



Wind Load, Design Pressure Ratings, and the VSI Product Certification Program

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Table of Contents

Introduction.....	1
Effective Date.....	1
Alternative Design Pressure Ratings.....	1
Application.....	2
Grouping of Profile.....	2-3
Required and Qualifying Test Data.....	4
Label Requirements.....	5
Review and Approval.....	5
Fees.....	6
Ongoing Verification.....	6-8
Appendix: Wind Speed Calculation Guidelines and Communication Protocol.....	9-16

Introduction

In 2017, ASTM revised standards for the three product categories eligible for certification under the VSI Product Certification Program: vinyl siding (D3679); polypropylene siding (D7254) and insulated vinyl siding (D7793). The revised standards included updates to the wind load resistance ratings process and design pressure determination. The pressure equalization factor (PEF) for vinyl and insulated vinyl siding is now 0.50 (previously 0.36). The polypropylene siding PEF remains at 0.36. Additionally, these revisions require a *specific design pressure rating* be determined and included on product or packaging label. One or more alternative design pressure ratings (*for alternative installations*) may be determined and included on labels.

This document addresses design pressure rating labeling requirements and creates guidelines for manufacturers and the Administrator to follow. Updates to this document are expected in the future and this document may be replaced if deemed appropriate.

Effective Date

- The **effective date** for compliance of certified products with the 2017 editions of ASTM D3679, D7254 and D7793 will be **January 1, 2020**. The primary change in those specifications that affects certification is a new requirement that a standard design pressure rating be determined and included on labeling of the product or the packaging. The specifications also provide for optional determination and labeling of alternative design pressure ratings (for alternative installations). For information on determining these ratings and the format for stating them, see the relevant ASTM standard.
- As of the effective date, all certified products must have labeling showing, at minimum, a standard design pressure rating. The data supporting the rating and the design of the label must have been reviewed and approved by the Administrator prior to use of the label.

Alternative Design Pressure Ratings

- In addition to the standard design pressure rating (resulting from testing with the standard fastening) required of all profiles, profiles may also optionally gain alternative design pressure ratings, using different attachment methods, which would be specifically tested and described in the installation instructions. Profiles do not need to stay within their group for this – individual profiles can get a design pressure rating that is different from the standard design pressure rating determined for the product's group. A profile can have only one standard design pressure rating, but could have many other design pressure ratings based on different installation methods.
- Alternative design pressure ratings can be developed by the manufacturer without being certified. However, any uncertified design pressure ratings cannot be associated with certification logos or labeling or in manufacturer literature where profiles are associated with certification.

Applications

- For manufacturers to be assured of having labels approved by the effective date, applications must be made, including all required testing and supporting data, by October 1, 2019, three months prior to the effective date. The Administrator is committed to processing all applications submitted by that date in time for the deadline. However, incomplete or otherwise unacceptable applications may result in delays, and completion of the process for untimely or incomplete applications cannot be guaranteed by the effective date.
- Applications must justify the proposed grouping of profiles by confirming that the selected profile has the same nail hem, no other profiles are thinner, and no other profiles have a narrower face width.
- Applications must include:
 - A listing and designation of any groups and indication of which profile is considered the representative for the group.
 - Documentation of test results, in the form of a test report or equivalent, from a laboratory acceptable to the Administrator. A test result must support each individual profile, or the representative profile of each group.
 - An actual sample of the label that will be applied to the product or packaging (or electronic facsimile), including the VSI Program logo/label, the statement of standard design pressure rating, and any alternative design pressure ratings, in the actual size and position that they will be used on the actual label.
 - Shop drawings of the profile providing the information that will be used as part of the ongoing verification process. See Ongoing Verification below.
 - Optionally, the manufacturer may include a proposed retesting schedule that ensures that all separate profiles or group representative profiles are retested under D5206 at least once every four years. The final schedule is subject to negotiation with the Administrator. If the manufacturer does not propose a schedule, the Administrator will propose one as part of the review of the application.
 - Other items that may be specified by the Administrator.

