Alberta

Canadian Home Builders' Association

Guideline for specifying the required NAFS ratings of Fenestration in low-rise buildings applicable to Part 9 of Division B of the Alberta Building Code 2014.

BACKGROUND TO THE PREPARATION OF THE GUIDELINE

In article **9.7.4.3 Performance Requirements**, the 2014 Alberta Building Code requires that performance grades for manufactured windows, doors and skylights within the scope of the NAFS standard be selected according to CSA A440S1 "Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights" so as to be appropriate for the conditions and geographic location in which the window, door or skylight will be installed.

CSA A440S1 provides a simplified method for determining the Specified Wind Load and Specified Driving Rain Wind Pressure to be used in selecting the NAFS performance grade and water resistance. This method uses the most conservative exposure factors and internal and external gust factors and pressure coefficients for High Rise buildings from *User's Guide – NBC 2010: Structural Commentary I.*

This results in values that are conservative for housing and small buildings compared to the values that would be generated under Part 4 of the code by reference to Structural Commentary I. This in turn requires much higher ratings for the fenestration products than is necessary to meet the actual environmental loads. This can mean significantly increased costs to supply products with the higher ratings, and in some cases products that meet the higher ratings may not be available.

The CSA Technical Committee on Performance Standards for Windows studied this matter in November 2015 and addressed it by approving an update to CSA A440S1 to be published sometime in 2016. However the updated version will not be recognized until the next Alberta Building Code.

Although CSA A440S1 explicitly allows values calculated in accordance with *User's Guide – NBC 2010: Structural Commentary I* in place of the default values, it is the practice of Safety Codes Officers not to allow this without the involvement of a professional engineer.

The Provincial Working Group

The Canadian Home Builders' Association Alberta sponsored a Provincial Working Group to consider this issue, consisting of manufacturers' representatives, builders' representatives, representatives of the Safety Codes Council and Alberta Municipal Affairs, the City of Calgary, the City of Edmonton, the Alberta Building Officials Association, RDH Building Science, and the British Columbia Building Safety and Standards Branch.

The working group decided that the best approach would be to calculate a table of required NAFS Performance Grade ratings for Part 9 buildings in Alberta municipalities similar to the one British Columbia adopted in Table C-4 of the 2012 BCBC introduced in Revision 8. Because making changes to the 2014 ABC is not feasible, it was proposed that such a table be provided in a guideline document.

The Provincial Working Group commissioned Berkeley Vadocz Engineering Inc. to create this guideline which is aligned with the amendments approved for the next update to CSA A440S1.

OBJECTIVE OF THE GUIDELINE

The objective of the guideline is to provide an engineered set of Specified Driving Rain Wind Pressure and Specified Wind Load values for Part 9 buildings for all municipalities having Climatic Data in Table C-2 of the code, so that code users do not have to commission engineering services on a case-by-case basis. The required NAFS ratings based on the Design Loads are also provided.

More accurate and possibly lower values can be calculated by a professional engineer under Part 4 of the Code by reference to Structural Commentary I.

SCOPE AND LIMITATIONS

This guideline contains values for the Specified Driving Rain Wind Pressure and Specified Wind Load certified by Berkeley Vadocz Engineering Inc. a specialty professional engineering firm employing professionals registered in the Province of Alberta. These values may be used in a municipality when permitted by the authority having jurisdiction.

Use of this document is limited to Part 9 Residential buildings subject to the scope and limitations listed below. Users of this document are responsible to familiarize themselves with the meaning of the terminology used.

- The values in the table apply only to buildings up to 10 metres in height. (Appendix item 1)
- The Specified Wind Loads do not apply to buildings located on Hills, Ridges, or Escarpments. (Appendix item 2)
- The Specified Wind Loads and Specified Driving Rain Wind Pressures are based on an Open Terrain condition.
- Lower values are possible for buildings in Rough Terrain. For Rough Terrain values, consult a qualified registered professional when permitted by the authority having jurisdiction.
- The guideline does not apply to skylights or sloped glazing as those products must also consider snow loads and higher suction pressures.
- Reference climate loads shall be in accordance with the values established by the authority having jurisdiction or, in the absence of such data, the climatic values provided in Appendix C of ABC 2014.
- The reference climate loads used to create the table in this guideline are from Appendix C of ABC 2014.

How to use the table

1) Look up the municipality you are in or the closest one to it in the left hand column.
2) Record the required NAFS Design Pressure (DP), Performance Grade (PG), and Water Resistance from the three right hand columns of the same row.
3) Manufactured windows and doors selected for construction need to meet or exceed the Specified NAFS ratings.

