



Thursday, April 9, 2020

**How to navigate changes in FM Global's  
Loss Prevention Data Sheets**

presented by



**NRCA**

**Mark S. Graham**

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National Roofing Contractors Association

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Tuesday, June 18, 2019

**ASCE 7-16 and its impact  
on roof system designs**

presented by

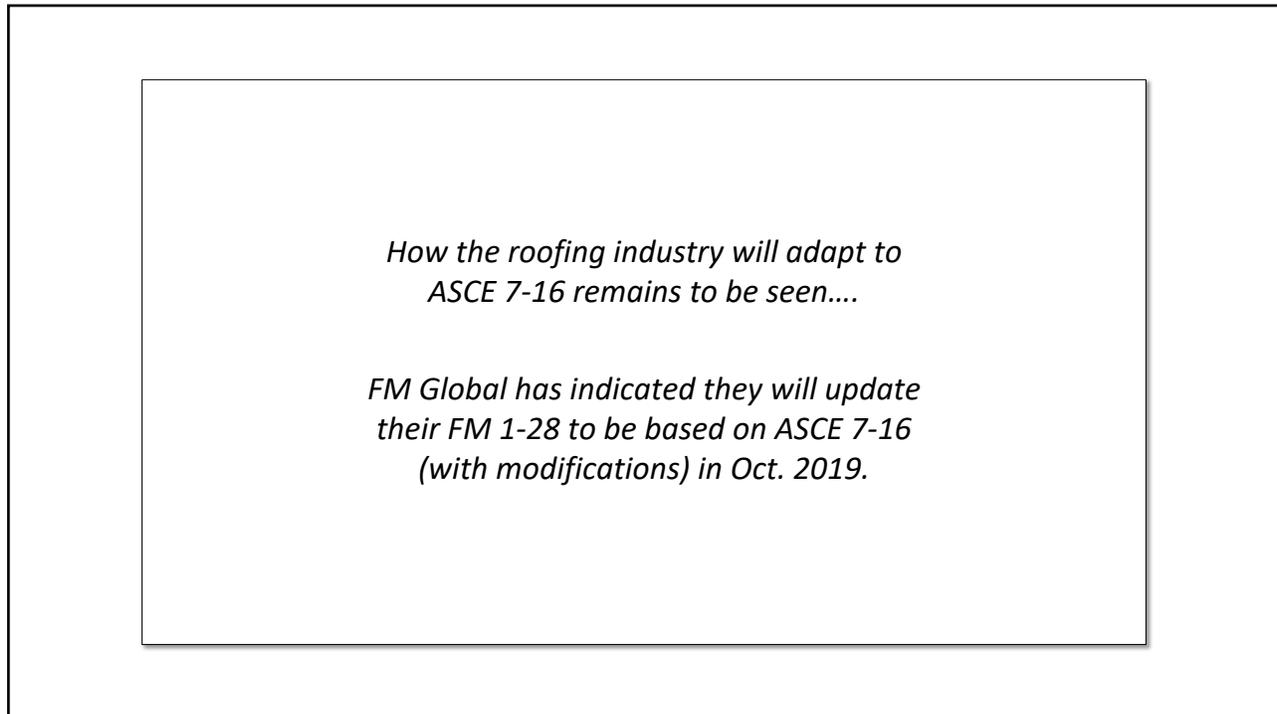


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**Who is Factory Mutual?**

- FM Approvals
  - A standards development organization (e.g., FM 4474)
  - A code-approved testing agency (e.g., 1-60, 1-90, etc.)
  - A subsidiary of FM Global
  
- FM Global
  - A mutually-owned insurance company (i.e., highly-protected risk)
  - Property Loss Prevention Data Sheets
  - Form X2688, “Checklist for Roofing System”

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CHECKLIST FOR ROOFING SYSTEM 

FM Global OFFICE REVIEW  
(Please leave blank for FM Global Office Review)

WIND:

Design Wind Speed: <input type="text"/> (mph)	Ground Terrain: <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
Uplift Pressure in field: <input type="text"/> (psf)	Uplift Rating Required: <input type="text"/>
Adequate Uplift Rating Provided: <input type="text"/>	Adequate? <input type="checkbox"/> Yes <input type="checkbox"/> No

If standing seam, has collapse been reviewed?  Yes  No

COMMENTS:

©2018 ENGINEERING (Rev. Oct 2016)

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**February 26, 2020**  
Publication date... and implementation date

**March 5, 2020**  
Roofing industry FM Coalition meeting

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## New FM Global Loss Prevention Data Sheets

February 26, 2020 – Accessible at [www.fmglobaldatasheets.com](http://www.fmglobaldatasheets.com)

