

# Design of Fiberglass-Reinforced Plastic (FRP) Stacks

This document uses both the  
International System of Units (SI)  
and customary units

American Society of Civil Engineers  
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Stacks**

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The following standards have been issued:

ANSI/ASCE 1-82 N-725 Guideline for Design and Analysis of Nuclear Safety Related Earth Structures  
ASCE/EWRI 2-06 Measurement of Oxygen Transfer in Clean Water  
ANSI/ASCE 3-91 Standard for the Structural Design of Composite Slabs and ANSI/ASCE 9-91 Standard Practice for the Construction and Inspection of Composite Slabs  
ASCE 4-98 Seismic Analysis of Safety-Related Nuclear Structures  
Building Code Requirements for Masonry Structures (ACI 530-02/ASCE 5-02/TMS 402-02) and Specifications for Masonry Structures (ACI 530.1-02/ASCE 6-02/TMS 602-02)  
ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures  
SEI/ASCE 8-02 Standard Specification for the Design of Cold-Formed Stainless Steel Structural Members  
ANSI/ASCE 9-91 listed with ASCE 3-91  
ASCE 10-97 Design of Latticed Steel Transmission Structures  
SEI/ASCE 11-99 Guideline for Structural Condition Assessment of Existing Buildings  
ASCE/EWRI 12-05 Guideline for the Design of Urban Subsurface Drainage  
ASCE/EWRI 13-05 Standard Guidelines for Installation of Urban Subsurface Drainage  
ASCE/EWRI 14-05 Standard Guidelines for Operation and Maintenance of Urban Subsurface Drainage  
ASCE 15-98 Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)  
ASCE 16-95 Standard for Load Resistance Factor Design (LRFD) of Engineered Wood Construction  
ASCE 17-95 Air-Supported Structures  
ASCE 18-96 Standard Guidelines for In-Process Oxygen Transfer Testing  
ASCE 19-96 Structural Applications of Steel Cables for Buildings  
ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations

ANSI/ASCE/T&DI 21-05 Automated People Mover Standards—Part 1  
ANSI/ASCE/T&DI 21.2-08 Automated People Mover Standards—Part 2  
ANSI/ASCE/T&DI 21.3-08 Automated People Mover Standards—Part 3  
ANSI/ASCE/T&DI 21.4-08 Automated People Mover Standards—Part 4  
SEI/ASCE 23-97 Specification for Structural Steel Beams with Web Openings  
ASCE/SEI 24-05 Flood Resistant Design and Construction  
ASCE/SEI 25-06 Earthquake-Actuated Automatic Cuts Shutoff Devices  
ASCE 26-97 Standard Practice for Design of Buried Precast Concrete Box Sections  
ASCE 27-00 Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction  
ASCE 28-00 Standard Practice for Direct Design of Precast Concrete Box Sections for Jacking in Trenchless Construction  
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EWRI/ASCE 34-01 Standard Guidelines for Artificial Recharge of Ground Water  
EWRI/ASCE 35-01 Guidelines for Quality Assurance of Installed Fine-Pore Aeration Equipment  
CI/ASCE 36-01 Standard Construction Guidelines for Microtunneling  
SEI/ASCE 37-02 Design Loads on Structures During Construction  
CI/ASCE 38-02 Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data  
EWRI/ASCE 39-03 Standard Practice for the Design and Operation of Hail Suppression Projects  
ASCE/EWRI 40-03 Regulated Riparian Model Water Code  
ASCE/SEI 41-06 Seismic Rehabilitation of Existing Buildings  
ASCE/EWRI 42-04 Standard Practice for the Design and Operation of Precipitation Enhancement Projects  
ASCE/SEI 43-05 Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities  
ASCE/EWRI 44-05 Standard Practice for the Design and Operation of Supercooled Fog Dispersion Projects  
ASCE/EWRI 45-05 Standard Guidelines for the Design of Urban Stormwater Systems  
ASCE/EWRI 46-05 Standard Guidelines for the Installation of Urban Stormwater Systems

ASCE/EWRI 47-05 Standard Guidelines for the Operation and Maintenance of Urban Stormwater Systems  
ASCE/SEI 48-05 Design of Steel Transmission Pole Structures  
ASCE/EWRI 50-08 Standard Guideline for Fitting Saturated Hydraulic Conductivity Using Probability Density Functions

ASCE/EWRI 51-08 Standard Guideline for Calculating the Effective Saturated Hydraulic Conductivity  
ASCE/SEI 52-10 Design of Fiberglass-Reinforced Plastic (FRP) Stacks

## FOREWORD

In early 1994, the American Society of Civil Engineers was approached by a group interested in formulating a standard for the design, fabrication, and erection of fiberglass reinforced plastic (FRP) stacks and their appurtenances. They felt there was a need for an FRP stack standard, similar to the ASME steel stack standard STS-1, to establish a better level of standardization in the industry and for safeguarding the community.