About the NAFS ratings

- The NAFS ratings are based on the allowable values in NAFS-11 Table 5.7, Gateway Requirements, and Table 5.4, Canadian (only) optional Performance Grades (PG).
- The NAFS Design Pressure must be equal to or greater than the Specified Wind Load.
- The required Performance Grade is based on the NAFS Design Pressure.
- The required Water Penetration Resistance must be equal to or greater than the Specified DRWP, but cannot be lower than the value associated with the Performance Grade in NAFS-11 Tables 5.7 and 5.4.

Berkeley Vadocz Engineering Inc. does not assume responsibility for errors, oversights, or consequences resulting from the misuse of the information contained in this guideline.

Berkeley Vadocz Engineering Inc.

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- Dave Goldsmith, P.Eng., Ply Gem Canada, CSA Technical Committee on Performance Standards for Windows.
- Al Jaugelis BScArch RDH Building Science Inc., CSA Technical Committee on Performance Standards for Windows.
- City of Calgary, Building Regulations Division
- Alberta Building Officials Association
- City of Edmonton, Development Services, Building Regulations

Part 9 Building <= 10m Tall	Climatic Data		Specified Loads			NAFS		
Open Terrain Exposure Ce = 1.0	1/5 DRWP	1/50 HWP	DRWP	Wind Load		Required Fenestration Performance		
Alberta Municipalities	**Pa**	**kPa**	**Pa**	**Pa**	**(psf)**	**DP**	**PG**	**Water Resist.**
Acadia Valley	220	0.49	220	992	20.72	1200	25	220
Airdrie	210	0.46	210	932	19.45	960	20	220
Athabasca	80	0.36	80	729	15.23	960	20	150
Banff	120	0.32	120	648	13.53	720	15	140
Barrhead	100	0.44	100	891	18.61	960	20	150
Bashaw	180	0.38	180	770	16.07	960	20	180
Bassano	220	0.51	220	1033	21.57	1200	25	220
Beaumont	160	0.43	160	871	18.19	960	20	180
Beaverlodge	100	0.36	100	729	15.23	960	20	150
Berwyn	100	0.33	100	668	13.96	720	15	140
Black Diamond	180	0.65	180	1316	27.49	1440	30	220
Blackfalds	190	0.40	190	810	16.92	960	20	220
Bon Accord	140	0.43	140	871	18.19	960	20	150
Bonnyville	120	0.37	120	749	15.65	960	20	150
Bow Island	210	0.55	210	1114	23.26	1200	25	220
Bowden	180	0.41	180	830	17.34	960	20	180
Brooks	220	0.52	220	1053	21.99	1200	25	220
Bruderheim	130	0.42	130	851	17.76	960	20	150
Calgary	220	0.48	220	972	20.30	1200	25	220
Calmar	150	0.42	150	851	17.76	960	20	150
Campsie	100	0.44	100	891	18.61	960	20	150
Camrose	160	0.39	160	790	16.49	960	20	180
Canmore	120	0.37	120	749	15.65	960	20	150
Cardston	140	0.72	140	1458	30.45	1680	35	260
Carstairs	190	0.44	190	891	18.61	960	20	220
Castor	200	0.35	200	709	14.80	720	15	220
Claresholm	200	0.58	200	1175	24.53	1200	25	220
Coaldale	200	0.65	200	1316	27.49	1440	30	220
Cochrane	180	0.48	180	972	20.30	1200	25	180
Cold Lake	140	0.38	140	770	16.07	960	20	150
Coleman	120	0.63	120	1276	26.64	1440	30	220

Part 9 Building <= 10m Tall	Climatic Data		Specified Loads			NAFS		
Open Terrain Exposure Ce = 1.0	1/5 DRWP	1/50 HWP	DRWP	Wind Load		Required Fenestration Performance		
Alberta Municipalities	**Pa**	**kPa**	**Pa**	**Pa**	**(psf)**	**DP**	**PG**	**Water Resist.**
Coronation	200	0.37	200	749	15.65	960	20	220
Cowley	140	1.01	140	2045	42.72	2160	45	330
Crossfield	200	0.45	200	911	19.03	960	20	220
Daysland	150	0.34	150	689	14.38	720	15	150
Devon	150	0.44	150	891	18.61	960	20	150
Didsbury	190	0.42	190	851	17.76	960	20	220
Drayton Valley	120	0.42	120	851	17.76	960	20	150
Drumheller	220	0.44	220	891	18.61	960	20	220
Eckville	160	0.39	160	790	16.49	960	20	180
Edmonton	160	0.45	160	911	19.03	960	20	180
Edson	100	0.46	100	932	19.45	960	20	150
Elk Point	100	0.37	100	749	15.65	960	20	150
Embarras Portage	80	0.37	80	749	15.65	960	20	150
Fairview	100	0.35	100	709	14.80	720	15	140
Falher	100	0.36	100	729	15.23	960	20	150
Foremost	210	0.56	210	1134	23.68	1200	25	220
Fort Chipewayan	80	0.39	80	790	16.49	960	20	150
Fort MacLeod	180	0.68	180	1377	28.76	1440	30	220
Fort McMurray	60	0.35	60	709	14.80	720	15	140
Fort Saskatchewan	140	0.43	140	871	18.19	960	20	150
Fort Vermilion	60	0.30	60	608	12.69	720	15	140
Fox Creek	80	0.39	80	790	16.49	960	20	150
Gibbons	140	0.43	140	871	18.19	960	20	150
Gleichen	220	0.51	220	1033	21.57	1200	25	220
Grand Centre	140	0.38	140	770	16.07	960	20	150
Grande Cache	80	0.45	80	911	19.03	960	20	150
Grande Prairie	120	0.43	120	871	18.19	960	20	150
Granum	190	0.63	190	1276	26.64	1440	30	220
Grimshaw	100	0.33	100	668	13.96	720	15	140
Habay	60	0.30	60	608	12.69	720	15	140
Hanna	220	0.45	220	911	19.03	960	20	220