Grouping of Profiles

- The standard design pressure rating can be determined separately for each profile by a test of that profile, or it can be determined for a group of profiles by one test on a representative member of the group.
- Manufacturers will be able to group profiles so that the standard design pressure rating for all members of the group is determined by test results from the profile deemed the most vulnerable, or least wind resistant. Determination of what is most vulnerable, and what profiles can be in the same group, is based on the following:

- All profiles in a group must have the same nail hem design; e.g. single, rolled, double.
- Thickness: thinner profile thickness is more vulnerable; all products in the group must have the same or greater thickness than the tested representative product.
- Face width: greater face width (exposure) is more vulnerable; all members must have the same or less total panel face width than the tested representative member.
- Manufacturers will create their profile groupings and submit them to the Administrator. Manufacturers can create as many or as few groups as they want (though different nail hem types must be in different groups); or each profile could be its own group. Each group must have a representative, and it is the representative that will be tested (or have an existing test report) to determine the design pressure rating.
- Manufacturer's must submit a full listing of the members of the group at the time of application, as well as an indication of which profile is the representative, and an ASTM D5206-06a or newer test report for the representative. In addition, drawings are to be supplied for each profile, regardless of whether they were provided as part of a prior submission.

Required and Qualifying Test Data

- Each certified product must have a standard design pressure supported by a D5206 test report. The report can be for a test on that particular profile, or on a profile that is determined to be representative of a group that the profile is a member of (see Groups, below). The average maximum sustained static test pressure (AMSTP, "test pressure") is used to calculate the design pressure rating according to the procedures in the appropriate product specification.
- Any test used to support the standard (or alternative) design pressure rating must follow ASTM D5206-06a or a newer edition. The test report must demonstrate that the test was run in accordance with the standard test method in all respects.
- The test must be performed by a laboratory acceptable to the Administrator. In general, accreditation of the laboratory for D5206 by a recognized accreditation agency is considered acceptable, though other criteria may be considered.
- Tests used to support the standard design pressure rating be conducted using the standard installation method for the siding, as set forth in the appropriate product standard.
- Tests used to support an alternative design pressure rating must clearly and completely describe the alternative installation. A manufacturer's instruction or other communication to installers must describe the installation with sufficient accuracy and detail so that an installer would be able to replicate the configuration under which the siding was tested.
- If an eligible previous test is not available, a new test must be performed. The results can be used for the tested profile and for other profiles in a group for which the tested profile is representative.
- If new testing must be conducted, manufacturers should allow sufficient time to repeat the test if the initial results do not support the expected design pressure rating. There is no limit to the number of tests that could be run, and the manufacturer can submit the report of any valid test to be used for certification.
 - Note, however: Since the design pressure rating will be the benchmark for future testing during ongoing verification, the manufacturer should consider the possibility of an unusually high result not being replicated later, with a consequent need to re-rate the profile or its group.

Label Requirements

- ASTM D3679, D7254, and D7793 require the standard wind load design pressure rating be stated on the product or the product package in one of two ways:
 - Section 7.6.1 of the respective ASTM standard allows a product packaged to be marked - "Standard Wind Load Design Pressure Rating: ##.# psf (ASD)".
 - Section 7.6.2 of the respective ASTM standard allows each siding panel to be marked - "Std Design Pressure Rating: ##.# psf (ASD)".
- No other formatting requirements, including type size, are specified. Inclusion of alternative design pressure ratings is optional. If the alternative rating is submitted to and reviewed and approved by the Administrator, it can be used in association with the certification.
- Alternative design pressure statements must include reference to the installation conditions necessary to support the rating, per the requirements of the appropriate standard, for example, fastener type, sheathing type, fastener spacing etc. The adequacy of the reference is subject to the approval of the Administrator.
- Alternative certified design pressures (for alternative installations), are permitted to *also* be included on label, at the manufacturer's option (not required). This will need to be stated in a way that ties it to the installation needed to achieve the higher rating. Example "Alternative wind load design pressure rating: ##.# psf (ASD) (See instructions for installation requirements.)"

