


**APA**

## Fire-Rated Systems in Wood Construction



Presented by: Kyle Tilley

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

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### Webinar Attendee Survey

**Kyle Tilley**

<https://www.apawood.org/fire-rated-systems-in-wood-construction-survey>

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**Course Description**

**While no building is truly fireproof, construction materials and systems can make a building firesafe. This session provides an introduction to fire-rated systems in wood-frame construction. Along with APA's Fire-Rated Systems design and construction guide, this webinar offers guidance on designing and constructing some of the most cost-effective, code-compliant fire-rated construction systems. Participants will learn what's available, what's acceptable and what's best practice.**

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**Learning Objectives**

- Identify the difference between Fireproof and Firesafe
- Discuss the basics of fire protection including key terms, practices, codes and measures
- Identify different protection methods which account for fire protection at the major areas of concern
- Describe the role different engineer wood products play in fire protection

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## Today's Agenda

1. What is fireproof vs firesafe?
2. What are the different fire protection methods and associated terms?
3. How do you protect the different areas of a building?
4. Considerations when using engineered wood products.



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## Why Wood?

- 33% of total land in the US is forest
- Annual net timber growth is 36% higher than removals
- 1.4 tons of CO<sub>2</sub> is sequestered in every 1 ton of wood
- US forests offset nearly 15% of total greenhouse gases



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## Terms

- **Critical Point**
  - The point human life is untenable
- **Flame Spread**
  - Spread of fire within a room once fire has started
- **Fire Resistance**
  - Protection against fire penetration through a wall, floor or roof
- **Protected Construction**
  - A construction assembly, with a fire-resistive material added to give primary protection to the wood members



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### Today's Agenda

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### Fireproof vs. Firesafe

- No building is fireproof
- Type of construction vs prompt detection
- Wood construction widely used for both low-rise and medium-rise construction



General Motors plant in Livonia, Michigan was unprotected metal construction (see text).



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### Fireproof vs. Firesafe

**A firesafe building can be designed with both combustible and noncombustible materials**




The presence of prompt detection along with an alarm system and the accessibility of numerous exits are far more vital.



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## Basics of Fire Protection

**Flame Spread** is a property of the surface material once fire has started, not the structure.

International Building Code (IBC) interior finish classifications.



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## Basics of Fire Protection

**Flame Spread Index of APA Performance-rated Wood Structural Panels.**

- Class A: Flame spread index 0 – 25; smoke-developed index 0 – 450
- Class B: Flame spread index 26 – 75; smoke-developed index 0 – 450
- Class C: Flame spread index 76 – 200; smoke-developed index 0 – 450

Performance Category	Flame Spread Index (FSI)	Flame Spread Class	Smoke-Developed Index (SDI)
<b>Oriented Strand Board (OSB) in Compliance with U.S. DOC PS 2</b>			
3/8	100	C	95
15/32	100	C	80
23/32	100	C	60
1-3/8	110	C	115
<b>Structural Plywood (Douglas-fir) in Compliance with U.S. DOC PS 1 or PS 2</b>			
1/4	85	C	70
3/8	65	B	60
15/32	40	B	50
23/32	35	B	55
<b>Structural Plywood (Southern Pine) in Compliance with U.S. DOC PS 1 or PS 2</b>			
1/2	75	B	115
15/32	95	C	135
23/32	65	B	175



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### Basics of Fire Protection

**How Building Areas Can Be Increased**

Photo Credit: Wood Works

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### Mass Timber

- Renewable resources
- Lower embodied energy
- 2021 IBC allows 18-story construction
- Cost benefits
- Recent projects:
  - 18-story student housing, Brock Commons (Vancouver, BC)
  - 25 story (19 = mass timber) apartment building, Ascent Tower (Milwaukee, WI)

Photo Credit: The University of British Columbia

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### Basics of Fire Protection

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**Protection Methods**

**Protected Construction Heavy Timber**  
 construction implies protection provided by massive wood members.

FIGURE 1  
WOOD STRUCTURAL PANEL HEAVY TIMBER ROOF CONSTRUCTION

Built-up roofing

Strength axis

1-3/32" or 1-1/8" APA RATED STURD-I-FLOOR

48 oc wood structural panel (tongue-and-groove edges)

Heavy timber or glulam beams (at least 4" nominal width)

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## Today's Agenda

1. What is fireproof vs firesafe?
2. What are the different fire protection methods and associated terms?
3. How do you protect the different areas of a building?
4. Considerations when using engineered wood products.



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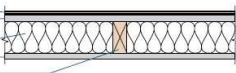
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## How To Build For Fire Protection

### Wall Systems

**2A – LOAD-BEARING EXTERIOR WALL SYSTEM**  
 Generic, nonproprietary assembly based on GA File No. WP9105 in Gypsum Association (G.A.) Fire Resistance Design Manual or Item 15-1.5 of Table 721.1(2) of the 2021 IBC®.



