rigid elbow) for all changes in airflow direction that is the same size as the crossover duct and is positioned towards the direction of flow

**Objective**

Maximize airflow

**5.0105.3d Duct connections**

**Specification**

Fasten duct connections in accordance with SWS detail "Duct Repair: Mechanical Fastening"

**Objective**

Durable duct connection

**5.0105.3e Duct support**

**Specification**

Support ducts in accordance with SWS detail "Duct Repair: Duct Support"

**Objective**

Durably supported ducts

**5.0105.3f Insulation**

**Specification**

Install insulation to a minimum of R-8 that includes a vapor retarder layer

**Objective**

Insulated duct that prevents condensation

**5.0105.3g Sealing**

## **Specification**

Seal all crossover ducts in accordance with SWS Subtopic "Duct Sealing"

## **Objective**

Minimize duct leakage at 25 PA

## **5.0105.4 Replace Return Air Systems That Use Building Cavities**

Section:Heating and Cooling

Topic:Forced Air

Sub-Topic:Duct Repair

## **Desired Outcome**

Effective, efficient, safe, and durable return air system

### **5.0105.4a Material selection**

## **Specification**

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, or NAIMA approved or conform to ASTM A653

## **Objective**

Select durable and safe duct materials

### **5.0105.4b Close existing return air openings**

## **Specification**

Close and seal existing return air openings in accordance with SWS detail for "Duct Repair: Mechanical Fastening" and SWS Subtopic "Duct Sealing"

## **Objective**

Reduce air leakage and improve indoor air quality

### **5.0105.4c Alternate return air path**

#### **Specification**

Provide alternate return air opening to the furnace closet (e.g., louvered door or install grilles)

Net free air flow must minimally meet manufacturer specifications for the installed equipment

## **Objective**

Ensure sufficient return air is provided to the system

### **5.0105.4d Sealing**

#### **Specification**

Seal entire return cavity with durable materials and UL 181 approved mastic and mesh tape (i.e., no foam allowed inside return systems)

## **Objective**

Minimize return leakage

### **5.0105.4e Filtration**

#### **Specification**

Provide accessible filter grill and filter with no air bypass of the filter

## **Objective**

Provide return air filtration without air bypass

## **5.0105.5 Replace MH Duct Boots**

Section: Heating and Cooling  
Topic: Forced Air  
Sub-Topic: Duct Repair

### **Desired Outcome**

Durable duct boot installation that prevents duct leakage @ 25 Pascals

### **5.0105.5a Material selection**

#### **Specification**

Use a minimum of 28 gauge galvanized or aluminum sheet metal to build new boots

#### **Objective**

Durable material selected

### **5.0105.5b Boot construction**

#### **Specification**

Build boot 1/8" smaller in width than the opening in the main duct trunk and a minimum of 2" longer than the distance between the top of the duct trunk and the top of the subfloor

Bend a 1/2" wide outward facing lip on all sides of the top facing end of the boot

Cut 1" wide tabs in the bottom 1-1/2" of the sheet metal boot that will fold under into the duct trunk

#### **Objective**

Boot fits in trunk and allows firm connection to both subfloor and trunk line

### **5.0105.5c Boot installation**

#### **Specification**

Install boot into subfloor register hole aligning sheetmetal tabs with the interior of the duct trunk register hole until the outward facing lip on the top of the boot is firmly in contact with the subfloor surface

Fold all tabs up into the duct trunk so that the boot is firmly in contact on both the top of the subfloor and the inside top of the duct trunk line

**Objective**

Secure and snug boot installation

**5.0105.5d Mechanical fastening**

**Specification**

Attach all four sides of the boot to the subfloor using galvanized or stainless steel fasteners

**Objective**

Prevent excessive duct boot movement

**5.0105.5e Sealing**

**Specification**

Seal the boot to the interior of the trunk line using UL 181 approved mesh tape and mastic

Seal the seam, joints, and any gaps in the boot using UL 181 approved mesh tape and mastic

Sealant will not be visible beyond edges of the register cover

**Objective**

Tightly sealed boot to trunk connection

**5.0105.5f Registers**

**Specification**

Allow sealing materials to dry before replacing register cover

Register must be easily removable by the occupant

## **Objective**

Occupant accessible boots that are aesthetically pleasing

### **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

### **5.0301.1 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

### **5.0401.1 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**

Separate all fuel-burning appliances (except ranges, ovens, illuminating appliances, clothes dryers, solid fuel-burning fireplaces, and solid fuel-burning fireplace stoves) from the interior atmosphere of the manufactured home with only combustion air inlets and flue gas outlets that are listed or certified as components of the appliance

##### **Objective**

Compliant and safe amount of combustion air for appliance

#### **5.0502.1b Installation**

##### **Specification**

The required separation may be obtained by:

- (1) Installing direct vent, sealed combustion appliances; or
- (2) Installing appliance enclosures that separate the appliance combustion system and venting system from the interior atmosphere of the manufactured home with no door, removable access panel, or other opening into the enclosure from the inside of the manufactured home and sealing any opening for ducts, piping, wiring, etc.

##### **Objective**

Compliant combustion air supply

#### **5.0503.1 Fuel-Fired Appliance Venting**

Section:Heating and Cooling

Topic:Combustion Safety  
Sub-Topic:Appliance Venting

### **Desired Outcome**

Combustion by-products safely vented to the outdoors

#### **5.0503.1a Design**

##### **Specification**

Design combustion appliance venting in accordance with applicable code (i.e., NFPA 54, NFPA 31, IFGC) and manufacturer specifications

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

##### **Objective**

Safe and compliant combustion venting design

#### **5.0503.1b Materials**

##### **Specification**

Select combustion appliance vent materials in accordance with applicable code (i.e., NFPA 54, NFPA 31, IFGC) and manufacturer specifications

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

##### **Objective**

Safe and compliant combustion venting materials

#### **5.0503.1c Installation**

##### **Specification**

Install combustion appliance venting in accordance with applicable code (i.e., NFPA 54, NFPA 31, IFGC) and manufacturer specifications

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

### **Objective**

Safe and compliant combustion venting installation

#### **5.0503.1d Terminations**

### **Specification**

Install combustion appliance terminations in accordance with applicable code (i.e., NFPA 54, NFPA 31, IFGC) and manufacturer specifications

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

### **Objective**

Safe and compliant combustion venting termination

#### **5.0503.1e Chimney liners**

### **Specification**

Select and install chimney liners for combustion appliances in accordance with applicable code (i.e., NFPA 54, NFPA 31, IFGC) and manufacturer specifications

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

### **Objective**

Safe and compliant chimney liner installation

#### **5.0504.1 Natural Gas/Propane Fuel Piping**

Section: Heating and Cooling

Topic: Combustion Safety

Sub-Topic: Fuel Delivery

### **Desired Outcome**

Safe, leak free, and optimal gas supply to all gas-fired equipment

#### **5.0504.1a Material selection**

##### **Specification**

Select approved pipe type in accordance with applicable code (e.g., NFPA 54/ANSI/AGA Z223.1)

##### **Objective**

Select compliant materials

#### **5.0504.1b Gas piping size**

##### **Specification**

Install gas piping capable of supporting the total connected load of all appliances in accordance with applicable code (e.g., NFPA 54/ANSI/AGA Z223.1)

##### **Objective**

Ensure safe and proper gas supply to equipment

#### **5.0504.1c Piping location**

##### **Specification**

Locate/route gas piping/train so as to not create a trip hazard, not be damaged by water, and to create the least pressure drop possible

##### **Objective**

Durable, safe, and effective installation

#### **5.0504.1d Support**

##### **Specification**

Support gas piping in compliance with applicable code (e.g., NFPA 54/ANSI/AGA Z223.1)

### **Objective**

Adequate and compliant pipe support

#### **5.0504.1e Required components**

### **Specification**

All piping installations must contain at a minimum a manual gas shut off valve, union joint, and a sediment trap at each appliance

### **Objective**

Safely allow service, replacement, and emergency shutoff of individual appliances

Protect appliance from moisture and debris in gas

#### **5.0504.1f Gas pressure regulator venting**

### **Specification**

If installed, vent all gas pressure regulators requiring venting to outside the building with code approved rigid pipe

Terminate pipe in a safe location without any thread, coupling, fitting, etc. that would allow a plug to be easily fitted

### **Objective**

Vent flammable gasses outside the building

#### **5.0504.1g Sealing**

### **Specification**

Seal all gas piping in accordance with manufacturer specifications

## **Objective**

Leak free gas piping

### **5.0504.1h Safety devices for propane**

#### **Specification**

Install a secondary LP safety detector system (e.g., valve, exhaust fan, alarm light) for propane piping installed below grade

## **Objective**

Detect accumulation of dangerous levels of propane in areas that are below grade

### **5.0504.1i Gas boosters**

#### **Specification**

If a gas pressure booster is necessary, confirm compatibility with the gas-fired equipment and check low and high gas pressure switches for proper operation

## **Objective**

Gas pressure booster is compatible and safe

### **5.0504.2 Oil Piping**

Section: Heating and Cooling

Topic: Combustion Safety

Sub-Topic: Fuel Delivery

#### **Desired Outcome**

Safe, leak free, and optimal oil supply to all oil-fired equipment

### **5.0504.2a Material selection**

#### **Specification**

Select approved pipe type in accordance with applicable code (e.g., NFPA 31, IMC)

**Objective**

Select compliant materials

**5.0504.2b Piping location**

**Specification**

Locate/route oil piping so as to not create a trip hazard and not be damaged by water

**Objective**

Durable, safe, and effective installation

**5.0504.2c Support**

**Specification**

Support oil piping in compliance with applicable code (e.g., NFPA 31, IMC)

**Objective**

Adequate and compliant pipe support

**5.0504.2d Required components**

**Specification**

All piping installations must contain at a minimum: a fire valve, a manual oil shut off valve, union joint, and filter fitting for each appliance

**Objective**

Safely allow service, replacement, and emergency shutoff of individual appliances

Protect equipment from debris in fuel

### **5.0504.2e Pumps**

#### **Specification**

If a fuel pump is required, design it in accordance with manufacturer specifications based on fuel type, distance from tank, and equipment size

Install a serviceable strainer in the pump supply side

Pump must be interlocked with appliance to cut off when appliance is not functioning

#### **Objective**

Provide adequate and clean fuel supply while protecting installed equipment

### **5.0504.2f Line connections**

#### **Specification**

Use connectors and filter fittings that are approved by applicable code (e.g., NFPA 31, IMC)

#### **Objective**

Compliant oil line installation

### **5.8801.1 Decommissioning**

Section: Heating and Cooling

Topic: Special Considerations

Sub-Topic: Equipment Removal

#### **Desired Outcome**

Protect workers, occupants, and environment during equipment removal

### **5.8801.1a Utility disconnect**

#### **Specification**

Turn off and lock out electricity and fuel prior to beginning removal of old appliance

## **Objective**

Protect workers and occupants from injury

### **5.8801.1b Refrigerant recovery**

## **Specification**

Recover and recycle all refrigerants in accordance with local and federal law (i.e., 40 CFR 608)

## **Objective**

Protect environment and comply with regulation

### **5.8801.1c Equipment disconnection**

## **Specification**

Disconnect all attachments to the equipment and terminate in accordance with applicable code and industry practice (e.g., refrigerant lines, plumbing, ducts, wiring, vents, fuel supply)

## **Objective**

Equipment ready for physical removal

### **5.8801.1d Equipment removal**

## **Specification**

Remove existing equipment (e.g., furnace, air handler, boiler, evaporator, condensing unit) from premises without damaging or disturbing property or existing insulation

Old equipment may not be left on client's property

## **Objective**

Equipment removed without physical damage to property

### **5.8801.1e Disposal**

#### **Specification**

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

Permanently decommission old equipment

#### **Objective**

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

### **6.0101.1 Ventilation Ducts**

Section: Ventilation

Topic: Infrastructure

Sub-Topic: Components

#### **Desired Outcome**

Durable, safe, airtight, and effective ventilation ducts that move the required air volume

