ANSI E1.2 – 2021

Entertainment Technology — Design, Manufacture and Use of Aluminum Trusses and Towers

Approved by the ANSI Board of Standards Review on 06 May 2021

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Interest category codes:

CP = custom-market producer	DE = designer
DR = dealer rental company	G = general interest
MP = mass-market producer	U = user

CONTENTS

An asterisk (*) next to a clause number indicates that there is a matching explanatory clause in the informative Appendix A.

FOREWORD

Prior to the original 2000 version of this standard, there were no specific American National Standards covering the design, manufacture and use of aluminum trusses in the entertainment industry. In an attempt to improve safety and standards in the industry, the Entertainment Services and Technology Association (ESTA) convened a series of meetings to prepare a draft standard. Columbus McKinnon Corporation kindly hosted these meetings at their facilities in Buffalo, New York and Abingdon, Virginia,

It is the intention of ESTA that this standard be put forward as the basis for an American National Standard to the American National Standards Institute. It should be noted that other ANSI Standards may be relevant, depending on the application and intended use of the aluminum trusses.

The preparation of the standard was entrusted to the Truss Team working as part of the Rigging Work Group for the Technical Standards Council (TSC) of ESTA. The Truss Team is generally comprised of manufacturers and their structural engineering advisors.

It has been assumed in the drafting of this standard that the execution of its design provisions are entrusted to appropriately qualified and experienced people, and that the fabrication and use is carried out by qualified and suitably experienced people and organizations.

This standard presents a coordinated set of rules that may serve as a guide to government and other regulatory bodies and municipal authorities responsible for the guarding and inspection of the equipment falling within its scope. The suggestions leading to accident prevention are given both as mandatory and advisory provisions; compliance with both types may be required by employers of their employees.

Safety codes and standards are intended to enhance public safety. Revisions result from committee consideration of factors such as technology advances, new data, and changing environmental and industry needs. Revisions do not imply that previous editions were inadequate.

Compliance with this Standard does not of itself confer immunity from legal obligations.

1 Scope

This document describes the design, manufacture and use of aluminum trusses, towers and associated aluminum structural components such as head blocks, sleeve blocks, bases, and corner blocks in the entertainment industry. It does not cover individual, separate rigging hardware such as half couplers and shackles.

The standards described herein are for a variety of uses that are confined to the entertainment industry and apply to a range of structures subjected to normal atmospheric conditions.

The standards described herein do not cover aerospace alloys, the detail design of castings, curved shell structures or structures subjected to severe thermal or chemical conditions. They are not intended to be used for the design of containment vessels, airborne structures or vessels or for any application where a specific standard exists.

If "truss" is referred to in a particular clause in this standard, then it shall equally apply to ‘tower’ and vice versa. It shall also apply to associated aluminum hardware.

2 Definitions

2.1 abrasion: loss of material due to wear.

2.2 allowable load: maximum static equivalent load that can be safely imposed on truss / tower in addition to the self-weight.

2.3 ancillary: supplementary

2.4 AWS: American Welding Society.

2.5 bent member, truss or tower: component or assembly that has permanent deviation from the intended center line.

2.6 bolted connection: a connection of two modules using bolts.

2.7 camber: intended vertical deviation of a truss, usually radiused.

2.8 chord: the element of a module that will carry the axial forces associated with flexural, axial, or combined flexural and axial loading.

2.9 competent person: a person who is capable of identifying existing and predictable hazards in the workplace and who is authorized to take prompt corrective measures to eliminate them.

2.10 components: parts of a whole.

2.11 connecting plates: plates welded to the end frames of a module that are used to connect adjacent modules together.

2.12 consumables: items that require regular replacement with use.

2.13 CPL (center point load): a concentrated load that is applied at the midspan of a truss or tower.

2.14 crack: a crevice type discontinuity in the material.

2.15 damage: condition that adversely affects the intended use of a module (usually load carrying capacity).

2.16 dent: localized permanent deformation in the surface of member or element.

