DrJ CERTIFICATION

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Technical Evaluation Report

TER 1010-03

Application of the 250 pound Sprinkler Installer Load

Trussway Industries, LLC

Product:

Application of the 250 pound Sprinkler installer Load

Issue Date:

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Revision Date:

March 18, 2020

Subject to Renewal:

April 1, 2021

COMPANY
INFORMATION:

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DIVISION: 01 00 00 - GENERAL REQUIREMENTS

SECTION: 01 60 00 - Product Requirements

DIVISION: 15 00 00 - MECHANICAL

SECTION: 15 30 00 - Fire Protection Piping

1 CODE COMPLIANCE PROCESS EVALUATED[1]

1.1 Application of the 250 pound Sprinkler installer Load

2 APPLICABLE CODES AND STANDARDS[2,3]

2.1 *Codes*

2.1.1 *IBC—12, 15, 18: International Building Code®*

2.1.2 *IRC—12, 15, 18: International Residential Code®*

2.2 *Standards and Referenced Documents*

2.2.1 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*

2.2.2 *NFPA 13: Standard for the Installation of Sprinkler Systems*

2.2.3 *NFPA 13D: Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*

2.2.4 *NFPA 13R: Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies*

2.2.5 *TPI 1: National Design Standard for Metal-plate-connected Wood Truss Construction*

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[1] Building codes require data from valid research reports be obtained from *approved sources*. Agencies who are accredited through ISO/IEC 17065 have met the code requirements for approval by the *building official*. DrJ is an ISO/IEC 17065 ANSI-Accredited Product Certification Body – Accreditation #1131.

Through ANSI accreditation and the IAF MLA, DrJ certification can be used to obtain product approval in any *jurisdiction* or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – "certified once, accepted everywhere."

Building official approval of a licensed *registered design professional* (RDP) is performed by verifying the RDP and/or their business entity complies with all professional engineering laws of the relevant *jurisdiction*. Therefore, the work of licensed RDPs is accepted by *building officials*, except when plan (i.e. peer) review finds an error with respect to a specific section of the code. Where this TER is not approved, the *building official* responds in writing stating the reasons for disapproval.

For more information on any of these topics or our mission, product evaluation policies, product approval process, and engineering law, visit drjcertification.org or call us at 608-310-6748.

[2] Unless otherwise noted, all references in this TER are from the 2018 version of the codes and the standards referenced therein (e.g., *ASCE 7, NDS, ASTM*). This material, design, or method of construction also complies with the 2000-2015 versions of the referenced codes and the standards referenced therein.

[3] All terms defined in the applicable building codes are italicized.

3 PERFORMANCE EVALUATION

3.1 The design practice of Trussway's metal plate connected wood trusses has been evaluated for compliance with *IBC* Section 903.3.1, which requires fire sprinkler systems to be designed and installed in accordance with *NPFA 13*, 13*R*, or *13D*.

3.1.1 For *NFPA 13* and *13R* systems, this includes loading of trusses to account for the weight of the water-filled pipe as well as a short duration load of 250 lb, to account for an impact should an installer lose balance and grab a pipe to steady themself.

3.1.2 For *NFPA 13D* systems, small diameter PVC or PEX piping is common. The dead load of the sprinkler system is generally covered in the normal dead loads applied to the trusses.

3.2 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.

3.3 Any engineering evaluation conducted for this TER was performed on the dates provided in this TER and within DrJ's professional scope of work.

4 PRODUCT DESCRIPTION AND MATERIALS

4.1 This report applies to metal plate connected roof and floor trusses designed and manufactured by Trussway Industries, LLC.

5 APPLICATIONS

5.1 *Structural Application Support Requirements*

5.1.1 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.

5.1.2 *IBC* Section 903.3.1 specifies that, where required, automatic sprinkler systems shall be designed and installed in accordance with the provisions of *NFPA 13*, *NFPA 13R,* or *NFPA 13D*.

