



Standard Practice for Design, Manufacture, Operation, Maintenance, and Inspection of Amusement Rides and Devices, in Canada¹

This standard is issued under the fixed designation F2783; 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.

Note—This ASTM Standard has been developed to replace CAN/CSA Z267-00 (R2011), which is being withdrawn as an active CSA Standard.

INTRODUCTION

The Canadian Standards Association (CSA) and the American Society for Testing Materials (ASTM) have paved the way for the development of new ASTM amusement device standards, introducing uniform safety criteria for both Canada and the United States of America.

Seeking to gain a level of consistency and eliminate much duplication, CSA and ASTM struck a subcommittee to develop a new ASTM F24 standard, a comprehensive, one-volume document, that provides a mechanism to:

- adapt F24 standards to Canadian needs;
- provide greater two way communication between CSA and ASTM; and
- facilitate adoption by Canadian provinces and territories.

This one-source standard replaces the current CSA Z267 Safety Code for Amusement Rides and Devices. As CSA Z267 was primarily based on the ASTM F24 Family of Standards, Practice F2783 is a realignment of those core essentials with new sections tailor-made for Canada. Categorized in four distinct sections, the standard includes:

- **Core Standards** (for example, Terminology, Design, Manufacture, Operation, Maintenance, and Inspection);
- **Supporting Standards** (for example, Measuring Ride Dynamics and Hardness of Composite Foam);
- **Specific Classification of Amusement Rides and Devices Standards** (for example, Go-Karts, Water Slides, Inflatables and Trains); and
- **Unclassified Amusement Rides and Devices Standard** (for example, Zip Lines, Bungee Type Devices, Gravity or Patron Controlled Non-mechanical Spherical Devices and Extreme Thrill Devices).

This standard is structured such that Section 2.1 listings of Core Standards capture the essential and broad safety requirements for all amusement rides and devices. Section 2.2 listings of Supporting Standards are intended to complement in design of all amusement rides and devices where applicable. Section 2.3 listings of Specific Classification of Amusement rides and Devices Standards capture supplemental requirements in addition to Core Standards for anomalous amusement rides and devices. Section 2.4 listing of Unclassified Amusement Rides and Devices Standards captures general essential safety requirements for new amusement rides or devices that have yet to be regulated but have recently appeared within the public domain for use in conjunction with Core Standards and Supporting Standards.

To provide greater application within Canada, Practice F2783 also incorporates specific sections that include: Standards Cross Referencing Table; Substitutions; Exceptions; and Additional Requirements.

This unique initiative would not have been possible were it not for the active collaboration of the CSA Z267 and the ASTM F24.80 Harmonization Committees, representative of a diverse stakeholder base, including delegates from government (regulators), manufacturers, engineers, park owners/operators as well as general and consumer interests.

Practice F2783 is supported by Canadian provincial and territorial regulators and amusement device stakeholders, the International Association of Amusement Parks and Attractions (IAAPA), CSA and ASTM.

This standard has been printed in Canada's two official languages.

1. Scope

1.1 This practice applies to the terminology, design, manufacture, operation, maintenance, and inspection of amusement rides and devices in Canada.

1.2 This practice adopts ASTM Committee F24 Standards listed under Sections 2.2, 2.3 and 2.4.

1.3 This practice includes an annex (mandatory), which provides additional information (for example, rationale, background, interpretations, drawings, commentary, etc.) related to the application of the criteria presented in this practice.

1.4 This practice includes an appendix (non-mandatory), which provides additional information (for example, rationale, background, interpretations, drawings, commentary, and so forth) to improve the user's understanding and application of the criteria presented in this practice.

1.5 It is the responsibility of the users of this practice and other ASTM Standards to judge their suitability for a particular purpose.

1.6 This practice includes the following sections:

Title	Section
Scope	1
Referenced Documents	2
ASTM Committee F24 Core Standards for Amusement Rides and Devices	2.2
ASTM Committee F24 Supporting Standards for Amusement Rides and Devices	2.3
ASTM Committee F24 Standards for Specific Classification of Amusement Rides and Devices	2.4
Reference Codes, Standards, Specifications, and Handbooks	2.6
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Auditing of Amusement Rides and Devices	8
Recognized Certification Marks	Annex A1
Significance and Use	Appendix X1
Hardness Measurement of Patron Seat and Restraint Padding	Appendix X2

1.7 For a glossary of terms that includes the meaning and intent of words such as shall, should, may, will, standard, practice, guide, classification, specification, etc. used in ASTM standards, please refer to “Form and Style for ASTM Standards,” which is available at www.astm.org.

1.8 *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 appro-*

priate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 The documents listed in 2.2, 2.3 and 2.4 contain provisions, which through reference in this standard, constitute provisions of this practice.

NOTE 1—For undated references, the latest edition of the referenced document applies. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, users of this practice are encouraged to investigate the possibility of applying the most recent editions of documents referenced below.

