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DURAFUSE FRAMES TECHNOLOGY

CSI Section:
05 12 00 Structural Steel Framing

1.0 RECOGNITION

The DuraFuse Frames Technology recognized in this report has been evaluated for use as beam-to-column connections with Special Moment Frames (SMF) and Intermediate Moment Frames (IMF). The structural performance of the DuraFuse Frames Technology complies with the intent of the provisions of the following codes and regulations:

- 2024, 2021, 2018, 2015, and 2012 International Building Code® (IBC)
- 2025 and 2022 California Building Code (CBC) – Attached Supplement
- 2026 and 2023 Los Angeles Building Code (LABC) – Attached Supplement

2.0 LIMITATIONS

Use of the DuraFuse Frames Technology recognized in this report is subject to the following limitations:

2.1 All connections and details of the DuraFuse Frames shall be designed by and the design documents prepared, stamped, and signed by a registered design professional working on behalf of DuraFuse Frames. The design documents shall be submitted to a registered design professional in responsible charge (engineer of record) for acceptance and to the building official for approval as described in Section 3.2.12 of this report.

2.2 Structural design drawings and specifications, shop drawings, and erection drawings shall comply with Section 1603 of the 2024, 2021, 2018, 2015, and 2012 IBC; Sections A4 and I1 of AISC 341-10, AISC 341-16 or AISC 341-22; and Section A4 of AISC 360-10, AISC 360-16, or AISC 360-22. If conflicts occur between the specifications and the requirements of this report, the more conservative shall govern.

2.3 Fabrication of the DuraFuse Frames assemblies shall comply with Section 3.3 of this report and with approved construction drawings specified by DuraFuse Frames, LLC, and shall be performed on the premises of a fabricator registered and approved by the building official in accordance with Section 1704.2.5.1 of the 2024, 2021, 2018, and 2015 IBC (1704.2.5.2 of the 2012 IBC) or as specified in Section 3.1 of this report.

2.4. Erection shall comply with Section 3.4 of this report and the approved construction drawings prepared by a registered design professional and specified by DuraFuse Frames, LLC.

2.5 Quality control and quality assurance shall comply with Section 3.5 of this report and the approved construction drawings specified by DuraFuse Frames, LLC.

3.0 PRODUCT USE

3.1 General: The DuraFuse Frames Technology complies with Chapter 22 of the 2024, 2021, 2018, 2015, and 2012 IBC, and Sections E2, E3, and K2 of AISC 341-10, AISC 341-16, and AISC 341-22. The DuraFuse Frames connection is prequalified for use in Special Moment Frame (SMF) and Intermediate Moment Frame (IMF) systems within the limits stated in Sections 3.2.2 through 3.2.12 of this report.

With the DuraFuse Frames TRU Technology, the beam is connected to the column via plates and bars. In one configuration, the column has cover plates on each side that are fillet welded to the column flanges (Figure 1a of this report). Four bars that extend past the face of the column are fillet-welded to the column cover plates. The column has a shear tab, with horizontal slotted holes, that is fillet welded to the column face. The beam web, with standard holes, is attached to the shear tab with tensioned bolts. The beam flanges are attached to the bars via top plates and a fuse plate (Figure 1 of this report). The beam flanges and bars have standard holes, while the top and bottom plates have oversized holes. The bottom plate functions as a structural fuse, and is proportioned such that certain regions of the plate experience shear yielding when the connection is subjected to severe earthquake loading. The bottom plate is bolted in place so that it can be removed and replaced following a severe earthquake. The top plates are intended to experience minimal yielding, such that they would not require repair following a severe earthquake. The various plates and bars in the connection are proportioned such that yielding does not occur in the column or beam.

Another configuration of the DuraFuse Frames Technology (DuraFuse Frames ARW) has the fuse plates oriented vertically, and flange plates attached to the column to accommodate the connection [Figure 1(g)-(i)].

In the DuraFuse Frames EDG connection, the beam is connected to the column via a fuse plate, a top plate, and a beam stub [Figure 1(j)-(l)]. External doubler plates can be added to strengthen or stiffen the panel zone, and stiffeners can be added when required by the *AISC Specification for*

The product described in this Uniform Evaluation Service (UES) Report has been evaluated as an alternative material, design or method of construction in order to satisfy and comply with the intent of the provision of the code, as noted in this report, and for at least equivalence to that prescribed in the code in quality, strength, effectiveness, fire resistance, durability and safety, as applicable, in accordance with Section 104.2.3 of the 2024 IBC and Section 104.11 of previous editions. This document shall only be reproduced in its entirety.