2.17 design strength: the capacity of a structural element or module determined using a recognized design manual.

2.18 diagonal: an element of a module that is not at a 90 degree angle to the main chords.

2.19 dye penetrant testing: a standard non-destructive testing method (NDT) using dye to highlight cracks in welds.

2.20 dynamic loading: forces caused by the acceleration or deceleration of an object.

2.21 flare test / drift test: a test on drawn, seamless aluminum round tubes to check structural integrity of the tube wall. Refer to ASTM B210-04.

2.22 incident: occurrence where damage to one or more modules has or may have been sustained.

2.23 manufacturer: person or company that fabricates modules or systems.

2.24 module: singular trussed structure that is stable under load and can be used alone or assembled interchangeably into larger assemblies as defined in this standard.

2.25 NDT (non-destructive test): a method for testing one or more aspects of structural integrity while leaving the tested material or piece intact.

2.26 pinned connector: chord end connector that uses a removable pin to effect a connection between modules.

2.27 qualified person: a person who, by possession of a recognized degree or certificate of professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work.

2.28 repetitive use: Describing a module regularly assembled in various configurations, with loads applied differently, supported at different points, or transported to different locations.

2.29 single use: the assembly and installation of modules or assemblies specifically intended to either be permanently left in place or scrapped after being dismantled.

2.30 shall: indicates that the rule is mandatory and must be followed.

2.31 should: indicates that the rule is a recommendation, the advisability of which depends on the facts and conditions in each situation.

2.32 skin: a material cover to a truss structure (usually on a roof system).

2.33 span: the distance between support points.

2.34 static equivalent load: a static load whose magnitude equals the peak force reached by a dynamically applied load.

2.35 sweep: intended lateral deviation of a truss, usually radiused.

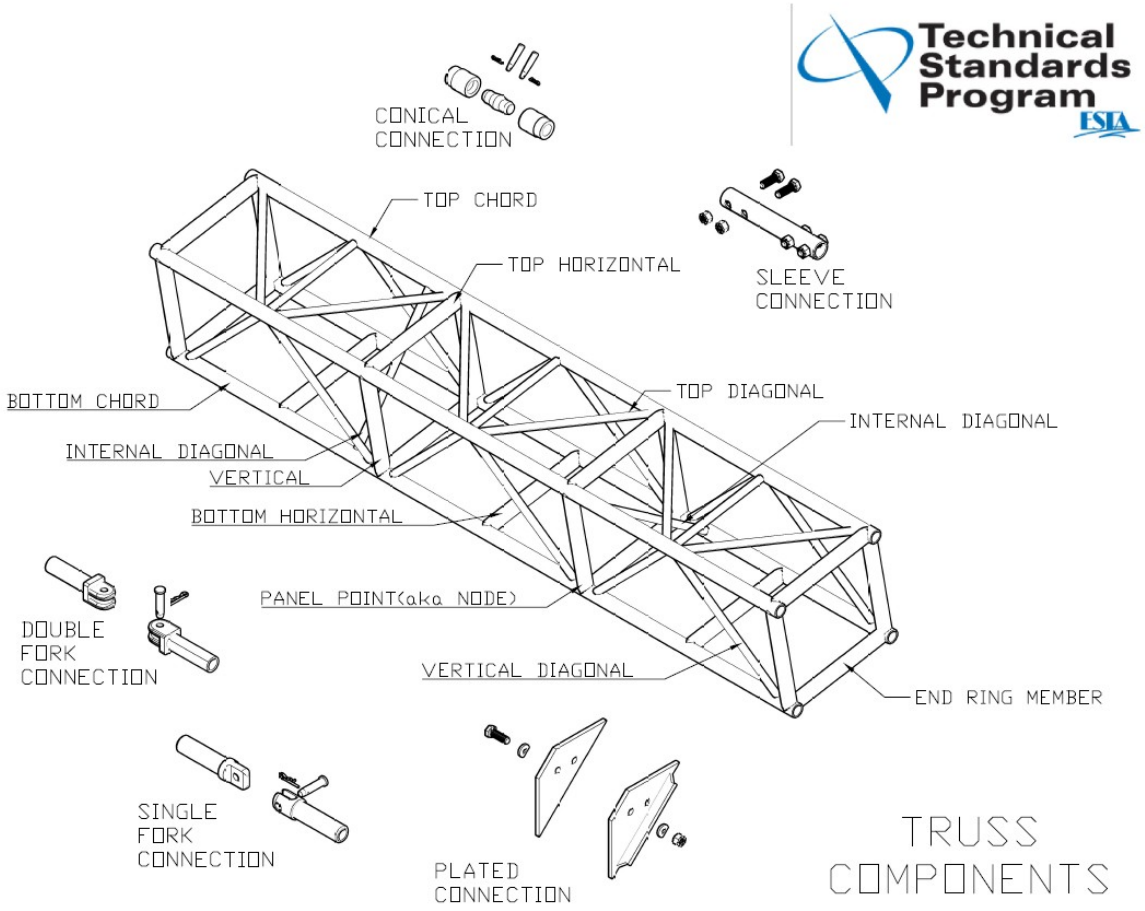
2.36 temporary: not permanent. Reference shall be made to local building codes for relevant definitions.