- 2.2 *Core Standards for Amusement Rides and Devices:*²
- F747 Terminology Relating to Amusement Rides and Devices
 - F770 Practice for Ownership, Operation, Maintenance, and Inspection of Amusement Rides and Devices
 - F1193 Practice for Quality, Manufacture, and Construction of Amusement Rides and Devices
 - F2291 Practice for Design of Amusement Rides and Devices
 - F2974 Guide for Auditing Amusement Rides and Devices

2.3 *Supporting Standards for Amusement Rides and Devices:*²

- F1957 Test Method for Composite Foam Hardness-Durometer Hardness
- F2137 Practice for Measuring the Dynamic Characteristics of Amusement Rides and Devices
- F2375 Practice for Design, Manufacture, Installation and Testing of Climbing Nets and Netting/Mesh used in Amusement Rides, Devices, Play Areas and Attractions

2.4 *Standards for Specific Classification of Amusement Rides and Devices:*²

- F2007 Practice for Design, Manufacture, and Operation of Concession Go-Karts and Facilities
- F2374 Practice for Design, Manufacture, Operation, and Maintenance of Inflatable Amusement Devices
- F2376 Practice for Classification, Design, Manufacture, Construction, and Operation of Water Slide Systems

2.5 *Other Standards:*

- D785 Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
- D2240 Test Method for Rubber Property—Durometer Hardness

2.6 *Reference Codes, Standards, Specifications, and Handbooks:*

NOTE 2—Table 1 provides cross-references of document(s) acceptable in lieu of specific editions of codes, standards, specifications, and handbooks referenced in standards from ASTM Committee F24 on Amusement Rides and Devices. Only that portion of the codes, standards, specifications and handbooks as specified by the requirements of this standard is applicable.

¹ This practice is under the jurisdiction of ASTM Committee F24 on Amusement Rides and Devices and is the direct responsibility of Subcommittee F24.80 on Harmonization.

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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.

TABLE 1 Cross-References of Documents

Reference Documents in ASTM F24 Committee Standards		Alternate Acceptable Documents in Canada	
ASTM Standards Reference Source	Designation (Publisher)	Title	Title
F1193	ANSI/AWS D1.1/D1.1M	Structural Welding Code - Steel	Certification of Companies for Fusion Welding of Steel Welded Steel Construction (Metal Arc Welding)
F1193	E543 (ASTM) or ASNT SNT-TC-1A	Standard Specification for Agencies Performing Nondestructive Testing Topical Outlines for Qualification of Nondestructive Testing Personnel	Nondestructive Testing: Qualification and Certification of Personnel
F2291	STP-1330 (ASTM)	Composite Materials: Fatigue and Fracture, 7th Volume	None
F2291	301 (ACI)	Specifications for Structural Concrete	National Building Code of Canada
F2291	318 (ACI)	Building Code Requirements for Structural Concrete (318) and Commentary (318R)	National Building Code of Canada
F2291	NDS 2005 (AF&PA - American Wood Council); or USDA-72 (US Department of Agriculture); or 16 (ASCE)	National Design Specification for Wood Construction; or The Wood Handbook – Wood As An Engineering Material, Forest Service, Forest Products Laboratory; or Standard for Load and Resistance Factor Design (LRFD) for Engineered Wood Construction	Consolidation – Engineering design in wood
F2291	316 (AISC)	Manual of Steel Construction, Allowable Stress Design (ASD)	Handbook of Steel Construction – Ninth Edition; and Design of Steel Structures
F2291	M015 (AISC)	Manual on Steel Construction, Load & Resistance Factor Design (LRFD)	Limit States Design in Structural Steel Ninth Edition, and Design of steel structures

Comments

Refer to **5.4.4** for additional information. CSA W47.1 and CSA W59 together are acceptable to ANSI D1.1

For all NDT Personnel:
Natural Resources Canada (NRCan), through the CANMET Materials Technology Laboratory (MTL), is the Certifying Agency for the Canadian Non-Destructive Testing (NDT) Personnel Certification Program. NRCan certifies individuals according to the Canadian General Standards Board Standard CAN/CGSB-48.9712 (Qualification and Certification of Non-Destructive Testing Personnel).
For NDT of Welding to CSA W47.1:
In Canada, the CWB (Canadian Welding Bureau) is the Certification Body for the administration of CSA Standard W178:
1) NDT shall be conducted by organization certified to W178.1-08 – Certification of Welding Inspection Organizations.
2) NDT shall be conducted by individual certified to W178.2-08 – Certification of Welding Inspectors.

Publication STP-1330 contains papers presented at the Seventh Symposium on Composite Materials, and Fatigue and Fracture. See also **5.3.2.6**.

See also **5.3.2.6**.

AISC 316, the CISC Handbook, and CSA S16 are to be used in conjunction with the section on loads and strengths in Practice **F2291**.

AISC M015, the CISC LSD publication, and CSA S16 are to be used in conjunction with the section on loads and strengths in Practice **F2291**.

