This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D4385 – 19

Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products[1]

This standard is issued under the fixed designation D4385; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This practice covers acceptance criteria for visual acceptance of thermosetting reinforced plastic pultruded rods, bars, shapes, and sheets.

1.2 This practice presents definitions of possible defects to serve as a guide for contracts, drawings, product specifications, and final inspection.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—There is no known ISO equivalent to this standard.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D883 Terminology Relating to Plastics

D3917 Specification for Dimensional Tolerance of Thermosetting Glass-Reinforced Plastic Pultruded Shapes

3. Terminology

3.1 *Definitions*—The definitions in this practice are in accordance with Terminology D883.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *connection areas*—areas associated with a pultruded member that form a connection in some form or fashion that will not be visible after fabrication.

3.2.2 *fiber blooming*—exposed reinforcements on the surface of a profile as a result of veil slippage or lack of resin. Such defects will cause the exposed fiber to "bloom" when exposed to ultraviolet light.

3.2.3 *internal layer*—refers to individual layers of unidirectional or transverse reinforcements in the form of roving/tows, continuous filament, woven or stitched mats formed and laminated via the pultrusion process to produce a specific thickness of or as part of a pultruded profile. A stitched or woven mat is made up of individual layers of roving woven or stitched together to form a single mat

3.2.4 *mat discoloration*—a discoloration (typically yellowing) of the reinforcing mats caused by binder migration. The discoloration can cause visual streaks on the surface of the pultrusion.

3.2.5 *test requirement*—minimum design, characteristic or specified values as dictated and or specified by codes, standards, industry, end customers, the manufacturer or the Engineer of Record.

4. Acceptance Criteria

4.1 The method and frequency of inspection shall be the responsibility of the pultruder as deemed necessary to maintain compliance to this specification, unless the purchaser and seller agree on other terms.

4.2 *Dimensions and Tolerances*—Refer to specifications in accordance with product drawing or in accordance with Specification D3917.

4.3 *Allowable Defects*—Defects that by nature, number, or frequency of occurrence do not affect the serviceability of the product. Allowable defects shall be fully described as to the type, size, number, extent allowed, and spacing. Defects in

[1] This practice is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.18 on Reinforced Thermosetting Plastics.

Current edition approved Nov. 1, 2019. Published December 2019. Originally approved in 1984. Last previous edition approved in 2013 as D4385 - 13. DOI: 10.1520/D4385-19.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States

Documents
Document Sharing Hub
Full document details: ASTM D4385-19

excess of those listed as allowable defects in the product specifications, drawings, or contracts, for the products, shall be cause for rejection.

4.4 *Repairable Defects*—Visual defects (for example, chips, exposed reinforcement, fiber bridging, fiber prominence, and scuffing) that do not affect the structural serviceability that are permitted to be repaired if agreed upon between the manufacturer and the purchaser. The repair procedure shall be documented and contractually agreed upon by all parties involved.

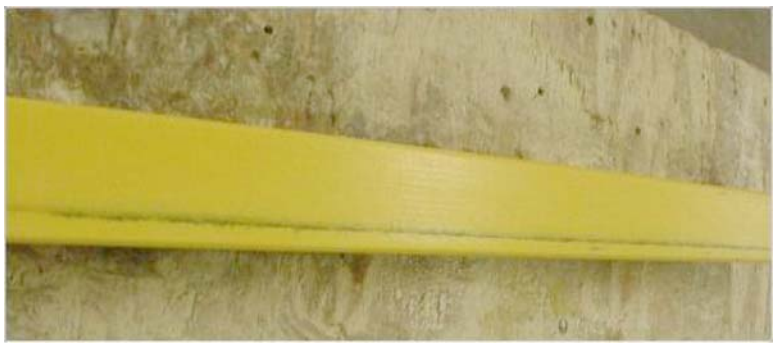
5. Acceptance Levels

5.1 *Visual Inspection*—Each sample selected in accordance with 4.1 shall be checked visually without the aid of magnification. Any defect not meeting the requirements of this standard, shall be cause for rejection. Any defect not covered in this specification shall be resolved between the purchaser and the seller and shall be fully described in the specification and contractual documents.