#### **6.0101.1a Material selection**

#### **Specification**

Select duct materials that have a flame spread no greater than 25

Select flexible ducts that are UL 181 listed or Air Diffusion Council approved

Select rigid ducts of 28 gauge or thicker

Select duct insulation with a flame spread/smoke development index of 25/50 or less when tested according to ASTM E84 or UL 723

#### **Objective**

Select durable, safe, and effective duct materials

### **6.0101.1b Design and configuration**

#### **Specification**

Install ventilation ducts as short, straight, smooth and fully extended as possible considering the following: Vent termination location; Amount of space for duct run; Roof condition, type, and access (e.g., metal, shingle, bowstring, flat)

Choose duct diameter that is equal to or greater than the exhaust fan outlet

Slope duct downwards towards the termination when possible

Install flexible duct so the radius at the centerline of any turn is no less than one duct diameter

#### **Objective**

Smooth and direct air movement

### **6.0101.1c Combining air streams**

#### **Specification**

If combining ducts, combine them on the upstream side of fan using "Y"-fittings or collection boxes

Do not combine dryer, kitchen, or garage exhausts streams with any other exhaust stream

#### **Objective**

Effective, safe exhaust of air from multiport systems

### **6.0101.1d Mechanical fastening**

#### **Specification**

Fasten all ducts as follows:

Round metal-to-metal or metal-to-PVC with a minimum of three equally spaced screws

For other metal-to-metal or metal-to-PVC with welds, gaskets, mastics (adhesives), mastic-embedded-fabric systems, or tapes

Flexible duct-to-metal or flexible duct-to-PVC with tie bands using a tie band tensioning tool

PVC-to-PVC materials with approved PVC primer and cement

Fasten other specialized duct fittings in accordance with manufacturer specifications

### **Objective**

Durable duct connections

### **6.0101.1e Sealing**

#### **Specification**

Seal all duct connections with UL 181B or 181B-M listed materials (e.g., mastic, tape)

### **Objective**

Airtight duct connections

### **6.0101.1f Insulation**

#### **Specification**

Insulate all ducts installed outside of the thermal boundary to a minimum of R-8

Insulate all ductwork exposed to the exterior of the building to a minimum of R-12

### **Objective**

Prevent condensation

### **6.0101.1g Support**

#### **Specification**

Support flexible and duct board ducts every 4' or less using a minimum of 1-1/2" wide material

Install support materials in a way that does not crimp ductwork or cause the interior dimensions of the ductwork to be less than specified

Support metal ducts every 10' or less using 1/2" or wider material, using 18 gauge or greater strapping or

12 gauge or greater galvanized wire

## **Objective**

Ducts secured to prevent damage

## **6.0101.2 Exhaust Terminations**

Section: Ventilation

Topic: Infrastructure

Sub-Topic: Components

### **Desired Outcome**

Appropriate, safe, weather-tight, pest-resistant, and effective termination fittings with unrestricted air flow

### **6.0101.2a Selection**

#### **Specification**

Select termination fitting:

that is appropriate for regional weather conditions and installation location

with an integrated collar at least the same diameter as the exhaust duct outlet

with an integrated pest screen with holes no less than 1/4" and no greater than 1/2", except for dryer terminations which will have no pest screen

for kitchen exhaust: made from galvanized steel, stainless steel, or copper

for dryer exhaust: that is designed for dryers exhaust and does not include a pest screen

in very cold climates: that have no backflow dampers or use backflow dampers that resist freezing

#### **Objective**

Appropriate, safe, and weather resistant termination

### **6.0101.2b Damper (if applicable)**

#### **Specification**

Damper must open in the direction of the desired flow

Damper will close when system is off

No damper is required if the system operates continuously

#### **Objective**

Prevent unwanted air movement while not restricting desired air flow

### **6.0101.2c Location**

#### **Specification**

Install termination to exhaust to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Install terminations:

A minimum of 3' away from any property line;

A minimum of 3' away from operable opening to houses;

A minimum of 10' away from mechanical intake;

Above the snow-line.

If the termination is at the soffit, seal all soffit vents within 6' of the termination

#### **Objective**

Prevent exhaust from reentering the structure

### **6.0101.2d Installation**

#### **Specification**

Cut hole no larger than a 1/4" greater than the termination fitting

Weather seal and flash the exterior fitting

Mechanically fasten termination in place following manufacturer specifications

Do not inhibit damper operation if included in termination

### **Objective**

Weather-resistant, durable, and effective installation

### **6.0101.2e Duct to termination connection**

#### **Specification**

If termination collar is larger than exhaust duct install a rigid metal transition

### **Objective**

Effective termination connection

### **6.0101.2f Sealing**

#### **Specification**

Seal all duct connections with UL 181B or 181B-M listed materials (e.g., mastic, tape)

### **Objective**

Airtight duct connections

## **6.0101.3 Exterior Intakes**

Section: Ventilation

Topic: Infrastructure

Sub-Topic: Components

### **Desired Outcome**

Appropriate, safe, weather-tight, pest-resistant and effective intake fittings with unrestricted air flow

### **6.0101.3a Selection**

#### **Specification**

Select intake fitting:

that is appropriate for regional weather conditions and installation location

with an integrated collar at least the same diameter as the exhaust duct outlet

with an integrated pest screen with holes no less than 1/4" and no greater than 1/2"

in very cold climates that have no backflow dampers or use backflow dampers that resist freezing

#### **Objective**

Appropriate, safe, and weather resistant termination

### **6.0101.3b Damper (if applicable)**

#### **Specification**

Damper must open in the direction of the desired flow

Damper will close when system is off

No damper is required if the system operates continuously

#### **Objective**

Prevent unwanted air movement while not restricting desired air flow

### **6.0101.3c Location**

#### **Specification**

Install intake to pull air from the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Install intake:

A minimum of 6" from grade;

A minimum of 10' from contaminant sources or exhaust outlets;

Above local snow or flood line;

A minimum of 18" above an asphalt based roof;

Never on a flat roof

### **Objective**

Unrestricted entry of contaminant-free air

### **6.0101.3d Installation**

#### **Specification**

Cut hole no larger than a 1/4" greater than the termination fitting

Weather seal and flash the exterior fitting

Mechanically fasten termination in place following manufacturer specifications

Do not inhibit damper operation if included in termination

### **Objective**

Weather-resistant, durable, and effective installation

### **6.0101.3e Duct to termination connection**

#### **Specification**

If termination collar is larger than intake duct install a rigid metal transition

### **Objective**

Effective termination connection

### **6.0101.3f Labeling**

#### **Specification**

Label intake fitting: "ventilation air intake"

#### **Objective**

Prevent fitting restriction

### **6.0101.3g Sealing**

#### **Specification**

Seal all duct connections with UL 181B or 181B-M listed materials (e.g., mastic, tape)

#### **Objective**

Airtight duct connections

## **6.0101.4 Fan Controls**

Section: Ventilation

Topic: Infrastructure

Sub-Topic: Components

#### **Desired Outcome**

Safe and effective fan control that supports the ventilation strategy

### **6.0101.4a Intermittent/continuous operation**

#### **Specification**

Install controls that are either internal to the fan or external

For intermittent ventilation strategies: Install a controller that can operate the fan intermittently to produce the intended flow

For continuous ventilation strategies: Install an automatic controller that can operate the fan

continuously to meet the intended flow rate

Only use continuous operation controls on fans containing ECM motors rated for continuous operation

### **Objective**

Meet intended ventilation strategy

### **6.0101.4b Optional sensors**

#### **Specification**

Install a manual override control to activate the fan as necessary

Occupancy sensors/humidistat:

Install an occupancy sensor and/or humidistat designed to function with the chosen fan and in accordance with manufacturer specifications

Carbon dioxide sensors (demand control):

Only use CO2 sensors with VFD or multispeed fans

### **Objective**

Provide ventilation on an as-needed basis

### **6.0101.4c Manual override**

#### **Specification**

Install a clearly labeled manual service disconnect for all ventilation fan controls

### **Objective**

Service disconnect available

### **6.0101.4d Labeling, if applicable**

#### **Specification**

Clearly label all whole-house ventilation system controls "Whole-House Ventilation Control"

## **Objective**

Fan control operation made clear

### **6.0201.1 Surface Mounted**

Section: Ventilation

Topic: Local Ventilation

Sub-Topic: Exhaust Systems

#### **Desired Outcome**

Efficient, safe, quiet, and effective removal of air contaminants from area

#### **6.0201.1a Fan selection**

##### **Specification**

Select a fan that:

produces no more than 2.0 sones at maximum speed

has an efficacy of 4 cfm/watt or more

moves at least 50 cfm after installation, ducting, and termination is complete

##### **Objective**

Select efficient and quiet equipment

#### **6.0201.1b Sealant selection**

##### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

### **Objective**

Select safe and effective sealant

### **6.0201.1c Damper**

#### **Specification**

If the fan does not contain an integrated damper, install a damper that:

opens in the direction of the desired flow

closes when the system is off

### **Objective**

Prevent unwanted air movement while not restricting desired air flow

### **6.0201.1d Location**

#### **Specification**

Install fan near the center of the space where odor, moisture, or other contaminants are generated but not inside a shower unless fan is rated for wet location installation

### **Objective**

Effective location for removal of contaminants

### **6.0201.1e Opening preparation**

#### **Specification**

Cut hole for fan leaving no more than a 1/4" gap on each side of the fan assembly

**Objective**

Properly sized opening

**6.0201.1f Fan orientation**

**Specification**

Orient the fan outlet toward the final termination location and so the equivalent length of the duct run is as short as possible

**Objective**

Short, effective fan venting

**6.0201.1g Fan mounting**

**Specification**

Mount fan using mechanical fasteners and per manufacturer's specifications so that fan housing does not shake, rattle, or vibrate when operating

**Objective**

Securely mounted fan

**6.0201.1h Wiring**

**Specification**

Install all electrical wiring according to manufacturer specifications and applicable code

**Objective**

Prevent an electrical hazard

### **6.0201.1i Sealing**

#### **Specification**

Seal gap around fan housing and enclose fan housing when possible

#### **Objective**

Airtight fan installation

### **6.0201.1j Insulate housing**

#### **Specification**

If fan housing is installed in unconditioned space, insulate fan housing to a minimum of R-8 or cover with insulation of more than R-8

#### **Objective**

Prevent condensation

### **6.0201.1k Fan access**

#### **Specification**

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

#### **Objective**

Accessible for service

### **6.0201.1l Venting**

#### **Specification**

Duct and terminate fan to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors, in accordance with SWS detail for "Ventilation Ducts"

## **Objective**

Exhausted to outdoors

## **6.0201.2 Kitchen Range Hoods**

Section: Ventilation

Topic: Local Ventilation

Sub-Topic: Exhaust Systems

### **Desired Outcome**

Efficient, safe, quiet, and effective removal of air contaminants from kitchens

### **6.0201.2a Fan selection**

#### **Specification**

Select a fan that:

is rated a maximum of 3 sones at one or more airflow settings greater than or equal to 100 cfm

has a minimum efficacy of 2.8 cfm/watt

moves at least 100 cfm intermittently or 5 kitchen air changes per hour (ACH) continuously after installation, ducting, and termination is complete

#### **Objective**

Select efficient and quiet equipment that moves the specified amount of air.