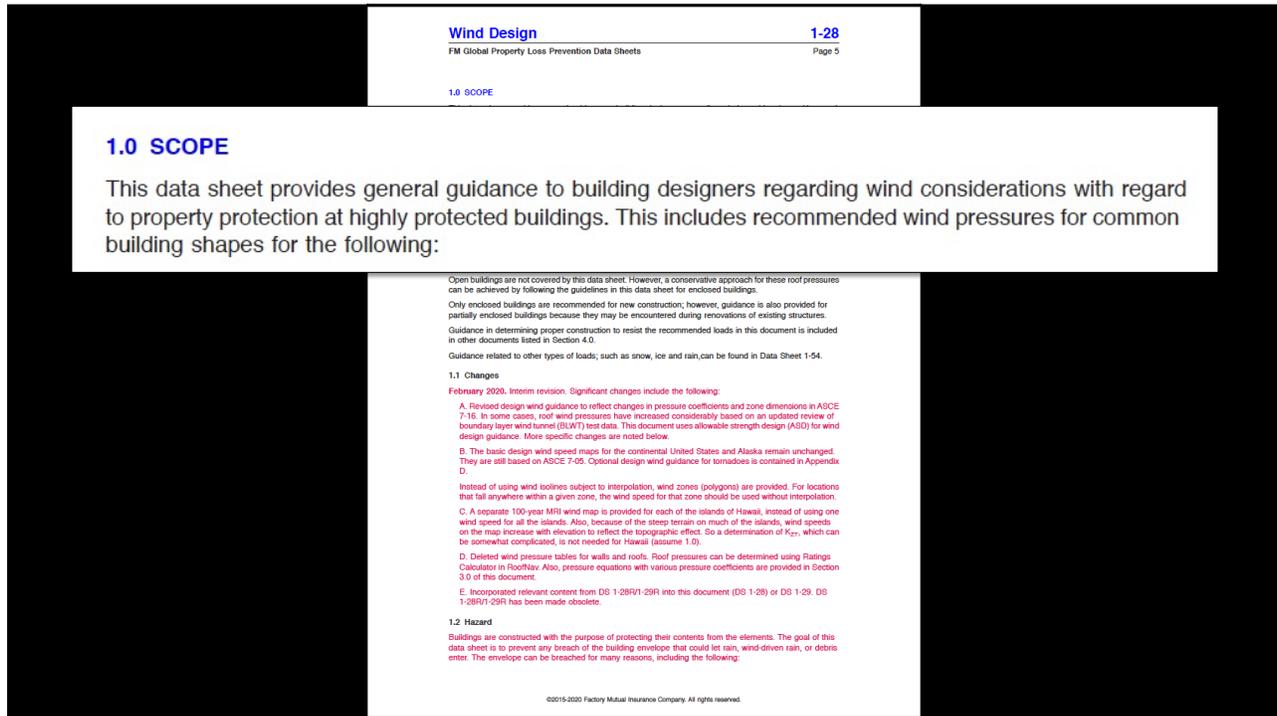
- FM 1-15, “Roof-Mounted Solar Photovoltaic Panels”
- FM 1-28, “Wind Design”
- FM 1-29, “Roof Deck Securement and Above-deck Roof Components”
- FM 1-30, “Repair of Wind-damaged Single- and Multi-ply Roof Systems”
- FM 1-31, “Roof Panel Systems”
- FM 1-34, “Hail Damage”
- FM 1-35, “Vegetative Roof Systems”
- FM 1-49, “Perimeter Flashing”
- FM 1-52, “Field Verification of Roof Wind Uplift Resistance”

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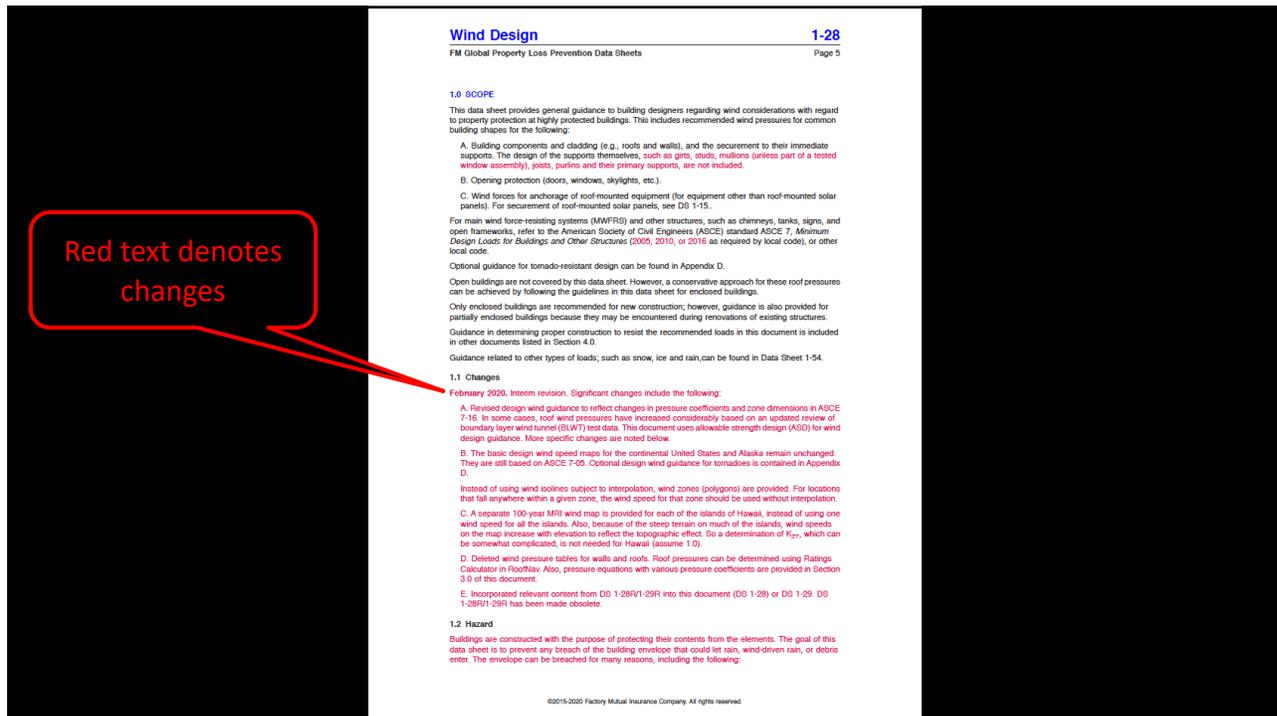
### FM 1-28

October 2015  
Interim Revision February 2020

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## Significant changes in FM 1-28, Feb. 2020

- Wind load determination tables have been removed from FM 1-28; now use the ratings calculator in RoofNav
- FM 1-28 now uses ASCE 7-16's pressure coefficients and zones
- FM 1-28 still uses ASCE 7-05's 100-year MRI maps
- FM 1-28 still uses the allowable strength design (ASD) method
- FM 1-28 uses (adds) an Importance Factor of 1.15

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## FM Approvals' RoofNav

[www.roofnav.com](http://www.roofnav.com)