TABLE 1 Continued

Reference Documents in ASTM F24 Committee Standards		Alternate Acceptable Documents in Canada			
ASTM Standards Reference Source	Designation (Publisher)	Title	Designation (Publisher)	Title	Comments
F2291	360-05 (ANSI/AISC)	Specifications for Structural Steel Buildings	(CISC) & S16 (CSA)	Limit States Design in Structural Steel Eighth Edition, and Design of steel structures	AISC 360, the CISC LSD publication, and CSA S16 are to be used in conjunction with the section on loads and strengths in Practice F2291 . None
F2291	Y32.10 (ANSI)	Graphic Symbols for Fluid Power Diagrams	None	None	None
F2291	T2.24.1 (NFPA)	Hydraulic fluid power—Systems standard for stationary industrial machinery—Supplement to ISO 4413:1998—Hydraulic fluid power	None	None	None
F2291	B11.TR3 (ANSI)	—General rules relating to systems Risk Assessment and Risk Reduction—A Guide to Estimate, Evaluate, and Reduce Risks Associated with Machine Tools	None	None	This technical report is intended to complement the topic about Ride Analysis covered in Practice F2291 . See also 5.4.3 .
F2291	B77.1 (ANSI)	Passenger Ropeways—Aerial Tramways, Aerial Lifts, Surface Lifts, Tows and Conveyors—Safety Requirements	Z98 (CSA)	Passenger ropeways and passenger conveyors	See also 5.4.3 .
F2291	7 (ASCE/SEI)	Minimum Design Loads for Buildings and Other Structures	NBCC (NPRCC)	National Building Code of Canada	ASCE 7 and the NBCC are to be used in conjunction with the section on loads and strengths in Practice F2291 . The ASM Atlas and the ASM Handbook are intended to complement the topic about fatigue strength of mechanical and structural components.
F2291	(ASM)	ASM Atlas of Fatigue Curves and ASM Handbook Volume 19: Fatigue and Fracture	None	None	Accumulators shall be constructed in accordance with Section 8, Division 1 of the ASME Boiler and Pressure Vessel Code for unfired pressure vessels, or equivalent. None
F2291	BPVC (ASME)	ASME Boiler and Pressure Vessel Code	B51 (CSA)	Boiler, pressure vessel, and pressure piping code.	
F2291	B15.1 (ASME)	Safety Standards for Mechanical Power Transmission Apparatus	None	None	
F2291	ASME A17.1-2010/CSA B44-10 (ASME/CSA)	Safety Code for Elevators and Escalators	ASME A17.1-2010/CSA B44-10 (ASME/CSA)	Safety code for elevators and escalators	This standard may be applicable where elevator and escalator technology is used in the design of amusement rides or devices. See also 5.4.4 . Note: CSA W47.1 and CSA W59 together are acceptable as an equivalent to AWS D1.1.
F2291	D1.1/D1.1M (ANSI/AWS)	Structural Welding Code—Steel	W47.1 (CSA) W59 (CSA)	Certification of companies for fusion welding of steel Welded steel construction (metal arc welding)	See also 5.4.4 .
F2291	D14.4 (ANSI/AWS)	Specification for Welded Joints in Machinery and Equipment	W59 (CSA)	Welded steel construction (metal arc welding)	See also 5.4.4 .
F2291	D1.1/D1.1M (ANSI/AWS)	Structural Welding Code – Steel	W178.1 (CSA) W178.2 (CSA)	Certification of welding inspection organizations Certification of welding inspectors	See also 5.4.4 .
F2291	BS 5400-10 (BSI) and BS 7608 (BSI)	Steel, Concrete and Composite Bridges—Code of Practice for Fatigue Design and Assessment of Steel Structures	None	None	BS 5400 and BS 7608 are intended to complement the topic about fatigue strength of mechanical and structural components.
F2291	International Building Code (ICC)	International Building Code Chapter 16, “Structural Design”	NBCC (NPRCC)	National Building Code of Canada	The International Building Code and the NBCC are to be used in conjunction with the section on loads and strengths in Practice F2291 .

TABLE 1 Continued
 Alternate Acceptable Documents in Canada

ASTM Standards Reference Source	Designation (Publisher)	Title	Designation (Publisher)	Title	Comments
F2291	Growth Charts (CDC) J833 (SAE) The MIT Press, Cambridge, MA, USA The MIT Press, Cambridge, MA, USA (CISC)	Basic Body Measurements Human Physical Dimensions Human Scale 4/5/6, Bardagly, J., Diffrient, N., and Tilley, A., 1981 Human Scale 7/8/9, Bardagly, J., Diffrient, N., and Tilley, A., 1982 Hollow Structural Section Connection and Trusses—A Design Guide	None 3411 (ISO) Tilley, A. R., Henry Dreyfuss & Associates. None	None Earth-moving machinery – Physical dimensions of operators and minimum operator space envelope. The measure of man and woman: Human factors in design None	SAE J833 has been superseded by ISO 3411. Human Scale 4/5/6 and 7/8/9 books are no longer published.
F2291	1055 (DIN) 1055-100 (DIN)	Actions on structures, Parts 1–7 Load combinations	NBCC (NRCC)	National Building Code of Canada	This document is referenced for the purpose of its application for design of structure using hollow structural section.
F2291	15018-1 (DIN)	Cranes; Steel Structures; Verification and Analyses Data	None	None	DIN 1055 and DIN 1055-100 are to be used in conjunction with the section on loads and strengths in Practice F2291 .
F2291	EN 280 (CEN)	Mobile Elevating Work Platforms –Design Calculations, Stability Criteria, Construction, Safety, Examinations, and Tests	B29.100 (ANSI/ASME)	Precision Power Transmission, Double-Pitch Power Transmission, and Double-Pitch Conveyor Roller Chains, Attachments and Sprockets	DIN 15018-1 is not specifically referenced in Practice F2291 . It is up to designer/engineer to determine its relevance in Practice F2291 . None
F2291	EN 954-1 (CEN)	Safety of Machinery—Safety Related Parts of Control Systems –General Principles for Design	ISO 13849-1 (ISO)	Safety of machinery—Safety-related parts of control systems –Part 1: General principles for design	ISO 13849 is intended to complement the topic of electrical, electronic, and programmable electronic systems covered in Practice F2291 .
F2291	EN 1050 (CEN)	Safety of Machinery—Principles for Risk Assessment	12100 (ISO)	Safety of machinery – General principles for design – Risk assessment and risk reduction	EN 1050 and ISO 12100 are intended to complement the topic of ride analysis covered in Practice F2291 .
F2291	EN 1991 (CEN) EN 1992 (CEN) EN 1993 (CEN) EN 1994 (CEN) EN 1995 (CEN)	Eurocode 1: Actions on structures Eurocode 2: Design of concrete structures Eurocode 3: Design of steel structures Eurocode 4: Design of composite steel and concrete structures Eurocode 5: Design of timber structures	NBCC (NRCC) National Building Code of Canada	National Building Code of Canada	The Eurocodes 1 to 5 and the NBCC are to be used in conjunction with the section on loads and strengths in Practice F2291 .
F2291	EN 60947-1 (CEN)	Low-Voltage Switchgear and Control gear	60947-1 (IEC)	Low-voltage switchgear and control gear—Part 1: General rules	None
F2291	6930 (FM Global)	Flammability Classification of Industrial Fluids	None	None	None
F2291	60204-1 (IEC)	Safety of Machinery—Electrical Equipment of Machines—Part 1: General Requirements	None	None	NFPA 79 is also used for these devices.
F2291	61496-1 (IEC)	Safety of Machinery—Electrosensitive Protective Equipment –General Requirements and Tests	E61496-1 (CSA)	Safety of machinery - electrosensitive protective equipment – Part 1: General requirements and tests	CAN/CSA-E61496-1 adopted IEC-61496-1 with Canadian deviations.
F2291	61508-1 (IEC)	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems –General Requirements	None	None	IEC 61508-1 is Part 1 of a series of standards on safety related control systems. It is used commonly for testing and certification of electrical, electronic, and programmable electronic systems.