Review and Approval

- The Administrator will review and process applications in the order received.
- Groupings and supporting data that have been reviewed and confirmed prior to submittal of the application will be reviewed and approved more quickly.
- Once the Administrator has reviewed and approved the application for an individual profile or group, the manufacturer may begin using certification labels with standard and (optional) alternative design pressure ratings, but use of the label is not required until 1/1/2020.
- The timeframe for follow up testing in the designated maximum four calendar-year cycle starts the day of approval and must be tested and re-approved by the Administrator by the end of the 4th calendar year. For example – a manufacturer is authorized to mark (label) on September 1, 2019. The next wind load testing and review by the Administrator would need to be completed, approved and ready to label by December 31, 2023. This modified 4-year cycle simplifies the administration of the Program and ensures that manufacturers can update marketing collateral as needed before labeling requirements are updated each 4-year cycle.

Fees

- Review of submittals for approval and upload to DB, revisions to groups or products: \$125 per hour.
- Product grouping reviews utilizing Intertek Evaluation Services technical staff: \$185 per hour.

Ongoing Verification

- As with other requirements of ASTM D3679, D7793 and D7254 compliance with the standard design pressure rating (and any certified alternative design pressure ratings) needs to be verified on a periodic basis in order to maintain certification. In VSI's program, most verification is done through repeating of the original test, and confirmation that performance is at least as good as it was in the original test.
- Verification of standard design pressure rating and any certified alternative design pressure ratings will be done by testing under D5206. The test would be performed on the representative profile of each group. If the test shows satisfactory performance, the continued compliance of all members of the group is verified.
- While some performance attributes are verified on a semi-annual basis during each inspection, wind load testing is relatively expensive. The frequency of testing, and the need to ensure that non-compliant products are detected and prevented from staying on the market for too long, needs to be balanced against the burden of frequent testing.
- Several of the factors that affect wind load resistance are routinely verified as not having changed during semi-annual inspections. These include the profile thickness, nail hem type, and the face width of the panel. These will continue to be measured to all profiles as is current practice. In addition, other specific measurements as identified below, will be added for representative profiles for each group. Frequent verification of essential physical properties makes it more likely that the wind load resistance of a product would not radically change in between full-scale wind load tests.
- The following new measurements will be applied only to the representative profile of each group, but will be applied with the same frequency as the other measurements. The measurements will be made against the dimensions shown on the profile drawing, and must be within the tolerances on the drawing. The Administrator will initially review drawings and work with manufacturer make sure tolerances are appropriate for this application.
 - Thickness of nail hem
 - Depth of wall projection at intermediate junctions between faces (intermediate butt height)
 - Interlock (buttlock): depth of lock, length of return, and material thickness.

- The representative profile for each group will be tested under D5206 on a maximum four calendar-year cycle;. Should the Administrator be unable to obtain the group leader profile during the first half inspection of the required test year, it is imperative that the profile be available during the second half inspection in order to avoid possible disqualification of the entire group. Any issues with plant inventory levels of the group leader should be communicated to the Administrator in advance whenever possible.
- The actual schedule of testing would be worked out between the Administrator and manufacturer. This might involve rolling sampling where a number of profiles are selected at each unannounced semi-annual inspection, or may involve selection and testing of a larger number of samples at different intervals. For instance, half of the representative samples may be selected and tested every two years, or all of them at one time before the end of four years.
- If the representative profile is produced in different plants or is marketed under different names, but is the otherwise the same product, with the same composition and measurements, either "version" may be used for testing or retesting after failure.
- If the verification test fails to meet the minimum requirement, the manufacturer will have the option of either 1) reducing the certified design pressure rating to match the value supported by the test; or 2) following standard procedure to resolve the failure and retain the current design pressure rating.
 - If the manufacturer elects to reduce the design pressure rating, the rating for all profiles in any group represented by the tested profile must also be reduced. All labeling, promotional material, spec sheets, etc. for all affected products must be updated immediately.
 - If the manufacturer elects to resolve the issue and try to retain the current rating, the standard action item resolution procedure will be applied to wind load tests: one immediate retest will be permitted, after which the manufacturer will need to show how the issue was addressed and perform a successful retest. The Administrator will work out a method to avoid the need to send an inspector to pull new samples for retest.
 - In the event that the representative sample cannot achieve the original design pressure rating (failure not resolved), the manufacturer would have the option to reduce the design pressure for the group as described above.
 - If, in the end, the product is disqualified, then the other members of its group are also disqualified. However, the manufacturer would be able to reorganize the group, choose a different representative, etc., and do testing to support a design pressure rating for the new group, and restore certification for the products in the group.
- If the test exceeds the original average maximum static test pressure, the manufacturer has the option of rerating the group to reflect the design