2.37 tower: one or more modules assembled vertically to carry primarily axial load; usually square or triangular in cross section.

2.38 truss: one or more modules assembled to carry load over a distance, generally horizontal, and primarily acting in flexure.

2.39 user: person or company who assembles or uses modules or systems, or who assembles and uses modules or systems.

2.40 UDL (uniform distributed load): a load that is evenly spread over the length of a truss or tower.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INTERNAL DIAGONAL
VERTICAL
BOTTOM HORIZONTAL
PANEL POINT(aka NODE)
DOUBLE FORK CONNECTION
VERTICAL DIAGONAL
END RING MEMBER
SINGLE FORK CONNECTION
PLATED CONNECTION
TRUSS COMPONENTS

Figure 1

3 ENGINEERING

3.1 Intent

The intent of this section is to provide the engineer with the minimum basis on which aluminum trusses and towers shall be designed.

3.2 Design

3.2.1 Design shall be performed in accordance with established engineering practice.

3.2.2 All relevant standards shall be used in the design of the structure and shall be dependent on the intended conditions of use. These shall include the following:

3.2.2.1 Aluminum Association:
ADM-2015 Aluminum Design Manual 2015: Part I-A Specification for Aluminum Structures, Allowable Stress Design; Part I-B Specification for Aluminum Structures, Load and Resistance Factor Design

3.2.2.2 American Welding Society (AWS):
D1.1/D1.1M:2015, Structural Welding Code – Steel
D1.2/D1.2M:2014, Structural Welding Code – Aluminum
B2.1/B2.1M:2014-AMD1, Specification for Welding Procedure and Performance Qualification

3.2.2.3 American Society of Civil Engineers:
ASCE 7-10 Minimum Design Loads for Buildings and Other Structures
ASCE 37-14, Design Loads on Structures During Construction

3.2.2.4 ASTM International:
ASTM B210/B210M-19 Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes

3.2.2.5 American Institute of Steel Construction:
“Manual of Steel Construction 15th Edition”

3.2.2.6 ESTA:
ANSI E1.21 - 2013, Entertainment Technology – Temporary Structures Used for Technical Production of Outdoor Entertainment Events

a. Welds shall be designed and detailed per D1.2/D1.2M-03.

b. Fasteners and other components composed of material other than aluminum shall be designed per ASM1-10 and Manual of Steel Construction 14th Edition.

c. Design loading including wind shall be in accordance with ASCE 7-10.

ANSI ES1.19-2018, Safety Requirements for Special Event Structures

ANSI E1.39-2015, Entertainment Technology – Selection and Use of Personal Fall Arrest Systems on Portable Structures Used in the Entertainment Industry

3.2.3 All conditions of use considered in design shall be outlined in the engineering documentation. Design strength may be established using either Load Factor Resistance Design, Allowable Stress Design methods or by physical testing as outlined in ADM-2015.