- APA Rated Siding Exterior
- 5/8" Type X gypsum sheathing
- Mineral wool or glass fiber insulation (optional)
- 5/8" Type X gypsum wallboard
- Min. 2x4 studs @ 16" or 24" o.c.



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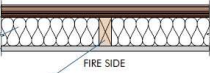
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## How To Build For Fire Protection


### Wall Systems

**2D – LOAD-BEARING EXTERIOR WALL SYSTEM**  
 Based on U.L. Design No. U356 in Underwriters Laboratories Inc. (U.L.) Fire Resistance Directory.



- APA Rated Siding Exterior or other exterior finish (code-approved type)
- Min. 7/16" APA Rated Sheathing Exposure 1 OSB or plywood
- Glass fiber (R13) or mineral wool insulation
- 5/8" Type X gypsum wallboard
- Min. 2x4 studs @ 16" o.c.

FIRE SIDE



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### Advantages of Nail-Base Sheathing

- Allows for the use of popular siding when studs are placed at 24" o.c.
- Allows for the use of shorter fasteners.
- Helps ensure that siding remains in place during high-wind events.
- Provides lateral stability for the structure allowing it to resist loads generated from high wind events.
- Provides a structural nail-base to permit the anchorage of numerous lightweight siding materials directly to the sheathing.



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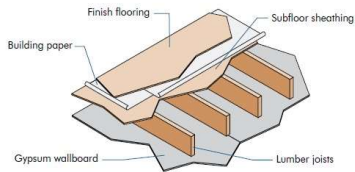
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### How To Build For Fire Protection

#### Floor and Roof Systems

FIGURE 4.1  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING AND ROOF-CEILING ASSEMBLIES WITH LUMBER JOISTS



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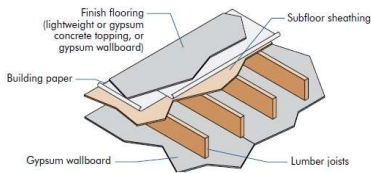
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### How To Build For Fire Protection

#### Floor and Roof Systems

FIGURE 4.2  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING AND ROOF-CEILING ASSEMBLIES WITH LUMBER JOISTS



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### How To Build For Fire Protection

**Floor and Roof Systems**

FIGURE 4.3  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING AND ROOF-CEILING ASSEMBLIES WITH LUMBER JOISTS

Floor sheathing

2 layers 5/8" Type X

Gypsum wallboard (face layer)

2x10 dimension lumber spaced at 24" OC

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### I-Joist Advantages

**Engineered design = More efficient**

Wood placed where stresses are greatest

- 46% less than lumber at 16" vs. I-joist at 19.2"
- 36% less when both are at 16"

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### Wood I-Joist

- **Standard Depths**
  - 9-1/2"
  - 11-7/8"
  - 14"
  - 16"
- **Varied flange widths and depths**
- **Structural performance varies by manufacturer**

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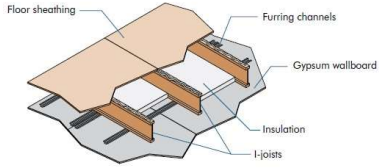
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## How To Build For Fire Protection

### Floor and Roof Systems

FIGURE 5.1  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING ASSEMBLIES WITH I-JOISTS\*



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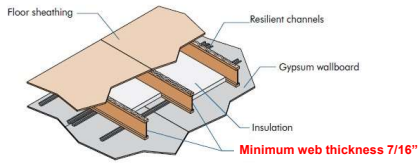
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## How To Build For Fire Protection

### Fire Protections of Floors

FIGURE 5.2  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING ASSEMBLIES WITH I-JOISTS\*



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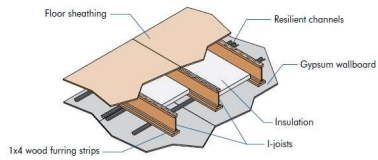
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## How To Build For Fire Protection

(APA Design and Construction Guide W305)

### Fire Protections of Floors

FIGURE 5.3  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING ASSEMBLIES WITH I-JOISTS\*



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### How To Build For Fire Protection

**Fire Protections of Floors**

FIGURE 5.4  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING ASSEMBLIES WITH I-JOISTS\*

Labels in diagram: Floor sheathing, Furring channels, Gypsum wallboard, Insulation, I-joists.

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### How To Build For Fire Protection

**Fire Protections of Floors**

FIGURE 5.5  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING ASSEMBLIES WITH I-JOISTS\*

Labels in diagram: Floor sheathing, Gypsum wallboard (base layer), Gypsum wallboard (face layer), I-joists.