pressure rating supported by the new test. Labels, literature and spec sheets must be immediately changed as described above and submitted to the Administrator for review and subsequent approval. The new test pressure will become the benchmark for future tests.

Reminder: As new products are added to the certification program, they will need to be identified within a group. Should a representative profile for a group be discontinued by the manufacturer and requested to be deleted from the program, a new representative profile must be identified for that group and related D5206 test must be submitted for review. Should an existing profile be modified (such as the thickness or nail hem changed), this may affect the existing group and notification should be provided to the Administrator (preferably prior to the change taking effect).

APPENDIX

WIND SPEED CALCULATION GUIDELINES AND COMMUNICATION PROTOCOL

Introduction

Wind load tests on vinyl siding are conducted according to ASTM D5206 - *Standard Test Method for Windload Resistance of Rigid Plastic Siding*. The result is an Average Maximum Sustained Static Test Pressure (called "test pressure" or AMSTP in this document) in units of pounds per square foot that the siding can withstand. This test pressure is used to establish a design pressure rating which, in turn, is used to determine if the siding is suitable for a particular application (geographic location, degree of wind exposure, building type and size, etc.), typically required by the building code or local authority having jurisdiction.

However, customers and specifiers of vinyl, insulated vinyl, and polypropylene siding prefer to hear about wind performance expressed as wind *speed* ratings in units of miles per hour. A given test pressure can correspond to numerous different wind speed ratings depending on the details of the building dimensions, building location, and which building code is followed in that area. VSI and its members must be clear and consistent in communications to customers and specifiers when discussing wind speed ratings. Therefore, the following method for converting test pressures to wind speeds in communications based on a widely-accepted ASCE standard has been developed.

The methods described in this document apply to siding that meets ASTM standards: ASTM D3679 (vinyl siding), D7793 (insulated vinyl siding), or D7254 (polypropylene siding).

ASD and Ultimate Wind Speeds

VSI wind speed calculation procedures are based on ASCE/SEI 7, *Minimum Design Loads for Buildings and Other Structures*, published by the American Society of Civil Engineers (called ASCE 7 in this document). This standard is the primary reference for determination of loads used in structural engineering. Beginning with the 2010 edition, ASCE 7-10 introduces a complication to determining the proper wind speed related to a given test pressure or design pressure rating. Wind speeds can be expressed on either an Allowable Stress Design (ASD) or Load and Resistance Factor Design (LRFD, "nominal" or "ultimate") basis, depending on the engineering philosophy used. ASCE 7-10 changes from previous practice to use ultimate wind speeds rather than ASD wind speeds.

Ultimate speeds are higher than ASD speeds, but it is not the intent to change the wind pressure loads determined for a particular application. A load factor is applied to convert ultimate loads back to ASD loads. The design pressures and

test requirements for vinyl siding and other building products have not changed as a result of this revision to ASCE 7-10. But the nominal wind speed associated with a given pressure can be expressed in two different ways.

The ultimate wind speeds are used to designate high wind zones on contour maps and reflect an estimation of the highest wind that may occur over the course of several centuries. These higher speeds approximately correspond to the median failure level of vinyl siding, where about 50% of products would be expected to fail, and are appropriate for structural building components. ASD wind speeds, on the other hand, correspond to a level where the majority of properly installed and maintained siding would be expected to *not* fail. Thus, to provide a realistic wind speed rating at which consumers should expect siding to perform acceptably, the ASD wind speed will continue to be used for polymeric siding products for that purpose under these Guidelines.