3.2.4 Two engineering design categories of trusses and towers are defined as follows:

a. Design of truss or tower structures for single use: Such structures shall be designed in accordance with the provisions of the standards cited herein.

b. Design of truss or tower modules for repetitive use: The design strength determined in accordance with the standards cited herein shall be multiplied by a factor of 0.85 when the components will be subjected to repetitive use. This reduced design strength shall be greater than or equal to the maximum demand on the module from the intended loading conditions.

3.3 Engineering Analysis

3.3.1 Engineering analysis of the truss or tower structures for the intended loading conditions shall be performed by calculation, modeling, or physical testing or by a combination of two or more of these methods.

3.3.2 Engineering analysis shall consider the worst combination, application, and configuration of loads and effects possible within the use guidelines.

3.3.3 The design shall be structurally stable for the intended applications.

3.3.4 The structure shall be designed for the effects of eccentricities in element and module connections.

3.3.5 Truss and tower deflections shall be calculated for load conditions provided in the User Information.

3.3.6 The design shall address any coating or surface finishing techniques used in manufacturing that affect the structural properties and load-bearing capabilities of the truss or tower structures.

3.4 Engineering Documentation

3.4.1 Engineering drawings of the truss or tower designs shall be developed and maintained. Engineering drawings shall include dimensions, components, subassemblies, material types, fastener types and specifications, weld sizes and types, and welding consumables.

3.4.2 All weld types and sizes shall be indicated in accordance with the AWS Standards D1.1/D1.1M-04 and D1.2/D1.2M-03. All welding procedures that are not prequalified under AWS shall be documented in accordance with AWS procedures.

3.4.3 Engineering calculations, design notes and/or test results that demonstrate compliance with this standard for the intended load conditions and uses shall be developed and maintained.

3.4.4 If the User Information includes a statement about the design factor, commonly called the safety factor or factor of safety, then the manufacturer shall clearly state to what condition the design factor refers and shall provide engineering documentation that supports the claims.

4 MANUFACTURING

4.1 Intent

The intent of this section is to ensure that all manufacturers maintain a satisfactory level of quality throughout the manufacturing process and that each and every module is traceable back to the manufacturer in the event of defect.

4.2 Material

4.2.1 The aluminum used shall comply with ADM-2015 . Component dimensions shall be within the set limits and tolerances given therein.

4.2.2 Drawn or extruded aluminum round tubes shall be flare tested as per ASTM B210-04.

4.3 Welding

4.3.1 All welders involved in producing modules through the welding process shall be certified in accordance with AWS Standards D1.1/D1.1M-03 and D1.2/D1.2M-04.

4.3.2 All welding processes shall be carried out in accordance with the AWS Standards listed in 3.2.2.2.

4.4 Inspection

4.4.1 After the welding process has been fully completed, all welds shall be visually inspected.

4.4.2 Any welds that do not appear sound shall be tested further by using the NDT method of dye penetration and repaired as required.

4.4.3 Inspection during and after fabrication shall verify the product has been built in accordance with design drawings.

4.5 Coatings and Surface Finishes

4.5.1 Coatings and surface finishes shall be applied only in accordance with 3.3.6.

4.5.2 The application of powder coating shall use processes during which modules are heated only in accordance with ADM-2015.

4.5.3 All preparations for painting or coating using a chemical process shall include a procedure to completely flush out or neutralize all corrosive materials that have entered the tubes.

4.5.4 Chemical removal of coatings and surface finishes shall be carried out only after consulting with the chemical manufacturer to ensure that the chemical will not affect the mechanical properties of the aluminum. Abrasion-blasting shall not be used on aluminum less than or equal to 1/8 inch (3mm) thick.

4.6 Identification

4.6.1 The manufacturer shall mark each module with an identification mark unique to that manufacturer and to that module. The mark shall be easily recognizable. The mark shall be durable and difficult to remove. The identification mark shall include the manufacturer's name and the date of manufacture.

