

ASCE STANDARD

ASCE/SEI

55-16

Tensile Membrane Structures

55-16

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Library of Congress Cataloging-in-Publication Data

Names: American Society of Civil Engineers.

Title: Tensile membrane structures / American Society of Civil Engineers.

Description: Reston, Virginia : American Society of Civil Engineers, 2017. |

"ASCE/SEI 55-16." | Includes index.

Identifiers: LCCN 2016034190| ISBN 9780784414378 (soft cover : alk. paper) |

ISBN 9780784479995 (PDF)

Subjects: LCSH: Tensile architecture--Standards--United States. | Lightweight construction--Standards--United States. | Roofs, Fabric--Standards--United States. | Synthetic fabrics--Standards--United States. | Structural frames--Standards--United States.

Classification: LCC TA663 .T45 2017 | DDC 624.1/77--dc23 LC record available at <https://lccn.loc.gov/2016034190>

Published by American Society of Civil Engineers

1801 Alexander Bell Drive

Reston, Virginia, 20191-4382

www.asce.org/bookstore | ascelibrary.org

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Errata: Errata, if any, can be found at <https://doi.org/10.1061/9780784414378>

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ISBN 978-0-7844-1437-8 (soft cover)

ISBN 978-0-7844-7999-5 (PDF)

doi: /10.1061/9780784414378

Manufactured in the United States of America.

24 23 22 21 20 19 18 17 2 3 4 5

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This version of ASCE 55 improves on the previous edition in three ways:

1. The inclusion of load resistance factor design (LRFD) and allowable stress design (ASD) load combinations;
2. The inclusion of air-supported membrane structures as Chapter 6 of this standard, which now replaces Standard ASCE 17-96, *Air-Supported Structures*; and
3. Providing a single document that deals with conventional tensile membrane structures, frame-covered membrane structures, and air-supported tensile membrane structures.

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The American Society of Civil Engineers (ASCE) acknowledges the devoted efforts of the Tensile Membrane Structures Standards Committee of the Codes and Standards Activities Committee. This group comprises individuals from many backgrounds

including: consulting engineering, research, construction industry, education, government, design, and private practice.

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CHAPTER 1 GENERAL

1.1 SCOPE

This standard provides minimum criteria for the analysis, design, and performance of membrane-covered cable and rigid member structures, including frame supported structures and air-supported structures, collectively known as tensile membrane structures, including permanent and temporary structures as defined herein. The requirements of this standard shall apply whether the tensile membrane structure is independent of or attached to another structure. This standard does not apply to air-inflated structures as defined in Section 1.2, Definitions. This standard does not apply to films as defined in Section 1.2.

This standard is applicable to all tensile membrane structures as described: Temporary structures with a plan area greater than 1,000 ft² (93 m²) or with any membrane span exceeding 10 ft (3 m), and permanent structures with a plan area greater than 225 ft² (21 m²), regardless of span.

This standard is applicable to tensile membrane structures erected under the requirements of the legally adopted building code of which this standard forms a part. In geographical areas without a legally adopted building code, this standard defines minimum acceptable standards of design and construction practice.

This standard supplements the building code and shall govern all matters pertaining to analysis, design, construction, and material properties. It may be used in the absence of a building code or where the building code does not address membrane structures adequately.

Elements of a tensile membrane structure not governed by this standard (e.g., structural steel, cables, timber, aluminum, or concrete) shall be proportioned in accordance with their respective standards.

1.2 DEFINITIONS

The following definitions apply in this standard:

Air Pressures—Pressures that are identified as

- Maximum internal pressure: the greatest pressure that the inflation system is capable of developing within the structure
- Maximum operating pressure: the greatest pressure permitted with immediate and continuous supervision of the pressure control system
- Minimum operating pressure: the lowest pressure at which the structure is designed to operate
- Normal operating pressure: the range of operating pressures specified when special methods are not necessary to accommodate unusual loads
- Residual pressure: the pressure used to determine the deflation index, D_i .

Air-inflated Structure—Membrane structure with a shape that is maintained by air pressure acting within cells or tubes enclosing all or part of the occupied space.

Air-supported Structure—Membrane structure that encloses an occupied space and has a shape that is maintained by air pressure acting within the occupied space.

Anchorage—Device used to secure a membrane or cable to a support or a supporting system.

Authority Having Jurisdiction—An organization, political subdivision, office, or individual charged with responsibility of administering and enforcing the provisions of this standard and those of the building code.

Biaxial Stress—Stress occurring simultaneously along two concurrent orthogonal directions, usually warp and fill.

Cable—Flexible linear or curvilinear element acting in tension. Cable may be wire rope, strand, or web.

Compensation (and Decompensation)—Adjustment during patterning of membrane panel dimensions that allows for stretching of the material as required to achieve the desired initial prestress and geometry.

Deflation Index—Calculated value used to ensure a margin of safety for emergency egress from an air-supported structure.

Design Strength—Strength determined by multiplying ultimate strength by one or more strength-reduction factors.

Effective Membrane Breaking Strength—Ultimate strength of the membrane or seam, whichever is less.

Effective Prestress—Prestress remaining in the structure after all losses, including long-term losses, have occurred.

Fabric—Cloth produced by interlacing or warp knit, yarns, fibers, or filaments that may be woven or laid, and may be impregnated with a matrix that binds them together. The fabric is frequently coated or laminated.

Factored Load—Product of the nominal loads and load factors used to proportion members by strength design.

Fan—Air-moving device, including axial, centrifugal, or propeller blowers.

Fibers—Individual threads of a material that can be spun into a yarn or made into a fabric by various methods including weaving, knitting, braiding, felting, and twisting.

Fill—Yarns that are placed in the narrow direction of the fabric as it is manufactured (also known as weft).

Film—Unreinforced sheet that does not contain fibers or yarn.

Frame-supported Membrane Structure—Membrane structure supported by a rigid framework of which the membrane may or may not be a part, or a supplement to the primary structural system.

Inflation System—All necessary components of a mechanical system required for inflation and operation of an air-supported structure. This may include but are not limited to fans, motors, backdraft dampers, relief dampers, heaters, housings, ducts not