However, because the ultimate speeds are used on published wind speed maps, sometimes a wind speed rating for siding must be available to compare with the nominal speed at a given location. These Guidelines allow the use of an ultimate wind speed rating for this specific application. Claims and statements should be guided by the following policies:

- For general statements relating to the wind speed that the siding product is expected to be able to withstand, an ASD-based wind speed rating is used. Examples of such statements include:
 - "Rated for winds of: ### (mph, ASD)"
 - "Able to withstand winds of: ### (mph, ASD)"
 - "Maximum wind speed: ### (mph, ASD)"
- For statements related specifically to nominal wind speed zones or design wind speeds at certain locations, a wind speed rating based on the ultimate wind speed is used. Such statements are limited to documents where the target audience is code officials, designers/architects, engineers, etc. Such statements must not be used in documents directed to consumers, installers or distributors.
 - Examples of such statements include:
 - "Suitable for use in zones or locations having a nominal design wind speed (ultimate) up to: ### (mph, ultimate)"

Values for both ASD and Ultimate wind speeds correlated to test pressure and design pressures are given in the tables and graphs below.

Pressure Equalization Factors

A pressure equalization factor (PEF) is part of the equation that relates wind speeds to design and test pressures. The PEF represents the ability of the pressures in front of and behind the siding to be equalized during rapid wind gusts. Greater equalization (expressed as a decimal percentage where lower is better) means that the siding is subjected to less load and therefore can be rated higher.

Based on earlier research, the PEF for vinyl siding and polypropylene siding had been set at 0.36 and for insulated vinyl siding at 0.70. In 2017 the pertinent ASTM standards were revised to a PEF of 0.50 for vinyl siding and insulated vinyl siding. Polypropylene siding's PEF was not changed and remains at 0.36.

As a result of these changes, the wind speed rating corresponding to a given test pressure has decreased for vinyl siding and increased for insulated vinyl siding, with no change for polypropylene. The values in the tables and graphs below reflect these changes.

Calculation Parameters

Calculation procedures are based on ASCE/SEI 7-10. Annex A1 of the appropriate ASTM standard specification for the product category includes the specific methodology for application of the ASCE 7 procedures to siding.

Unless otherwise stated, wind speed calculations that refer to this Guideline use the following parameters:

- Exposure category B
- Mean roof height of 30 feet
- Wind tributary area of 10 square feet
- Ratings based on negative wind pressure
- Safety factor of 1.5
- Pressure equalization factor of 0.50 (vinyl and insulated vinyl) or 0.36 (polypropylene)

Most vinyl siding is located in Exposure Category B, where buildings are grouped together rather than isolated. The procedures in ASCE 7-10 provide certain conversion factors to reflect the protection afforded by adjacent buildings, and this affects the relationship between test pressure and wind speed calculated in Annex A1. Similarly, siding located on a building with a mean roof height greater than 30 feet would have a different wind speed rating. The tables and charts below are appropriate for Category B exposures and 30-foot mean roof height. For locations with a different exposure category or buildings with a different mean roof height, refer to ASCE 7-10.

Standard Assumptions

Wind speed calculations under these Guidelines are based on the following assumptions:

- When a single wind speed is provided to represent a product family, that wind speed rating is based on the siding profile within that family that has the widest coverage. Narrower profiles would yield higher wind speed ratings.
- The calculations are based on building designs typical of single-family residences
- The calculations assume no wind speed increases due to nearby hills.
- The calculations are based on forces at the most severe location on the walls, that is, near corners at the top of the wall.
- The siding is installed consistent with the most stringent provisions of applicable building codes, the manufacturer's instructions, and the VSI installation manual.
- The standard wind speed rating cited will correspond to the Standard Design Pressure Rating resulting from testing under the respective product specifications.
- Alternatively, communications can cite an alternative wind speed rating corresponding to an Alternative Design Pressure Rating developed through testing with an alternative installation configuration. Since the alternative wind speed rating is dependent on the alternative installation method, a description of that method must accompany the alternative wind speed rating.