The screenshot shows the RoofNav website interface. At the top, there is a navigation bar with links for 'MY PROJECTS', 'PRODUCT SEARCH', 'SYSTEM SEARCH', 'ASSEMBLY SEARCH', 'RATINGS CALCULATOR', and 'REFERENCE MATERIALS'. The 'RATINGS CALCULATOR' link is circled in red. Below the navigation bar, there is a 'Help us improve RoofNav!' section with a 'Take a Brief Survey' button. The main content area is titled 'Welcome to RoofNav' and contains a 'What's New' section. A red arrow points to the 'What's New' section, which lists several updates:

- 2/28/2020** Changes have been made to the RoofNav Ratings Calculator to account for updates to relevant data sheets.
- 3/22/2018** The Hail Map for the Contiguous US has been revised and is now posted. Data Sheet 1-34 has also been revised.
- 11/28/2017** An additional 33 Very Severe Hail (VSH) rated assemblies have been added. There are now 190 VSH rated assemblies in RoofNav.

Below the 'What's New' section, there is a 'Getting Started' section with links for 'Downloadable RoofNav Quick Start Guide', 'RoofNav Online Training', and 'Help Documentation'.

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## What impacts do these changes have?

### An example calculation using the Ratings Calculator:

**Example:** A low-rise office building (Risk Category II) is located in Chicago, IL. The building is an enclosed structure with a mean roof height of 60 ft. The building is located in an open terrain area that can be categorized as Exposure Category C.

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Calculate Wind Uplift

Roof Area Properties	Dimensions	1000 x 1000 ft (304.8 x 304.8 m)
	Height	60 ft (18.29 m)
	Slope	0.25 in 12 (1.2°)
	Min 3 ft (1 m) continuous parapet	N
Site Properties	Surface Roughness	C
	Wind Speed	90 mph
	In a Tropical Cyclone Prone region	N
	Enclosure Classification	Enclosed
Wind Pressures	Zone 1 Prime	24 psf (1.1 kPa)
	Zone 1	43 psf (2.1 kPa)
	Zone 2	57 psf (2.7 kPa)
	Zone 3	77 psf (3.7 kPa)
Wind Uplift Ratings	Zone 1 Prime	60 psf
	Zone 1	90 psf
	Zone 2	120 psf
	Zone 3	165 psf

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### Comparing ASCE 7-05, FM 1-28, ASCE 7-10 and ASCE 7-16

**Example:** A low-rise office building (Risk Category II) is located in Chicago, IL. The building is an enclosed structure with a mean roof height of 60 ft. The building is located in an open terrain area that can be categorized as Exposure Category C.

Document	Basic wind speed (mph)	Design wind pressure (psf)			
		Zone 1' (Center)	Zone 1 (Field)	Zone 2 (Perimeter)	Zone 3 (Corners)
ASCE 7-05	$V_{ASD} = 90$	--	24	40	58
FM 1-28 (old)	$V_{ASD} = 90$	--	27	46	69
FM 1-28 (new)	$V_{ASD} = 90$	24	43	57	77

A 59% increase

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### Comparing ASCE 7-05, FM 1-28, ASCE 7-10 and ASCE 7-16

**Example:** A low-rise office building (Risk Category II) is located in Chicago, IL. The building is an enclosed structure with a mean roof height of 60 ft. The building is located in an open terrain area that can be categorized as Exposure Category C.

Document	Basic wind speed (mph)	Design wind pressure (psf)			
		Zone 1' (Center)	Zone 1 (Field)	Zone 2 (Perimeter)	Zone 3 (Corners)
ASCE 7-05	$V_{ASD} = 90$	--	24	40	58
FM 1-28 (old)	$V_{ASD} = 90$	--	27	46	69
FM 1-28 (new)	$V_{ASD} = 90$	24	43	57	77
ASCE 7-10 Ult.	$V_{ULT} = 115$	--	39	65	97
ASCE 7-10 ASD	$V_{ASD} = 90$	--	23	39	58
ASCE 7-16 Ult.	$V_{ULT} = 105$	30	51	67	92
ASCE 7-16 ASD	$V_{ASD} = 90$	18	31	46	55

FM 1-60

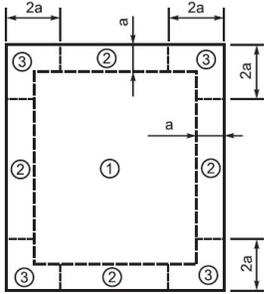
FM 1-90

FM 1-75

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Calculate Wind Uplift

	Dimensions	1000 x 1000 ft (304.8 x 304.8 m)
Roof Area Properties	Height	150 ft (46.72 m)
	Slope	0.25 in 12 (1.2°)
	Min 3 ft (1 m) continuous parapet	N
	Surface Roughness	C
Site Properties	Wind Speed	90 mph
	In a Tropical Cyclone Prone region	N
	Enclosure Classification	Enclosed
Wind Pressures	Zone 1	44 psf (2.1 kPa)
	Zone 2	69 psf (3.3 kPa)
	Zone 3	94 psf (4.5 kPa)
Wind Uplift Ratings	Zone 1	90 psf
	Zone 2	150 psf
	Zone 3	195 psf



a = 10% of the lesser horizontal dimension, but not less than 3ft. (0.9m)

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### Comparing ASCE 7-05, FM 1-28, ASCE 7-10 and ASCE 7-16

**Example:** A high-rise office building (Risk Category II) is located in Chicago, IL. The building is an enclosed structure with a mean roof height of 150 ft. The building is located in an open terrain area that can be categorized as Exposure Category C.