Therefore, in 1994 a group comprising FRP stack users, researchers, designers, fabricators, and erectors

convened under the auspices of the American Society of Civil Engineers to formulate such a standard.

With the aforementioned mission in mind, the group subdivided and began gathering information to formulate guidelines for material selection, mechanical and structural design, vibration, access, safety, electrical, fabrication, erection, inspection, and maintenance requirements.

The following publication is a result of their work and investigation.

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## INTRODUCTION

The following standard applies to fiberglass-reinforced plastic (FRP) stacks, that is, those stacks where the primary supporting shell is made of FRP. This standard can be applicable to both single- and multiple-walled FRP stacks, guyed FRP stacks, or certain aspects of tower stacks. The stack may be supported on a foundation or from another structure.

This Standard covers the design of FRP stacks. The Standard outlines the considerations which must be made for both the mechanical and structural design; emphasizes what consideration must be taken for wind and seismic-induced vibrations; gives guidelines for the ultraviolet protection, selection of materials, linings, and coatings; states the requirements for lighting and lightning protection based upon existing building and federal codes; gives the requirements for climbing and access based upon current Occupational Safety and Health Administration (OSHA) standards; emphasizes the important areas regarding fabrication and construction; and outlines areas requiring maintenance and inspection following initial operation.

The information presented has been prepared in accordance with established engineering principles utilizing state-of-the-art information and is intended for general information. While every effort has been made to ensure its accuracy, the information should not be relied upon for any specific application without the consultation of a competent, licensed professional engineer, to determine its suitability. It is therefore recommended that Engineering/Design drawings and related documents of the stack bear the Professional Engineer Seal, signature, and date.

Nothing in the Standard shall be construed to alter or subvert the requirements of any existing code or authority having jurisdiction over the facility. Furthermore, alternate methods and materials to those herein indicated may be used, provided that the engineer can demonstrate their suitability to all agencies and authorities. Note that several of the sections are similar to ASTM D 5364 and ASME Steel Stack STS-1 Standard, and many members of that committee are also on the FRP Stack Standard Committee.

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# CONTENTS

CHAPTER 1 DEFINITIONS AND MATERIALS .....	1
1.1 DEFINITIONS .....	1
1.2 MATERIALS .....	4
1.3 RESINS .....	4
1.3.1 Polyester Resins .....	4
1.3.2 Vinyl Ester Resins .....	4
1.3.3 Phenolic Resins .....	5
1.3.4 Epoxy Resin .....	5
1.4 REINFORCEMENTS .....	5
1.4.1 Glass Reinforcements .....	5
1.4.2 Rovings .....	5
1.4.3 Mats .....	6
1.4.4 Combination Woven Roving/Chopped Strand Mat .....	6
1.4.5 Woven And Weft Inserted (Unidirectional) Fabrics .....	6
1.4.6 New Technology .....	6
1.5 RESIN ADDITIVES .....	6
1.5.1 Fire Retardants .....	6
1.5.2 Promoters .....	6
1.5.3 Inhibitors .....	6
1.5.4 Thixotropic Agents .....	6
1.5.5 Pigments, Coatings, Gel Coats .....	7
1.5.6 Light Inhibitors .....	7
CHAPTER 2 MECHANICAL DESIGN .....	7
2.1 DESIGN BASIS .....	7
2.1.1 General .....	7
2.1.2 Mechanical Section Symbols .....	7
2.1.3 Mechanical Section Definition .....	7
2.2 SIZE SELECTION .....	7
2.2.1 Height .....	7
2.2.2 Diameter .....	8
2.2.3 Shape .....	8
2.3 AVAILABLE DATA .....	8
2.3.1 Natural Draft .....	8
2.3.2 Draft Losses .....	8
2.4 HEAT LOSS .....	9
2.4.1 Ambient Conditions .....	9
2.4.2 Film Coefficients .....	9
2.4.3 Heat Loss Calculations .....	9
2.5 THERMAL EXPANSION .....	9
2.6 OPTIONAL APPURTENANCES .....	10