TABLE 1 Continued

Reference Documents in ASTM F24 Committee Standards		Alternate Acceptable Documents in Canada	
ASTM Standards Reference Source	Designation (Publisher)	Title	Title
F2291	61511 (IEC)	Functional Safety: Safety Instrumented Systems for the Process Industry Sector	None
F2291	62061 (IEC)	Safety of Machinery-Functional Safety—Electrical, Electronic, and Programmable Electronic Control Systems	None
F2291	4113 (ISO)	Road Vehicles – Calibration Fluid for Diesel Injection Equipment	None
F2291	4413 (ISO)	Hydraulic fluid power – General rules relating to systems	None
F2291	4414 (ISO)	Pneumatic Fluid Power General Rules Relating to Systems	None
F2291	4406 (ISO)	Particle Count Chart	None
F2291	6149-1 (ISO)	Connections for hydraulic fluid power and general use – Ports and stud ends with ISO 261 metric threads and O-ring sealing – Part 1: Ports with truncated housing for O-ring seal	None
F2291	17 (MIL)	The Composite Materials Handbook	None
F2291	882C (MIL)	System Safety Program Requirements	None
F2291	250 (NEMA)	Enclosures for Electrical Equipment	C22.2 NO. 94 (CSA)
F2291	79 (NFPA)	Electrical Standard for Industrial Machinery	C22.2 NO. 14 (CSA)
F2291	70 (NFPA)	National Electric Code (NEC)	C22.1 (CSA)
F2291	101 (NFPA)	Life Safety Code	None
F2291	B93.114M (ANSI)	Pneumatic Fluid Power—Systems Standard for Industrial Machinery (was NFPA/JIC T2.25.1M)	4414:2010 (ISO)
F2291	T2.25.1M (NFPA/JIC)	Pneumatic Fluid Power—Systems Standard for Industrial Machinery	T2.25.1(NFPA/JIC) 4414:2010 (ISO)
F2291	SAE J517	Hydraulic Hose	None
F2291	SAE J-211	Instrumentation for Impact Test –Electronic Instrumentation	None
			Comments
			IEC 61511 relates primarily to instrumentation used in the process industry sector.
			IEC 62061 plays an increasing role in the achievement of overall machine safety as a result of automation, demand for increased production and reduced operator physical effort. See 8.2.2.7 of ISO 4113.
			See 8.2.2.7 of ISO 4113.
			None
			None
			None
			None
			None
			MIL 882C is intended to complement the topic of ride analysis covered in Practice F2291 .
			None
			None
			See also 5.3.2 and 5.3.3 .
			None
			None
			ANSI/(NFPA) T2.25.1 is based upon the provisions of ISO 4414:1998, with certain exceptions as described in ANSI/(NFPA)T2.25.1. The user of ANSI/(NFPA) T2.25.1 will require both of these standards for use on a pneumatic systems application.
			None
			SAE J211 provides guidelines and recommendations for the techniques of measurement used in impact tests. The aim is to achieve uniformity in instrumentation practice and in reporting test results. Use of this recommended practice will provide a basis for meaningful comparisons of test results from different sources.