### **6.0201.2b Sealant selection**

#### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

### **Objective**

Select safe and effective sealant

### **6.0201.2c Location**

#### **Specification**

Install fan within at least 5' of the primary cooking surface (e.g., range, oven, stove)

### **Objective**

Effective location for removal of contaminants

### **6.0201.2d Damper**

#### **Specification**

If the fan does not contain an integrated damper, install a damper that:

opens in the direction of the desired flow

closes when the system is off

### **Objective**

Prevent unwanted air movement while not restricting desired air flow

### **6.0201.2e Installation**

#### **Specification**

Mount fan using mechanical fasteners and per manufacturer specifications so that fan housing does not shake, rattle, or vibrate when operating

Ensure internal components are correctly oriented to exhaust air through the duct system

**Objective**

Securely mounted and vent ready fan

**6.0201.2f Wiring**

**Specification**

Install all electrical wiring according to manufacturer specifications and applicable code

**Objective**

Prevent an electrical hazard

**6.0201.2g Sealing**

**Specification**

Seal any gap around fan housing where air can leak to outside the pressure boundary

**Objective**

Reduce infiltration

**6.0201.2h Fan access**

**Specification**

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

**Objective**

Accessible for service

**6.0201.2i Venting**

## **Specification**

Duct fan flow through smooth wall metal duct and terminated to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors, in accordance with SWS detail for "Ventilation Ducts"

## **Objective**

Safely exhausted to outdoors

### **6.0201.2j Make-up air**

## **Specification**

Provide make-up air if the range hood operation interferes with combustion appliance operation

## **Objective**

Prevent excessive depressurization from fan

### **6.0201.3 Inline and Multiport Fans**

Section: Ventilation

Topic: Local Ventilation

Sub-Topic: Exhaust Systems

## **Desired Outcome**

Efficient, safe, durable, and airtight fan installation that maximizes air flow

### **6.0201.3a Fan selection**

## **Specification**

Select a fan that:

has an electrically commutated motor (ECM)

has an efficacy of 3.8 cfm/watt or more

## **Objective**

Efficient fan selection

### **6.0201.3b Sealant selection**

#### **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

## **Objective**

Select safe and effective sealant

### **6.0201.3c Wiring**

#### **Specification**

Install all electrical wiring according to manufacturer specifications and applicable code

## **Objective**

Prevent an electrical hazard

### **6.0201.3d Fan orientation**

#### **Specification**

Orient the fan outlet toward the final termination location and so the equivalent length of the duct run is as short as possible

## **Objective**

Short, effective fan venting

### **6.0201.3e Fan mounting**

#### **Specification**

Mount fan using mechanical fasteners and per manufacturer's specifications so that fan housing does not shake, rattle, or vibrate when operating

## **Objective**

Securely mounted fan

### **6.0201.3f Damper**

#### **Specification**

If the fan does not contain an integrated damper, install a damper that:

opens in the direction of the desired flow

closes when the system is off

## **Objective**

Prevent unwanted air movement while not restricting desired air flow

### **6.0201.3g Intake grill openings**

#### **Specification**

Cut hole for intakes leaving no more than a 1/8" gap on each side

Install register boots using mechanical fasteners sufficient to prevent movement

## **Objective**

Durable intake boots with properly sized opening

### **6.0201.3h Air sealing**

#### **Specification**

Seal gaps around intake register boots with compatible sealant

#### **Objective**

Airtight fan installation

### **6.0201.3i Fan Access**

#### **Specification**

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

#### **Objective**

Accessible for service

### **6.0201.3j Venting**

#### **Specification**

Duct and terminate fan to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors, in accordance with SWS detail for "Ventilation Ducts"

#### **Objective**

Exhausted to outdoors

## **6.0201.4 Garage Exhaust Fans**

Section: Ventilation

Topic: Local Ventilation

Sub-Topic: Exhaust Systems

#### **Desired Outcome**

Safely and efficiently remove pollutants from garage space

#### **6.0201.4a Fan selection**

##### **Specification**

Select a fan that:

- has an electrically commutated motor (ECM)
- has an efficacy of 3.8 cfm/watt or more
- exhausts 100 cfm per garage bay after installation

##### **Objective**

Efficient fan selection

#### **6.0201.4b Sealant selection**

##### **Specification**

Select sealants that:

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

##### **Objective**

Select safe and effective sealant

#### **6.0201.4c Wiring**

##### **Specification**

Install all electrical wiring according to manufacturer specifications and applicable code

### **Objective**

Prevent an electrical hazard

### **6.0201.4d Fan orientation**

#### **Specification**

Orient the fan outlet toward the final termination location and so the equivalent length of the duct run is as short as possible

### **Objective**

Short, effective fan venting

### **6.0201.4e Fan mounting**

#### **Specification**

Mount fan using mechanical fasteners and per manufacturer's specifications so that fan housing does not shake, rattle, or vibrate when operating

### **Objective**

Securely mounted fan

### **6.0201.4f Damper**

#### **Specification**

If the fan does not contain an integrated damper, install a damper that:

opens in the direction of the desired flow

closes when the system is off

### **Objective**

Prevent unwanted air movement while not restricting desired air flow

#### **6.0201.4g Controls**

##### **Specification**

Fan must operate continuously or have automatic controls that activate the fan whenever the garage is occupied and for 15 minutes after the garage is vacated

##### **Objective**

Correct exhaust strategy

#### **6.0201.4h Exhaust system openings**

##### **Specification**

Cut hole for intakes or surface mounted fans leaving no more than a 1/4" gap on each side

Install register boots using mechanical fasteners sufficient to prevent movement

##### **Objective**

Durable intake boots with properly sized opening

#### **6.0201.4i Air sealing**

##### **Specification**

Seal gaps around intake register boots or fan housing with compatible sealant

Seal leakage locations between living space and garage

Remove or cap and seal supply and/or return registers in garage that are connected to the same duct system as living space

##### **Objective**

Minimize air exchange between garage and dwelling

#### **6.0201.4j Fan access**

##### **Specification**

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

##### **Objective**

Accessible for service

#### **6.0201.4k Outdoor termination location**

##### **Specification**

Terminate exhaust venting a minimum of 15' from any doors, windows, or outside air intakes

##### **Objective**

Prevent reentry of exhausted pollutants

#### **6.0201.4l Venting**

##### **Specification**

Duct and terminate fan to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors, in accordance with SWS detail for "Ventilation Ducts"

##### **Objective**

Exhausted to outdoors

#### **6.0202.1 Clothes Dryer**

Section: Ventilation

Topic: Local Ventilation

Sub-Topic: Appliance Exhaust

##### **Desired Outcome**

Dryer vented to outdoors safely and effectively

### **6.0202.1a Duct selection**

#### **Specification**

Select dryer transition ducting materials that are UL 2158A approved and less than 8 feet in total length with no joints

Select primary dryer ducting material that is 28 gauge metal with a smooth interior

#### **Objective**

Smooth airflow that does not collect lint

### **6.0202.1b Venting installation**

#### **Specification**

Vent all clothes dryers to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Choose the shortest practical installation path

Install a dryer booster fan that is listed and labeled to UL 705 for dryer ducts exceeding 35' in equivalent length

Install ducts according to SWS detail for "Ventilation Ducts"

#### **Objective**

Dryer ducted to outdoors durably and effectively

### **6.0202.1c Lint collection devices**

#### **Specification**

If a lint collection device is installed, it must:

be UL approved for dryers

be installed according to manufacturer specifications

be airtight when dryer is operating

### **Objective**

Safe and airtight lint collection

### **6.0202.1d Mechanical fasteners**

#### **Specification**

Fasten all duct connections with mechanical fasteners that do not penetrate the interior of the duct (e.g., clamps, gasketed fitting)

No fastener may penetrate the interior of the duct

### **Objective**

Securely fastened without obstructing flow

### **6.0202.1e Make-up air**

#### **Specification**

If the dryer operation interferes with combustion appliance operation, make-up air must be provided according to applicable code

### **Objective**

Safe operation of combustion appliances

### **6.0202.1f Duct insulation**

#### **Specification**

Insulate dryer ducts installed outside of the thermal boundary to a minimum of R-8

### **Objective**

Prevent condensation

### **6.0202.1g Termination fitting**

#### **Specification**

Vent dryer through a termination manufactured for use with dryers that includes a backdraft damper

Termination may not contain a pest screen

#### **Objective**

Dryer termination that is effective, safe and does not inhibit flow

### **6.0202.1h Sealing**

#### **Specification**

Seal all duct connections with 181B or 181B-M listed material

#### **Objective**

Airtight ducts

### **6.0202.1i Condensing dryers**

#### **Specification**

Plumb condensing dryers to a drain

#### **Objective**

Condensate properly disposed

## **6.0301.1 Fresh Air Intake In Forced Air System**

Section: Ventilation

Topic: Whole-Building Ventilation

Sub-Topic: Supply Ventilation

## **Desired Outcome**

Efficiently supply adequate, clean ventilation air

### **6.0301.1a Pre-work qualifications**

#### **Specification**

Existing forced air system duct leakage to outside will be less than 10% of the air handler flow when measured at 25 pascals with reference to outside

Any portion of the return located inside a combustion appliance zone will be sealed

#### **Objective**

Prevent contamination through duct leakage

### **6.0301.1b Intake location**

#### **Specification**

Install intake to pull air from the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Install intake:

A minimum of 6" from grade;

A minimum of 10' from contaminant sources or exhaust outlets;

Above local snow or flood line;

A minimum of 18" above an asphalt based roof;

Never on a flat roof

#### **Objective**

Unrestricted entry of contaminant-free air

### **6.0301.1c Labeling**

#### **Specification**

Intake fitting will be labeled "ventilation air intake"

#### **Objective**

Prevent fitting restriction

### **6.0301.1d Pest exclusion**

#### **Specification**

Install corrosion resistant screen, louver, or grille material over exterior intake with a hole size of no less than 1/4" and no greater than 1/2" in any direction

#### **Objective**

Prevent pest entry while allowing proper air flow.

### **6.0301.1e Motorized damper**

#### **Specification**

Install a motorized damper or equivalent between the intake fitting and the return side duct connection

Damper will be open only when the air handler fan is operating

#### **Objective**

Prevent unwanted air flow

### **6.0301.1f System control**

#### **Specification**

Provide air flow by sequenced or scheduled operation of the damper or equivalent technology

Control system must operate both the air handler and the motorized damper or be interlocked to prevent

damper operation when air handler is not on

### **Objective**

Sufficient controlled ventilation rate

### **6.0301.1g Wiring**

#### **Specification**

Install all electrical wiring according to manufacturer specifications and applicable code

### **Objective**

Prevent an electrical hazard

### **6.0301.1h Fresh air filtration**

#### **Specification**

All mechanically-supplied outdoor air must pass through a filter before combining with conditioned air

Filtration must meet a minimum efficiency of MERV 8

Filter or air cleaning systems that intentionally produce ozone are not allowed

### **Objective**

Outdoor air filtered for particles

### **6.0301.1i Filter accessibility and fit**

#### **Specification**

Install filtration in a readily accessible location for service

Filter opening must allow filter to be fully removed and inserted without bending or damaging the filter

Filter access panel must include gasket or comparable sealing mechanism and fit snugly against exposed edge of filter when closed

Filter plenum must be airtight and mechanically fastened to adjoining ductwork

**Objective**

Filter accessible for service and prevents air bypass

**6.0301.1j Access**

**Specification**

Ensure motorized dampers and service disconnect switches are accessible for maintenance according to NEC, or applicable building code

**Objective**

Serviceable parts are readily accessible

**6.0301.1k Ducting**

**Specification**

Install all ducting in accordance with SWS detail for "Ventilation Ducts"

**Objective**

Unrestricted ventilation air flow

**6.0301.1l Fire dampers**

**Specification**

If fire dampers are required in the fresh air supply duct, install them according to applicable building code

Fire dampers must be accessible for inspection and/or testing

Sealing activities must not interfere with the operation of fire dampers, balancing dampers, or backdraft dampers

**Objective**

Fire dampers function effectively and are accessible

### **6.0301.1m System balancing**

#### **Specification**

Adjust fan speed, dampers, and registers until design specifications are met

#### **Objective**

Ensure complete dwelling ventilation

### **6.0302.1 Individual Exhaust Fan Serving Entire Dwelling**

Section: Ventilation

Topic: Whole-Building Ventilation

Sub-Topic: Exhaust Ventilation

#### **Desired Outcome**

Safe, efficient, and adequate whole dwelling exhaust ventilation

### **6.0302.1a Fan selection**

#### **Specification**

Select a fan that:

uses an ECM motor designed for continuous operation

produces no more than 1.0 sones at maximum speed

has an efficacy of 2.8 cfm/watt or more

#### **Objective**

Select efficient and quiet equipment

### **6.0302.1b Sealant selection**

## **Specification**

Select sealants that:

are compatible with their intended surfaces,

allow for differential expansion and contraction between dissimilar materials,

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

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

## **Objective**

Select safe and effective sealant

### **6.0302.1c Termination location**

## **Specification**

Terminate exhaust system to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Install terminations: A minimum of 3' away from any property line; A minimum of 3' away from operable opening to houses; A minimum of 10' away from mechanical intake; Above the snow-line

If the termination is at the soffit, seal soffit vents within 6' of the termination

## **Objective**

Prevent exhaust from reentering the structure

### **6.0302.1d Pest exclusion**

## **Specification**

Install corrosion resistant screen, louver, or grille material over exterior termination with a hole size of no less than 1/4" and no greater than 1/2" in any direction

## **Objective**

Prevent pest entry while allowing proper air flow.