5.1.3 *NFPA 13* provides the minimum requirements for the design and installation of automatic fire sprinkler systems and exposure protection sprinkler systems for buildings of all occupancies.

5.1.4 *NFPA 13R* is intended for a more specific type of building and provides the design and installation criteria of automatic sprinkler systems for protection against fire hazards in Group R occupancies up to and including four stories in height.

5.1.4.1 Examples of buildings typically covered by *NFPA 13R* include:

5.1.4.1.1 Apartment buildings and condominiums

5.1.4.1.2 Lodging and rooming houses

5.1.4.1.3 Board and care facilities (slow-evacuation type with 16 or fewer occupants and prompt-evacuation type)

5.1.4.1.4 Hotels, motels and dormitories

5.1.5 *NFPA 13D* provides the design and installation criteria of automatic sprinkler systems for protection against fire hazards in buildings for which the *IRC* applies, as well as manufactured homes.

5.2 Sprinkler Systems Installed per *NFPA 13* or *NFPA 13R*

5.2.1 Structural members supporting sprinkler piping designed and installed in accordance with *NFPA 13* or *NFPA 13R* are required to support the weight of the water-filled pipe plus a 250 lb concentrated load applied at the location of the pipe attachment. Section 9.2.1.3.1 of *NFPA 13* states:

> 9.2.1.3.1 Unless the requirements of 9.2.1.3.3 apply, sprinkler piping shall be substantially supported from the building structure, which must support the added load of the water-filled pipe plus a minimum of 250 lb (114 kg) applied at the point of hanging, except where permitted by 9.2.1.1.2, 9.2.1.3.3, and 9.2.1.4.1.

5.2.1.1 Section 9.2.1.3.3 refers to flexible piping installation.

5.2.1.2 Section 9.2.1.1.2 refers to toggle hangers for the support of $1^1/_2$" and smaller pipe under ceilings of hollow tile or metal lath and plaster.

5.2.1.3 Section 9.2.1.4.1 refers to branch line hangers attached to metal deck limitation of 1" or smaller pipe.

5.2.2 The 2007 Commentary to Section 9.2.1.3.1 provides the following insight as to the intention of these loading requirements:

> Each individual point where the hanger is attached to the structure must be able to support the weight of the water-filled pipe plus 250 lb (114 kg), as stated in 9.2.1.3.1. This requirement does not intend to add 250 lb (114 kg) concurrently for each hanger when determining the minimum strength of the building structure. As mentioned in the commentary to 9.1.1, the 250-lb (114-kg) load represents the assumed weight of a sprinkler pipe fitter with associated work equipment who grasps the pipe during a mishap. It is a temporary point load applied at any hanger.

5.2.3 The Commentary to Section 9.2.1.3.1 of *NFPA 13* makes it clear that the 250 lb concentrated load is intended to represent the weight of a sprinkler installer and is to be applied for a very short time (i.e., just long enough for the pipefitter to regain their balance).

5.2.3.1 This load is considered an installation live load and is not intended to be applied simultaneously at all pipe support locations or concurrently with other live loads such as floor, roof, snow, or wind.

5.2.4 The weight of the water-filled pipe is a dead load that is most often evaluated as an additional uniformly distributed load.

5.2.4.1 The magnitude of this load can vary considerably depending on the size and type of pipe, the spacing between the pipe supports and the number of supports on each truss.

5.2.4.2 Alternatively, concentrated loads for the sprinkler system may be given when attachment locations are known.

5.2.4.3 Main sprinkler lines, risers and lines running parallel to trusses may require special design provisions.

5.2.5 Section 2.3.2.4 (d) of *ANSI/TPI 1-2014* indicates that loads from fire sprinkler systems that are to be supported by trusses must be included by the Building Designer in the Construction Documents for the building.