Additional Notes

Calculations under these guidelines are estimates of wind speed resistance for siding given one uniform set of assumptions. Estimates provided according to these guidelines should not be interpreted as assuring compliance with any specific building code. Estimates of wind speed ratings calculated under these guidelines will not apply to all locations due to differences in the local building codes, etc. More accurate estimates for a specific building and location may be calculated if detailed information is available. However, if a precise wind speed rating or code compliance assurance is required for a given building, a qualified structural engineer should be consulted to evaluate all variables involved for that specific structure and location.

Note that siding is part of a water resistive system that is not intended to be a part of the structural system of the wall. The structural wind resistance of a wall will not be increased as a result of installing siding. The strength of a given wall may be less than the maximum wind speed rating calculated for a specific siding product.

Statements Regarding Wind Speeds

Identification Statement (Required)

Wind speed rating of siding panels in accordance with these guidelines shall identify the wind speed rating with an individual standard notation. The following standard notation must either appear next to the rating or be referenced by an asterisk and appear elsewhere in the communication.

Rating per VSI Wind Speed Calculation Guidelines

Description Statement (Elective)

The following statement (disclaimer) may be used in lieu of the statement above to explain and clarify the intent and limitations of VSI's Wind Speed Calculation Guidelines:

The wind speed rating (in MPH) reported in this publication is calculated using VSI's (the Vinyl Siding Institute) Wind Speed Calculation Guidelines and based on testing in accordance to D5206. It is an estimate of wind speed resistance of the siding itself calculated utilizing ASCE/SEI 7-10 given one uniform set of assumptions. Vinyl siding is part of a water resistive assembly but not a part of the structural wall.

Wind Speed Reference

The following tables and charts may be used to determine the wind speed rating that corresponds to the AMSTP and design pressure rating for a siding product. Because the PEF for polypropylene siding is different from that for vinyl and insulated vinyl siding, the corresponding wind speed values are different, and are presented in a different table and figure.

Table 1: Wind Speed Corresponding to Selected Test Pressures for Vinyl and Insulated Vinyl Siding

1: Vinyl and Insulated Vinyl Siding		Average Maximum Sustained Test Pressure and Design Pressure Rating from D5206 Testing (psf, lbf/ft²)					
Test Pressure		22.5	25.0	30.0	35.0	40.0	45.0
Design Pressure Rating		30.0	33.3	40.0	46.7	53.3	60.0
Wind Speed Rating (mph)	ASD	112	118	129	139	149	158
	Ultimate	144	152	166	180	180	180

Test Pressure		50.0	55.0	60.0	65.0	70.0	75.0
Design Pressure Rating		66.67	73.33	80.00	86.67	93.33	100.00
Wind Speed Rating (mph)	ASD	166	175	182	190	197	204
	Ultimate	180	180	180	180	180	180
Notes	1	All calculations based on pressure equalization factor of 0.50, safety factor of 1.5, exposure category B, mean roof height 30 ft.					
	2	Linear interpolation between columns is permitted, or use the graph below to determine wind speeds between 5 psf test pressure intervals.					
	3	Ultimate wind speed is to be used only in statements referring to wind zones, such as "Suitable for use in zones or locations having a nominal design wind speed (ultimate) up to: ### (mph)"					
	4	Ultimate wind speed does not go higher than 180 mph since that is the highest North American wind speed zone.					

Figure 1: Wind Speed Corresponding to Test Pressures for Vinyl and Insulated Vinyl Siding