### **6.0302.1e Damper**

#### **Specification**

If the fan does not contain an integrated damper, install a damper that:

opens in the direction of the desired flow

closes when the system is off

## **Objective**

Prevent unwanted air movement while not restricting desired air flow

### **6.0302.1f Interior intake location**

#### **Specification**

Install exhaust intake in a central location within the main body of the dwelling

## **Objective**

Effective location for removal of contaminants

### **6.0302.1g Opening preparation**

#### **Specification**

Cut hole for exhaust intake leaving no more than a 1/4" gap on each side of the fan assembly

## **Objective**

Properly sized opening

### **6.0302.1h Fan orientation**

## **Specification**

Orient the fan outlet toward the final termination location and so the effective length of the duct run is as short as possible

## **Objective**

Short, effective fan venting

### **6.0302.1i Fan mounting**

## **Specification**

Mount fan using mechanical fasteners and per manufacturer's specifications so that fan housing does not shake, rattle, or vibrate when operating

## **Objective**

Securely mounted fan

### **6.0302.1j Wiring**

## **Specification**

Install all electrical wiring according to manufacturer specifications and applicable code

## **Objective**

Prevent an electrical hazard

### **6.0302.1k Sealing**

## **Specification**

Seal gap between the fan housing and interior surface

Seal fan housing to be substantially airtight

## **Objective**

Fan housing sealed to prevent air movement (except through the designed outlet) at 50PA of pressure

### **6.0302.1l Insulate housing**

#### **Specification**

Insulate fan housing located outside the thermal boundary to a minimum of R-8 or cover with insulation of more than R-8

## **Objective**

Prevent condensation

### **6.0302.1m Fan access**

#### **Specification**

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

## **Objective**

Accessible for service

### **6.0302.1n Venting**

#### **Specification**

Duct and terminate fan to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors, in accordance with SWS detail for "Ventilation Ducts"

## **Objective**

Exhausted to outdoors

### **6.0302.1o System balancing**

## **Specification**

Adjust fan speed, dampers, and registers until design specifications are met

## **Objective**

Ensure complete dwelling ventilation

## **6.0303.1 HRV/ERV Installation**

Section: Ventilation

Topic: Whole-Building Ventilation

Sub-Topic: Balanced Ventilation

## **Desired Outcome**

Efficient, effective, safe, and adequate ventilation air

### **6.0303.1a Fan selection**

## **Specification**

Select Energy or Heat Recovery Ventilators (ERV/HRV) that are ENERGY STAR, equivalent, or better

## **Objective**

Select efficient equipment

### **6.0303.1b Wiring**

## **Specification**

Install all electrical wiring according to manufacturer specifications and applicable code

## **Objective**

Prevent an electrical hazard

### **6.0303.1c Exterior exhaust termination location**

#### **Specification**

Terminate exhaust system to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Install terminations: A minimum of 3' away from any property line; A minimum of 3' away from operable opening to houses; A minimum of 10' away from mechanical intake; Above the snow-line

If the termination is at the soffit, seal soffit vents within 6' of the termination

#### **Objective**

Prevent exhaust from reentering the structure

### **6.0303.1d Exterior intake location**

#### **Specification**

Install intake to pull air from the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors

Install intake:

A minimum of 6" from grade;

A minimum of 10' from contaminant sources or exhaust outlets;

Above local snow or flood line;

A minimum of 18" above an asphalt based roof;

Never on a flat roof

#### **Objective**

Unrestricted entry of contaminant-free air

### **6.0303.1e Pest exclusion**

#### **Specification**

Install corrosion resistant screen, louver, or grille material over exterior terminations with a hole size of no less than 1/4" and no greater than 1/2" in any direction

### **Objective**

Prevent pest entry while allowing proper air flow.

### **6.0303.1f Interior intake location**

#### **Specification**

Install interior intakes a minimum of 10' from interior fresh air supplies, cooking surfaces, or combustion appliances

### **Objective**

Remove pollutants without damaging fan or interfering with fresh air supply

### **6.0303.1g Interior supply location**

#### **Specification**

Install interior fresh air supply:

near high traffic areas and occupied spaces (e.g., living rooms, hallways, bedrooms)

not within 10' of interior exhaust intakes

### **Objective**

Supply fresh air where needed

### **6.0303.1h Combining air streams**

#### **Specification**

If combining ducts, combine them on the upstream side of fan using "Y"-fittings or collection boxes

Do not combine/connect dryer, kitchen, or garage exhaust streams with any other exhaust stream

## **Objective**

Effective, safe exhaust of air from multiport systems

### **6.0303.1i Backdraft prevention**

#### **Specification**

Ensure system contains a backdraft damper between the ventilator and all exterior terminations/intakes that only allows air flow in the desired direction

Equip outdoor air intakes and exhausts with automatic or gravity dampers that close when the ventilation system is not operating

## **Objective**

Prevent unwanted air movement

### **6.0303.1j Fresh air filtration**

#### **Specification**

All mechanically-supplied outdoor air must pass through a filter before combining with conditioned air

Filtration must meet a minimum efficiency of MERV 8

Filter or air cleaning systems that intentionally produce ozone are not allowed.

## **Objective**

Outdoor air filtered for particles

### **6.0303.1k Fan mounting**

#### **Specification**

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

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

## **Objective**

Secure, vibration-isolated ventilator

### **6.0303.1l Sealing**

#### **Specification**

Seal all air moving portions of the system using UL 181 products without interfering with the function of dampers

## **Objective**

Airtight ventilation system with freely operating dampers

### **6.0303.1m Condensate drain**

#### **Specification**

If unit has a condensate drain, connect drain according to manufacturer specifications to a drain location approved by applicable code

Insulate all condensate lines outside the thermal boundary to a minimum of R-4

## **Objective**

Safe and reliable condensate drainage

### **6.0303.1n Access**

#### **Specification**

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

## **Objective**

Serviceable parts are readily accessible

### **6.0303.1o Fire dampers**

#### **Specification**

If fire dampers are required in the fresh air supply duct, install them according to applicable building code

Fire dampers must be accessible for inspection and/or testing

Sealing activities must not interfere with the operation of fire dampers, balancing dampers, or backdraft dampers

#### **Objective**

Fire dampers function effectively and are accessible

### **6.0303.1p System balancing**

#### **Specification**

Adjust fan speed, dampers, and registers until the incoming air volume is equal to the outgoing air volume

If the HRV/ERV is ducted to the air handler, balance it with the air handler running

#### **Objective**

Ensure complete dwelling ventilation

### **6.0303.1q Very cold climate considerations**

#### **Specification**

In climate zones 6B, 7, and 8 (as defined by ASHRAE 62.2) do not install ERVs unless they are equipped with frost controls

#### **Objective**

Prevent freezing of ventilators and condensation

### **6.0303.1r Hot-humid climate considerations**

## **Specification**

In climate zones 0A, 1A, 2A (as defined by ASHRAE 62.2) it is preferential to install an ERV rather than an HRV

Do not terminate ventilation air intake at the roof

Determine whether net latent load from ventilation (both natural and mechanical) requires dehumidification; if so, install dehumidification

## **Objective**

Prevent excessive heat and moisture from entering the ventilation air.

## **6.0306.1 Decommissioning Ventilation Systems**

Section: Ventilation

Topic: Whole-Building Ventilation

Sub-Topic: Decommissioning

### **Desired Outcome**

Safe and proper elimination of ventilation components

### **6.0306.1a Power supply**

#### **Specification**

Disconnect power supply and terminate it in a visible junction box per applicable code

#### **Objective**

Safely disconnect and terminate power supplies

### **6.0306.1b Fan and component removal**

#### **Specification**

Remove all ventilation components (i.e., fans, ducts, terminations) from dwelling

## **Objective**

Preserve aesthetics and thermal and pressure boundary

### **6.0306.1c Sealing holes and openings**

## **Specification**

Seal and insulate all openings and voids left by the removal of the ventilation system including exterior terminations

## **Objective**

Preserve the thermal/pressure boundary

### **6.0306.1d Disposal**

## **Specification**

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

Permanently decommission old equipment

## **Objective**

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

## **7.0101.1 Refrigerator and Freezer Replacement**

Section:Baseload

Topic:Plug Load

Sub-Topic:Refrigeration

## **Desired Outcome**

Safe, efficient, compliant, and accessible appliance installation

### **7.0101.1a Pre-work qualifications**

#### **Specification**

Electrical receptacle meets the requirements of NFPA 70 (Article 440)

#### **Objective**

Safe electrical connection

### **7.0101.1b Selection**

#### **Specification**

Select an ENERGY STAR qualified appliance, equivalent, or better

Select appliance with a minimum one-year warranty that provides a replacement appliance if repeated issues relating to health, safety, or performance occur

Ensure new appliance will not block access to light switches, cabinets, etc. and will fit through the smallest opening between the outside and installation location

#### **Objective**

Select safe, efficient, and durable appliance

### **7.0101.1c Installation**

#### **Specification**

Install appliance according to manufacturer specifications and applicable code

#### **Objective**

Safe and proper installation

### **7.0101.1d Accessibility**

#### **Specification**

Where applicable, ensure appliance is accessible as required by the Federal Fair Housing Act and ICC A117.1

The appliance shall not reduce required maneuvering clearances in the kitchen to less than that permitted by local, state, or federal guidelines

**Objective**

Accessible kitchen

**7.0101.1e Disposal**

**Specification**

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

Permanently decommission old appliance

**Objective**

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

**7.0101.1f Documentation**

**Specification**

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

**Objective**

Manufacturer supplied information available to occupant

**7.0101.2 Refrigerator/Freezer Clean and Tune**

Section:Baseload

Topic:Plug Load

Sub-Topic:Refrigeration

## **Desired Outcome**

Improve refrigeration efficiency without effecting performance

### **7.0101.2a Clearances and location**

#### **Specification**

If possible, position the appliance to allow sufficient air flow over coils according to manufacturer specifications (i.e., move away from wall in back, remove excessive clutter from top)

Provide shading of windows or doors that allow direct sunlight to affect appliance function

Direct heating supply register air flow away from appliance

#### **Objective**

Sufficient airflow to allow refrigerant heat transfer to occur effectively

### **7.0101.2b Coil cleaning**

#### **Specification**

Gently vacuum all debris from exterior coils

Using warm water, clean the coils and exterior surfaces until critical air flow surfaces are clean

Vacuum out all compressor and control areas and underneath the appliance and all air venting openings

#### **Objective**

Improved air flow through refrigerant coils and increased compressor heat removal

### **7.0101.2c Condensation settings**

#### **Specification**

Set condensation controls in the appropriate position, based on moisture load in the house

## **Objective**

Reduce unnecessary energy use

### **7.0101.2d Temperature settings**

#### **Specification**

Set and verify interior appliance temperatures at 0 degrees F for freezer, and 35-40 degrees F for refrigerator

## **Objective**

Food safely preserved

### **7.0102.1 Consumer Electronics Replacement**

Section:Baseload

Topic:Plug Load

Sub-Topic:Electronics

#### **Desired Outcome**

Decreased electricity consumption without reducing performance

### **7.0102.1a Pre-work qualifications**

#### **Specification**

Verify electrical receptacle meets the requirements of NFPA 70 (Article 440)

## **Objective**

Safe electrical connection

### **7.0102.1b Selection**

#### **Specification**

Select equipment:

that is ENERGY STAR qualified, equivalent, or better

that does not have to be left on during non-use periods for updates (e.g., gaming systems, set-top boxes)

with system standby losses of one watt or less

### **Objective**

Select efficient appliances

### **7.0102.1c Installation**

#### **Specification**

Install equipment according to manufacturer specifications (e.g., for air circulation) and applicable code

Enable all energy saving features unless specifically directed otherwise by the occupant