Part 9 Building <= 10m Tall	Climatic Data		Specified Loads			NAFS		
Open Terrain Exposure Ce = 1.0	1/5 DRWP	1/50 HWP	DRWP	Wind Load		Required Fenestration Performance		
Alberta Municipalities	**Pa**	**kPa**	**Pa**	**Pa**	**(psf)**	**DP**	**PG**	**Water Resist.**
Hardisty	140	0.36	140	729	15.23	960	20	150
High Level	60	0.30	60	608	12.69	720	15	140
High Prairie	80	0.40	80	810	16.92	960	20	150
High River	200	0.65	200	1316	27.49	1440	30	220
Hinton	100	0.46	100	932	19.45	960	20	150
Innisfail	190	0.41	190	830	17.34	960	20	220
Irvine	220	0.47	220	952	19.88	960	20	220
Jasper	80	0.32	80	648	13.53	720	15	140
Keg River	80	0.30	80	608	12.69	720	15	140
Killam	150	0.35	150	709	14.80	720	15	150
Kitscoty	110	0.38	110	770	16.07	960	20	150
Lac la Biche	80	0.36	80	729	15.23	960	20	150
Lacombe	180	0.40	180	810	16.92	960	20	180
Lake Louise	80	0.33	80	668	13.96	720	15	140
Lamont	130	0.42	130	851	17.76	960	20	150
Leduc	160	0.41	160	830	17.34	960	20	180
Lethbridge	200	0.66	200	1337	27.91	1440	30	220
Lloydminster	110	0.40	110	810	16.92	960	20	150
Magrath	160	0.69	160	1397	29.18	1440	30	220
Manning	80	0.30	80	608	12.69	720	15	140
Mayerthorpe	100	0.43	100	871	18.19	960	20	150
McLennan	90	0.36	90	729	15.23	960	20	150
Medicine Hat	220	0.48	220	972	20.30	1200	25	220
Milk River	190	0.68	190	1377	28.76	1440	30	220
Millet	160	0.40	160	810	16.92	960	20	180
Morinville	140	0.43	140	871	18.19	960	20	150
Morrin	220	0.41	220	830	17.34	960	20	220
Mundare	110	0.39	110	790	16.49	960	20	150
Nanton	200	0.63	200	1276	26.64	1440	30	220
Okotoks	200	0.64	200	1296	27.07	1440	30	220
Olds	180	0.41	180	830	17.34	960	20	180

