AAMA/WDMA/CSA 101/I.S.2/A440-11

NAFS 2011 — North American Fenestration Standard/Specification for windows, doors, and skylights









8

Contents

-		
P٢	eface	IX

4.6.7

4.7 4.7.1

4.7.2 4.8

0 Intr	oduction 1
0.1	General 1
0.1.1	Applicability 1
0.1.2	Sustainability 1
0.1.3	Content 1
0.2	Performance Classes and Grades 2
0.2.1	General 2
0.2.2	Guidance for the specifier/purchaser 6
0.2.3	Performance Grade (PG) designations 6
0.2.4	Positive and negative design pressure (DP) 7
0.2.5	Water penetration resistance testing and performance
0.2.6	Operation/cycling performance 9
0.3	Short-form specification 9
	1
1 Scop	
1.1	General 10
1.2	Terminology 10
1.3	Units of measurement 10
2 Refe	erence publications 11
3 Defi	initions 22
4 Gen	eral requirements 32
4.1	General 32
4.2	Gateway performance requirements 33
4.3	Performance Grades (PG) 33
4.3.1	Assignment of Performance Grade (PG) 33
4.3.2	Optional Performance Grades (PG) 33
4.4	Product designations 34
4.4.1	General 34
4.4.2	Primary designator 34
4.4.3	Secondary designator 50
4.5	Dual windows or dual doors 52
A F 1	Dadi Willacks of addi accis 32
4.5.1	General 52
4.5.1	General 52 Requirements 52
4.5.2 4.6	General 52 Requirements 52 Mullions 53
4.5.2 4.6 4.6.1	General 52 Requirements 52 Mullions 53 Mullion rating 53
4.5.2 4.6 4.6.1 4.6.2	General 52 Requirements 52 Mullions 53 Mullion rating 53 Composite units 58
4.5.2 4.6 4.6.1	General 52 Requirements 52 Mullions 53 Mullion rating 53 Composite units 58 Combination assemblies 58
4.5.2 4.6 4.6.1 4.6.2 4.6.3 4.6.4	General 52 Requirements 52 Mullions 53 Mullion rating 53 Composite units 58 Combination assemblies 58 Field mulling without manufacturer's involvement 58
4.5.2 4.6 4.6.1 4.6.2 4.6.3	General 52 Requirements 52 Mullions 53 Mullion rating 53 Composite units 58 Combination assemblies 58

Vertical (dead load) deflection 59 Mullion assembly performance 59

Mullion assembly primary designator 59

Water testing 59
Air leakage testing 59

November 2011

R

8.3.1

General 98

5 Clas	ss R and LC windows and sliding doors 60
5.1	Class R and LC requirements (specific to the U.S.) 60
5.1.1	General 60
	Uniform load deflection test 63
5.2	Class R and LC requirements (specific to Canada) 63
	General 63
5.2.2	100 F.001
5.3	Requirements applicable to the U.S. and Canada 66
5.3.1	General 66
5.3.2	Test specimen installation 67
5.3.3 5.3.4	Uniform load deflection test 67 Alternative minimum test sizes and minimum Performance Grades (PG) for selected Class
J.J.T	products (optional) 67
5.3.5	Auxiliary/durability tests for Class R and LC windows 68
5.3.6	Safety drop test (non-hung vertical operating products only) 70
5.3.7	Unit dead load test (greenhouse windows only) 70
6 Side	e-hinged doors (all classes) 72
6.1	General 72
6.2	Side-hinged door requirements (specific to the U.S.) 72
6.3	Side-hinged door requirements (specific to Canada) 73
6.3.1	General 73
6.3.2	Canadian (only) air infiltration/exfiltration 74
6.3.3	Example 75
6.4	Requirements applicable to the U.S. and Canada 76 General 76
6.4.1 6.4.2	
6.4.3	Gateway requirements 76 Test specimen installation 77
6.4.4	Limited water testing 77
6.4.5	Force-to-latch for side-hinged door systems 77
6.4.6	Uniform load deflection test 78
6.4.7	Operation cycling performance (side-hinged door systems only) 79
6.4.8	Vertical loading resistance (side-hinged door systems only) 79
6.4.9	Composite units and unique framing members 79
	ss CW and AW windows and doors 81
	Class CW and AW requirements (specific to the U.S.) 81
7.2	Class CW and AW requirements (specific to Canada) 83
7.2.1	General 83
7.2.2	Canadian (only) air infiltration/exfiltration 86
7.2.3	Example 86
7.3 7.3.1	Requirements applicable to the U.S. and Canada 87
7.3.1	Gateway requirements 87 Test specimen installation 87
7.3.2	Uniform load deflection test 88
7.3.4	Auxiliary/durability tests for Class CW and AW windows and doors 88
7.3.5	Life cycle testing (Class AW products only) 95
7.3.6	Operation/cycling-slam test performance (architectural terrace doors only) 95
	, , , , , , , , , , , , , , , , , , , ,
8 Tub	ular daylighting devices, roof windows, and unit skylights 96
8.1	General 96
8.2	TDD, roof window, and unit skylight requirements (specific to the U.S.) 96
8.3	TDD, roof window, and unit skylight requirements (specific to Canada) 98