> 2.3.2.4 Required Information in the Construction Documents.
>
> (d) The location, direction, and magnitude of all dead, live, and lateral loads applicable to each Truss including, but not limited to, loads attributable to: roof, floor, partition, mechanical, fire sprinkler, attic storage, rain and ponding, wind, snow (including snow drift and unbalanced snow), seismic; and any other loads on the Truss

5.3 *Sprinkler Systems Installed Per NFPA 13D*

5.3.1 There are no special strength requirements specified for structural members supporting sprinkler piping designed and installed in accordance with *NFPA 13D*.

5.3.2 Chlorinated Polyvinyl Chloride (CPVC) and Crosslinked Polyethylene (PEX) tubing are the most common types of sprinkler pipe used in residential applications, with pipe sizes ranging from ½" to 1¼" in diameter.

5.3.2.1 Sprinkler systems with these sizes and types of pipes typically add less than 0.75 psf of dead load to the structural framing members and can be easily supported by most plumbing code recognized hangers.

5.3.3 Further, the additional weight of these sprinkler systems is usually accounted for in the miscellaneous dead load for the floor or roof system.

5.4 *Serviceability Requirements*

5.4.1 Sprinkler Systems Installed per *NFPA 13* or *NFPA 13R*

5.4.1.1 *NFPA 13* and *NFPA 13R* establish no minimum serviceability (i.e., deflection limitation) requirements for the structural members supporting the sprinkler piping or the 250 lb concentrated load.

5.4.1.2 *IBC* Section 1604.3 includes the minimum serviceability requirements for structural systems and members. *IBC* Table 1604.3 provides maximum deflection limits for various construction and load conditions (Figure 1).

CONSTRUCTION	L or L_r	S or W[f]	$D + L$[d, g]
Roof members:[e]			
Supporting plaster or stucco ceiling	*l*/360	*l*/360	*l*/240
Supporting nonplaster ceiling	*l*/240	*l*/240	*l*/180
Not supporting ceiling	*l*/180	*l*/180	*l*/120
Floor members	*l*/360	—	*l*/240
Exterior walls:			
With plaster or stucco finishes	—	*l*/360	—
With other brittle finishes	—	*l*/240	—
With flexible finishes	—	*l*/120	—
Interior partitions:[b]			
With plaster or stucco finishes	*l*/360	—	—
With other brittle finishes	*l*/240	—	—
With flexible finishes	*l*/120	—	—
Farm buildings	—	—	*l*/180
Greenhouses	—	—	*l*/120

For SI: 1 foot = 304.8 mm.

a. For structural roofing and siding made of formed metal sheets, the total load deflection shall not exceed *l*/60. For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed *l*/150. For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed *l*/90. For roofs, this exception only applies when the metal sheets have no roof covering.

b. Flexible, folding and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1607.15.

c. See Section 2403 for glass supports.

d. The deflection limit for the $D+(L+L_r)$ load combination only applies to the deflection due to the creep component of long-term dead load deflection plus the short-term live load deflection. For lumber, structural glued laminated timber, prefabricated wood I-joists and structural composite lumber members that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection shall be permitted to be estimated as the immediate dead load deflection resulting from 0.5D. For lumber and glued laminated timber members installed or used at all other moisture conditions or cross laminated timber and wood structural panels that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection is permitted to be estimated as the immediate dead load deflection resulting from D. The value of 0.5D shall not be used in combination with ANSI/AWC NDS provisions for long-term loading.

e. The preceding deflections do not ensure against ponding. Roofs that do not have sufficient slope or camber to ensure adequate drainage shall be investigated for ponding. See Chapter 8 of ASCE 7.

f. The wind load shall be permitted to be taken as 0.42 times the "component and cladding" loads or directly calculated using the 10-year mean return interval wind speed for the purpose of determining deflection limits in Table 1604.3. Where framing members support glass, the deflection limit therein shall not exceed that specified in Section 1604.3.7

g. For steel structural members, the detection due to creep component of long-term dead load shall be permitted to be taken as zero.

h. For aluminum structural members or aluminum panels used in skylights and sloped glazing framing, roofs or walls of sunroom additions or patio covers not supporting edge of glass or aluminum sandwich panels, the total load deflection shall not exceed *l*/60. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed *l*/175 for each glass lite or *l*/60 for the entire length of the member, whichever is more stringent. For aluminum sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed *l*/120.

i. *l* = Length of the member between supports. For cantilever members, l shall be taken as twice the length of the cantilever.