### **Objective**

Safe and compliant installation

### **7.0102.1d Disconnecting means**

#### **Specification**

Provide a readily accessible means of disconnection (e.g., power strip, timer) for equipment that must be disconnected from the power source to avoid standby losses and whose performance will not be damaged by being disconnected

### **Objective**

Reduce standby energy use

### **7.0102.1e Disposal**

#### **Specification**

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

Permanently decommission old equipment

### **Objective**

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

### **7.0102.1f Documentation**

#### **Specification**

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

### **Objective**

Manufacturer supplied information available to occupant

### **7.0103.1 Lighting Replacement**

Section:Baseload

Topic:Plug Load

Sub-Topic:Lighting

#### **Desired Outcome**

Improved lighting efficacy without performance loss

### **7.0103.1a Selection**

#### **Specification**

Select lighting that:

is appropriate for the intended application (e.g., enclosed, dimmable, potential for breakage, indoor, and outdoor)

provide lighting level quality required for the intended application (e.g., task lighting, hazards lighting, nightlights)

is the highest level of efficiency within a technology (e.g., LED bulbs)

are ENERGY STAR qualified, equivalent or better, and UL approved

facilitate upgrade to future lighting technologies

is rated no more than the rated wattage of fixture

### **Objective**

Select efficient, reliable, and safe lighting improvements

### **7.0103.1b Installation**

#### **Specification**

Install lighting in accordance with manufacturer specifications and applicable code (i.e., NFPA 70, NFPA 101, NECA/IESNA 500)

If applicable, clean lens and reflector before installing new bulb

### **Objective**

Safe and proper installation

### **7.0103.1c Electrical installation**

#### **Specification**

Install all electrical wiring according to applicable code (i.e., NFPA 70)

### **Objective**

Safe electrical installation

### **7.0103.1d Disposal**

## **Specification**

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

Permanently decommission old equipment

## **Objective**

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

### **7.0103.1e Documentation**

## **Specification**

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

## **Objective**

Manufacturer supplied information available to occupant

### **7.0103.2 Lighting Reduction**

Section:Baseload

Topic:Plug Load

Sub-Topic:Lighting

## **Desired Outcome**

Reduce lighting density without compromising life safety

### **7.0103.2a Design**

## **Specification**

Follow IESNA protocols for appropriate light levels for certain tasks when designing delamping procedure

Ensure final lighting levels are in accordance with ASHRAE 90.1 or 90.2

Ensure final egress lighting levels are in accordance with NFPA 70 and 101

Ensure that delamping does not impact required egress lighting, as required by ANSI/NFPA 101

### **Objective**

Determine appropriate strategy

### **7.0103.2b Removal**

#### **Specification**

De-energize circuit and lock out power before work begins

Remove bulbs or fixtures per plan ensuring that no open connections will remain after work is finished

Terminate all unused electrical connections in appropriate covered junction box per NFPA 70

Seal any penetrations created by removal as per ANSI/NFPA /ICC Fire Code

### **Objective**

Safe and proper removal of fixtures and bulbs

### **7.0103.2c Reuse**

#### **Specification**

If removed bulbs or fixtures meet retrofit standards and are operational, store them in a dry location for reuse

### **Objective**

Store appropriate lighting equipment for future use

### **7.0103.2d Disposal**

#### **Specification**

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

Permanently decommission old equipment

### **Objective**

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

## **7.0103.3 Ballast Replacement**

Section:Baseload

Topic:Plug Load

Sub-Topic:Lighting

### **Desired Outcome**

Improved lighting efficacy without performance loss

### **7.0103.3a Selection**

#### **Specification**

Select pulse start, high-efficiency, electronic ballasts that meet the appropriate nationally recognized product standards (ANSI C82.1, ANSI C82.4, UL 924, UL 1029, NEMA) and have a ballast factor of 0.85 or greater

Select ballasts that match the input and output voltage of the existing fixture, that fit within the existing enclosure, and will support the necessary wattage of the bulbs

### **Objective**

Select safe, efficient, and effective ballasts

### **7.0103.3b Removal and installation**

#### **Specification**

De-energize circuit and lock out power before work begins

Install ballasts in accordance with manufacturer specifications

Clean the lens and reflector once installation is complete

### **Objective**

Safe and effective installation

### **7.0103.3c Disposal**

#### **Specification**

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

Permanently decommission old equipment

### **Objective**

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

### **7.0103.3d Documentation**

#### **Specification**

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

### **Objective**

Manufacturer supplied information available to occupant

### **7.0103.6 Security Lighting**

Section:Baseload

Topic:Plug Load

Sub-Topic:Lighting

### **Desired Outcome**

Efficient, effective security lighting that minimizes disturbances of occupant and light pollution

### **7.0103.6a Selection**

#### **Specification**

Select security light fixtures that:

- are UL approved for location installed (i.e., indoor, outdoor, wet location)
- provide the required lighting conditions with the lowest possible energy-use
- are vandal-proof
- are dark sky approved
- are ENERGY STAR qualified, equivalent, or better

#### **Objective**

Select efficient, reliable, and safe lighting improvements

### **7.0103.6b Installation**

#### **Specification**

De-energize circuit and lock out power before work begins

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

Aim light fixtures to minimize light emitted above the horizontal, beyond the perimeter of the property, and not directly into any window of a residence

Clean the lens and reflector once installation is complete

#### **Objective**

Safe, effective, and efficient installation that does not disturb occupants

### **7.0103.6c Controls**

## **Specification**

Install both photo and motion sensors and configure to only activate when sun is down and to switch off within 5 minutes if no motion is detected

## **Objective**

Energy saving control strategy

### **7.0103.6d Disposal**

## **Specification**

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

Permanently decommission old equipment

## **Objective**

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

### **7.0103.6e Documentation**

## **Specification**

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

## **Objective**

Manufacturer supplied information available to occupant

### **7.0103.7 Daylighting**

Section: Baseload

Topic: Plug Load

Sub-Topic: Lighting

## **Desired Outcome**

Reduce need for artificial lighting

### **7.0103.7a Daylighting**

#### **Specification**

Replace or maneuver window coverings (e.g., blinds, shades, movable insulation) to maximize useful daylight where appropriate

#### **Objective**

Improve use of daylight for interior lighting

### **7.0104.1 Occupancy Sensors**

Section:Baseload

Topic:Plug Load

Sub-Topic:Lighting Controls

#### **Desired Outcome**

Lighting only on when needed without compromising required lighting levels, or safety

#### **7.0104.1a Selection**

#### **Specification**

Select sensors that:

are compatible with the existing wiring and lighting fixture

is UL approved and listed for the installed location

#### **Objective**

Select efficient, reliable, and safe lighting control

### **7.0104.1b Installation**

#### **Specification**

Install sensor in accordance with NFPA 70 and manufacturer specifications

Do not install occupancy sensors in areas accessed for electrical and mechanical maintenance

Set controls to match the intended use of the space (i.e., time off setting not too short or too long)

#### **Objective**

Safe installation that doesn't compromise service access

### **7.0104.1c Documentation**

#### **Specification**

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

#### **Objective**

Manufacturer supplied information available to occupant

## **7.0104.2 Stand-Alone Timers**

Section:Baseload

Topic:Plug Load

Sub-Topic:Lighting Controls

#### **Desired Outcome**

Reduce lighting run time without compromising required lighting levels, or safety

### **7.0104.2a Selection**

#### **Specification**

Select timer that:

is compatible with existing wiring and lighting

is UL approved and listed for the installed location

has at least 10 hours of battery backup time

has at least two programmable schedules

has an appropriate manual override

### **Objective**

Safe, effective, and reliable timer selection

### **7.0104.2b Installation**

#### **Specification**

Install timer in accordance with NFPA 70 and manufacturer specifications, in a secure location, and in location appropriate enclosure (e.g., weatherproof)

Do not install timers for egress lighting required by NFPA 101

### **Objective**

Safe, secure, and proper installation

### **7.0104.2c Timer settings**

#### **Specification**

Set timer to turn off exterior fixtures when there is sufficient daylight (civil twilight) or when lighting is no longer needed at night per ASHRAE 90.1 or 90.2

Set timer to turn off interior fixtures when light is no longer needed in the space

### **Objective**

Lights on when required

### **7.0104.2d Documentation**

#### **Specification**

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

#### **Objective**

Manufacturer supplied information available to occupant

### **7.0104.3 Motion Control Sensors**

Section:Baseload

Topic:Plug Load

Sub-Topic:Lighting Controls

#### **Desired Outcome**

Reduce lighting run time without compromising required lighting levels, or safety

### **7.0104.3a Selection**

#### **Specification**

Select sensor that:

is compatible with existing wiring and lighting

is UL approved and listed for the installed location

is location and climate appropriate (e.g., outdoor weatherproof fixture)

#### **Objective**

Safe, effective, and reliable sensor selection

### **7.0104.3b Location**

#### **Specification**

Locate sensor where it will minimize false starts

**Objective**

Reduce unnecessary operation of lighting

**7.0104.3c Installation**

**Specification**

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

**Objective**

Safe, secure, and proper installation

**7.0104.3d Settings**

**Specification**

Set controls of motion sensor based on anticipated occupant usage or security needs

Set control to turn off lighting if no motion is detected for a maximum of 15 minutes

**Objective**

Meet lighting needs for area

**7.0104.3e Documentation**

**Specification**

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

**Objective**

Manufacturer supplied information available to occupant

## **7.0104.4 Outdoor Photo Sensors**

Section:Baseload

Topic:Plug Load

Sub-Topic:Lighting Controls

### **Desired Outcome**

Lights only on when needed without compromising required lighting levels, or safety

### **7.0104.4a Selection**

#### **Specification**

Select sensor that:

is compatible with existing wiring and lighting

is UL approved for installation location (e.g., UL 60730-1)

is location and climate appropriate (e.g., outdoor weatherproof fixture)

Select fixture that allows for replacement of photo sensor independently

#### **Objective**

Safe, effective, serviceable, and reliable sensor selection

### **7.0104.4b Installation**

#### **Specification**

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

Position sensor to properly sense natural light, but shielded from artificial light sources (e.g., other outdoor lighting)

#### **Objective**

Safe and secure installation that operates lighting when needed without interruption

#### **7.0104.4c Documentation**

##### **Specification**

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

##### **Objective**

Manufacturer supplied information available to occupant

#### **7.0105.1 Washing Machine**

Section:Baseload

Topic:Plug Load

Sub-Topic:Laundry

##### **Desired Outcome**

Reduce energy and water usage with a fully functioning washing machine that does not inhibit accessibility

#### **7.0105.1a Pre-work qualifications**

##### **Specification**

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

##### **Objective**

Safe electrical connection

#### **7.0105.1b Selection**

##### **Specification**

Select appliance that:

is an ENERGY STAR and WaterSense appliance, equivalent, or better

has a minimum one-year warranty that provides a replacement appliance if repeated issues relating to health, safety, or performance occur

will fit in location with manufacturer required clearance without blocking access to cabinets and light switches

fits through the smallest opening between outdoors and the installation location

that has standby losses of one watt or less

### **Objective**

Efficient, safe, and reliable appliance selected

### **7.0105.1c Installation**

#### **Specification**

Install appliance according to manufacturer specifications and applicable code

### **Objective**

Safe, secure, and proper installation

### **7.0105.1d Water management**

#### **Specification**

Install shut-off valves if not already present

Install hoses that can withstand the local water pressure

If located in or above conditioned area, install an overflow pan and drain to a code approved location

### **Objective**

Provide service shutoffs, durable hoses, and prevent water damage to structure

### **7.0105.1e Accessibility**

#### **Specification**

Where applicable, ensure appliance is accessible as required by the Federal Fair Housing Act and ICC A117.1

The appliance shall not reduce required maneuvering clearances to less than that permitted by local, state, or federal guidelines