iv November 2011

- 8.3.2 Canadian (only) air infiltration/exfiltration 99
- 8.3.3 Canadian (only) optional Performance Grades (PG) 100
- 8.4 TDD, roof window, and skylight requirements applicable to the U.S. and Canada 101
- 8.4.1 General 101
- 8.4.2 Example 2 102
- 8.4.3 Test specimen installation 102
- 8.4.4 Air leakage testing 104
- 8.4.5 Water penetration testing Roof windows, TDDs, and unit skylights 104
- 8.4.6 Uniform load testing 104
- 8.4.7 Auxiliary tests for roof windows, unit skylights, and TDDs 104

9 General testing requirements 105

- 9.1 Testing sequence 105
- 9.1.1 Applicability 105
- 9.1.2 Details of testing sequence 105
- 9.1.3 Test specimens 105
- 9.2 Test specimen requirements 105
- 9.2.1 General 105
- 9.2.2 Composite units and combination assemblies 105
- 9.2.3 Alterations 106
- 9.2.4 Specimen size 106
- 9.2.5 Test specimen installation 106
- 9.3 Testing methods 108
- 9.3.1 Operating force 108
- 9.3.2 Air leakage resistance test 109
- 9.3.3 Water penetration resistance test 110
- 9.3.4 Uniform load tests 111
- 9.3.5 Forced-entry resistance test 112
- 9.3.6 Auxiliary (durability) tests 112
- 9.4 Optional tests 122
- 9.4.1 Condensation resistance 122
- 9.4.2 Thermal transmittance 122
- 9.4.3 Acoustical performance 123
- 9.4.4 Impact performance 123
- 9.5 Laboratory test report 124
- 9.5.1 Summary data 124
- 9.5.2 Detailed data 124

10 Material requirements 126

- 10.1 Material tolerance 126
- 10.2 Glazing and glass 126
- 10.2.1 Reference Standards 126
- 10.2.2 General requirements 126
- 10.2.3 Glass selection 126
- 10.2.4 Multiple glazing panels (MGPs) 130
- 10.2.5 Plastic glazing 131
- 10.3 Framing/cladding materials 132
- 10.3.1 General 132
- 10.3.2 Wood 132
- 10.3.3 Wood flush and molded fiber doors 133
- 10.3.4 Vinyl 133
- 10.3.5 Cellular PVC 134
- 10.3.6 Aluminum 134
- 10.3.7 Fiberglass 135