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Structural Steel Buildings (AISC 360). The top plate may be integrated with the beam stub to minimize bolting. The web of the beam stub has slotted holes and is bolted with pretensioned bolts through standard holes in the beam web. Inelastic drifts are accommodated by a combination of bolt slip and fuse yielding. The geometry of the fuse plate is designed such that inelastic response through tension and compression yielding occurs without significant strength loss, such that the connection meets the ductility and strength requirements of a special and intermediate moment frame. The fuse plate can have either a single or two parallel fuse regions. The fuse plate is bolted in place to permit removal and replacement following a severe earthquake. The top plate and beam stub are proportioned to remain essentially elastic such that repair or replacement should not be necessary following a severe earthquake.

Figures 2(a) and 2(b) of this report illustrate the connection geometry for biaxial configurations of DuraFuse Frames TRU with built-up flanged cruciform sections and with HSS or built-up box columns, respectively. HSS or box columns may be filled with concrete if needed. Figure 2(c) illustrates the connection geometry for DuraFuse Frames ARW biaxial configurations when the fuse plates are oriented vertically. Figure 2(d) illustrates the connection geometry for DuraFuse Frames EDG biaxial configurations. DuraFuse Frames ARW and EDG can also be used with HSS or built-up box columns.

3.2 Design:

3.2.1 General: The design of the structural steel seismic force-resisting systems shall comply with Chapter 22 of the 2024, 2021, 2018, 2015, or 2012 IBC. The SMF or IMF shall be designed and detailed in accordance with the specific requirements for the systems as set forth in 2024 IBC Section 2202.2, or 2018, 2015, or 2012 IBC Section 2205.2 and Table 12.2-1 of ASCE/SEI 7-10, ASCE/SEI 7-16 with Supplement 1, or ASCE/SEI 7-22. The design of structural welds in the DuraFuse Frames shall comply with AWS D1.1 and AWS D1.8.

3.2.2 Connection Properties: The structural model used for evaluating frame stiffness shall: use the combined thickness of the cover plates and beam web for determining panel zone stiffness (or justifying a rigid panel zone assumption); assume no column flexural deformations within the panel zone; assume no flexural or shear deformation of the beam within the panel zone; assume that the beam-to-column connection is fully rigid.

3.2.3 Plastic Hinge Location: For design purposes, the plastic hinge may be considered to form at the face of the column.

3.2.4 Required Shear Strength: The required shear strength for the beam and the shear-tab-to-column connection, V_h, shall be calculated using equation Eq-1:

$$V_h = 2M_p/L_h + V_{gravity} \quad \text{(Eq-1)}$$

where

M_p = the nominal plastic moment of the beam, kip-in (N-mm)
L_h = clear-span beam length, in. (mm)
$V_{gravity}$ = beam shear force resulting from $1.2D + f_1L + 0.2S$ (where f_1 is the load factor determined by the applicable building code given in Section 1.0 of this report for live loads, but not less than 0.5), kips (N).

3.2.5 Beam Limitations: Beams in the moment frame for the DFF TRU and DFF ARW shall satisfy the following limitations:

(1) Beams shall be rolled wide flange or built-up I-shaped beams conforming to the requirements of Section 4.2.1 of this report.
(2) Rolled and built-up wide-flange beam depth shall be limited to W44 (W1118) maximum.
(3) Rolled and built-up wide-flange beam weight shall be limited to 575 lb/ft (857 kg/m) maximum.
(4) The width-to-thickness ratios for beam flanges and webs shall conform to the limits for compact sections in Section B4 of AISC 360-10, AISC 360-16, or AISC 341-22.
(5) Beam lateral bracing per Sections D1.2, E2.4a, and E3.4b of AISC 341-10, AISC 341-16, or AISC 341-22 is not required.

3.2.6 Beam Limitations: Beams in the moment frame for the DFF EDG shall satisfy the following limitations:

(1) Beams shall be rolled wide flange or built-up I-shaped beams conforming to the requirements of Section 4.2.1 of this report.
(2) Rolled and built-up wide-flange beam depth shall be limited to W40 (W1118). Rolled and built-up wide flange weight shall be limited based on the maximum thickness of fuses that comply with the requirements of Section 3.2.8 of this report.
(3) The width-to-thickness ratios for beam flanges and webs shall conform to the limits for compact sections in Section B4 of AISC 360-10, AISC 360-16, or AISC 341-22.
(4) Beam lateral bracing per Sections D1.2, E2.4a, and E3.4b of AISC 341-10, AISC 341-16, or AISC 341-22 is not required.