#### **Objective**

Accessible home

### **7.0105.1f Disposal**

#### **Specification**

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

Permanently decommission old equipment

#### **Objective**

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

### **7.0105.1g Documentation**

#### **Specification**

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

#### **Objective**

Manufacturer supplied information available to occupant

## **7.0105.2 Clothes Dryer**

Section:Baseload  
Topic:Plug Load  
Sub-Topic:Laundry

### **Desired Outcome**

Safely reduce energy use for drying clothes

### **7.0105.2a Pre-work qualifications**

#### **Specification**

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

#### **Objective**

Safe electrical connection

### **7.0105.2b Selection**

#### **Specification**

Select dryer that:

is equipped with moisture sensor

has energy features that reduce both peak electric demand and absolute energy use

has a standby losses of one watt or less

best matches the venting options (e.g., central location, length of vent, cost of venting)

has a minimum one-year warranty that provides a replacement appliance if repeated issues relating to health, safety, or performance occur

will fit in location with manufacturer required clearance without blocking access to cabinets and light switches

fits through the smallest opening between outdoors and the installation location

**Objective**

Efficient, safe, and reliable appliance selected

**7.0105.2c Installation****Specification**

Install appliance according to manufacturer specifications and applicable code

**Objective**

Safe, secure, and proper installation

**7.0105.2d Dryer venting****Specification**

Vent dryer to outdoors according to SWS detail 6.0202.1 (Ventilation: Local Ventilation: Appliance Exhaust: Clothes Dryer)

**Objective**

Dryer vented to outdoors safely and effectively

**7.0105.2e Accessibility****Specification**

Where applicable, ensure appliance is accessible as required by the Federal Fair Housing Act and ICC A117.1

The appliance shall not reduce required maneuvering clearances to less than that permitted by local, state, or federal guidelines

**Objective**

Accessible home

### **7.0105.2f Disposal**

#### **Specification**

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

Permanently decommission old appliance

#### **Objective**

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

### **7.0105.2g Documentation**

#### **Specification**

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

#### **Objective**

Manufacturer supplied information available to occupant

## **7.0188.1 Ceiling Fan Replacement**

Section:Baseload

Topic:Plug Load

Sub-Topic:Special Considerations

#### **Desired Outcome**

Reduce energy use by installing an efficient, safe, compliant, and operable ceiling fan without reducing performance

### **7.0188.1a Pre-work qualifications**

#### **Specification**

Verify electrical outlet box meets the requirements of NFPA 70 (Section 314.27(C)) for ceiling fan

mounting

### **Objective**

Safe and secure mechanical attachment

### **7.0188.1b Selection**

#### **Specification**

Select ceiling fan and lighting that:

is ENERGY STAR qualified, equivalent, or better

is compatible with the existing switching and wiring configuration

is of similar functionality and size

carries a minimum of a 1-year warranty

### **Objective**

Select safe, efficient, effective, compatible, and durable fan

### **7.0188.1c Installation**

#### **Specification**

Install fixture in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications

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

### **Objective**

Compliant and safe installation

### **7.0188.1d Lighting**

#### **Specification**

Install and select light bulbs for fixture according to SWS detail 7.0103.1 (Lighting Replacement)

### **Objective**

Improved lighting efficacy without performance loss

### **7.0188.1e Disposal**

#### **Specification**

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

Permanently decommission old equipment

### **Objective**

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

### **7.0188.1f Documentation**

#### **Specification**

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

### **Objective**

Manufacturer supplied information available to occupant

### **7.0201.1 Low-Flow Devices**

Section:Baseload

Topic:Water Conservation

Sub-Topic:Water Preservation Devices

#### **Desired Outcome**

Leak-free and safe installation of water saving devices without affecting performance

### **7.0201.1a Pre-work qualifications**

#### **Specification**

Verify current plumbing infrastructure is sufficient to support the installation(s) and water is free of visible debris that may clog the equipment

#### **Objective**

Verify adequacy of plumbing and water source

### **7.0201.1b Selection**

#### **Specification**

Select showerheads rated for 2.5 gallons per minute (GPM) or less that include an antiscald valve

If multiple heads are provided in a shower stall, the total flow rate may not exceed 2.5 GPM

Select features that meet any special needs of the occupant (e.g., shut off, swivel, handheld showers)

Select aerators with a flow rate of 2.2 GPM or less

#### **Objective**

Select appropriate low-flow devices

### **7.0201.1c Installation**

#### **Specification**

Install equipment in accordance with manufacturer specifications and applicable building code

Install low-flow devices using a non-hardening thread sealant (i.e., thread tape)

#### **Objective**

Safe and proper installation that is serviceable

### **7.0201.1d Disposal**

#### **Specification**

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

Permanently decommission old equipment

#### **Objective**

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

### **7.0201.1e Documentation**

#### **Specification**

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

#### **Objective**

Manufacturer supplied information available to occupant

## **7.0201.2 Dishwasher**

Section:Baseload

Topic:Water Conservation

Sub-Topic:Water Preservation Devices

#### **Desired Outcome**

Reduce dishwashing energy use with a leak-free and safe dishwasher installation

### **7.0201.2a Pre-work qualifications**

#### **Specification**

Verify electrical receptacle or direct connection circuit meets the requirements of NFPA 70 (Article 422)

## **Objective**

Safe electrical connection

### **7.0201.2b Selection**

#### **Specification**

Select an appliance that:

is ENERGY STAR qualified, equivalent, or better

fits in the available space without blocking access to light switches, cabinets, etc.

includes a minimum 1-year warranty

## **Objective**

Select safe, efficient, and reliable appliance

### **7.0201.2c Installation**

#### **Specification**

De-energize circuit and lock out power before work begins

Install equipment in accordance with NFPA 70 (Article 422.31), manufacturer specifications, and applicable code

Install plumbing supply lines with the shortest length possible

## **Objective**

Safe and proper installation

### **7.0201.2d Disposal**

#### **Specification**

Permanently remove old appliance from job site and recycle or dispose of removed appliance and

refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990)

Permanently decommission old appliance

### **Objective**

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

### **7.0201.2e Documentation**

#### **Specification**

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

#### **Objective**

Manufacturer supplied information available to occupant

### **7.0301.1 Pipe Insulation**

Section:Baseload

Topic:Water Heating

Sub-Topic:Thermal Loss Reduction

#### **Desired Outcome**

Safely reduce thermal loss and prevent freezing of water distribution piping

#### **7.0301.1a Pre-work qualifications**

##### **Specification**

Confirm sufficient clearance exists between pipes and heat-producing devices (e.g., combustion venting)

##### **Objective**

Verify pipes can be safely insulated

### **7.0301.1b Insulation selection**

#### **Specification**

Select insulation that:

is a minimum of R-3

is a vapor retarder

is the correct interior diameter to match pipes

is UV-protected if installed outside

#### **Objective**

Select durable and correctly sized pipe insulation

### **7.0301.1c Installation**

#### **Specification**

Install insulation without gaps

Do not install insulation around pumps (i.e., prevent overheating)

Seal all pipe insulation seams, joints, connections with tape, tie straps, or other independent means (i.e., manufactured adhesive seam seal is not sufficient)

#### **Objective**

Safe, continuous, and durable installation

### **7.0301.1d Clearance**

#### **Specification**

Maintain a minimum clearance of 6" between combustible pipe insulation and fuel-fired water heater draft hood and/or single wall metal vent materials

#### **Objective**

Prevent a fire hazard

## **7.0301.2 Tank Insulation**

Section:Baseload

Topic:Water Heating

Sub-Topic:Thermal Loss Reduction

### **Desired Outcome**

Safely reduce standby loss from storage tanks

### **7.0301.2a Pre-work qualifications**

#### **Specification**

Verify tank is not labeled as prohibiting insulation

Verify sufficient space exists to wrap tank

#### **Objective**

Verify tank can be insulated

### **7.0301.2b Insulation selection**

#### **Specification**

Select an insulation that:

is a minimum of R-10

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

is clearly labeled with R-value

#### **Objective**

Select safe and effective insulation of the correct R-value

### **7.0301.2c Insulation installation**

#### **Specification**

Install insulation according to manufacturer specifications over entire storage tank while ensuring that insulation does not obstruct pressure relief valve, plumbing pipes, gas valves, combustion air intakes, etc.

Permanently secure insulation with minimal compression

Seal all seams and edges airtight using compatible and durable tape

#### **Objective**

Safe, effective, and durable installation

### **7.0301.2d Clearance**

#### **Specification**

Maintain a minimum clearance of 6" between combustible tank insulation and fuel-fired water heater draft hood and/or single wall metal vent materials

Do not wrap the top of fuel-fired water heaters or cover combustion air intakes

#### **Objective**

Prevent a fire hazard

### **7.0301.2e Service access**

#### **Specification**

Pre-cut flaps at access plates and label them clearly indicating access purpose

Tap access flaps closed

#### **Objective**

Provide easy service access and prevent future damage to insulation

## **7.0302.1 Electric Storage Tank Water Heater**

Section:Baseload

Topic:Water Heating

Sub-Topic:Water Heater Installation

### **Desired Outcome**

Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible water heater

### **7.0302.1a Pre-work qualifications**

#### **Specification**

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

#### **Objective**

Verify adequacy of plumbing

### **7.0302.1b Equipment selection**

#### **Specification**

Select a water heater that:

is ENERGY STAR certified, equivalent, or better

has an Energy Factor (EF) of 0.93 or better

fits in the installation space with required clearances

provides sufficient hot water for the home and occupants

#### **Objective**

Select efficient and properly sized water heater

### **7.0302.1c Location**

## **Specification**

Install appliance where it is protected from freezing and accessible for service

## **Objective**

Select freezeproof, safe, and accessible location

### **7.0302.1d Installation**

## **Specification**

Install water heater in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications

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

## **Objective**

Compliant and safe installation

### **7.0302.1e Equipment accessibility**

## **Specification**

Provide a level working space not less than 30" in length and 30" in width in front of the control side of the appliance

Install appliance and plumbing to allow for inspection, maintenance, and replacement of the appliance and its components, without disturbing other installed equipment, controls, piping, and components, other than what requires repair/replacement

Ensure that anode rod is accessible for replacement

## **Objective**

Ensure the appliance can be easily maintained and replaced

### **7.0302.1f TandP valve and piping**

## **Specification**

Install a Temperature and Pressure (TandP) relief valve per the IRC and manufacturer specifications

Pipe the valve to within 6" of the floor or drain pan or to the outdoors and must terminate in an observable location

Select piping material based on IRC requirements

## **Objective**

Direct scalding water away from occupants

### **7.0302.1g Emergency drain pan**

## **Specification**

If appliance is installed in or above conditioned space or in a location where water damage could occur, install a drain pan according to the requirements of the IRC

Drain pan to the exterior of the building

## **Objective**

Prevent water damage from leaking water

### **7.0302.1h Shut-off valves**

## **Specification**

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

## **Objective**

Allow isolation of tank

### **7.0302.1i Expansion tank**

## **Specification**

Install an expansion tank anytime a storage water heater is supplied with cold water that passes through a check valve, pressure reducing valve or backflow preventer

Connect the tank to the cold water supply line at a point that is downstream of all check valves, pressure reducing valves and backflow preventers

Size thermal expansion tanks in accordance with the tank manufacturer's instructions and applicable code (e.g., IRC, IBC)

### **Objective**

Protect tank and connected piping from expansion damage or leaks

### **7.0302.1j Dielectric unions**

#### **Specification**

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

### **Objective**

Prevent corrosion between dissimilar metals

### **7.0302.1k Heat traps**

#### **Specification**

Install heat traps on the inlet and outlet piping where not provided by manufacturer

### **Objective**

Reduce thermal loss from convection or siphoning

### **7.0302.1l Discharge temperature settings**

#### **Specification**

Set discharge temperature to not exceed 120 degrees or as prescribed by local code

## **Objective**

Prevent biological growth in tank but prevent scalding

### **7.0302.1n Disposal**

#### **Specification**

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

Permanently decommission old equipment

## **Objective**

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

### **7.0302.1o Documentation**

#### **Specification**

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

## **Objective**

Manufacturer supplied information available to occupant

## **7.0302.2 Fuel-Fired Storage Tank Water Heater**

Section:Baseload

Topic:Water Heating

Sub-Topic:Water Heater Installation

#### **Desired Outcome**

Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible water heater

### **7.0302.2a Pre-work qualifications**

#### **Specification**

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

#### **Objective**

Verify adequacy of plumbing

### **7.0302.2b Equipment selection**

#### **Specification**

Select a system that:

is ENERGY STAR certified, equivalent, or better

includes a low nitrogen oxide burner

fits in the installation space with required clearances

provides sufficient hot water for the home and occupants

#### **Objective**

Select efficient, durable, and properly sized water heater

### **7.0302.2c Location**

#### **Specification**

Install appliance where it is protected from freezing and accessible for service

#### **Objective**

Select freezeproof, safe, and accessible location

### **7.0302.2d Installation**

## **Specification**

Install water heater in compliance with applicable code (e.g., IRC, NFPA 31, NFPA 54) and manufacturer specifications