November 2011

10.3.9 10.3.10 10.3.11 10.3.12	Steel materials and coatings 136 Cellulosic composite materials 136 Fiber-reinforced PVC 136 Acrylonitrile-butadiene-styrene (ABS) 137 Doorlite insert frame materials 137 Other materials 137
11.1 11.2 11.2.1 11.2.2 11.2.3 11.2.4 11.2.5 11.2.6 11.2.7 11.2.8 11.2.9 11.3 11.4 11.5 11.6 11.7	General 138 General 138 Hardware 138 Testing 138 Window opening control devices and window fall prevention devices 139 Hung window hardware 140 Casement, awning, hopper, and projected window hardware 140 Parallel opening window hardware 140 Door hardware 140 Hinged window hardware 141 Tropical window hardware 141 Dual-action window hardware 141 Fasteners 141 Reinforcing 142 Weatherstrip and/or weatherseal for non-static joints 142 Insect screens 143 Sealants 143 Coatings and finishes 143 Integral ventilating systems/devices 144 Blinds in dual-glazed products 144 Setting blocks 144
12.1 12.2 12.2.1 12.2.2 12.3 12.3.1 12.3.2 12.3.3 12.3.4 12.3.5 12.3.6 12.4 12.4.1 12.4.2 12.4.3 12.4.4	Product dimensions and tolerances 145 Dimensions 145 Tolerances 147 Qualification of designs, configurations, and assemblies 147 General 147 Geometry and components 147 Operation and orientation 148 Dividers (muntins) 148 Qualifying unequal lite assemblies 148 Composite units and unique framing members 149 Specialty products, basement windows, hinged windows, side lites, transoms, and secondary storm products 154 Specialty products 154 Basement windows 154 Hinged windows 154 Side lites, fixed doors, and door transoms 154
	Side lites, fixed doors, and door transoms 154 Secondary storm products 154

Annexes

A (informative) — Contact information for standards development organizations 168 **B** (informative) — Certification 171

Vi November 2011

Tables

- **0.1** Table of correspondences 2008 and 2011 editions of this Standard/Specification 3
- **4.1** Product types *36*
- **5.1** U.S. (only) optional Performance Grades (PG) 61
- **5.2** U.S. (only) operating force requirements 62
- **5.3** Maximum allowable air leakage 63
- **5.4** Canadian (only) optional Performance Grades (PG) 64
- **5.5** Canadian (only) operating force requirements 65
- **5.6** Canadian (only) air infiltration/exfiltration levels 66
- **5.7** Gateway requirements 67
- **5.8** Alternative minimum test sizes and associated minimum Performance Grades (PG) for selected Class R products 68
- **5.9** Deflection limits for sash vertical deflection test 68
- **5.10** Deflection limits for sash/leaf concentrated load test on latch rail 69
- **5.11** Loads for distributed load test 69
- **5.12** Loads for stabilizing arm load test 69
- **5.13** Deflection limits for sash blocked operation test 70
- **5.14** Limits for vertical load hardware deflection test 70
- **6.1** U.S. (only) optional Performance Grades (PG) 72
- **6.2** U.S. (only) air leakage levels 73
- 6.3 Canadian (only) optional Performance Grades (PG) 74
- **6.4** Canadian (only) air infiltration/exfiltration levels 75
- **6.5** Gateway requirements 76
- **6.6** Deflection limits for sash/leaf concentrated load test on latch rail 78
- **6.7** Loads for stabilizing arm load test 79
- **6.8** Operation cycling performance (side-hinged door systems) 79
- **7.1** U.S. (only) optional Performance Grades (PG) 81
- **7.2** U.S. (only) operating force requirements 82
- 7.3 Maximum allowable air leakage 83
- **7.4** Canadian (only) optional Performance Grades (PG) 84
- **7.5** Canadian (only) operating force requirements 85
- **7.6** Canadian (only) air infiltration/exfiltration levels 86
- **7.7** Gateway requirements 87
- **7.8** Deflection limits for sash vertical deflection test 88
- **7.9** Deflection limits for sash/leaf torsion test 89
- 7.10 Deflection limits for sash/leaf concentrated load test on latch rail 90
- **7.11** Deflection limits for vertical concentrated load test 91
- **7.12** Deflection limit for vertical concentrated load test on intermediate frame rails 93
- **7.13** Loads for distributed load test 93
- **7.14** Load for hold-open arm/stay bar test 94
- 7.15 Load for stabilizing arm load test 94
- **7.16** Deflection limits for sash blocked operation test 94
- **7.17** Limits for sash vertical load hardware deflection test 95
- **8.1** U.S. (only) operating force requirements 96
- **8.2** Maximum allowable air leakage for gateway size (or maximum size tested) 97
- 8.3 U.S. (only) optional Performance Grades (PG) for TDDs, roof windows, and unit skylights 97
- **8.4** Canadian (only) operating force requirements 99
- **8.5** Canadian (only) air infiltration/exfiltration levels for gateway size (or maximum size tested) 99
- **8.6** Canadian (only) optional Performance Grades (PG) for TDDs, roof windows, and unit skylights 100
- **8.7** Gateway requirements for TDDs, roof windows, and skylights 101
- **8.8** Load for distributed load test 104
- **10.1** Allowable IGU glass loads for Examples 1 and 2 in Clause 10.2.3.3 128
- **10.2** Plastic glazing combustibility classes 132