4.6.2 The manufacturer shall be responsible for keeping records relating to module identification marks.

4.7 User Information

4.7.1 For each type of truss and tower, Manufacturers shall produce User Information Sheets or documentation which shall include the following minimum information:

- a statement that towers, and assemblies made with combinations of trusses and towers, require review by a qualified person;
- the maximum horizontal span into which modules may be assembled and used according to the manufacturer's guidance;
- the maximum allowable load, UDL and CPL, for a range of truss spans, which must also list the design standards used, and whether the indicated loads are for single use or repetitive use;
- theoretical maximum truss deflection expected at each given load and span combination;
- to what extent, if any, dynamic loading has been considered in the design;
- the proper way to store, handle, and transport the truss and towers;
- the recommended connection hardware, and its recommended installation methods;

- requirements for regular and annual inspections, manufacturer-specific inspection criteria, and routines for each size and type of truss and tower in accordance with Section 6;
- that full engineering documentation exists, and how it may be obtained.

4.7.2 It is stressed that the above list of information, instructions and cautions is the minimum information that a Manufacturer shall provide for each type and size of truss and tower. For configurations outside of those specified by the Manufacturer, the user shall engage a qualified person.

5 USE AND CARE

5.1 Intent

The intent of this section is to provide the end-user with sufficient information to ensure that modules are handled correctly during storage, transportation, erection, and dismantling, and that the assembled truss and tower systems are used on site within the limitations of the User Information provided by the Manufacturer.

5.2 User Information

5.2.1 User shall obtain, read and keep on file User Information Sheets from the manufacturer for each type and size of truss and tower as specified in Section 4.7.1.

5.2.2 It is stressed that the requirements in Section 4.7.1 are the minimum information that a User shall receive and file for each type and size of truss and tower.

5.3 Coatings and Surface Finishes

5.3.1 Coatings and surface finishes shall only be applied after consultation with the coating or finish manufacturer or other party qualified to evaluate the possible effects of the coating or surface finish on the structural properties and load-bearing capabilities of the module.

5.3.2 The application of powder coating shall use only a low cure process. The heating of truss and tower modules shall only be done in accordance with Table A.3.2 in ADM-2015 (see 3.2.2.1 above for full reference.)

5.3.3 Records shall be kept detailing the application of any coating or surface finish with particular attention to processes requiring the application of heat.

5.3.4 Chemical removal of coatings and surface finishes shall be carried out only after consulting with the chemical manufacturer to ensure that the chemical will not affect the mechanical properties of the aluminum. Abrasion-blasting shall not be used on aluminum less than or equal to 1/8 inch (3mm) thick.

5.4 Applied Loads

5.4.1 When assessing loads on the fully assembled system, the weight of all equipment, including, but not limited to, any hoists, light and sound equipment, multicore cables, follow-spot chairs, temporary personnel occupancy, and reactions from fall protection systems shall be considered.

5.4.2 Consideration shall be given to the following:

a) disposition of the loads on the trusses, and whether the loads are evenly balanced beneath the centerline of the truss or are mainly concentrated on one side or the other.

b) the increase in weight of the multicore cables towards the point of entry of those cables onto the trussing.

c) the possible dynamic effects on the trusses from the raising and lowering of the suspended equipment, or from the raising and lowering of the completed truss system.

d) the wind forces that could load the truss system during erection and after completion in both the unloaded and fully loaded state.

e) any additional windage imposed on the system from items such as banners, roof skins, sound and lighting equipment, projection screens, scenery, etc.

f) the effects of changes in temperature during the use of the system, of the weight of snow that may lie on the system or any covering, of seismic action that might affect the overall stability of the system, and of accidental impact damage occurring during the period in which the system is operational. The requirements of the local building codes and regulations shall be adhered to in all cases.

5.4.3 Consideration for all loads related to truss and tower systems used outdoors shall be in accordance with Section 3.5 of ANSI E1.21.