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### How To Build For Fire Protection

**Fire Protections of Floors**

FIGURE 5.6  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING ASSEMBLIES WITH I-JOISTS\*†

Labels in diagram: Floor sheathing, Resilient channels, Gypsum wallboard (base layer), Gypsum wallboard (face layer), I-joists.

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### How To Build For Fire Protection

**Fire Protections of Floors**

FIGURE 5.7  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING ASSEMBLIES WITH I-JOISTS\*

Labels in diagram: Floor sheathing, Resilient channels, Gypsum wallboard (base layer), Gypsum wallboard (face layer), Insulation, I-joists.

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### How To Build For Fire Protection

**Fire Protections of Floors**

FIGURE 5.7a  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING ASSEMBLIES WITH I-JOISTS\*

Labels in diagram: Floor sheathing, Resilient channels, Gypsum wallboard (base layer), Gypsum wallboard (face layer), Insulation, I-joists.

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### How To Build For Fire Protection

**Fire Protections of Floors**

FIGURE 5.8  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING ASSEMBLIES WITH I-JOISTS\*

Labels in diagram: Floor sheathing, Resilient channels, Gypsum wallboard (base layer), Gypsum wallboard (face layer), Insulation, I-joists.

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### How To Build For Fire Protection

**Fire Protections of Floors**

FIGURE 5.8a  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING ASSEMBLIES WITH I-JOISTS\*

Labels in diagram: Floor sheathing, Gypsum wallboard (base layer), Gypsum wallboard (face layer), I-joists.

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### How To Build For Fire Protection

(APA Design and Construction Guide W305)

**Fire Protections of Floors**

FIGURE 5.9  
ONE-HOUR COMBUSTIBLE FLOOR-CEILING ASSEMBLIES WITH I-JOISTS\*

Labels in diagram: Floor sheathing, Resilient channels, Single layer of 3/4" Type X Gypsum Wallboard, Insulation, I-joists.

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### How To Build For Fire Protection

**Fire Protections of Floors**

FIGURE 6  
TWO-HOUR COMBUSTIBLE FLOOR-CEILING ASSEMBLIES WITH I-JOISTS\*

Labels in diagram: Floor sheathing, Furring channels, Insulation, Gypsum wallboard (base layer), Gypsum wallboard (middle layer), Gypsum wallboard (face layer), I-joists.

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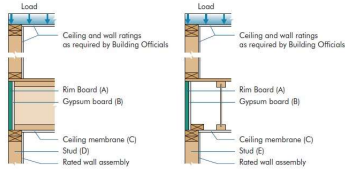
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# How To Build For Fire Protection

## APA Rim Board Assemblies (One and Two-Hour)

Fire Resistance Rated Rim Board Assembly **RB1** from APA Data File: **D350**

This fire resistance design is listed in accordance with ASTM E119 and CAN/ULC S101.



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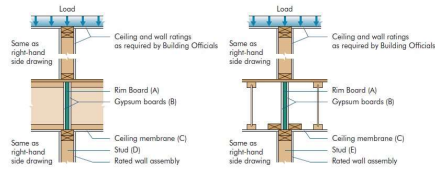
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# How To Build For Fire Protection

## APA Rim Board Assemblies (One and Two-Hour)

Fire Resistance Rated Rim Board Assembly **RB2** from APA Data File: **D350**

This fire resistance design is listed in accordance with ASTM E119 and CAN/ULC S101.



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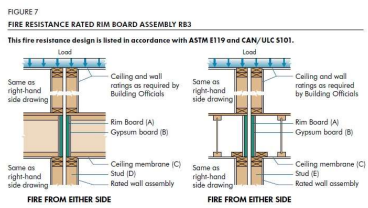
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# How To Build For Fire Protection

## APA Rim Board Assemblies (One and Two-Hour)



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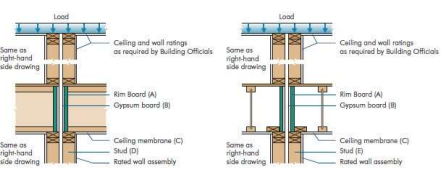
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## How To Build For Fire Protection

### APA Rim Board Assemblies (One and Two-Hour)

**Fire Resistance Rated Rim Board Assembly RB4 from APA Data File: D350**  
This fire resistance design is listed in accordance with ASTM E119 and CAN/ULC S101.