FIGURE 1. 2018 *IBC* TABLE 1604.3, DEFLECTION LIMITS

5.4.1.3 As clarified in the Commentary to the 2012 *IBC*, the serviceability requirements provided in *IBC* Section 1604.3 are intended only for finished construction and do not apply to structural systems or members during construction.

Q3. In Table 1604.3, Note g states "dead load shall be taken as zero for structural steel members." Would this apply to the precomposition check of composite beam deflection limits under wet weight of concrete?

A3. No. The serviceability requirements of Section 1604.3 apply to the finished construction. The loading condition described would be a construction consideration, which is not directly regulated by the serviceability criteria.

5.4.1.4 The weight of the water-filled pipe is a permanent (i.e., dead) load and is subject to the deflection limitations of *IBC* Table 1604.3, when evaluated in conjunction with total design load.

5.5 Sprinkler Systems Installed per *NFPA 13D*

5.5.1 There are no special serviceability requirements specified for structural members supporting sprinkler piping designed and installed in accordance with *NFPA 13D*.

5.5.2 The minimal additional dead load provided by these systems is subject to the deflection limitations of the *IRC*, when evaluated in conjunction with total design load.

6 INSTALLATION

6.1 Installation shall comply with the manufacturer's installation instructions and this TER. In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.

6.2 The product(s) evaluated by this TER fall within the scope of one or more of the model, state or local building codes for building construction. The testing and/or substantiating data used in this TER is limited to buildings, structures, building elements, construction materials and civil engineering related specifically to buildings.

6.3 The provisions of model, state or local building codes for building construction do not intend to prevent the installation of any material or to prohibit any design or method of construction. Alternatives shall use consensus standards, performance-based design methods or other engineering mechanics based means of compliance. This TER assesses compliance with defined standards, accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.

7 TEST ENGINEERING SUBSTANTIATING DATA

7.1 Some information contained herein is the result of testing and/or data analysis by other sources which conform to *IBC* Section 1703 and relevant professional engineering law. DrJ relies on accurate data from these sources to perform engineering analysis. DrJ has reviewed and found the data provided by other professional sources to be credible.

7.2 Where appropriate, DrJ's analysis is based on design values that have been codified into law through codes and standards (e.g., *IBC, IRC, NDS®,* and *SDPWS*). This includes review of code provisions and any related test data that aids in comparative analysis or provides support for equivalency to an intended end-use application. Where the accuracy of design values provided herein is reliant upon the published properties of commodity materials (e.g., lumber, steel, and concrete), DrJ relies upon the grade mark, stamp, and/or design values provided by raw material suppliers to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8 FINDINGS

8.1 Sprinkler Systems Installed per *NFPA 13* or *NFPA 13R:*

8.1.1 The 250 lb sprinkler installer load required by *NFPA 13* for structural members supporting sprinkler systems designed and installed in accordance with *NFPA 13* or *NFPA 13R* requirements is an installation live load.