CHAPTER 3 STRUCTURAL DESIGN .....	10
3.1 SCOPE .....	10
3.2 GENERAL .....	10
3.2.1 Design Limitations .....	10
3.2.2 Drawings and Computations .....	10
3.2.3 Location .....	10
3.2.4 Shop Drawings .....	10
3.3 TYPES OF FRP STACKS .....	11
3.3.1 Self-Supported Stacks .....	11
3.3.2 Braced Stacks .....	11
3.3.3 Guyed Stacks .....	11
3.4 APPLIED LOADING .....	11
3.4.1 Dead Load .....	11
3.4.2 Live Load .....	11
3.4.3 Wind Load .....	11
3.4.4 Thermal Load .....	11
3.4.5 Drag Load Interference Effects .....	12
3.4.6 Concentrated Loads due to Braced or Guyed System .....	12
3.4.7 Other Loads .....	12
3.5 MATERIAL .....	12
3.5.1 Selection of Material of Construction .....	12
3.6 LOAD AND RESISTANCE FACTOR DESIGN PROCEDURE (LRFD) .....	12
3.6.1 General .....	12
3.6.2 Load Factors (LF) .....	12
3.6.3 Resistance Factors (RF) .....	12
3.6.4 Loading Combinations .....	13
3.6.5 Allowable Longitudinal Stress .....	13
3.6.6 Allowable Circumferential Stress .....	13
3.6.7 Allowable Bending of Stiffeners or Base Plate Elements .....	13
3.6.8 Circumferential Stiffener Requirements .....	13
3.6.9 Interaction Equation for Longitudinal and Circumferential Stress .....	13
3.7 DEFLECTION .....	13
3.8 DISCONTINUITIES IN THE SHELL .....	13
3.9 BASE DESIGN .....	14
3.10 ANCHOR BOLTS .....	14
3.10.1 Material–Anchors Bolts, Washers, and Nuts .....	14
3.11 FOUNDATION .....	14
3.12 SPECIAL CONSIDERATIONS .....	14
3.13 SYMBOLS .....	14
CHAPTER 4 VIBRATION .....	15
4.1 SCOPE .....	15
4.1.1 Loads .....	15
4.2 GENERAL .....	15
4.2.1 Basis for Vibration Consideration .....	15

4.3	DYNAMIC RESPONSES . . . . .	15
4.3.1	Dynamic Characteristics . . . . .	15
4.3.2	Frequencies . . . . .	15
4.3.3	Mathematical Modeling . . . . .	15
4.3.4	Earthquake Responses . . . . .	16
4.3.5	Wind Responses . . . . .	16
4.4	PREVENTION OF EXCESSIVE VIBRATION . . . . .	17
4.4.1	General . . . . .	17
4.4.2	Aerodynamic Methods . . . . .	17
4.4.3	Stiffness Methods . . . . .	18
4.5	ESTIMATION OF VIBRATION CYCLES . . . . .	19
4.6	SYMBOLS . . . . .	19
	CHAPTER 5 ACCESS, SAFETY, AND ELECTRICAL . . . . .	19
5.1	SCOPE . . . . .	19
5.2	GENERAL . . . . .	19
5.3	LADDERS . . . . .	20
5.3.1	Ladders, Design Loads . . . . .	20
5.3.2	Ladder Parts . . . . .	20
5.3.3	Pitch . . . . .	20
5.3.4	Safety Cages and Wells . . . . .	20
5.3.5	Ladder Safety Devices . . . . .	20
5.3.6	Prevention of Unauthorized Access . . . . .	21
5.4	PLATFORMS AND LANDINGS . . . . .	21
5.4.1	Work and Sampling Platforms . . . . .	21
5.4.2	Aviation Light Platforms . . . . .	21
5.4.3	Rest Landings . . . . .	21
5.4.4	Catwalks between Stack and Adjacent Structures . . . . .	21
5.4.5	Parts . . . . .	21
5.5	ELECTRICAL . . . . .	21
5.5.1	Codes, Standards, and Other Documents . . . . .	21
5.5.2	Aviation Obstruction Marking Light System . . . . .	21
5.5.3	Lighting Protection . . . . .	22
5.5.4	Convenience Lighting . . . . .	22
5.5.5	Convenience Power Outlets . . . . .	22
	CHAPTER 6 FABRICATION AND ERECTION . . . . .	22
6.1	PURPOSE . . . . .	22
6.2	SCOPE . . . . .	22
6.3	FABRICATOR'S RESPONSIBILITES . . . . .	22
6.3.1	Written Procedure . . . . .	22
6.3.2	Qualification Laminates . . . . .	22
6.4	QUALITY ASSURANCE . . . . .	23
6.4.1	Resin Cure . . . . .	23
6.4.2	Acetone Test . . . . .	23
6.4.3	Surface Condition . . . . .	23
6.4.4	Internal Corners . . . . .	23