3.2.7 Column Limitations: Columns in the moment frame shall satisfy the following limitations:

(1) Columns shall be rolled wide flange shapes, built-up I-shapes, boxed I-shapes, box shapes (built-up or HSS), and/or flanged cruciform sections built up from rolled shapes or plates conforming to the requirements of Section 4.2.1 of this report. Flange and web plates of built-up box columns may be continuously

connected by fillet welds or PJP groove welds along the length of the column.

(2) The rolled and built-up wide-flange column depths shall be limited to W44 (W1118) maximum. Box-shaped columns (built-up or HSS) depths shall be limited to 44 inches (1118 mm) maximum.

(3) There is no limit on column weight per foot.

(4) Width-to-thickness ratios for the flanges and webs of columns shall conform to the requirements of Sections D1.1, E2.5a (for IMF systems), or E3.5a (for SMF systems) of AISC 341-10 for the 2015 and 2012 IBC, AISC 341-16 for the 2021 and 2018 IBC, or AISC 341-22 for the 2024 IBC.

3.2.8 Plate Limitations: Plates in the moment frame shall satisfy the following limitations:

(1) Fuse plate thickness for the DFF TRU shall range from 0.5 inch (13 mm) to 2.5 inches (64 mm). The width-to-thickness ratio of the yielding regions in the fuse plates shall range from 1.5 to 4.25. The width-to-depth ratio of the yielding regions of the fuse plates range from 0.5 to 1.25.

(2) The fuse plate thickness for the DFF ARW shall range from 0.375 inch (10 mm) and to 0.875 inch (22 mm). The width-to-thickness and the width-to-depth ratios for the DFF ARW fuse regions shall be the same as DFF TRU in Section 3.2.8 (1) of this report.

(3) Fuse plate thickness for the DFF EDG shall range from 0.5 inch (13 mm) to 2.5 inches (649.7 mm). The length of the fuse region shall range from 4.4 times to 5 times the thickness of the fuse plate. The width-to-thickness ratio of the fuse region shall be equal to or greater than 2.0.

3.2.9 Protected Zone: The protected zone of the connection shall consist of only the bottom fuse plate (TRU and EDG) or plates (ARW) (Figure 1 of this report).

3.2.10 Column-Beam Relationship Limitations: Column-to-beam connections shall satisfy the following limitations:

(1) The beam flange width for DuraFuse Frames TRU shall satisfy equation Eq-2 for geometric compatibility:

$$b_{bf} + 0.25 \text{ in.} \leq b_{cf} + 2t_{cp} \qquad \text{(Eq-2)}$$

where:

b_{bf} = width of the beam flange
b_{cf} = width of the column flange
t_{cp} = thickness of the cover plates

(2) Panel zones shall conform to the applicable requirements of AISC 341-10 for the 2015 or 2012 IBC, AISC 341-16 for the 2021 and 2018 IBC, or AISC 341-22 for the 2024 IBC.

(3) For SMF systems, column-beam moment ratios shall conform to Eq-3:

$$\Sigma M_{pc}^* / \Sigma M_{pb}^* > 1.0 \qquad \text{(Eq-3)}$$

where:

ΣM_{pc}^* = the sum of the projections of the nominal flexural strengths (M_{pc}) of the column above and below the connection joint, at the location of theoretical hinge formation in the column (one-quarter of the column depth above and below the edges of the cover plates), to the beam centerline with a reduction for axial force in the column, and shall satisfy Eq-4:

$$\Sigma M_{pc}^* = \Sigma Z_c (H/H_p)(F_{yc} - P_{uc}/A_g) \qquad \text{(Eq-4)}$$

where:

Z_c = plastic section modulus of the column, in.^{3} (mm^3)
H = half of the story height, in. (mm)
H_p = distance from the column mid-height to the theoretical hinge location (one-quarter of the column depth above or below the edges of the cover plates), in. (mm)
F_{yc} = minimum specified yield strength of the column, ksi (MPa)
P_{uc} = required compressive column strength using LRFD load combinations, including amplified seismic load, kips (N)
A_g = gross area of the column, in.^{2} (mm^2)

$$\Sigma M_{pb}^* = \Sigma (Z_b F_{yb})(1 + d_c/L_h) \qquad \text{(Eq-5)}$$

where:

Z_b = plastic section modulus of the beam, in.^{3} (mm^3)
F_{yb} = minimum specified yield strength of the beam, ksi (MPa)
d_c = depth of the column, in. (mm)
L_h = clear-span beam length, in (mm)

For biaxial configurations, the column-beam moment ratio is checked per AISC 341-22 or AISC 341-16, similar to other biaxial connections, but using Eq-4 of this report to compute column strengths in each direction.