6. Keywords

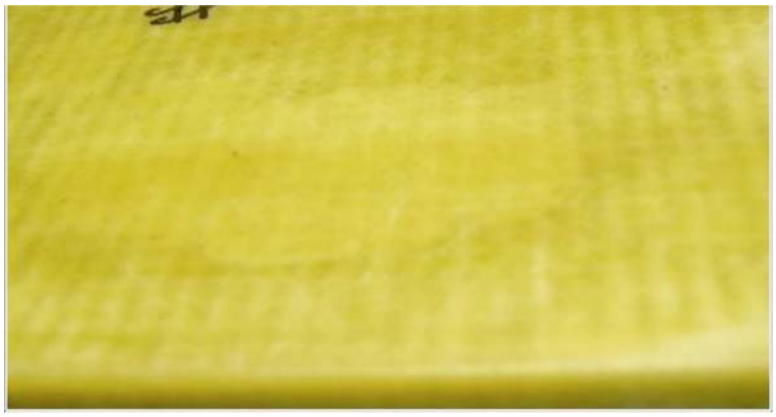
6.1 pultrusion; structural shapes; visual

TABLE 1 Acceptance Criteria

Name	Definition	Acceptance/Rejection Criteria
Black Marking	Black smudges on the surface of the pultruded product that are unremovable by cleaning, scrubbing, or wiping with solvent. **Note**—This defect is cosmetic in nature and does not affect the structural serviceability.	A single smudge shall fit in a 1 in. (25.4 mm) diameter circle. Multiple smudges are permitted.
 *Note: Photo shown depicts profile not meeting the specification.*		
Blister	A rounded elevation of the pultruded profile surface with boundaries that has the potential to be sharply defined. It is possible that blisters will exist within the pultrusion as a hollow delaminated area (gas-filled) under a raised portion of the surface. **Note**—The rounded elevation somewhat resembles in shape a blister on the surface of human skin. **Note**—This defect is cosmetic in nature and does not affect the structural serviceability.	Permitted if formed between the surfacing veil layer and balance of laminate, width is no greater than 80 % of surface width, but limited to 1.25 in. (31.75 mm) in diameter and length is not over 8 in. (20.32 cm). Not more than two per 10 ft (3.048 m) of length. Popcorn blisters less than 0.060 in. (1.524 mm) in diameter and 0.010 in. (0.254 mm) high are permitted. Blisters are not permitted within connection areas intended for bonding purposes.

Documents
Document Sharing Hub
Full document details: ASTM D4385-19

TABLE 1 *Continued*

Name	Definition	Acceptance/Rejection Criteria
		
	Note: Photo shown depicts profile not meeting the specification.	

Documents
Document Sharing Hub
Full document details: ASTM D4385-19

TABLE 1 *Continued*

Name	Definition	Acceptance/Rejection Criteria
Burn or Thermal Decomposition	A discoloration, distortion, or destruction of the pultruded surface as a result of thermal decomposition. **Note**—This defect affects the structural serviceability.	Not acceptable.

Note: Photo shown depicts profile not meeting the specification.

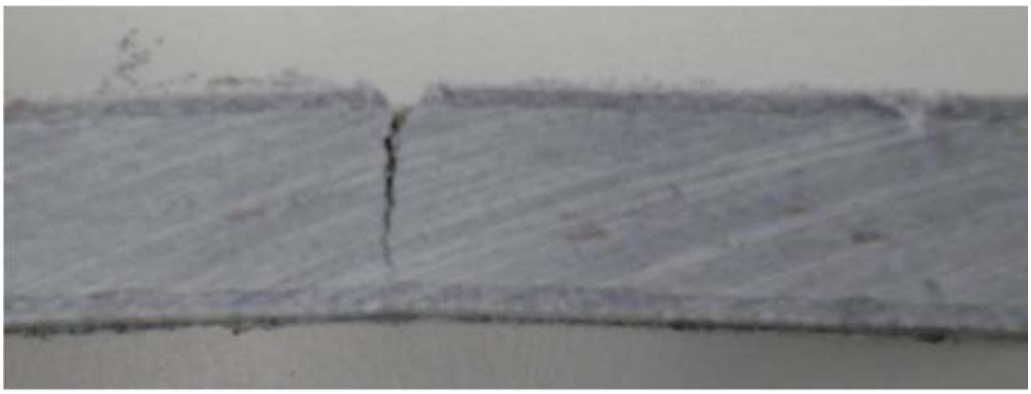
Chips (Gouges)	Minor damage to the pultruded surface that removes material but does not cause a crack or craze. **Note**—This defect is cosmetic in nature and does not affect the structural serviceability.	Not over 0.393 in. (10 mm) wide or long. Not more than five per 10 ft (3.048 m) length. Chips that penetrate past the depth of the surface veil are not permitted.

Note: Photo shown depicts profile meeting the specification.

Documents
Document Sharing Hub
Full document details: ASTM D4385-19

TABLE 1 *Continued*

Name	Definition	Acceptance/Rejection Criteria
Crack	A visual separation that penetrates down from the pultruded surface to the equivalent of one full ply or more reinforcement 0.02 in. (0.508 mm). Reference Internal Shrinkage Cracks. **Note**—This defect affects the structural serviceability.	Not acceptable.



Note: Photo shown depicts profile not meeting the specification.