5.4.4 Consideration for all loads related to fall protection installed on truss shall be in accordance with ANSI E1.39

5.5 Handling

5.5.1 Individual modules and assembled trusses and towers, together with any ancillary components that form part of a complete system, shall not be subjected to impact damage and abrasion during handling.

5.5.2 The modules, trusses, and towers shall not be dragged across the ground, but shall be carried or moved on dollies or trolleys; the modules and assemblies shall not be dropped, but shall be set down without damage or abrasion.

5.5.3 The modules, trusses, and towers shall be adequately secured and supported during transportation and shall be stacked with sufficient spacers between successive heights and adjacent stacks to prevent abrasion.

5.5.4 End connections shall be protected from damage.

5.5.5 Attaching hardware shall be applied in a manner that does not cause damage.

5.6*Erection

5.6.1 Proper layout drawings and calculations shall be prepared for each use of the system and shall include the following minimum information:

a) accurate overall dimensions,
b) the locations of applied loads,
c) the locations of suspension points and ground support points,
d) the reactions at each suspension point and ground support point with supporting calculations.

5.6.2 Modules shall be inspected before assembly in accordance with Section 6 (User Inspection) and shall be assembled, joined together, and erected in accordance with the layout drawings and calculations by competent persons.

5.6.3 If the trusses are to be supported on towers which form part of the complete system, then a qualified person shall make a full assessment of the load bearing capabilities of the ground on which the towers are to be erected. If stipulated by the qualified person after their assessment, the ground shall be improved to provide a suitable bearing surface or load bearing spreader plates of sufficient capacity and size shall be provided beneath the tower bases to adequately distribute the tower loads.

5.6.4 The completed system shall be inspected by a competent person prior to each use in accordance with Section 6 User Inspection

6 USER INSPECTION

The intent of this section is to establish minimum required inspection routines and guidelines for the module user. While every effort is made to provide a thorough listing of situations and inspection criteria, complete listings are beyond the scope of this standard. Specific advice shall be sought by the user for specific inspection routines from the manufacturer or a qualified person.

All truss modules shall be inspected in accordance with the manufacturer's recommendations.

6.1 Inspection records

6.1.1 Initial inspections and annual inspections shall be documented.

6.1.2 Regular inspections shall not require documentation.

6.1.3 Inspection records for each truss module shall be kept on file by the owner.

6.1.4 Inspection records shall be dated and signed by the person conducting the inspection.

6.1.5 Repairs, and removal from service, shall be documented in the inspection records.

6.2 Initial Inspection

When purchased from the manufacturer or acquired used, all modules shall be inspected in accordance with Section 6.3.

6.3 Regular Inspection

Regular inspections shall be conducted by a competent person prior to each use.

6.3.1 The following items shall be visually inspected as part of a regular inspection.

6.3.1.1 Module geometry. Truss module geometry shall be inspected for the presence of module twisting, racking, or bending of any truss module component (see Figure 1).

6.3.1.2 Missing elements. Truss module inspections shall verify that all module elements are present, according to the manufacturer's module layout drawings.

6.3.1.3 Damaged elements. All truss elements shall be inspected for the presence of deformities, bending, dents, and abrasion.

6.3.1.4 Connection elements. As applicable to the truss module, connection elements shall be inspected for deformation in plates, forks or spigots, tolerance and roundness of connection hole, and that all fasteners are in accordance with the manufacturer’s criteria.

6.3.1.5 Weldments. Welds shall be visually inspected for breaks, cracks, and deformities.

6.4 Annual Inspection

Annual inspections shall be conducted by a qualified person at least once every 12 months. The module shall be removed from service during the inspection.

6.4.1 Annual inspections shall include the same criteria as regular inspections.

6.4.2 The following additional items shall be inspected as part of the annual inspection.

6.4.2.1 Geometry. Truss modules shall be inspected for sweep and camber.

6.4.2.2 Connection methods. Connection forks and spigots shall be inspected for presence of deformities and wear at the location where the connection attaches to the truss module.