3.2.11 Surrounding Elements: The design of supporting and supported elements and connections to the DuraFuse Frames shall comply with the provisions of the IBC, including Chapter 19 for concrete, Chapter 21 for masonry, and Chapter 22 for steel. Provisions for non-participating supported components in Section 12.12 of ASCE/SEI 7 shall

apply. Column bases to concrete and masonry shall be designed and detailed to preclude brittle failure.

3.2.12 Design Responsibility: After completing the preliminary selection of beam and column sizes using DuraFuse Frames Technology, satisfying the provisions 3.2.4 to 3.2.8 of this report, the registered design professional (engineer of record) submits a computer model to DuraFuse Frames, LLC. Upon completion of the computer model review and after any additional required information has been supplied by the engineer of record, DuraFuse Frames engineers provide project-specific connection designs, including structural notes and details for connections. The design documents shall be prepared, stamped, and signed by a registered design professional working on behalf of DuraFuse Frames. The engineer of record reviews calculations and drawings prepared by DuraFuse Frames to ensure that all connections have been adequately designed and detailed. The resulting design documents shall be submitted to the building official for approval.

3.3 Fabrication: The DuraFuse Frames shall be manufactured by an approved fabricator in accordance with Section 1704.2.5.1 of the 2024, 2021, and 2018 IBC, and Section 1704 of the 2015 and 2012 IBC. All welders, tack welders, and welding operators shall be qualified in conformance with AWS D1.1, Clause 4, Part C. Welders and welding operators performing welds as described in AWS D1.8 Clause 5.1.1, shall be subjected to Supplemental Welder Qualification Testing in accordance with AWS D1.8 Chapter 5.

Welding shall be performed under a Welding Procedure Specification (WPS) in accordance with AWS D1.1, which shall be prepared for every different welding application, including welding position, welding process, electrode manufacturer, filler metal trade name for the electrode type selected, and other essential variables as defined in AWS D1.1. In addition, for demand-critical welds, supplemental requirements in Clause 6.1 of AWS D1.8 apply.

For the TRU and EDG connections, no welds are designated as Demand Critical. For the ARW connection, the complete-joint penetration weld of the bottom haunch plate to the column flange is designated as Demand Critical and shall comply with the requirements of AWS D1.8 Clauses 6.1, 6.2, and 6.3.

3.4 Erection: Erection of the DuraFuse Frames shall be in accordance with Chapter M of AISC 360, AISC 303, Chapter I of AISC 341, and Chapter 22 of the IBC.

Shims with a maximum overall thickness of ¼ inch (6.4 mm) may be used between the top plates and bars or beams and between the fuse plate and bars or beams. Shims, if required, may be finger shims or may be produced with drilled or punched holes.

Standard hardened washers are permitted for all locations, including oversized and long-slotted holes. Plate washers, oversized hardened washers, or extra-thick hardened washers are not required at any location.

3.5 Quality Control and Quality Assurance: A quality assurance plan conforming to Sections 1704.2.5.1 and 1705.2 of the 2024, 2021, 2018, and 2015 IBC (1704.2.5.1 and 1705.2.1 of the 2012 IBC) shall be included in the structural design by the registered design professional and approved by the building official.

Special inspections, tests, and structural observations shall comply with the applicable requirements in Chapter 17 of the IBC, Chapter N of AISC 360, Chapter J of AISC 341, provisions within AISC 303, and Clause 7 of AWS D1.8.

4.0 PRODUCT DESCRIPTION

4.1 General: The DuraFuse Frames Technology complies with Sections E2, E3, and K1 of AISC 341-10 for the 2015 and 2012 IBC, complies with Sections E2, E3, and K1 of AISC 341-16 for the 2021 and 2018 IBC, and complies with Sections E2, E3, and K1 of AISC 341-22 for the 2024 IBC. The DuraFuse Frames Technology is permitted for use in special moment frame (SMF) and intermediate moment frame (IMF) beam-to-column connections.

DuraFuse Frames products compliant with the scope of this report may also occur under the following commercial names: DuraFuse Frames TRU, DuraFuse Frames ARW, and DuraFuse Frames EDG.