Document	Basic wind speed (mph)	Design wind pressure (psf)			
		Zone 1' (Center)	Zone 1 (Field)	Zone 2 (Perimeter)	Zone 3 (Corners)
ASCE 7-05	$V_{ASD} = 90$	--	38	60	82
FM 1-28 (old)	$V_{ASD} = 90$	--	44	69	94
FM 1-28 (new)	$V_{ASD} = 90$	--	44	69	94
ASCE 7-10 (Ult.)	$V_{ULT} = 115$	--	63	98	134
ASCE 7-10 ASD	$V_{ASD} = 90$	--	38	59	80
ASCE 7-16 Ult.	$V_{ULT} = 105$	--	52	82	112
ASCE 7-16 ASD	$V_{ASD} = 90$	--	31	49	67

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*The values derived from FM 1-28 are not consistent with ASCE 7-16's ASD values (IBC 2018). Using FM 1-28 typically results in higher design wind loads.*

Complying with the code is a minimum legal requirement.

- Where FM 1-28's values are lower, use of the code's required wind loads is recommended
- Where FM 1-28's values are higher, these may be a project-specific contract requirement

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RESEARCH+TECH



**FM Global makes some changes**  
A new FM 1-28 introduces wind design complications for FM-insured buildings  
by Mark S. Graham

**Professional Roofing**  
April 2020

[Link to article](#)

22 www.professionalroofing.net APRIL 2020

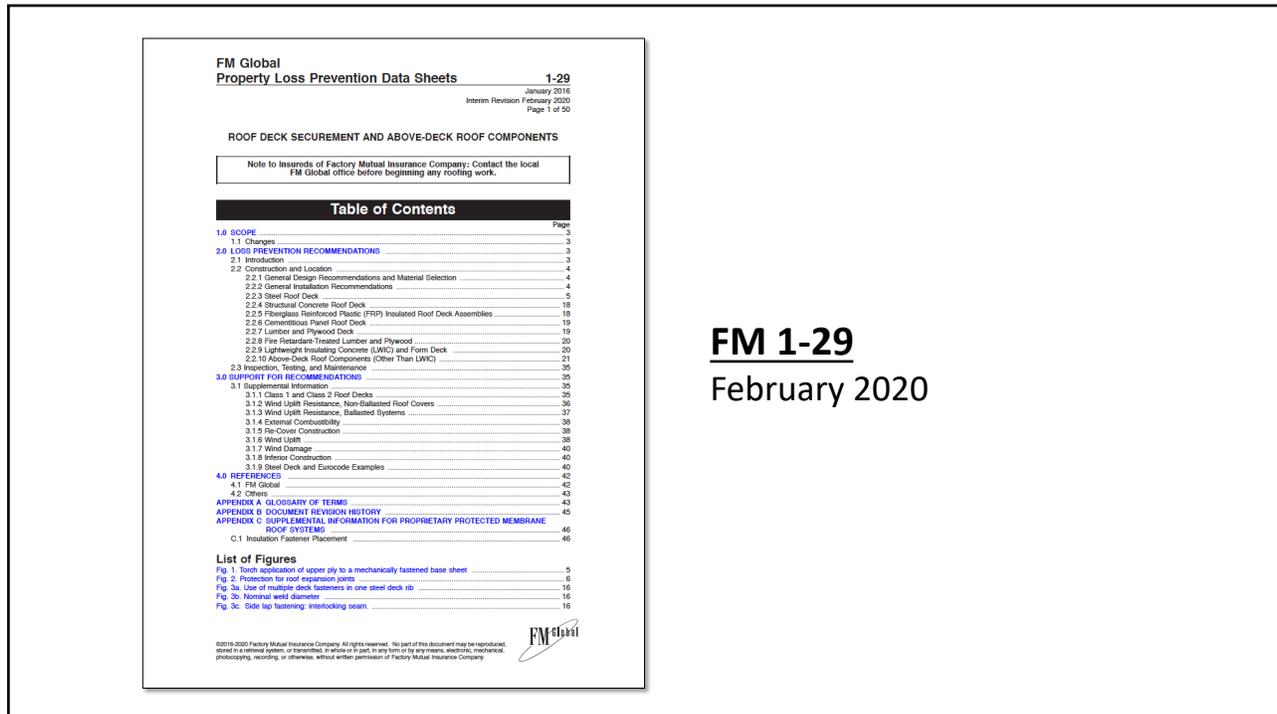
In Feb. 2020, FM Global updated its Property Loss Prevention Data Sheet 1-28, "Wind Design," to reflect changes in its wind load determination methodology. FM 1-28 is intended to provide designers with general guidance for highly protected, FM Global-insured buildings. Following is an overview of the roofing-specific changes.

FM 1-28's changes

FM 1-28 is a 100-page document divided into five primary sections: scope, loss prevention recommendations, support for recommendations, references and appendices. Wind speed maps for the US, including detailed maps for Hawaii, are provided in Appendix C. Changes from FM 1-28's previous edition, released in October 2015, are denoted in red. Also, Section 1.1 Changes summarizes significant changes.