6.4.2.3 Weldments. All welds shall be visually inspected for presence of breaks, cracks, abrasions, and deformities. Any weld suspected of being defective shall be additionally tested using dye penetrant or other non-destructive testing methods. Testing shall be performed by a qualified person. Test results shall be documented in the inspection records.

6.5 Inspection of truss and towers in permanent installations
Permanently installed truss shall be inspected in accordance with the requirements of section 6.5.1 or section 6.5.2, as applicable.

6.5.1 Permanent installations, stationary
Inspections shall be performed in accordance with section 6.4. The frequency for such inspections shall be determined based upon the exposure to prevailing environmental conditions and consultation with the manufacturer or qualified person.

6.5.2 Permanent installations, moving
Inspections shall be performed every three months on all modules installed in a permanent configuration, where movement of all or part of the system is an integral part of its use. Inspections shall be performed in accordance with section 6.4.

6.6 Removal from Service

6.6.1 Truss modules showing questionable results from the regular inspection, showing visible damage, or that are suspected of containing a damaged element, whether visible or not, shall be removed from service.

6.6.2 Inspection shall be performed in accordance with section 6.4 before returning the module to service.

6.6.3 Unrepairable truss modules shall be permanently removed from service.

6.6.4 Damaged modules shall be marked in a manner that clearly and visibly indicates their condition.

6.7 Repairs

6.7.1 Repairs to damaged truss modules shall be permitted only when the original structural design capacity can be restored.

6.7.2 A qualified person shall perform and document an assessment of the module, to determine if it can be repaired and subsequently returned to service. If repairable, the person performing the assessment shall define the repair methods.

6.7.3 Repairs shall be made by a qualified person.

Appendix A, Commentary

This commentary is not part of the Standard and contains no mandatory requirements. It offers some explanatory information about the clauses in the standard. The relevant clauses have the same clause number, but without the "A" prefix. The clause numbering here is not continuous because no comments are offered on some of the clauses in the Standard.

Since no mandatory requirements are stated in this commentary, if there is any disagreement between the text of this appendix and the requirements stated in the body of the standard, the requirements in the body of the standard shall prevail.

A1 Scope The minimum requirements described within this document are for a variety of uses of aluminum truss, towers and their related aluminum components confined to the entertainment and event industry. Furthermore, this standard also applies to the use of these components to create various structures or be incorporated into other structures.

A2.6 A typical bolted connection is one that utilizes a bolt through connection plates. This is not an axial or pinned connection and is typically less efficient structurally. It is also the most common connection seen in USA.

A2.7 Camber is typically used minimize the visible deflection of a truss span. The use of cambered truss requires extra attention to ensure the proper orientation.

A2.9 This is the OSHA definition of a “competent person”.

A2.14 Cracks in these types of aluminum components will typically be either weld related, or material related. Either type may lead to failure of the component. Refer to the manufacturer for guidance.

A2.15 It is important to note that a component may exhibit damage but said damage may NOT adversely affect the performance or use of the component. Refer to the manufacturer for guidance.

A2.17 Design strength, as defined here, should not be confused with the commonly discussed “Design Factors”.

A2.19 For more information on NDT methods, see section E 2.25

A2.25 NDT is regularly recommended to verify the integrity of various components. The most common of these, dye-penetrant testing is used to identify cracks in welds. However, it is important to note that this testing only identifies those cracks at the surface level. It cannot verify the depth of the weld or proper fusion of the materials.

Ultrasonic testing is an available option, however, with the varying thicknesses of material, different intersecting angles of components within a module, and variances in weld sizes, this testing can lead to inconsistent results. Furthermore, there is much that can be left open to interpretation leading to different inspectors coming do different conclusions from the same data.

Lastly, with aluminum as a non-ferrous metal, magnetic particle testing, which can more readily identify surface and subsurface variances, is not an available option for the types of modules addressed in this standard.