TABLE 1 Continued

Reference Documents in ASTM F24 Committee Standards		Alternate Acceptable Documents in Canada			
ASTM Standards Reference Source	Designation (Publisher)	Title	Designation (Publisher)	Title	Comments
F2291	J518 (SAE)	Hydraulic Flanged Tube, Pipe, and Hose Connections, Four-Bolt Split Flange Type	None	None	None
F2291	J1926 (SAE)	Connections for General Use and Fluid Power- Ports and Stud Ends with ASME B1.1 Threads and O-Ring Sealing Part 3: Light-Duty (L-Series) Stud Ends	None	None	None
F2291	HS 4000 (SAE)	Fastener Standards	None	None	SAE HS 4000 is intended to complement the topic of fasteners covered in Practice F2291 .
F2291	260 (SIA) 261 (SIA)	Basics of Planning Structural Design Projects	NBCC (NRCC)	National Building Code of Canada	SIA 260, SIA 261, and NBCC are to be used in conjunction with the section on loads and strengths in Practice F2291 .
F2291	508 (UL)	Actions on Structures	None	Industrial control equipment	None
F2291	508A (UL)	Industrial Control Equipment	C22.2 NO. 14 (CSA)	Industrial control equipment	None
F2291	Organisation Internationale Pour L'Etude De L'Endurance Des Cables (OIPeec)	The International Journal of Rope Science and Technology	None	None	OIPeec is also known as International Organization for the Study of the Endurance of Ropes.
F2291	(Springer Verlag, Berlin, Germany)	Handbook of Mechanical Engineering, Beltz, W., Heinrich, D., and Kuitner, K.H., 1994	None	None	<i>The International Journal of Rope Science and Technology</i> is intended to complement the testing of wire ropes to validate rope fatigue and life calculations covered in Practice F2291 .
F2291	(McGraw-Hill, New York, NY)	Mechanical Engineering Design, Budynas, R., Mischke, C., and Shigley, J., 1988	None	None	The <i>Handbook of Mechanical Engineering</i> is intended to complement the topic on fatigue behavior due to surface finish and other material conditions as referenced in Practice F2291 .
F2291	(Abington Publishing, Cambridge, England)	Fatigue Strength of Welded Structures, Maddox, S.J., 1993	None	None	<i>Mechanical Engineering Design</i> is intended to complement the topic on fatigue behavior due to surface finish and other material conditions as referenced in Practice F2291 .
F2291	(McGraw-Hill, New York, NY)	Standard Handbook of Machine Design, Mischke, C., and Shigley, J., 1996	None	None	<i>Fatigue Strength of Welded Structures</i> is intended to complement the topic on fatigue of welded structures as referenced in Practice F2291 .
F2783	None	None	CSA Z98 (CSA)	Passenger ropeways and passenger conveyors	The <i>Standard Handbook of Machine Design</i> is useful general reference for design and manufacture of amusement rides or devices covered in Practice F2291 . Refer to 7.4.6 for additional information.

3. Terminology

3.1 Terms that are meant to have common meaning among the ASTM Committee F24 standards referenced in Section 2 are defined in Terminology F747.

3.2 Terms that are meant to have specific meaning within the ASTM Committee F24 standards are defined in those standards referenced in Section 2.

3.3 *engineer, n*—an engineer as defined by and licensed in accordance with the applicable provincial or territorial statute.

3.4 *Clarification of Terminology in ASTM Committee F24 Standards:*

3.4.1 The term “attractions” used in the ASTM F24 Committee Standards for Amusement Rides and Devices hold the same meaning as “amusement devices or rides” defined in Terminology F747.

3.4.2 The term “English” used in the ASTM F24 Committee Standards for Amusement Rides and Devices means “English and French” for the purpose of this Standard.

4. Significance and Use

4.1 The purpose of this practice is to adopt the ASTM F24 Committee Standards for Amusement Rides and Devices for use in Canada.

4.2 This practice provides guidance for use of additional codes and standards in Canada.

4.3 In cases where conflicts exist between this practice and local codes, local codes would prevail.

5. Design

5.1 *General*—Amusement devices and rides shall be designed in accordance with Practice F2291.

5.2 The significance and use of Practice F2291 are explained in X1.1.

5.3 *Substitution of Referenced Documents in Practice F2291 with Alternate Documents:*

5.3.1 *General:*

5.3.1.1 Subsection 2.6 lists substitution of referenced documents in Practice F2291 with acceptable alternate documents for their applicability in Canada.

5.3.1.2 Amusement rides and devices shall meet the requirements specified in Sections 5.3.2 and 5.3.3.

5.3.2 *Canadian Standards:*

5.3.2.1 All electrical apparatus and wiring in amusement rides and devices shall conform to the requirements CSA C22.1.

5.3.2.2 All references to NFPA 70 (the National Electrical Code) in Practice F2291 shall have substituted the applicable rules of CSA C22.1, Canadian Electrical Code.

5.3.2.3 Where electrical equipment used in an amusement ride or device is not certified or listed, and marked or labeled to the pertinent standard in Part II of the Canadian Electrical Code, it shall be field evaluated and labeled or marked to the requirements of CSA SPE-1000, Model Code for the Field Evaluation of Electrical Equipment.

NOTE 3—Carnival and traveling show owners or operators, where

required by the local jurisdiction, should arrange to have installation and connection of electrical equipment on amusement rides or devices inspected at every event to ensure they meet the safety standards defined in the adopted Electrical Safety Code. Annex A1 provides a listing of certification agencies acceptable by authorities having jurisdiction.

5.3.2.4 *Overhead Utilities*—Amusement devices or rides shall not be located in proximity to overhead electric supply and communication utility systems unless the overhead system meets the requirements of CAN/CSA-C22.3 No. 1.

NOTE 4—Proximity as defined in CAN/CSA-C22.3 No. 1 means that lines are so located that the failure of a conductor or any part of the overhead system (such as overturning at the ground line) would interfere with the normal use, operation, or maintenance of an amusement device or ride by contact or encroachment on minimum clearance requirements by the conductor or structure.

5.3.2.5 *Clearances to Structures*—Clearances between an amusement device or ride and structures not forming part of the amusement device shall meet the requirements of the National Fire Code of Canada (NFCC).

5.3.2.6 *Fixed Amusement Devices or Rides Foundation*—Foundations for fixed amusement devices or rides shall be designed in accordance with the National Building Code of Canada (NBCC).

5.3.2.7 *Amusement Devices or Rides Structure*—Wind, snow, ice, and earthquake loads on amusement devices or rides structure shall be calculated in accordance with requirements specified in the NBCC.