Crater	A small, shallow pultrusion surface imperfection. **Note**—This defect is cosmetic in nature and does not affect the structural serviceability.	Acceptable if it does not reduce the part thickness below the minimum specification.

Note: Photo shown depicts profile meeting the specification.

Documents
Document Sharing Hub
Full document details: ASTM D4385-19

TABLE 1 *Continued*

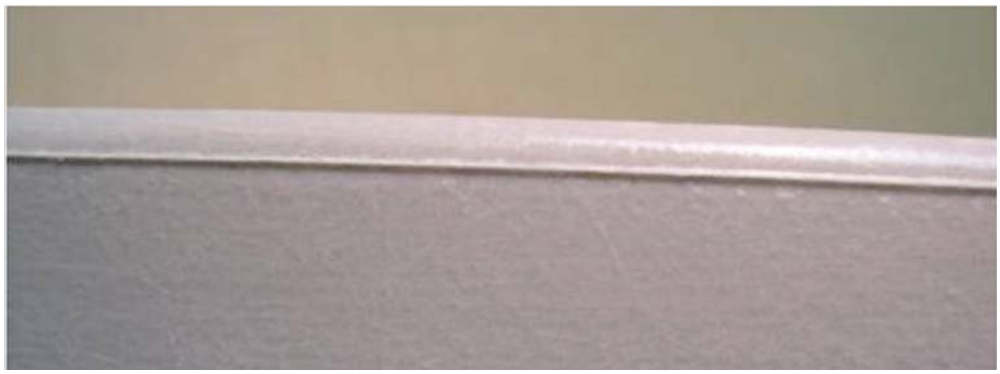
Name	Definition	Acceptance/Rejection Criteria
Craze	Multiple fine separation cracks at the pultruded surface not penetrating into the reinforcement or to the equivalent depth of one ply of reinforcement. **Note**—This condition is usually due to resin shrinkage during cure in resin-rich areas. **Note**—This defect is cosmetic in nature and does not affect the structural serviceability.	Acceptable and can be over the entire length of the part.
 Note: Photo shown depicts profile meeting the specification.		
Delamination	The separation of two or more layers or plies of reinforcing material within a pultrusion. **Note**—This defect affects the structural serviceability.	Not acceptable.
 Note: Photo shown depicts profile not meeting the specification.		

Documents
Document Sharing Hub

Full document details: ASTM D4385-19

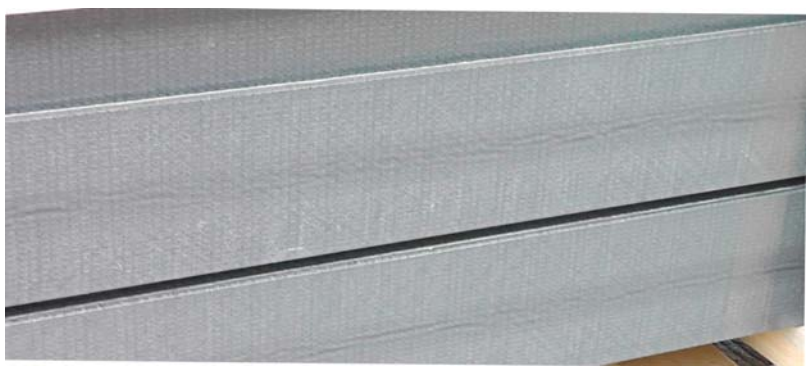
TABLE 1 *Continued*

Name	Definition	Acceptance/Rejection Criteria
Die Parting Line	A lengthwise flash or depression on the surface of a pultruded plastic part. The die parting line is not part of the dimensional tolerance. **Note**—The die parting line is associated with the area where separate pieces of the die join together to form the cavity. **Note**—This defect is cosmetic in nature and does not affect the structural serviceability.	The line projection caused by the die parting line shall not extend past the product's surface by more than 0.02 in. (0.508 mm). It shall not create a sharp feeling or have loose reinforcement fibers.



Note: Photo shown depicts profile meeting the specification.

Discoloration	A streak or other pattern on the surface that causes a noticeable change of color from the rest of the pultruded surface that has not been exposed to the weather. **Note**—This defect is cosmetic in nature and does not affect the structural serviceability.	Spots of any color not over 0.75 in. (19.05 mm) in diameter or eight per 10 ft (3.048 m) of length are permitted. Streaks or longitudinal stains permitted if not over 0.75 in. (19.05 mm) wide, 10 in. (25.4 cm) long, or more than six per 10 ft (3.048 m) of length. Continuous discolorations caused by a veil overlap or resin rich areas are permitted. Mat discolorations are not rejectable.



Note: Photo shown depicts profile meeting the specification.

Documents
Document Sharing Hub

Full document details: ASTM D4385-19