Part 9 Building <= 10m Tall	Climatic Data		Specified Loads			NAFS		
Open Terrain Exposure Ce = 1.0	1/5 DRWP	1/50 HWP	DRWP	Wind Load		Required Fenestration Performance		
Alberta Municipalities	**Pa**	**kPa**	**Pa**	**Pa**	**(psf)**	**DP**	**PG**	**Water Resist.**
Oyen	220	0.48	220	972	20.30	1200	25	220
Peace River	100	0.32	100	648	13.53	720	15	140
Penhold	200	0.40	200	810	16.92	960	20	220
Picture Butte	210	0.63	210	1276	26.64	1440	30	220
Pincher Creek	140	0.96	140	1944	40.60	2160	45	330
Ponoka	170	0.40	170	810	16.92	960	20	180
Provost	150	0.41	150	830	17.34	960	20	150
Rainbow Lake	60	0.30	60	608	12.69	720	15	140
Ranfurly	100	0.36	100	729	15.23	960	20	150
Raymond	170	0.66	170	1337	27.91	1440	30	220
Red Deer	200	0.40	200	810	16.92	960	20	220
Redcliff	220	0.48	220	972	20.30	1200	25	220
Redwater	120	0.43	120	871	18.19	960	20	150
Rimbey	150	0.39	150	790	16.49	960	20	150
Rocky Mountain House	120	0.36	120	729	15.23	960	20	150
Ryley	140	0.37	140	749	15.65	960	20	150
Sangudo	110	0.44	110	891	18.61	960	20	150
Sedgewick	150	0.35	150	709	14.80	720	15	150
Sexsmith	110	0.43	110	871	18.19	960	20	150
Sherwood Park	160	0.45	160	911	19.03	960	20	180
Slave Lake	80	0.37	80	749	15.65	960	20	150
Smoky Lake	100	0.41	100	830	17.34	960	20	150
Spirit River	110	0.38	110	770	16.07	960	20	150
Spruce Grove	120	0.45	120	911	19.03	960	20	150
Stavely	200	0.60	200	1215	25.38	1440	30	220
Stettler	200	0.36	200	729	15.23	960	20	220
Stony Plain	120	0.45	120	911	19.03	960	20	150
Strathmore	220	0.48	220	972	20.30	1200	25	220
St. Albert	150	0.45	150	911	19.03	960	20	150
St. Paul	90	0.37	90	749	15.65	960	20	150
Suffield	220	0.49	220	992	20.72	1200	25	220

Part 9 Building <= 10m Tall	Climatic Data		Specified Loads			NAFS		
Open Terrain Exposure Ce = 1.0	1/5 DRWP	1/50 HWP	DRWP	Wind Load		Required Fenestration Performance		
Alberta Municipalities	**Pa**	**kPa**	**Pa**	**Pa**	**(psf)**	**DP**	**PG**	**Water Resist.**
Sundre	160	0.42	160	851	17.76	960	20	180
Swan Hills	80	0.37	80	749	15.65	960	20	150
Sylvan Lake	180	0.41	180	830	17.34	960	20	180
Taber	200	0.63	200	1276	26.64	1440	30	220
Thorhild	110	0.41	110	830	17.34	960	20	150
Three_Hills	220	0.41	220	830	17.34	960	20	220
Tofield	150	0.37	150	749	15.65	960	20	150
Trochu	220	0.41	220	830	17.34	960	20	220
Turner Valley	180	0.65	180	1316	27.49	1440	30	220
Two Hills	90	0.36	90	729	15.23	960	20	150
Valleyview	80	0.42	80	851	17.76	960	20	150
Vauxhall	210	0.57	210	1154	24.11	1200	25	220
Vegreville	100	0.36	100	729	15.23	960	20	150
Vermilion	100	0.36	100	729	15.23	960	20	150
Viking	120	0.36	120	729	15.23	960	20	150
Vulcan	210	0.61	210	1235	25.80	1440	30	220
Wagner	80	0.37	80	749	15.65	960	20	150
Wainwright	120	0.36	120	729	15.23	960	20	150
Warner	180	0.68	180	1377	28.76	1440	30	220
Wembley	100	0.40	100	810	16.92	960	20	150
Westlock	110	0.42	110	851	17.76	960	20	150
Wetaskiwin	160	0.39	160	790	16.49	960	20	180
Whitecourt	80	0.37	80	749	15.65	960	20	150
Wimborne	200	0.40	200	810	16.92	960	20	220

APPENDIX:

1. **Building Height *h***
   h is the height of the top of the window or door above ***grade*** in metres.

   grade means the lowest of the average levels of finished ground adjoining each exterior wall of a building, except that localized depressions need not be considered in the determination of average levels of finished ground.

2. **Wind Speed-up over Hills, Ridges, and Escarpments**
   Buildings sited on the upper half of an isolated hill, ridge or escarpment constituting an abrupt change in the general topography may experience wind speed-up leading to increased wind loads that can be determined by a professional engineer.

   This is only a concern when buildings and other site conditions and location of structures meet **ALL** off the following conditions:

   a) The hill, ridge or escarpment is isolated and unobstructed by other similar topographic features of similar height for 100 times the height H of the topographic feature or 3km, whichever is less. This distance shall be measured horizontally from the point at which the height H is determined.
   b) The hill, ridge or escarpment protrudes above the height of other terrain features within a 3km radius by a factor of two or more.
   c) The building is located in the upper one-half of a hill or ridge or near the crest of an escarpment as shown in Figure 1.
   d) The incline of the slope is greater than 1 in 10 ($H/L_h \geq 0.2$ in Figure 1)

Figure 1

Definitions:

Escarpment: A cliff or steep slope generally separating two levels or gently sloping areas.

Hill: A land surface characterized by strong relief in any horizontal direction.

Ridge: An elongated crest of a hill characterized by strong relief in two directions.

Lh: Distance upwind of crest of hill or escarpment to where the difference in ground elevation is half the height of hill or escarpment.