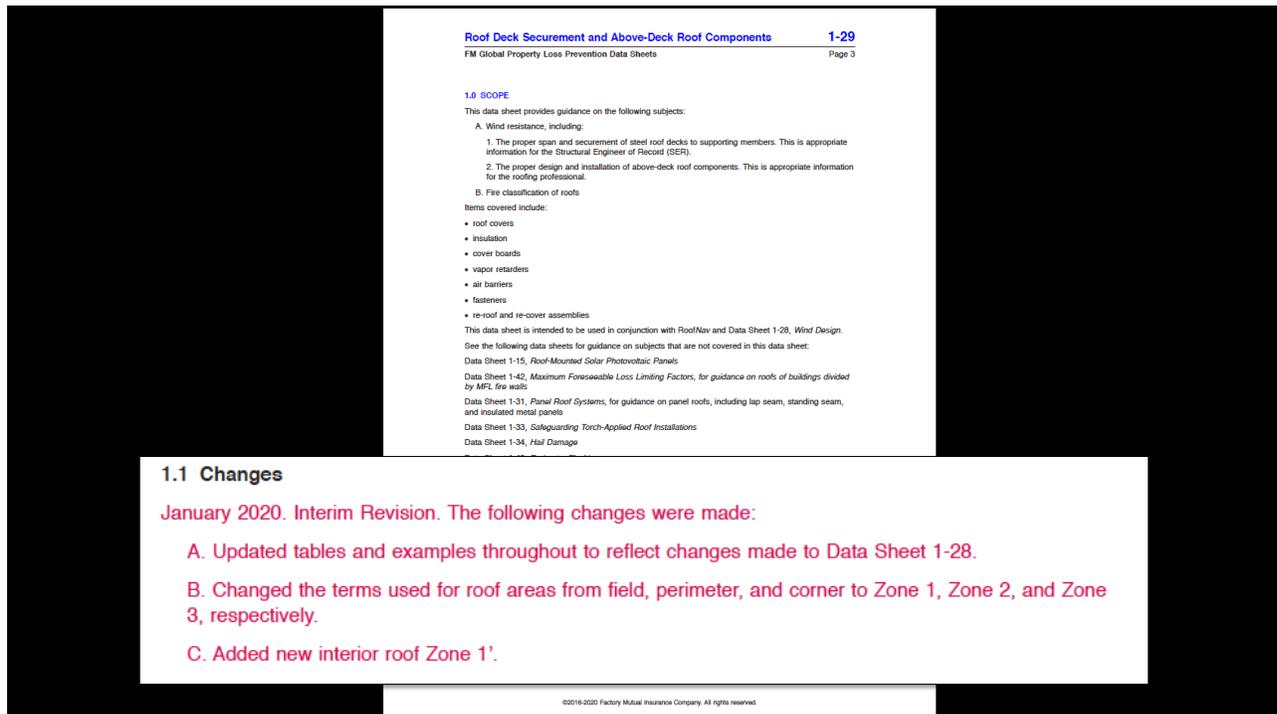
The most notable change is the spiral design pressure tables that appeared in the previous edition have been removed. Now, use of the Ratings Calculator provided in FM Approvals' RoofNav application ([www.roofnav.com](http://www.roofnav.com)) is recommended. The pressure equations and various pressure coefficients used in the Ratings Calculator are described in FM 1-28's Section 3.

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**FM 1-29**  
February 2020

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**1.1 Changes**  
January 2020. Interim Revision. The following changes were made:

- A. Updated tables and examples throughout to reflect changes made to Data Sheet 1-28.
- B. Changed the terms used for roof areas from field, perimeter, and corner to Zone 1, Zone 2, and Zone 3, respectively.
- C. Added new interior roof Zone 1'.

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1-29      **Roof Deck Securement and Above-Deck Roof Components**  
Page 14      FM Global Property Loss Prevention Data Sheets

Table 1E. 3 in. (75 mm) Deep, Type N Steel Deck with 8 in. (200 mm) Rib Spacing for Wind Ratings from 60 to 225 psf (2.8 to 10.8 kPa)  
 (NOTE: Use this table when the distance between rows of roof cover fasteners is one-half the deck span or less. Green font indicates that deflection governs over bending stress.)

Yield Stress per Deck Gauge	Deck Gauge	Ultimate Wind Rating per RoofNav (psf)											
		60	75	90	105	120	135	150	165	180	195	210	225
30,000	22	13.29	11.88	10.63	10.04	9.40	8.80	8.40	8.01	7.67	7.37	7.10	6.86
	20	14.83	13.27	12.11	11.21	10.49	9.89	9.38	8.94	8.56	8.23	7.93	7.66
	18	17.28	15.56	14.26	13.19	12.30	11.60	11.00	10.48	10.04	9.65	9.30	8.99
	16	20.45	18.29	16.69	15.49	14.46	13.63	12.83	12.33	11.80	11.34	10.93	10.56
40,000	22	14.62	13.07	11.93	11.05	10.34	9.74	9.24	8.81	8.44	8.11	7.81	7.56
	20	16.32	14.59	13.32	12.33	11.54	10.88	10.32	9.84	9.42	9.05	8.72	8.43
	18	19.13	17.11	15.62	14.40	13.53	12.75	12.10	11.54	11.05	10.61	10.23	9.88
	16	22.28	20.12	18.36	17.00	16.00	14.99	14.22	13.56	12.98	12.48	12.02	11.61
45,000	22	14.62	13.07	12.06	11.12	10.40	10.34	9.81	9.35	8.95	8.60	8.29	8.01
	20	16.50	14.83	13.53	12.54	11.74	11.05	10.44	9.99	9.59	9.23	8.94	

**2.2.3.4 Provide deck securement as required by RoofNav for the needed wind rating using one of the following methods:**

**A. Performance-based approach:** Where RoofNav assemblies are selected to account for the higher wind ratings needed in **Zone 2 and Zone 3**, the entry for the RoofNav assembly will address the specific securement requirements.

**B. Prescriptive enhancement approach:** Where a single RoofNav assembly is selected based on the needed **Zone 1** rating (assuming deck span is adequate for all areas as noted above), enhance deck securement in **Zone 2 and Zone 3** as follows:

1. **Zone 2:** Increase deck securement by a minimum of 50% compared to that required by RoofNav for the Zone 1 rating.
2. **Zone 3:** Provide deck securement equivalent to at least 2 times that required by the RoofNav listing for Zone 1 and in accordance with Tables 2 or 3, where applicable.

In most cases, due to steel deck module spacing, it will be practical for both Zone 2 and Zone 3 to provide deck securement equivalent to 2 times that required by the RoofNav listing for Zone 1.