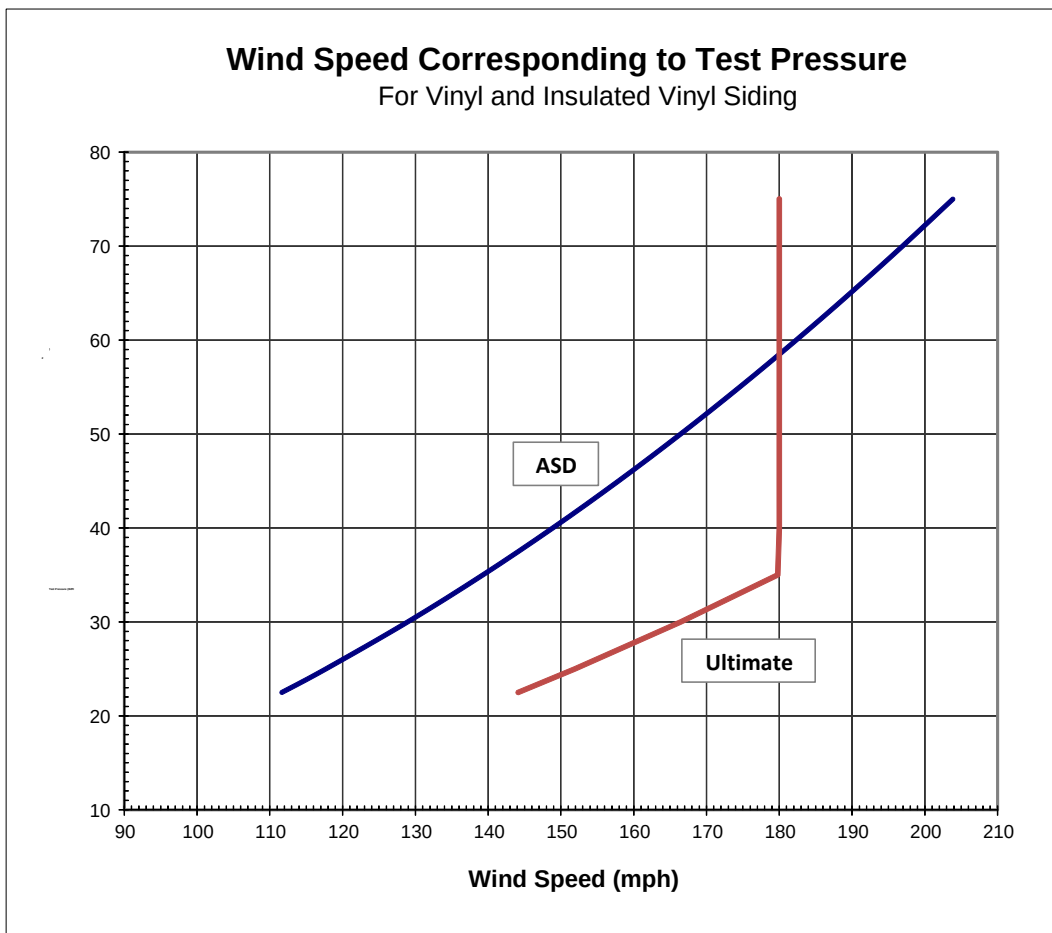


Table 2: Wind Speed Corresponding to Selected Test Pressures for Polypropylene Siding

2: Polypropylene Siding		Average Maximum Sustained Test Pressure and Design Pressure Rating from D5206 Testing (psf, lbf/ft²)					
Test Pressure		16.70	20.00	25.00	30.00	35.00	40.00
Design Pressure Rating		30.93	37.04	46.30	55.56	64.81	74.07
Wind Speed Rating (mph)	ASD	113	124	139	152	164	175
	Ultimate	146	160	179	180	180	180

Test Pressure		45.00	50.00	55.00	60.00	65.00	70.00
Design Pressure Rating		83.33	92.59	101.85	111.11	120.37	129.63
Wind Speed Rating (mph)	ASD	186	196	206	215	224	232
	Ultimate	180	180	180	180	180	180

Notes	1	All calculations based on pressure equalization factor of 0.36, safety factor of 1.5, exposure category B, mean roof height 30 ft.
	2	Linear interpolation between columns is permitted, or use the graph below to determine wind speeds between 5 psf test pressure intervals.
	3	Ultimate wind speed is to be used only in statements referring to wind zones, such as "Suitable for use in zones or locations having a nominal design wind speed (ultimate) up to: ### (mph)"
	4	Ultimate wind speed does not go higher than 180 mph since that is the highest North American wind speed zone.

Figure 2: Wind Speed Corresponding to Test Pressures for Polypropylene Siding