4.2 Materials:

4.2.1 Structural Shapes: Rolled wide-flange beam and column sections, HSS column shapes, and plates for built-up wide flange or built-up box shapes shall conform to Section A3.1 of AISC 341.

4.2.2 Plates: All fuse plates shall be fabricated from structural steel complying with ASTM A572/A572M Grade 50 steel. Fuse plates shall be fabricated from plates with a mill-certified tensile strength less than or equal to 85 ksi (586 MPa) unless independent material testing determines that the tensile strength is less than or equal to 85 ksi (586 MPa). All other plates, including but not limited to external continuity plates, cover plates, top plates, and shear tabs shall be fabricated from structural steel that complies with ASTM A572 Grades 50, 55, 60, 65, and/or ASTM A709 Grade 70. Plates that are thicker than 2 in. (50 mm) shall have a minimum Charpy V-notch (CVN) toughness of 20 ft-lb (27 J) at 70°F (21°C) in accordance with Section A3.3 of AISC 341-22 for the 2024 IBC, Section A3.3 of AISC 341-16 for the 2021 and 2018 IBC, and Section A3.3 of AISC 341-10 for the 2015 and 2012 IBC.

4.2.3 Welds: All welding shall be performed using E70 electrodes. The weld filler metal and associated welding

process for all welds shall comply with the requirements of any of the following:

- E70T-6, E7IT-8, or E70TG-K2 for flux-cored arc welding (FCAW)
- E7XT-9 for flux-cored arc welding (FCAW) with gas shielding
- F7A2-EXXX for submerged arc welding (SAW)
- E7018 stick electrode for shielded metal arc welding (SMAW)
- ER70S-X, E70C-XM, or E70C-XC for gas metal arc welding, except for short circuit transfer.

All weld filler material shall satisfy the requirements specified in Clause 6.3 of the Structural Welding Code-Seismic Supplement (AWS D1.8/D1.8M), including the minimum Charpy V-notch (CVN) toughness 20 ft-lb (27 J) at a temperature lower than 0°F (-18°C) as indicated in Section A3.4 of AISC 341-22 for the 2024 IBC, Section A3.4 of AISC 341-16 for the 2021 and 2018 IBC, or Section A3.4 of AISC 341-10 for the 2015 IBC and 2012 IBC.

4.2.4 Bolts, Nuts, and Washers: Bolts shall be pretensioned high-strength bolts conforming to ASTM F3125 Grade A490 or A490M, Grade A325 or A325M, Grade F2280 or F2280M, Grade F1852 or F1852M, or ASTM F3148 Grade 144. The bolt diameter is limited to a maximum of 1¼ inches (32 mm). Nuts and washers shall comply with the requirements corresponding to the bolt grade, type, and style. Faying surfaces shall have at least a Class A slip coefficient but shall not have a slip coefficient greater than 0.5 (Class B).

5.0 IDENTIFICATION

A notice of intellectual property shall be affixed on each sheet of shop detail and field erection drawings containing the DuraFuse Frames. Such notice shall be provided by DuraFuse Frames, LLC in a format suitable to the needs of the fabricator's detailer. Identification of structural steel elements containing the DuraFuse Frames shall be in accordance with the 2024, 2021, and 2018 IBC Section 2202 (2015 and 2012 IBC Section 2203).

The DuraFuse Frames Technology described in Section 4.0 of this report is identified by a label showing DuraFuse Frames or one of the commercial names listed in Section 4.1 of this report.

6.0 SUBSTANTIATING DATA

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Steel Moment Frame Connection Systems (AC129) approved March 2026. The data includes testing and analysis in conformance with the Special Moment Frames (SMF) requirements in AISC 341-22.

6.2 Test reports are from laboratories in compliance with ISO/IEC 17025.

7.0 STATEMENT OF RECOGNITION

This evaluation report describes the results of research completed by IAPMO Uniform Evaluation Service on the DuraFuse Frames Technology to assess conformance to the codes shown in Section 1.0 of this report and serves as documentation of the product certification.