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Roof Deck Securement and Above-Deck Roof Components      **1-29**  
FM Global Property Loss Prevention Data Sheets      Page 15

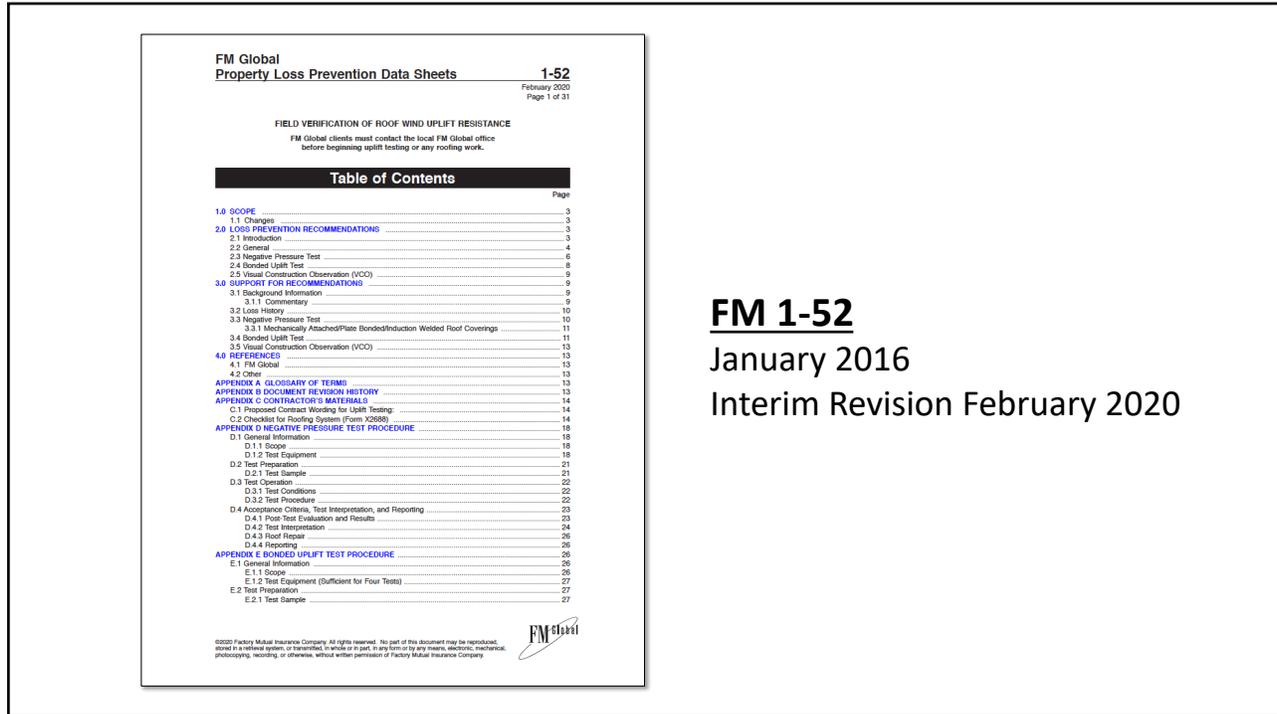
Table 2. Steel Roof Deck, Zone 3 Enhancement Options for 6 in. (150 mm) Module (Rib Spacing), Common With 1 1/2 in. (38 mm) Deep Deck

Required Zone 1 Securement	Zone 3 Securement
5/8 in. welds @ 12 in. (300 mm)	5/8 in. welds or FM Approved deck fasteners @ 6 in. (150 mm)
5/8 in. welds @ 6 in. (150 mm)	Two 5/8 in. welds or two FM Approved deck fasteners @ 6 in. (150 mm)
3/4 in. welds @ 12 in. (300 mm)	3/4 in. welds or FM Approved deck fasteners @ 6 in. (150 mm)
3/4 in. welds @ 6 in. (150 mm)	Two 3/4 in. welds or two FM Approved deck fasteners @ 6 in. (150 mm)
One FM Approved deck fastener @ 12 in. (300 mm)	One FM Approved deck fastener with minimum 1/2 in. integral washer diameter or 3/4 in. washer @ 6 in. (150 mm)
One FM Approved dek fasteners @ 6 in. (150 mm)	Two FM Approved deck fasteners with minimum 1/2 in. integral washer diameter or 3/4 in. washers @ 6 in. (150 mm)
Two FM Approved deck fasteners @ 6 in. (150 mm)	Two FM Approved deck fastener with 3/4 in. washer @ 6 in. (150 mm)

Table 3. Steel Roof Deck, Zone 3 Enhancement Options for 8 in. (200 mm) Module (Rib Spacing), Common with 3 in. (75 mm) Deep Deck