5.3.3 *Specific References within Canadian Standards:*

5.3.3.1 With respect to electrical grounding, reference to NFPA 70, Section 525-Ca in Practice F2291 may be understood to refer to CSA C22.1, Section 66.

5.3.3.2 With respect to wet areas, reference to NFPA 70, Section 680 in Practice F2291 shall mean CSA C22.1, Section 68.

5.4 *Exceptions from Practice F2291:*

5.4.1 *Sections 1.2.10 and 1.2.11 of Practice F2291*—Subsections 1.2.10 and 1.2.11 of Practice F2291 shall not apply. This practice does not apply to the pre-existing design of amusement rides or devices or major modifications designed in the five years preceding the effective date of publication of this practice provided the manufacturer can demonstrate to the satisfaction of the authority having jurisdiction (AHJ) the following:

5.4.1.1 Historical summary of the amusement ride or device showing the date of the initial design, and any changes to design and operation including any major modifications recommended and performed by the manufacturer between the date of the initial design and current day.

5.4.1.2 A list of all significant design-related failures, significant design-related safety issues, and incidents resulting in death or serious injury during operation or use of the amusement ride or device.

5.4.1.3 Details for each items listed under 5.4.1.2 mitigated in accordance with the ASTM Committee F24 on Amusement Rides and Devices in place at the time of the mitigation.

5.4.1.4 A list of all bulletins issued by the manufacturer pertaining to the amusement ride or device.

5.4.2 *Sections 1.2.8 and 1.2.9 of Practice F2291*—The exclusion of Sections 1.2.8 and 1.2.9 from the scope of Practice

F2291 shall be determined by ride analysis in accordance with Section 5.1 of Practice **F2291**.

5.4.3 *Section 13.3.3 of Practice F2291*—Subsection 13.3.3 of Practice **F2291** shall not apply. Aerial tramways and aerial lifts shall comply with CSA Z98, Passenger ropeways and Passenger conveyors.

5.4.4 *Section 15.2 and 15.3 of Practice F2291*—Subsection 15.2 and 15.3 of Practice **F2291** shall not apply. Welding performed and inspected in accordance with standards other than those referenced in Practice **F2291** or this practice (refer Section 2) shall be acceptable if:

5.4.4.1 Standards are suitably referenced in the amusement rides and devices code of the country of origin of the structure or component, and the requirements in the Standards meet or exceed the requirements of Practice **F2291** or this practice;

5.4.4.2 Qualifications of all welders performing the work and the welding procedures are in accordance with the class of welding being performed; and

5.4.4.3 Welds are inspected by a qualified welding inspector and a statement confirming compliance is provided.

5.4.5 *Section 12.1.4.1 of Practice F2291*—Subsection 12.1.4.1 of Practice **F2291** shall not apply. Any electrical work done on an existing amusement ride or device other than for routine maintenance/repair shall conform to sections 5.1, 11 and 12 of Practice **F2291**.

5.4.6 *Section 12.1.4.2 of Practice F2291*—Subsection 12.1.4.2 of Practice **F2291** shall not apply. New electrical equipment shall meet the requirements of Practice **F2291** unless excluded by 5.4.1.

5.4.7 *Section 12.1.4.3 of Practice F2291*—Subsection 12.1.4.3 of Practice **F2291** shall not apply. An existing or used amusement ride or device shall conform to Section 12 of Practice **F2291**.

5.5 *Additional Requirements:*

5.5.1 Where major modifications of service proven and previously compliant amusement rides or devices are designed after the publication of this practice, those major modifications shall be in accordance with the current ASTM Committee F24 standards on amusement rides and devices.

5.5.2 Where mitigations addressing significant design-related failures, significant design-related safety issues, and incidents resulting in death or serious injury during operation or use of the amusement ride or device are designed after the publication of this practice, those mitigations shall be in accordance with the current ASTM Committee F24 standards on amusement rides and devices.

5.5.3 Where ASTM Committee F24 standards on amusement rides and devices require action by a designer/engineer or manufacturer who is no longer in business, that action shall be performed by an engineer.

5.5.4 Where provisions exist, selection and applicability of an equivalent or alternate standard, document or method to the one specified in the Practice **F2291** shall be determined and specified by designer/engineer of amusement rides or devices.

5.5.5 Where non-mandatory or optional words (for example, may, should, recommend, etc.) are used in the Practice **F2291**, designer/engineer of amusement rides or

devices shall apply Section 5.1 of Practice **F2291** to support resolution of their applicability in the context of their use.

5.5.6 Where non-specific words (for example, adequate, appropriate, significant, most, primary, etc.) are used in the Practice **F2291**, designer/engineer of amusement rides or devices shall apply Section 5.1 of Practice **F2291** to support resolution of their applicability in the context of their use.

5.5.7 Where the term “ride analysis” is used in the Practice **F2291**, Section 5.1 of Practice **F2291** shall be applied for the purpose of its resolution in the context of its use.

5.5.8 *Cold Formed Steel Structures*—Cold formed steel structural members on amusement devices or rides shall be designed in accordance with CSA S136, North American Specification for the Design of Cold-Formed Steel Structural Members or other standard acceptable by engineers/designers of amusement devices or rides.

5.5.9 *Aluminum Structures*—Aluminum structures shall be designed in accordance with CAN/CSA-S157, Strength Design in Aluminum or other standard acceptable by engineers/designers of amusement devices or rides.

5.5.10 *Welding of Aluminum Structures*—Welding for aluminum structures shall be performed in accordance with CSA W47.2, Certification of companies for fusion welding and CSA W59.2, Welded Aluminum Construction or other standard acceptable by engineers/designers of amusement devices or rides.