For additional information about this evaluation report please visit www.uniform-es.org or email us at info@uniform-es.org

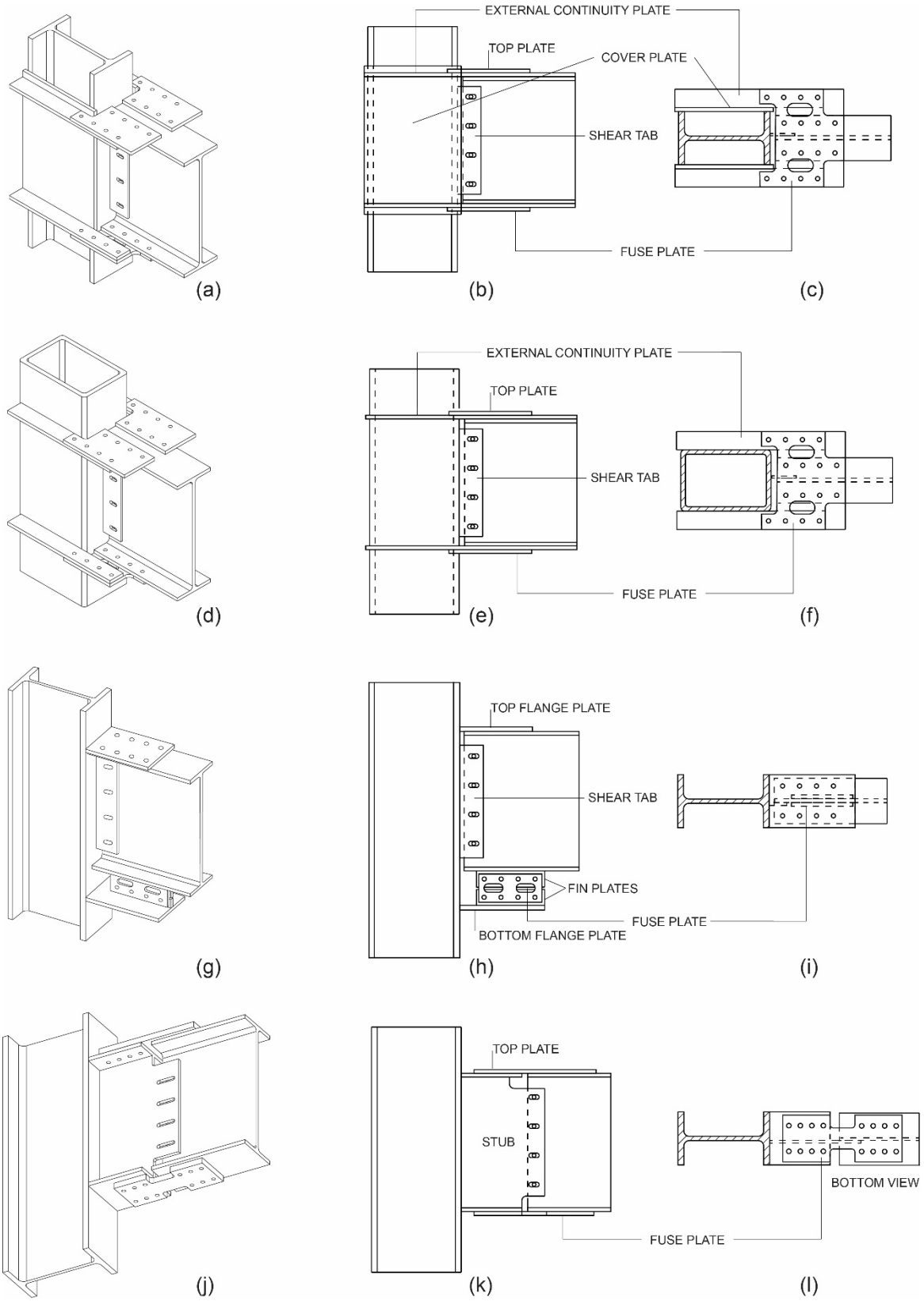

FIGURE 1 – DURAFUSE FRAMES CONNECTION

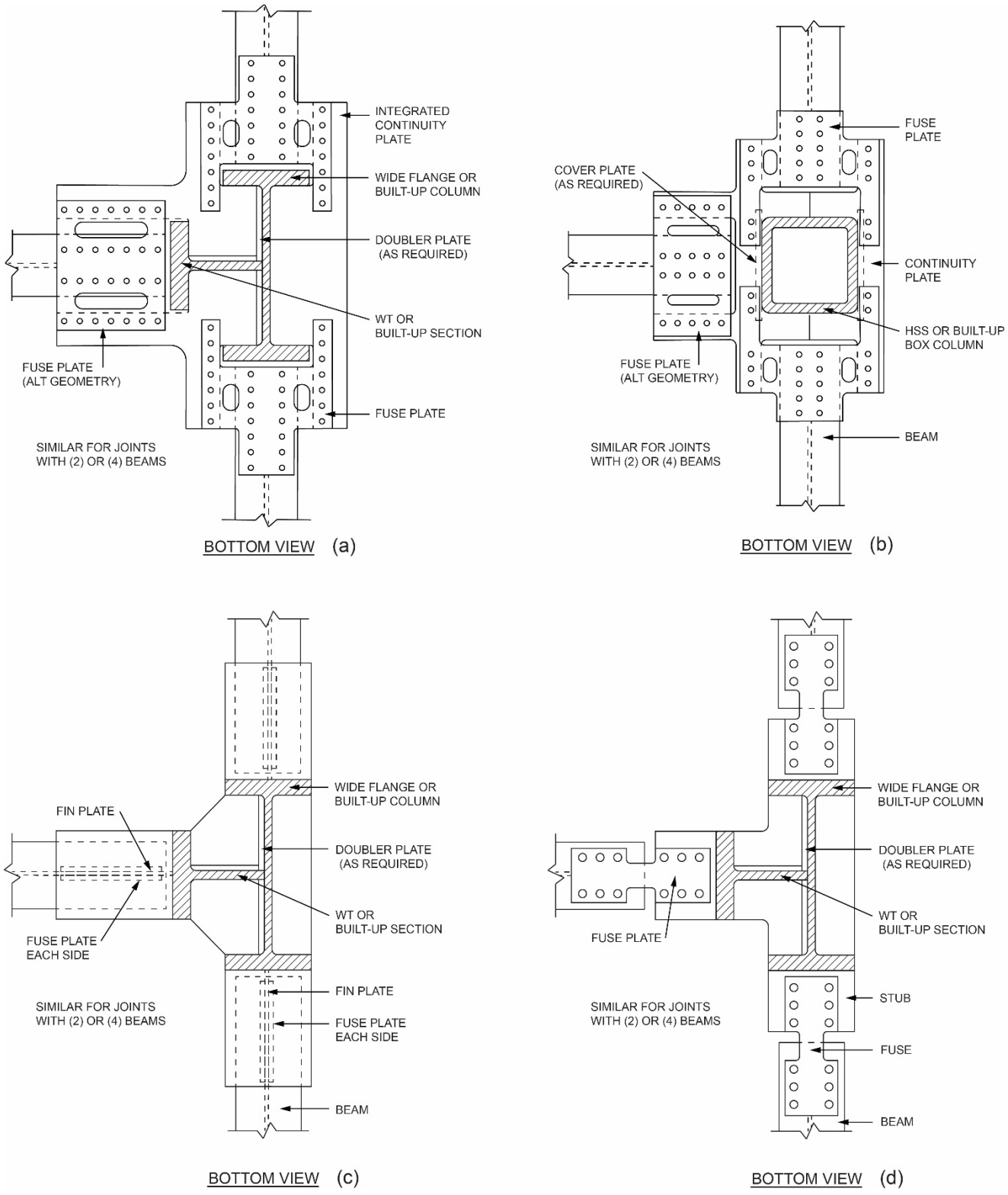

FIGURE 2 – DURAFUSE FRAMES BI-AXIAL CONFIGURATIONS

CALIFORNIA SUPPLEMENT

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DURAFUSE FRAMES TECHNOLOGY

CSI Section:
05 12 00 Structural Steel Framing

1.0 RECOGNITION

The DuraFuse Frames Technology described in IAPMO UES ER-610, and this supplemental report, has been evaluated for use as beam-to-column connections with Special Moment Frame (SMF) and Intermediate Moment Frame (IMF) beam-to-column connections. The structural performance of the DuraFuse Frames Technology complies with the intent of the provisions of the following codes and regulations:

- 2025 and 2022 California Building Code (CBC)

2.0 LIMITATIONS

Use of the DuraFuse Frames Technology recognized in this supplement is subject to the following limitations:

2.1 The DuraFuse Frames Technology shall comply with the provisions in IAPMO UES ER-610 applicable to the 2024 IBC for use under the 2025 CBC.

The DuraFuse Frames Technology shall comply with the provisions in IAPMO UES ER-610 applicable to the 2021 IBC for use under the 2022 CBC.

2.2 All connections and details of the DuraFuse Frames shall be designed by and the design documents prepared, stamped, and signed by a California registered design professional working on behalf of DuraFuse Frames. The design documents shall be submitted to the project's registered design professional (engineer of record) for acceptance and to the building official for approval as described in Section 3.2.12 of IAPMO UES ER-610.