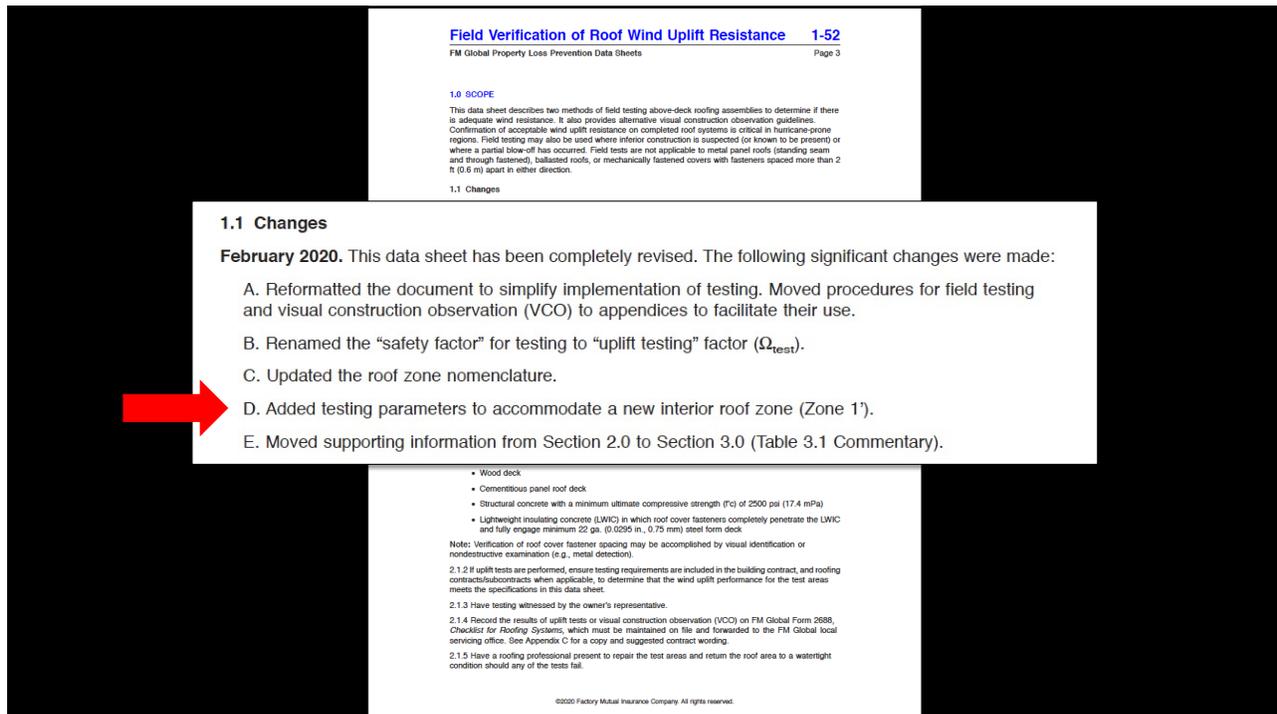
Required Zone 1 Securement	Zone 3 Securement
5/8 in. welds @ 8 in. (200 mm)	Two 5/8 in. welds or two FM Approved deck fasteners @ 8 in. (200 mm)
3/4 in. welds @ 8 in. (200 mm)	Two 3/4 in. welds or two FM Approved deck fasteners @ 8 in. (200 mm)
One FM Approved deck fastener @ 8 in. (200 mm)	Two FM Approved deck fasteners with minimum 1/2 in. integral washer diameter or 3/4 in. washer @ 8 in. (200 mm)
Two 5/8 in. (16 mm) welds @ 8 in. (200 mm)	Two FM Approved deck fasteners with 3/4 in. washers @ 8 in. (200 mm)

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**FM 1-52**  
January 2016  
Interim Revision February 2020

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**1-52 Field Verification of Roof Wind Uplift Resistance**  
Page 8 FM Global Property Loss Prevention Data Sheets

Zone 3\*\*    Zone 1\*  
Zone 2  
Zone 1

\* Not all roofs include a Zone 1' area. For roofs without a Zone 1', this area is included within the designation of Zone 1.  
\*\* Regardless of roof zone shape, the quantity of tests performed should be equal to what is depicted.

Fig. 2.3.12-1. Uplift test location example. Nine sections. All with individual roof areas up to 60,000 ft<sup>2</sup> (5,600 m<sup>2</sup>) and no change in above-deck roofing assembly for Zones 1 and 1'.

**Table 2.3.12-1. Minimum Number of Negative Pressure Tests**

Roof Area (A) [ft <sup>2</sup> or m <sup>2</sup> ]	Minimum Number of Individual Tests(per Roof Zone)			
	Zone 1'	Zone 1	Zone 2	Zone 3
A < 10,000 (930)	See Note 1.	1	1	1
10,000 (930) < A < 60,000 (5,600)		2	2	1
A > 60,000 (5,600) or multiple adjoining roof areas	See Note 1.			

1 See Sections 2.3.8 to 2.3.12 and Figure 2.3.12-1.

per Equation 2:

$$F_{req} [lb] = U_1 [psf] \times A_{subsample} [ft^2] + Weight_{subsample} [lb]$$

$$F_{req} [kN] = U_1 [kPa] \times A_{subsample} [m^2] + Weight_{subsample} [kN]$$

(Eq. 2)

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**1-52 Field Verification of Roof Wind Uplift Resistance**  
Page 6 FM Global Property Loss Prevention Data Sheets

**Table 2.2.5-2. Required Passing Uplift Test Pressures**

Roof Zone	Velocity Pressure, U <sub>1</sub> [psf]	Pressure Coeff. (C <sub>p</sub> ) <sup>1</sup>	Design Wind Pressure, p [psf]	Minimum FM Approved Rating <sup>2</sup> [psf]	Uplift Testing Factor (U <sub>1</sub> ) <sup>2</sup>	Required Passing Uplift Test Pressure <sup>2</sup> [psf]
3	29.8	0.35	-109.3	1,210	1.25	129
2		-2.48	-73.9	1,150	1.25	62
1	17	-1.88	-59.8	1,120	1.25	70
1'		-1.69	-52.0	1,120	1.25	49

<sup>1</sup> Due to the lower end limit (1-60) and 15 psf increments for FM Approved roof assembly ratings, in some cases the rating of the installed roof assembly may be significantly higher than both the design wind pressure and required passing uplift test pressure. The leasthood of this scenario is particularly true for Zone 3.

<sup>2</sup> The minimum FM Approved roof assembly rating is based upon a test or rating of 2 over the design wind pressure. The required passing uplift test pressure is lower than the minimum FM Approved rating in all scenarios.

2.2.6 Except where otherwise noted, evaluation of uplift tests resulting in a passing designation is based on withstanding the required passing uplift test pressure (U<sub>1</sub>) or equivalent for its respective roof zone for a period of 1 minute without experiencing any defined mode of failure.

2.2.7 To prevent water damage to insulation, promptly patch and make watertight all damaged/failed test areas.

2.2.8 Perform repairs in accordance with Data Sheets 1-30, Repair of Wind Damaged Single- and Multi-Ply Roof Systems; 1-26, Wind Design; and 1-29, Roof Deck Securement and Above-Deck Roof Components.

**2.3 Negative Pressure Test**

2.3.1 The negative pressure uplift test is generally preferable to the bonded uplift test. It is not to be used directly on porous surfaces because the test requires an airtight seal between the test apparatus and the roof covering.