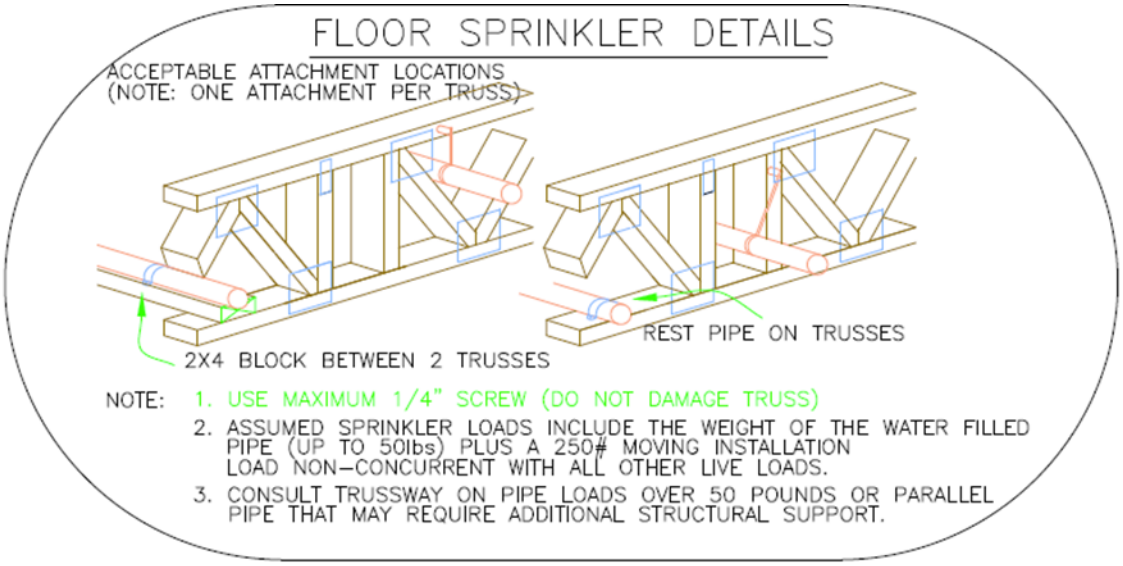
8.1.1.1 This is a very short-term load condition that will use a 2.0 load duration factor per *NDS Appendix B*.

8.1.1.2 This load is to be applied concurrently with only the design dead loads.

8.1.1.3 Trussway trusses account for this load as follows:

8.1.1.3.1 The 250 lb sprinkler installer load is attached as a single point load hung from the top chord of the trusses, or

8.1.1.3.2 is attached to the bottom chord of the trusses and is distributed to two adjacent trusses. See Figure 2 for details.