November 2011 Vii

- **11.1** Test Method B materials 139
- 11.2 Door hardware reference Standards 140
- **11.3** Corrosion resistance requirements for metal fasteners and reinforcing 142
- **11.4** Requirements for finishes 144
- **12.1** Gateway requirements for secondary storm products 155
- **12.2** Gateway performance requirements 156

Figures

- **1.1** Short-form specification 9
- **4.1** Primary designator (Example 1) 35
- **4.2** Primary designator (Example 2) 35
- **4.3** Product type illustrations 37
- **4.4** Special shapes and sizes Single-hung windows 42
- 4.5 Special shapes and sizes Double-hung windows 44
- **4.6** Special shapes and sizes Single sliding windows and doors 46
- **4.7** Special shapes and sizes Double sliding windows 48
- **4.8** Special shapes and sizes Specialty products 50
- **4.9** Mullion types and applications 54
- **4.10** Mullion assembly designator 59
- **5.1** Set-up for unit dead load test 71
- **6.1** Secondary designator (Example 1) 75
- **6.2** Primary designator (Example 3) 77
- **6.3** Side-hinged door assembly qualification 80
- 7.1 Secondary designator (Example 2) 87
- **7.2** Set-up for sash/leaf torsion test 89
- **7.3** Set-up for vertical concentrated load test 91
- **7.4** Set-up for vertical concentrated load test on intermediate frame rails 92
- **7.5** Set-up for hold-open arm/stay bar test 93
- **8.1** Secondary designator (Example 3) 102
- **8.2** TDD test specimen mounting 103
- **9.1** Water test plane detail 107
- 9.2 Test specimen mounting 108
- 9.3 Set-up for thermoplastic corner weld test 114
- **9.4** Set-up for sash vertical deflection test 115
- 9.5 Perpendicular (normal to the plane) load for sash/leaf concentrated load test on latch rail 116
- **9.6** Parallel (in the plane) load for sash/leaf concentrated load test on latch rail 117
- 9.7 Set-up for distributed load test 118
- **9.8** Set-up for stabilizing arm load test 119
- **9.9** Set-up for awning, hopper, projected hardware load test 120
- **9.10** Set-up for parallel opening window (POW) Vertical load 121
- **9.11** Set-up for parallel opening window (POW) Horizontal load 122
- **9.12** Test report summary of results 124
- 9.13 Test report summary of results for any Class AW rating above the minimum design pressure (DP) of 1920 Pa (~40.10 psf) 125
- **12.1** Product dimension measurement 146
- **12.2** Examples of specialty products 149
- **12.3** Window and door assembly qualification Typical configurations 150

VIII November 2011