2.3.2 Negative pressure uplift tests may be conducted on totally adhered built-up roofs (BUR), modified bitumen (mod bit), or single-ply membranes. This test can also be performed on mechanically attached base sheets, or mechanically attached/bonded/reinforced single-ply membranes if fasteners are spaced no more than 2 ft (0.6 m) on center in both orthogonal directions.

2.3.3 For the fastened base sheets or reinforced single-ply membranes described in Section 2.3.2, the negative pressure apparatus may be used provided a minimum of one fastener is tested at its full fastener-to-fastener span in both orthogonal directions.

2.3.4 Conduct negative pressure uplift tests in accordance with Appendix D, Negative Pressure Test Procedure.

2.3.5 Determine the minimum number of individual negative pressure tests per roof area (NOT per building) in accordance with Table 2.2.5-2.

2.3.10 Only two tests are required for every interior roof area (see Figure 2.3.12-1).

2.3.11 If a roof area includes Zone 1', and the construction of the above-deck roofing assembly does differ between Zone 1 and Zone 1', test Zone 1' using the appropriate Zone 1' test pressure.

2.3.12 If a roof area includes Zone 1 and Zone 1', and the construction of the above-deck roofing assembly does not differ between Zone 1 and Zone 1', testing of Zone 1 is sufficient.

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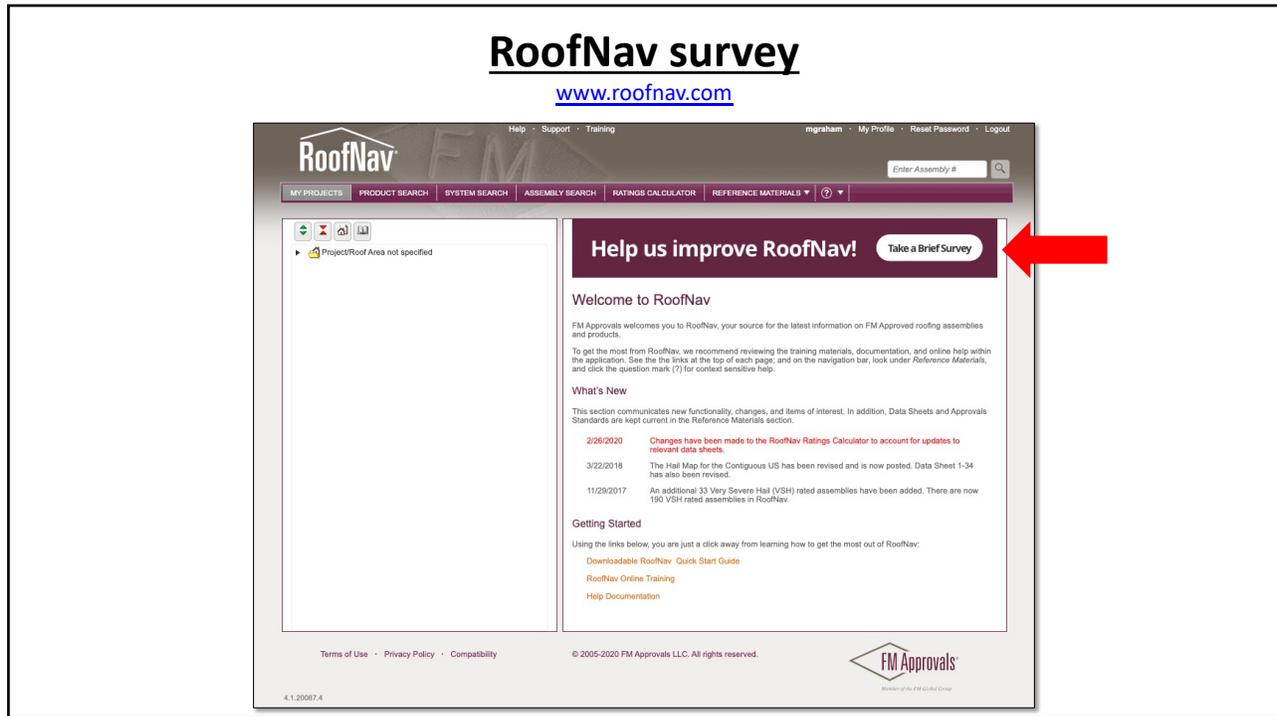
*FM Global intends these new guidelines to be effective as of February 26, 2020 (date of publication)*

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## [www.fmglobaldatasheets.com](http://www.fmglobaldatasheets.com)

The screenshot shows the homepage of the FM Global Property Loss Prevention Data Sheets website. At the top, there is a navigation bar with the FM Global logo on the left, and links for CAREERS, CONTACT, UNITED STATES - ENGLISH, and CONNECT WITH US on the right. Below the navigation bar is a search bar and three buttons: Report a Loss, Report an Impairment, and MyRisk®. A dark purple navigation menu contains links for About Us, Products & Services, Insights & Impacts, Research & Resources, and News & Events. The main content area features the breadcrumb path: FM Global > Research & Resources > FM Global Data Sheets. The primary heading is "FM GLOBAL PROPERTY LOSS PREVENTION DATA SHEETS" in large, bold, black letters. To the right of this heading is a green "Subscribe" button with an envelope icon. Below the heading is a paragraph of text: "To reduce risk at your existing facilities—as well as those under construction—it's important to have proven engineering guidelines. Look no further than FM Global Property Loss Prevention Data Sheets. These exacting standards help you reduce the chance of property loss due to fire, weather conditions, and failure of electrical or mechanical equipment. They incorporate nearly 200 years of property loss experience, research and engineering results, as well as input from consensus standards committees, equipment manufacturers and others. FM Global Property Loss Prevention Data Sheets make your business—and the world—more resilient. Access them free of charge through [www.fmglobaldatasheets.com](http://www.fmglobaldatasheets.com) or MyRisk®, our secure client extranet."

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