A2.26 There are a variety of “pinned connectors” in use within the entertainment industry. Some of these can be described as fork and blade, spigoted, or conical. The important similarity to all of these connection types is that they engage the main chords of the truss component in a manner that the connection is directly in line with the central axis of the chord. All of these connection types could equally be referred to as “axial connections”.

A2.27 This is the OSHA definition of a “qualified person”.

A2.36 The definition of “temporary” can vary by jurisdiction. Some relevant references within entertainment standards can be found in E1.21 for outdoor structures. Also, ASCE 37 for buildings under construction can provide reference.

A2.40 Uniform distributed loaded is typically conveyed in a per unit measurement or a total load. It is imperative that the user refer to manufacturer data to identify the relevant per unit increment (i.e. foot, meter, etc.).

A3.2.2 c. Wind loads can present special challenges in some indoor environments, especially when it is generally not considered a factor. It is important the user identify these conditions and address them during the operation and use of the components.

Indoor wind pressure can come from open dock doors, or close proximity to HVAC systems. Additional windage areas such as banners or signs can exacerbate the wind pressures exerted onto the truss or tower modules.

A3.2.4 b. The intent of this 0.15 reduction is to account for the inevitable wear and tear that occurs with aluminum truss in a rental or repetitive-use environment. Individual scrapes, abrasions and dents on an aluminum module might be within a manufacturer’s guidelines, but cumulatively could weaken the module. This reduction factor provides a modest safeguard against this occurrence.

Additionally, manufacturers may not include this reduction in their published load tables on the basis that they do not know where the product will ultimately be used. Therefore, if it is not stated on published load data, it is incumbent on the User to verify with the manufacturer and apply the load data accordingly.

A3.4.5 Aluminum truss modules are typically considered “purpose-built components” rather than overhead lifting materials. Because of this, the typically used design factors used in entertainment rigging that apply to hoists, wire rope slings, or other hardware does not apply. Design factors according to this standard, and the standards upon which it is based, are much lower.

If the User information does include a reference to the design factor, then per this standard that documentation must state that factor to be to ultimate failure, or point of elasticity, or other applicable state.

A4.5.4 Abrasion blasting can remove unquantifiable amounts of material, thereby reducing the thickness of the material below that which was considered in the design. Additionally, due to the nature of aluminum, abrasive blasting can cause work hardening of the material, increasing brittleness and the likelihood of cracks developing in the modules.

A4.7.1 bullet 2 The truss manufacturer must state if the repetitive use factor has been applied to their respective loading tables. However, regardless if a repetitive use reduction is applied to the manufacturer's table, the user is responsible for determining if the repetitive use reduction applies in their actual use condition.

A5.3.4 Abrasion blasting can remove unquantifiable amounts of material, thereby reducing the thickness of the material below that which was considered in the design. Additionally, due to the nature of aluminum, abrasive blasting can cause work hardening of the material, increasing brittleness and the likelihood of cracks developing in the modules.

A5.6 If the trusses are to be suspended from the roof beams or other structure within an existing building or from a framework that is not part of the complete trussing system, then a full assessment should be made by a qualified person of the roof beams or other structure from which the trusses are to be suspended. If necessary, the position of the suspension points should be moved to other acceptable locations and/or suitable strengthening measures shall be made to the existing structure.

A5.6.1 There is not currently an industry wide consensus on the format of layout drawings or rigging plots. The important aspect of these drawings is that they can be shared and used to demonstrate the layout has been properly planned and included all of the necessary factors.

A5.6.3 When the bearing capacity of the supporting surface is insufficient, a typical remediation is to increase the size of the base to further spread the load over a larger area. Consideration must be given to the type of material used to spread this load to ensure that it is stiff enough to properly transfer force across the surface. Additionally, bearing capacity has to be considered by calculating the area of the base that is in contact with the floor. For example, a 2 foot square base may not equate to 4 sq. ft of contact area if the bottom of the base is a frame and not fully in contact with the ground over the entire 4 sq. ft area.