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

## **Objective**

Compliant and safe installation

### **7.0302.2e Equipment accessibility**

## **Specification**

Provide a level working space not less than 30" in length and 30" in width in front of the control side of the appliance

Install appliance and plumbing to allow for inspection, maintenance, and replacement of the appliance and its components, without disturbing other installed equipment, controls, piping, and components, other than what requires repair/replacement

Ensure that anode rod is accessible for replacement

## **Objective**

Ensure the appliance can be easily maintained and replaced

### **7.0302.2f Fuel supply**

## **Specification**

Install fuel supply components per NFPA 31 (for oil) and NFPA 54 (for gas) and manufacturer specifications

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

Install an emergency fuel cut-off switch within reach of the water heater

## **Objective**

Safe and effective fuel delivery that provides for emergency fuel cut-off

### **7.0302.2g Emergency drain pan**

#### **Specification**

If appliance is installed in or above conditioned space or in a location where water damage could occur, install a drain pan according to the requirements of the IRC

Drain pan to the exterior of the building

#### **Objective**

Prevent water damage from leaking water

### **7.0302.2h Shut-off valves**

#### **Specification**

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

#### **Objective**

Allow isolation of tank

### **7.0302.2i Expansion tank**

#### **Specification**

Install an expansion tank anytime a storage water heater is supplied with cold water that passes through a check valve, pressure reducing valve or backflow preventer

Connect the tank to the cold water supply line at a point that is downstream of all check valves, pressure reducing valves and backflow preventers

Size thermal expansion tanks in accordance with the tank manufacturer's instructions and applicable code (e.g., IRC, IBC)

#### **Objective**

Protect tank and connected piping from expansion damage or leaks

### **7.0302.2j TandP valve and piping**

#### **Specification**

Install a Temperature and Pressure (TandP) relief valve per the IRC and manufacturer specifications

Pipe the valve to within 6" of the floor or drain pan or to the outdoors and must terminate in an observable location

Select piping material based on IRC requirements

#### **Objective**

Direct scalding water away from occupants

### **7.0302.2k Dielectric unions**

#### **Specification**

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

#### **Objective**

Prevent corrosion between dissimilar metals

### **7.0302.2l Heat traps**

#### **Specification**

Install heat traps on the inlet and outlet piping where not provided by manufacturer

#### **Objective**

Reduce thermal loss from convection or siphoning

### **7.0302.2m Discharge temperature settings**

## **Specification**

Set discharge temperature to not exceed 120 degrees or as prescribed by local code

## **Objective**

Prevent biological growth in tank but prevent scalding

### **7.0302.2o Disposal**

## **Specification**

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

Permanently decommission old equipment

## **Objective**

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

### **7.0302.2p Documentation**

## **Specification**

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

## **Objective**

Manufacturer supplied information available to occupant

## **7.0302.3 Heat Pump Storage Tank Water Heater**

Section:Baseload

Topic:Water Heating

Sub-Topic:Water Heater Installation

## **Desired Outcome**

Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible water heater

### **7.0302.3a Pre-work qualifications**

#### **Specification**

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

#### **Objective**

Verify adequacy of plumbing

### **7.0302.3b Equipment selection**

#### **Specification**

Select a water heater that:

is ENERGY STAR certified, equivalent, or better

fits in the installation space with required clearances

provides sufficient hot water for the home and occupants

#### **Objective**

Select efficient and properly sized water heater

### **7.0302.3c Location**

#### **Specification**

Install appliance where it:

is in conditioned space

is accessible for service

has sufficient volume of air per manufacturer specifications

will not affect indoor thermostat readings or blow directly on occupants

### **Objective**

Select indoor, safe, and accessible location with sufficient air volume

### **7.0302.3d Installation**

#### **Specification**

Install water heater in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications

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

### **Objective**

Compliant and safe installation

### **7.0302.3e Equipment accessibility**

#### **Specification**

Provide a level working space not less than 30" in length and 30" in width in front of the control side of the appliance

Install appliance and plumbing to allow for inspection, maintenance, and replacement of the appliance and its components, without disturbing other installed equipment, controls, piping, and components, other than what requires repair/replacement

Ensure that anode rod is accessible for replacement

### **Objective**

Ensure the appliance can be easily maintained and replaced

### **7.0302.3f TandP valve and piping**

## **Specification**

Install a Temperature and Pressure (TandP) relief valve per the IRC and manufacturer specifications

Pipe the valve to within 6" of the floor or drain pan or to the outdoors and must terminate in an observable location

Select piping material based on IRC requirements

## **Objective**

Direct scalding water away from occupants

### **7.0302.3g Emergency drain pan**

## **Specification**

If appliance is installed in or above conditioned space or in a location where water damage could occur, install a drain pan according to the requirements of the IRC

Drain pan to the exterior of the building

## **Objective**

Prevent water damage from leaking water

### **7.0302.3h Shut-off valves**

## **Specification**

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

## **Objective**

Allow isolation of tank

### **7.0302.3i Expansion tank**

## **Specification**

Install an expansion tank anytime a storage water heater is supplied with cold water that passes through a check valve, pressure reducing valve or backflow preventer

Connect the tank to the cold water supply line at a point that is downstream of all check valves, pressure reducing valves and backflow preventers

Size thermal expansion tanks in accordance with the tank manufacturer's instructions and applicable code (e.g., IRC, IBC)

### **Objective**

Protect tank and connected piping from expansion damage or leaks

### **7.0302.3j Dielectric unions**

#### **Specification**

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

### **Objective**

Prevent corrosion between dissimilar metals

### **7.0302.3k Heat traps**

#### **Specification**

Install heat traps on the inlet and outlet piping where not provided by manufacturer

### **Objective**

Reduce thermal loss from convection or siphoning

### **7.0302.3l Discharge temperature settings**

#### **Specification**

Set discharge temperature to not exceed 120 degrees or as prescribed by local code

## **Objective**

Prevent biological growth in tank but prevent scalding

### **7.0302.3m Disposal**

#### **Specification**

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

Permanently decommission old equipment

## **Objective**

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

### **7.0302.3n Documentation**

#### **Specification**

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

## **Objective**

Manufacturer supplied information available to occupant

### **7.0302.5 Tankless On-Demand/Point-Of-Use Appliances**

Section:Baseload

Topic:Water Heating

Sub-Topic:Water Heater Installation

#### **Desired Outcome**

Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible water heater

### **7.0302.5a Pre-work qualifications**

#### **Specification**

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

#### **Objective**

Verify adequacy of plumbing

### **7.0302.5b Equipment selection**

#### **Specification**

Select a water heater that:

is ENERGY STAR certified, equivalent, or better

fits in the installation space with required clearances

provides sufficient hot water for the home and occupants

#### **Objective**

Select efficient and properly sized water heater

### **7.0302.5c Location**

#### **Specification**

Install appliance where it:

is protected from freezing

is accessible for service

will minimize distance between tank and primary hot water outlets

#### **Objective**

Select freeze protected, safe, efficient and accessible location

### **7.0302.5d Installation**

#### **Specification**

Install water heater in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications

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

#### **Objective**

Compliant and safe installation

### **7.0302.5e Equipment accessibility**

#### **Specification**

Provide a level working space not less than 30" in length and 30" in width in front of the control side of the appliance

Install appliance and plumbing to allow for inspection, maintenance, and replacement of the appliance and its components, without disturbing other installed equipment, controls, piping, and components, other than what requires repair/replacement

#### **Objective**

Ensure the appliance can be easily maintained and replaced

### **7.0302.5f Shut-off valves**

#### **Specification**

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

#### **Objective**

Allow isolation of tank

### **7.0302.5g TandP valve and piping**

## **Specification**

Install a Temperature and Pressure (TandP) relief valve per the IRC and manufacturer specifications

Pipe the valve to within 6" of the floor or drain pan or to the outdoors and must terminate in an observable location

Select piping material based on IRC requirements

## **Objective**

Direct scalding water away from occupants

### **7.0302.5h Fuel supply**

## **Specification**

Install fuel supply components per NFPA 31 (for oil) and NFPA 54 (for gas) and manufacturer specifications

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

Install an emergency fuel cut-off switch within reach of the water heater

## **Objective**

Safe and effective fuel delivery that provides for emergency fuel cut-off

### **7.0302.5i Dielectric unions**

## **Specification**

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

## **Objective**

Prevent corrosion between dissimilar metals

### **7.0302.5j Discharge temperature settings**

#### **Specification**

Set discharge temperature to not exceed 120 degrees or as prescribed by local code

#### **Objective**

Prevent biological growth in tank but prevent scalding

### **7.0302.5k Disposal**

#### **Specification**

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

Permanently decommission old equipment

#### **Objective**

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

### **7.0302.5l Documentation**

#### **Specification**

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

#### **Objective**

Manufacturer supplied information available to occupant

## **7.0302.6 Solar Water Heater**

Section:Baseload

Topic:Water Heating

Sub-Topic:Water Heater Installation

## **Desired Outcome**

Adequate hot water supplied by a leak free, safe, durable, efficient, and accessible water heater

### **7.0302.6a Pre-work qualifications**

#### **Specification**

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

If a roof installation is planned, verify that the roof will support the installation (e.g., dead load, wind load) and that the current roof has more than 10 years of useful life remaining

#### **Objective**

Verify adequacy of plumbing

### **7.0302.6b Storage tank selection**

#### **Specification**

Select a storage/backup water heaters that:

is ENERGY STAR certified, equivalent, or better

fits in the installation space with required clearances

provides sufficient hot water for the home and occupants

is insulated to R-12.5 or greater

#### **Objective**

Efficient, and appropriate tank selected

### **7.0302.6c Solar collector location**

#### **Specification**

Locate solar collectors to minimize shading factor and maximize solar gain, but not interfere with other

appliance operation (e.g., chimneys, vents, exhaust terminations)

### **Objective**

Maximize system performance

### **7.0302.6d Installation**

#### **Specification**

Install water heater in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications

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

### **Objective**

Compliant and safe installation

### **7.0302.6e Accessibility**

#### **Specification**

Install and plumb storage tank and solar collectors to allow for inspection, maintenance, and replacement of the appliance and its components

Ensure that anode rod is accessible for replacement

Provide a path that allows the solar collector to be safely accessed without damaging the roof

### **Objective**

System is safely accessible for service

### **7.0302.6f Freeze protection**

#### **Specification**

Incorporate system freeze protection for applicable climates, including, but not limited to, closed glycol loops, drain back systems, supplemental heat, or other methods, as approved by applicable code and

manufacturer specifications

### **Objective**

Prevent freezing liquid in pipes in cold weather climates

### **7.0302.6g Emergency drain pan**

#### **Specification**

If appliance is installed in or above conditioned space or in a location where water damage could occur, install a drain pan according to the requirements of the IRC

Drain pan to the exterior of the building

### **Objective**

Prevent water damage from leaking water

### **7.0302.6h TandP valve and piping**

#### **Specification**

Install a Temperature and Pressure (TandP) relief valve per the IRC and manufacturer specifications

Pipe the valve to within 6" of the floor or drain pan or to the outdoors and must terminate in an observable location

Select piping material based on IRC requirements

### **Objective**

Direct scalding water away from occupants

### **7.0302.6i Dielectric unions**

#### **Specification**

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

## **Objective**

Prevent corrosion between dissimilar metals

### **7.0302.6j Heat traps**

## **Specification**

Install heat traps on the inlet and outlet piping where not provided by manufacturer

## **Objective**

Reduce thermal loss from convection or siphoning

### **7.0302.6k Isolation valves**

## **Specification**

Install a separate water cut-off valve for both the hot and cold incoming water lines at the storage tank, and between each additional components of the system (e.g., mixing valves, solar collector, additional storage tank)