6.5	TOLERANCES	23
6.5.1	Peaking	23
6.5.2	Cylindrical Sections	23
6.5.3	Matching Cylindrical Sections	24
6.5.4	Rectangular Sections	24
6.5.5	Height	24
6.5.6	Squareness of Ends	24
6.5.7	Fittings	24
6.5.8	Straight Connections / Butt Joints	24
6.5.9	Vertical Butt Seams	24
6.5.10	Diameter	24
6.5.11	Wall Laminate Thickness	24
6.6	INSPECTION	24
6.6.1	Dimension and Thickness Checks	24
6.6.2	Physical Property and Laminate Tests	24
6.6.3	Visual Inspection	24
6.6.4	Penetrant Inspection	24
6.7	SHOP FABRICATION AND FIELD ERECTION	24
6.7.1	Assembly of Bolted Connections	24
6.7.2	Flanges	24
6.7.3	Exterior Laminate	25
6.7.4	Cut Edges	25
6.7.5	Joints	25
6.7.6	Inner Surfaces	25
6.7.7	Sampling Ports	25
6.7.8	Electrical Requirements	25
6.7.9	Straightening	25
6.7.10	Anchor Bolt Straightening	25
6.7.11	Plumbness	25
6.7.12	Cranes	25
6.7.13	Temporary Devices	26
6.7.14	Erection Equipment	26
6.8	GROUTING	26
6.8.1	Use	26
6.8.2	Grout Properties	26
6.8.3	Surface Areas	26
6.8.4	Temperature	26
6.8.5	Sleeves	26
6.8.6	Torque	26
6.9	HANDLING AND STORAGE	26
6.9.1	Safety	26
6.9.2	Cleanliness	26
6.9.3	Rigging	26
6.9.4	Storage	26
	CHAPTER 7 INSPECTION AND MAINTENANCE	26
7.1	INSPECTION DURING FABRICATION AND INSTALLATION	26
7.1.1	Scope	26
7.1.2	Inspection and Responsibility	26
7.1.3	User's Inspection	26

7.1.4	Dimensions and Inspection Requirements	26
7.1.5	Packaging, Shipment, and Installation	27
7.2	FACTORS THAT INFLUENCE THE NEED FOR STRUCTURAL EXAMINATIONS	27
7.2.1	General	27
7.2.2	Original Design Basis versus Operating Basis	28
7.2.3	Exposure to Weather, Chemical, and Thermal Conditions	28
7.2.4	Operations Records	28
7.2.5	Cumulative Effect of Exposure and Operating Conditions	29
7.2.6	Ensuring Structural Adequacy	29
7.3	FIELD EXAMINATION TECHNIQUES	29
7.3.1	General	29
7.3.2	Preparation and Planning	29
7.3.3	Safety Considerations	30
7.3.4	Equipment	30
7.3.5	Identification of Critical Stack Sections	31
7.3.6	Exterior Inspections	31
7.3.7	Interior Inspections	31
7.3.8	Thickness Measurements	32
7.3.9	Sounding Measurements	32
7.3.10	Temperature Monitoring	32
7.3.11	Displacement Measuring	32
7.3.12	Surface Hardness Measurements	32
7.3.13	Infra-Red Survey	32
7.3.14	X-ray Tests	32
7.3.15	Laboratory Test Samples	32
7.3.16	Documentation	33
7.4	POTENTIAL DAMAGE AREAS	33
7.4.1	General	33
7.4.2	Indicators	33
7.4.3	Structural Elements	34
7.5	EXAMINATION DATA, EVALUATION, AND DISPOSITION	35
7.5.1	General	35
7.5.2	Examination Data Assimilation	35
7.5.3	Repairs	35
7.5.4	Evaluation and Disposition Considerations	35
7.5.5	Final Report	36
7.6	MAINTENANCE	36
7.6.1	Program	36
7.6.2	Guidelines	36
	FURTHER READING	37
	INDEX	39