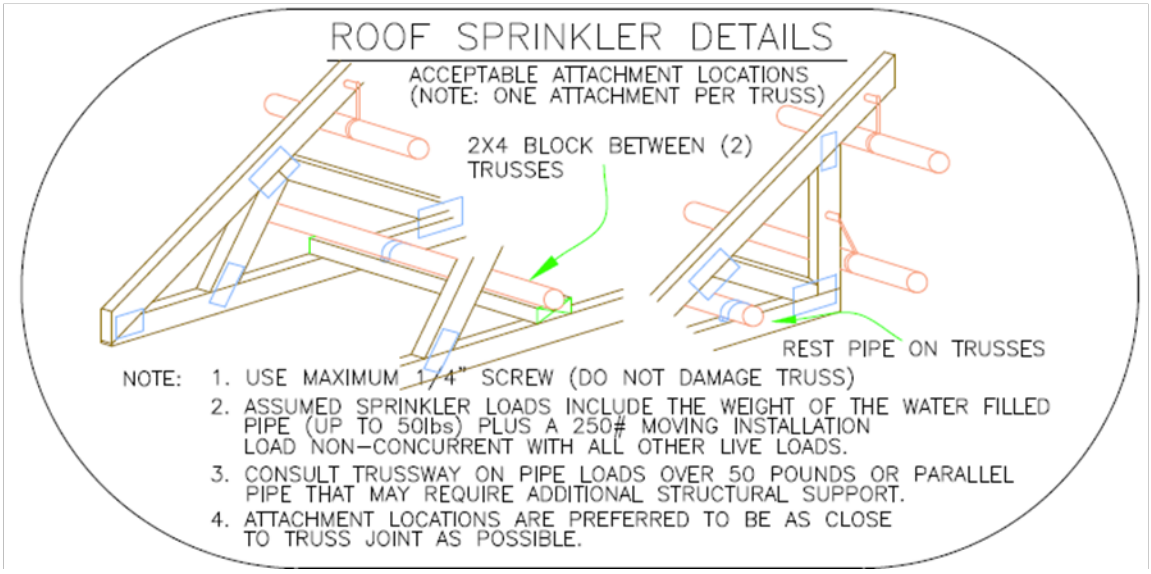


FIGURE 2. ASSUMED SPRINKLER ATTACHMENTS TO TRUSSWAY TRUSSES

8.1.1.4 Trusses designed to support this load shall include the following note.

8.1.1.4.1 Note: The truss design accounts for *IBC* Section 903.3.1 and *NFPA 13*, *NFPA 13R*, or *NFPA 13D* compliance requirements relating to a 250 lb short-term (C_D=2.0) installer load to be supported at a hanger point on top chord or by two trusses on bottom chord, non-concurrent with other live loads.

8.1.2 The deflection limitations of the building code are not applicable to the 250 lb concentrated load check because this loading condition typically occurs during the construction phase of the building.

8.1.2.1 This is a strength issue, not a deflection issue, from a safety perspective.

8.1.3 The location, direction, and magnitude of the dead load used to approximate the weight of the water-filled fire sprinkler system to be supported by the trusses must be provided by the Building Designer, or Trussway will apply 50 lbs.

8.1.3.1 This is a permanent load condition, the magnitude of which will be dependent on the size and spacing of the pipe.

8.1.3.2 When defined by the Building Designer, this load is added to the bottom chord dead load and is subject to the deflection limitations of *IBC* Table 1604.3 when evaluated in conjunction with other dead and live loads that are being applied to the truss system.

8.2 Sprinkler Systems Installed per *NFPA 13D*

8.2.1 The 250 lb sprinkler installer load does not apply to sprinkler systems installed per the requirements of *NFPA 13D*.

8.2.2 Sprinkler systems installed per *NFPA 13D* typically weigh less than 0.75 psf.

8.2.3 These systems can easily be supported by most plumbing code recognized hangers.

8.2.4 The additional weight of these sprinkler systems is usually accounted for in the miscellaneous bottom chord dead load for the floor or roof system, unless otherwise specified by the Building Designer.

8.3 *IBC* Section 104.11 (*IRC* Section R104.11 and *IFC* Section 104.9 are similar) states:

> 104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code…Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons the alternative was not *approved*.

9 Conditions of Use

9.1 Where required by the *building official*, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed, this TER and the installation instructions shall be submitted at the time of *permit* application.

9.2 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.

9.3 Design loads shall be determined in accordance with the building code adopted by the *jurisdiction* in which the project is to be constructed and/or by the Building Designer (e.g., *owner* or *registered design professional*).

9.4 At a minimum, this product shall be installed per Section 6 of this TER.

9.5 This product is manufactured under a third-party quality control program in accordance with *IBC* Section 104.4 and 110.4 and *IRC* Section R104.4 and R109.2.

9.6 The actual design, suitability, and use of this TER, for any particular building, is the responsibility of the *owner* or the owner's authorized agent. Therefore, the TER shall be reviewed for code compliance by the *building official* for acceptance.

9.7 The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party quality assurance program and procedures, proper installation per the manufacturer's instructions, the *building official's* inspection, and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.

10 IDENTIFICATION

10.1 Each Trussway floor truss covered by this TER is identified on the truss design drawing (TDD) and/or the truss placement diagram (TPD) with the truss type.

10.2 Additional technical information can be found at trussway.com.

11 REVIEW SCHEDULE

11.1 This TER is subject to periodic review and revision. For the most recent version of this TER, visit drjcertification.org.

11.2 For information on the current status of this TER, contact DrJ Certification.