6. **Manufacture**

6.1 Amusement rides and devices shall be manufactured in accordance with Practice **F1193**.

6.2 The significance and use of Practice **F1193** are explained in **X1.2**.

6.3 *Substitution of Referenced Documents in Practice F1193 with Alternate Documents:*

6.3.1 *General*—Subsection 2.6 lists substitution of referenced documents in Practice **F1193** with acceptable alternate documents for their applicability in Canada.

7. **Ownership, Operation, Maintenance, and Inspection**

7.1 Ownership, operation, maintenance, and inspection of amusement devices and rides shall meet the requirements specified in Practice **F770**.

7.2 The significance and use of Practice **F770** are explained in **X1.3**.

7.3 *Exceptions from Practice F770*—Section 5 about patron responsibility shall not apply.

7.4 *Additional Requirements:*

7.4.1 An amusement device or ride shall cease to operate when there is an electrical storm in its immediate vicinity.

7.4.2 If electrical storm conditions develop while an amusement device or ride is in operation, loading of riders shall be terminated. Operation shall be continued only as long as necessary to unload all patrons.

7.4.3 The operator of an amusement ride or device shall be kept advised informed of adverse changes in weather conditions.

7.4.4 *Evacuation Plan:*

7.4.4.1 Where required for an amusement ride or device, a written plan shall be provided to evacuate patrons in a reasonable length of time based on hazards and risks to patrons. The plan shall include:

(1) the definition of the line of authority in the event of an evacuation, including:

(a) the individuals or positions responsible for ordering an evacuation;

(b) the individuals or positions responsible for performing the evacuation, first-aid, and ground care of evacuated passengers; and

(c) the minimum number of trained personnel available during operation hours for each task related to the evacuation procedure identified in the evacuation plan;

(2) a description of the equipment necessary for evacuation and where it is stored;

(3) an estimate of the time necessary for the complete evacuation of the amusement ride or device;

(4) a description of unusual terrain conditions and how each of these conditions shall be dealt with during an evacuation;

(5) an estimate of when an evacuation should begin in the event that the amusement ride or device becomes inoperable;

(6) provision for communication with riders of an amusement ride or device, when communication shall start, and how often subsequent communication shall be repeated;

(7) the method of evacuation to be used for a typical rider and the method to be used for an incapacitated rider;

(8) provisions for lockout of the amusement device or ride and the method to be used to isolate specific energy sources prior to performing an evacuation;

(9) provision for communication with the evacuation teams;

(10) provision for suspending the evacuation in the event that the amusement ride or device is made operable during the evacuation;

(11) provision for control and assistance of evacuated persons until released; and

(12) provision for a post-evacuation report.

7.4.4.2 Evacuation drills shall be conducted at established intervals that shall not exceed 12 months, and at the start of each new season, and with new staff. Drills shall be recorded in the operating log.

7.4.4.3 The following shall be taken into account to determine the evacuation equipment required:

(1) probable operating and evacuation conditions;

(2) storage locations;

(3) number of amusement rides or devices at a specific location; and

(4) periods of operation that may influence evacuation (day, night, or dusk).

7.4.4.4 The following shall apply to the equipment that is provided and maintained for the purpose of emergency evacuation:

(1) when not in use, equipment shall be carefully stored in such a location that it is readily available for use on a specific amusement ride or device; and

(2) prior to each season's operation and after each use, each device shall be thoroughly inspected and any worn or damaged components shall be replaced or repaired.

7.4.5 Record Keeping:

7.4.5.1 Records shall be maintained including inspections, tests, and records of operation, maintenance, and injuries and illnesses, with entries signed (manually or electronically) by the person responsible for conducting or reporting the named activities, or by that person's supervisor, to record:

(1) results of each inspection and test carried out on the amusement device or ride;

(2) results of operating data, including information related to any injuries and illnesses that may involve the amusement device or ride; and

(3) maintenance procedures performed, including data concerning modifications to the amusement device or ride.

7.4.5.2 The records shall include information about components serviced, the condition of the components, and the replacement of components.

7.4.6 *Wire Rope Inspection, Rejection, and Maintenance Criteria*—Use of CSA Z98 Passenger Ropeways and Passenger Conveyors for inspection, rejection, and maintenance criteria for wire ropes is acceptable in addition to ANSI B77.1.

8. Auditing of Amusement Rides and Devices

8.1 Practice F2974 may be used for the purpose of appraising compliance of practices referenced in 2.2 of this practice during design, manufacturing, installation, commissioning, major modifications and operation of amusement rides and devices.

8.2 The significance and use of Practice F2974 are explained in Appendix X1.4.

9. Supporting Standards

9.1 Dynamic Characteristics:

9.1.1 The dynamic characteristics of amusement devices and rides shall be measured in accordance with Practice F2137 and conform to Practice F2291.

9.1.2 The significance and use of Practice F2137 are explained in Appendix X1.5.

9.2 *Hardness Measurement of Patron Seat and Restraint Padding*—Test methods listed in Appendix X2 may be used for the purpose of measuring the hardness property of patron seat and restraint padding.

9.3 Climbing Nets and Netting/Mesh:

9.3.1 Performance specifications of climbing nets and netting mesh shall meet the requirements specified in Practice F2375.

9.3.2 The significance and use of Practice F2375 are explained in Appendix X1.6.

ANNEX
(Mandatory Information)
A1. RECOGNIZED CERTIFICATION MARKS

A1.1 *Subsection 5.3.2.3 – Certification Agencies*—The following is a list of agencies accredited by the Standards Council of Canada:³

(1) Canadian Standards Association (CSA) operating as CSA Group

(2) Curtis-Straus LLC

(3) FM Approvals LLC

(4) Intertek Testing Services NA Inc.