## **Objective**

Allow isolation and service of each system component

### **7.0302.6l Expansion tank**

## **Specification**

Install an expansion tank anytime a storage water heater is supplied with cold water that passes through a check valve, pressure reducing valve or backflow preventer

Connect the tank to the cold water supply line at a point that is downstream of all check valves, pressure reducing valves and backflow preventers

Size thermal expansion tanks in accordance with the tank manufacturer's instructions and applicable code (e.g., IRC, IBC)

## **Objective**

Protect tank and connected piping from expansion damage or leaks

### **7.0302.6m Insulate piping**

#### **Specification**

Insulate all accessible pipes carrying hot water to a minimum R-3 per SWS (Water Heating: Thermal Loss Reduction: Pipe Insulation"

## **Objective**

Reduce heat loss through hot water pipes

### **7.0302.6n Discharge temperature settings**

#### **Specification**

Install a suitable thermostatic mixing valve and set discharge temperature to not exceed 120 degrees or as prescribed by local code

Install a temperature-indicating device at the discharge outlet of the thermostatic mixing valve

## **Objective**

Prevent biological growth in tank but prevent scalding

### **7.0302.6p Disposal**

#### **Specification**

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

Permanently decommission old equipment

## **Objective**

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

regulation

### **7.0302.6q Documentation**

#### **Specification**

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

#### **Objective**

Manufacturer supplied information available to occupant

### **7.0303.1 Mixing Valves**

Section:Baseload

Topic:Water Heating

Sub-Topic:Distribution Components

#### **Desired Outcome**

Safe and reliable water temperature control

### **7.0303.1a Pre-work qualifications**

#### **Specification**

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

#### **Objective**

Verify adequacy of plumbing

### **7.0303.1b Location**

#### **Specification**

Install mixing valves at as many locations as necessary to deliver safe and adequate hot water

## **Objective**

Optimal water temperature throughout the system

### **7.0303.1c Installation**

#### **Specification**

Install equipment in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications

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

## **Objective**

Compliant and safe installation

### **7.0303.1d Equipment accessibility**

#### **Specification**

Install valve and plumbing to allow for inspection, maintenance, and replacement of the appliance and its components, without disturbing other installed equipment, controls, piping, and components, other than what requires repair/replacement

## **Objective**

Ensure the valve can be readily maintained and replaced

### **7.0303.1e Isolation valves**

#### **Specification**

Install a separate water cut-off valve for both the hot and cold incoming water lines

## **Objective**

Allow isolation and service of mixing valve

### **7.0303.1f Check valves**

#### **Specification**

Install check valves on the hot and cold water supply lines upstream of the mixing valve

#### **Objective**

Eliminate crossover

### **7.0303.1g Heat traps**

#### **Specification**

Install mixing valve with a heat trap or at a distance from heat sources sufficient enough to prevent scaling or damage to the valve

#### **Objective**

Prevent scaling and valve damage

### **7.0303.1h Temperature gauges**

#### **Specification**

Install temperature gauges on hot, cold, and tempered supply water lines within sight of the mixing valve

#### **Objective**

Verification of proper mixing valve operation

### **7.0303.1i Wiring**

#### **Specification**

Install controls and sensors in accordance with manufacturer specifications and applicable code (NFPA 70)

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

## **Objective**

Safe and compliant mixing valve operation

### **7.0303.1j Dielectric unions**

#### **Specification**

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

## **Objective**

Prevent corrosion between dissimilar metals

### **7.0303.1k Discharge temperature settings**

#### **Specification**

Set discharge temperature to not exceed 120 degrees or as prescribed by local code

## **Objective**

Prevent biological growth in tank but prevent scalding

### **7.0303.1l Documentation**

#### **Specification**

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

## **Objective**

Manufacturer supplied information available to occupant

## **7.0303.2 Piping**

Section:Baseload

Topic:Water Heating  
Sub-Topic:Distribution Components

**Desired Outcome**

Safe, compliant, and efficient water distribution

**7.0303.2a Pre-work qualifications**

**Specification**

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

**Objective**

Verify adequacy of plumbing

**7.0303.2b Material selection**

**Specification**

Select piping materials according to the applicable code requirements (i.e., IRC, IBC)

**Objective**

Safe and compliant material selection

**7.0303.2c Decommissioning existing piping**

**Specification**

Cap obsolete but inaccessible piping as close as possible to the point of no access

**Objective**

Prevent reuse of abandoned piping

**7.0303.2d Piping location**

## **Specification**

Locate piping with the following priority: Within conditioned space; Within the building; Outdoor; Below ground (insulated and sleeved)

## **Objective**

Prevent freezing and reduce thermal loss

### **7.0303.2e New pipe installation**

## **Specification**

Install piping in compliance with applicable code (e.g., NFPA 70, IRC, IBC, IMC) and manufacturer specifications according to the following design:

minimize length of runs

allow for insulation on each individual pipe (e.g., no bundling)

install and label tracer lines when piping is installed below ground or when the pipe is hidden within the building

install piping to protect all occupants from contact with hot water pipes

## **Objective**

Safe, efficient, and durable pipe installation

### **7.0303.2f Insulate piping**

## **Specification**

Insulate all accessible pipes carrying hot water to a minimum R-3 per SWS (Water Heating: Thermal Loss Reduction: Pipe Insulation"

## **Objective**

Reduce heat loss through hot water pipes

### **7.0303.2g Friction loss**

#### **Specification**

Minimize friction loss using the following criteria:

Use smooth piping

Use as few joints and fittings as possible

Use sweeps instead of 90o elbows

Use full port valves

#### **Objective**

Efficient delivery of water

### **7.0303.2h Dielectric unions**

#### **Specification**

Install dielectric unions when connecting copper to galvanized steel piping in accordance with the IRC and manufacturer specifications

#### **Objective**

Prevent corrosion between dissimilar metals

### **7.0303.2i Stray voltage protection**

#### **Specification**

Bond and ground piping as required by NEC (NFPA 70)

#### **Objective**

Eliminate stray voltage from piping

### **7.0303.2j Disposal**

## **Specification**

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

Permanently decommission old equipment

## **Objective**

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

## **7.0303.5 Expansion Tank (Potable Water)**

Section:Baseload

Topic:Water Heating

Sub-Topic:Distribution Components

### **Desired Outcome**

Safe, compliant, leak-free, and properly sized expansion tank installation

### **7.0303.5a Expansion tank selection**

#### **Specification**

Select a tank that:

is rated for potable water

is sized according to applicable code (i.e., IPC, IRC, IBC) and manufacturer specifications

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

#### **Objective**

Safe and properly sized expansion tank

### **7.0303.5b Location**

## **Specification**

Locate the expansion tank on the cold water inlet to the water heater between the water heating equipment and the required shut off

## **Objective**

Prevent isolation of the expansion tank from the water heater

### **7.0303.5c Installation**

## **Specification**

Install expansion tank in accordance with the manufacturer's installation instructions and applicable code

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

## **Objective**

Safe and compliant installation

### **7.0303.5d Support**

## **Specification**

Support expansion tank so that it does not move or sag using rigid support material that is able to support twice the weight of the tank filled with water

## **Objective**

Durable rigid support

### **7.0303.5e Air pressure**

## **Specification**

Set the pressure in the expansion tank to match the incoming water pressure

## **Objective**

Set correct air pressure

### **7.0303.5f Documentation**

#### **Specification**

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

#### **Objective**

Manufacturer supplied information available to occupant

### **7.8802.1 Motor Replacement**

Section:Baseload

Topic:Special Considerations

Sub-Topic:Spas, Hot Tubs, Saunas

#### **Desired Outcome**

Safe, efficient, and compatible motor replacement

### **7.8802.1a Pre-work qualifications**

#### **Specification**

Verify that existing plumbing and electrical systems can support the new installation

#### **Objective**

Verify adequacy of existing utilities

### **7.8802.1b Equipment Selection**

#### **Specification**

Select a motor that:

is compatible with phase and voltage of existing wiring

is physically compatible with frame size

is at least 2-speed

is UL listed for pool, spa, or hot tub use

meets or exceeds efficiency standards of APSP-15

Select controls that are UL listed for the installation location (e.g., wet location)

### **Objective**

Select safe, efficient, and compatible motor

### **7.8802.1c Installation**

#### **Specification**

Install motor in accordance with NFPA 70 (Article 680) and manufacturer specifications

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

### **Objective**

Safe and compliant installation

### **7.8802.1d Disposal or reuse**

#### **Specification**

If operational, store replaced motor for temporary backup use and label as such

If nonoperational, recycle or dispose of removed equipment according to local and federal law (e.g., EPA) (i.e., do not leave replaced equipment at the client home)

### **Objective**

Provide backup motor, protect the environment and comply with regulation

### **7.8802.1e Documentation**

#### **Specification**

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

#### **Objective**

Manufacturer supplied information available to occupant

### **7.8802.2 Control Replacement**

Section:Baseload

Topic:Special Considerations

Sub-Topic:Spas, Hot Tubs, Saunas

#### **Desired Outcome**

Safe, efficient, and compatible control replacement

### **7.8802.2a Pre-work qualifications**

#### **Specification**

Verify that existing plumbing and electrical systems can support the new installation

#### **Objective**

Verify adequacy of existing utilities

### **7.8802.2b Equipment selection**

#### **Specification**

Select controls that:

are UL listed for the installation location (e.g., wet location)

provide reduced energy consumption options (i.e., timers, schedules)

**Objective**

Select safe, efficient, and compatible controls

**7.8802.2c Installation****Specification**

Install controls in accordance with NFPA 70 (Article 680) and manufacturer specifications

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

**Objective**

Safe and compliant installation

**7.8802.2d Disposal or reuse****Specification**

If operational, store replaced controls for temporary backup use and label as such

If nonoperational, recycle or dispose of removed equipment according to local and federal law (e.g., EPA) (i.e., do not leave replaced equipment at the client home)

**Objective**

Provide backup motor, protect the environment and comply with regulation

**7.8802.2e Documentation****Specification**

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

**Objective**

Manufacturer supplied information available to occupant

## **7.8803.1 Water Softening System Installation**

Section:Baseload

Topic:Special Considerations

Sub-Topic:Water Conditioning

### **Desired Outcome**

Safe, compliant, and leak-free system installation that meets the needs of the water consumer without damaging the water system

### **7.8803.1a Pre-work qualifications**

#### **Specification**

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

#### **Objective**

Verify adequacy of plumbing

### **7.8803.1b Equipment selection**

#### **Specification**

Select equipment that:

provides the treatment level needed in accordance with the National Association of Corrosion Engineers (NACE TPC 7)

meets the local water standards and requirements

#### **Objective**

Prevent damage to water distribution system and protect water consumer

### **7.8803.1c Location**

#### **Specification**

Install system on a level surface where it is protected from freezing and accessible for service

### **Objective**

Accessible, freeze-protected installation

### **7.8803.1d Equipment accessibility**

#### **Specification**

Provide a level working space not less than 30" in length and 30" in width in front of the control side of the appliance

Install appliance and plumbing to allow for inspection, maintenance, and replacement of the appliance and its components, without disturbing other installed equipment, controls, piping, and components, other than what requires repair/replacement

### **Objective**

Ensure the appliance can be easily maintained and replaced

### **7.8803.1e Installation**

#### **Specification**

Install system on the cold water side of any water heating system according to manufacturer specifications and applicable codes

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

### **Objective**

Safe, compliant, and durable installation

### **7.8803.1f Electrical wiring**

#### **Specification**

Install all electrical wiring in compliance with NFPA 70 and manufacturer specifications

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

**Objective**

Safe and compliant pump installation

**7.8803.1g Isolation and bypass valves**

**Specification**

Install a cut-off valve for the incoming water line and install bypass piping and valve

**Objective**

Allow isolation and bypass of conditioning system

**7.8803.1h Salt storage**

**Specification**

Store salts for treating the system in a cool and dry environment, not in contact with the floor, and away from metal solids

**Objective**

Prevent corrosion

**7.8803.1i Documentation**

**Specification**

Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information as well as a copy of the NACE recommendations

**Objective**

Manufacturer supplied information available to occupant