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## How To Build For Fire Protection

### APA Rim Board Assemblies (One and Two-Hour)

DOUBLE WALL CONFIGURATION WITH LOAD TRANSFER BASE ASSEMBLY						
Rim Board Thickness, in.	Rim Board Protection	Ceiling Membrane Req. for 1-hr	Ceiling Membrane Req. for 2-hr	Min. Stud Size	Min. Stud Size	
A	B	C	C	D	E	
1	Unprotected	1/2" Type X	90-min Fire-rated Assembly	2x4	2x4	
	(1) 1/2" Type X	No Ceiling Required	1-hour Fire-rated Assembly	2x4	2x4	
	(1) 5/8" Type X	No Ceiling Required	45-min Fire-rated Assembly	2x4	2x4	
	(2) 1/2" Type X	No Ceiling Required	No Ceiling Required	2x6	2x4	
1-1/8	Unprotected	1/2" Type X	90-min Fire-rated Assembly	2x4	2x4	
	(1) 1/2" Type X	No Ceiling Required	1-hour Fire-rated Assembly	2x4	2x4	
	(1) 5/8" Type X	No Ceiling Required	5/8" Type X	2x4	2x4	
	(2) 1/2" Type X	No Ceiling Required	No Ceiling Required	2x6	2x4	
1-1/4	Unprotected	1/2" Regular	90-min Fire-rated Assembly	2x4	2x4	
	(1) 1/2" Type X	No Ceiling Required	45-min Fire-rated Assembly	2x4	2x4	
	(1) 5/8" Type X	No Ceiling Required	5/8" Regular	2x6	2x4	
	(2) 1/2" Type X	No Ceiling Required	No Ceiling Required	2x6	2x4	

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## How To Build For Fire Protection

### APA Rim Board Assemblies (One and Two-Hour)

1-3/4	Unprotected	No Ceiling Required	Fire-rated Assembly	2x4	2x4
	(1) 1/2" Type X	No Ceiling Required	1/2" Type X	2x6	2x4
	(1) 5/8" Type X	No Ceiling Required	No Ceiling Required	2x6	2x4
	(2) 1/2" Type X	No Ceiling Required	No Ceiling Required	2x6	2x6

1. Rim assembly for fire from either side of wall. "With load transfer" assumes load transfer to the adjacent rim board if the fire exposed rim board fails.
2. Gypsum wallboard shown on the ceiling is to protect the rim board only. It does not necessarily cause the floor assembly to be tested.
3. Attach 1-layer Type X (1/2" or 5/8-inch) gypsum wallboard to rim board with 1-1/2-inch Type W drywall screws spaced 12 inches o.c.
4. Attach 2-layer Type X (1/2" or 5/8-inch) gypsum wallboards to rim board with 2-inch Type W drywall screws spaced 12 inches o.c.
5. Provide min. 1/4-inch bearing for 1-joint.
6. Type C may be substituted for Type X, and Type X may be substituted for regular gypsum wallboard of the same thickness.
7. Rim Board and gypsum wallboard thicknesses are shown as minimums. Thicker Rim Board and gypsum wallboard may be substituted.
8. When 2-layer gypsum wallboards are used, 1-joint and nails shall be 16d box (0.135 inch x 3-1/2 inch) nails.
9. Rim Board shall be sized for vertical and lateral loads.
10. Stud size may be reduced if the gypsum protection is discontinuous, provided that other requirements in the code are satisfied.

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## How To Build For Fire Protection

(APA Design and Construction Guide W305)

### APA Rim Board Assemblies (One and Two-Hour)

**Fire Resistance Rated Rim Board Assembly RB5 from APA Data File: D350**  
 This fire resistance design is listed in accordance with ASTM E119 and CAN/ULC S101.

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## How To Build For Fire Protection

(APA Design and Construction Guide W305)

### APA Rim Board Assemblies (One and Two-Hour)

**Fire Resistance Rated Rim Board Assembly RB6 from APA Data File: D350**  
 This fire resistance design is listed in accordance with ASTM E119 and CAN/ULC S101.

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## Today's Agenda

1. What is fireproof vs firesafe?
2. What are the different fire protection methods and associated terms?
3. How do you protect the different areas of a building?
4. Considerations when using engineered wood products.

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### Building with Engineered Wood

**How Building Areas Can Be Increased**

- One-hour fire resistance
- Automatic sprinkler protection
- Building separation
- Unlimited areas
- Fire walls



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### Today's Agenda

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### Questions?



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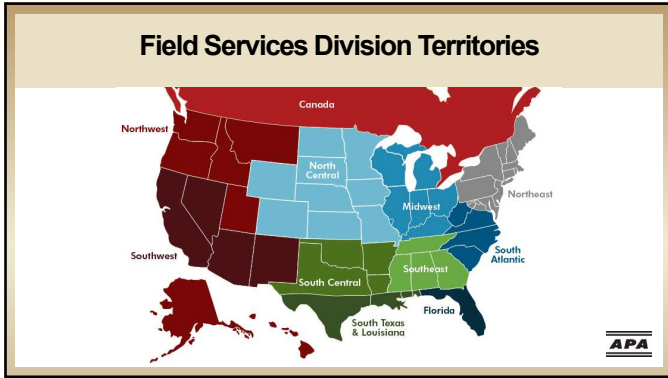
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