(5) Met Laboratories, Inc. (MET)

(6) OMNI Test Laboratories, Inc.

(7) QPS Evaluation Services, Inc.

(8) Quality Auditing Institute

(9) TÜV SÜD America Inc.

(10) TÜV Rheinland of North America, Inc.

(11) Underwriters Laboratories of Canada (ULC)

(12) UL LLC

³ Visit www.scc.ca for the most current list of certification agencies and their associated certification markings.

A1.2 Products approved for use in Canada shall bear a marking from a certification agency listed in **A1.1**.³

APPENDIXES
(Nonmandatory Information)
X1. SIGNIFICANCE AND USE

NOTE X1.1—The significance and use is cited from the ASTM Committee F24 standards referenced hereunder:

X1.1 *Subsection 5.2 – Practice F2291*—The purpose of this practice is to provide designers, engineers, manufacturers, owners, and operators with criteria and references for use in designing amusement rides and devices or a major modification for amusement rides or devices.

X1.2 *Subsection 6.2 – Practice F1193*—The purpose of this practice is to:

X1.2.1 Provide the minimum manufacturing requirements for amusement rides and devices and to provide the minimum requirements for a written quality assurance program for an amusement ride or device manufacturer, or component supplier. This is not intended to include suppliers of off-the-shelf components (for example, fasteners, electrical wire, etc.);

X1.2.2 Provide the minimum information necessary for the proper identification, placement, erection, and operation of each amusement ride or device;

X1.2.3 Delineate information and to establish procedures for the operation of amusement rides and devices;

X1.2.4 Establish pertinent test data on a given ride or device which shall be used as the basis for the evaluation of the ride or device's performance, including developmental testing, installation testing, and operational testing;

X1.2.5 Intended for the use of manufacturers, owners/operators, and those persons or agencies involved in the installation and operational testing of amusement rides and devices;

X1.2.6 Delineate information for the maintenance of amusement rides and devices;

X1.2.7 Provide to the new owner of an amusement ride or device, available information for the identification, placement, erection, operation, and maintenance of the amusement ride or device;

X1.2.8 Delineate information and recommend inspections for amusement rides and devices; and

X1.2.9 Determine conformance with applicable ASTM Committee F24 standards.

X1.3 *Subsection 7.2 – Practice F770*—The purpose of this practice is to provide information and to delineate procedures for the operation, maintenance, and inspection of amusement rides and devices.

X1.4 *Subsection 8.2 – Practice F2974*:

X1.4.1 This practice may be used as guidance during a planned examination conducted by an individual or a group, to provide an appraisal to determine compliance with the ASTM standards referenced in **2.2** through design, manufacturing, installation, commissioning, major modifications and operation stages of amusement ride or device.

X1.4.2 A planned examination conducted by an individual or a group may include complete or limited inspections, evaluations, or examinations during the design, manufacturing, installation, commissioning, major modification, or operation stages of an amusement ride or device.

X1.4.3 A planned examination may or may not be a recurring activity.

X1.5 *Subsection 9.1.2 – Practice F2137*:

X1.5.1 This practice is intended for use whenever the dynamic characteristics of an amusement ride or device are to

be determined. The existence of this practice is not intended to imply that there is a requirement to perform specific testing on amusement rides or devices.

X1.5.2 The general provisions of this practice provide instrumentation specifications, data acquisition and testing procedures, and documentation requirements that when applied will improve the repeatability, reliability, and utility of the test results.

X1.5.3 Based on the general provisions of this practice, the SARC Test specifications, when followed, will yield standardized test results regarding the patron-related, dynamic motion

of amusement rides or devices. The SARC Test will facilitate both the meaningful comparison of the dynamic motion of different amusement rides or devices and the tracking of changes, if any, in the dynamic characteristics of a given ride or device.

X1.6 *Practice F2375*—This practice establishes performance specifications and performance standards for the design, manufacturing, and maintenance of netting and or mesh used in play areas and systems designed for interactive play activities within amusement attractions.

X2. HARDNESS MEASUREMENT OF PATRON SEAT AND RESTRAINT PADDING

X2.1 *Subsection 9.2 – Hardness Measurement of Patron Seat and Restraint Padding:*

X2.1.1 *Test Method F1957*—This test method is based on the penetration by a specific type of indenter when forced into the material under specified conditions. The indentation hardness is related inversely to the penetration and is dependent on the elastic modulus and viscoelastic behavior of the material. The geometry of the indenter and the applied force influence the measurements, such that no simple relationship exists between the measurements obtained with one type of durometer and those obtained with another type of durometer or other

instruments used for measuring hardness. This test method is an empirical test intended primarily for control purposes. No simple relationship exists between indentation hardness determined by this test method and any fundamental property of the material tested. For specification purposes it is recommended that Test Method **D785** be used for hard materials and Test Method **D2240** be used for solid elastomers.

X2.1.2 For composite foam material use Test Method **F1957**.

X2.1.3 For hard material use Test Method **D785**.

X2.1.4 For solid elastomers use Test Method **D2240**.

ASTM would again like to recognize the support and cooperation of CSA Group, the CSA Z267 Technical Committee and the ASTM F24.80 Harmonization Committees, Canadian provincial and territorial regulators, amusement device stakeholders, and the International Association of Amusement Parks and Attractions (IAAPA). CSA Group is authorized to market and distribute ASTM F2783-14 in English or French Language.



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