2.3 Structural design drawings and specifications, shop drawings, and erection drawings shall comply with Sections 1603 and, as applicable, 1603A of the CBC, Sections A4 and I1 of AISC 341, and Section A4 of AISC 360.

2.4 Fabrication of the DuraFuse Frames assemblies shall comply with Section 3.3 of this supplemental report and with the approved construction drawings specified by DuraFuse Frames, LLC., as "DuraFuse General Notes", and shall be performed on the premises of a fabricator registered and approved by the building official in accordance with Section 1704.2.5.1 of the CBC or as specified in Section 3.1 of this supplemental report.

2.5 Erection shall comply with Section 3.4 of this supplemental report and the approved construction drawings prepared by a registered design professional and specified by DuraFuse Frames, LLC. as "DuraFuse General Notes".

2.6 Quality control and quality assurance shall comply with Section 3.5 of this supplemental report and approved construction drawings specified by DuraFuse Frames, LLC as "DuraFuse General Notes".

2.7 This supplement expires concurrently with IAPMO UES ER-610.

3.0 PRODUCT USE

3.1 The DuraFuse Frames Technology complies with Chapters 22 and, as applicable, 22A of the CBC and Sections E2, E3, K1, and K2 of AISC 341. The DuraFuse Frames' connection is prequalified for use in Special Moment Frame (SMF) and Intermediate Moment Frame (IMF) systems within the limits stated in Sections 3.1 of IAPMO UES ER-610 and Section 3.2 of this supplemental report.

3.2 Design:

3.2.1 General: The design of the structural steel seismic force-resisting systems shall comply with Chapters 22 and, as applicable, 22A of the CBC, and Section 3.2 of IAPMO UES ER-610, except as modified in this section. The SMF or IMF shall be designed and detailed in accordance with the specific requirements for the systems as set forth in 2025 CBC Section 2202.2, including modifications in Section 2202.4.5, or 2022 CBC Section 2205.2, and Table 12.2-1 of ASCE/SEI 7.
For use under DSA and HCAI/OSHPD, the SMF or IMF shall be designed and detailed in accordance with the specific requirements for the systems as set forth in 2025 CBC Sections 2202A.2 and 2202A5, including modifications in Section 2202A.4.5, or 2022 CBC Section 2205A.2 and Table 12.2-1 of ASCE/SEI 7. The design of structural welds in the DuraFuse Frames shall comply with AWS D1.1 and AWS D1.8.

3.2.2 Beam Limitations: Beams shall satisfy the requirements in Section 3.2.5 of IAPMO UES ER-610.

In addition, in accordance with 2025 CBC Section 2202A.4.5 for use under HCAI/OSHPD, Sections 3.2.5 (3) and 3.2.5 (4) of IAPMO UES ER-610 shall be replaced with the following:

(3) Rolled and built-up wide-flange beam weight shall be limited to 232 lb/ft (345 kg/m) maximum.
(4) Beam flange width-to-thickness ratio shall satisfy AISC 341 Table D1.1b.

In addition, in accordance with 2022 CBC Section 2205A.4 for use under HCAI/OSHPD, Sections 3.2.5 (2) and 3.2.5 (3) of IAPMO UES ER-610 shall be replaced with the following:

(2) Rolled and built-up wide-flange beam depth shall be limited to 44 inches (1118 mm) maximum.
(3) Rolled and built-up wide-flange beam weight shall be limited to 575 lb/ft (856 kg/m) maximum.

3.2.3 Column Limitations: Columns shall satisfy the requirements in Section 3.2.6 of IAPMO UES ER-610. In addition, Section 3.2.6 (4) of IAPMO UES ER-610 shall be replaced with the following:

(4) Width-to-thickness ratios for the flanges and webs of columns shall conform to the requirements of Sections D1.1, E2.5a (for IMF systems), or E3.5a (for SMF systems) of AISC 341.

3.2.4 Column-Beam Relationship Limitations: Column-to-beam connections shall satisfy the requirements in Section 3.2.8 of IAPMO UES ER-610. In addition, Section 3.2.8 (2) of IAPMO UES ER-610 shall be replaced with the following:

(2) Panel zones shall conform to the applicable requirements of AISC 341-22 or AISC 341-16.

3.2.5 Surrounding Elements: Section 3.2.9 of IAPMO UES ER-610 shall be replaced with the following:

Design of supporting and supported elements and connections to the DuraFuse Frames shall comply with the provisions of the CBC, including Chapters 19 and, as applicable, 19A for concrete; Chapters 21 and, as applicable, 21A for masonry; and Chapters 22 and, as applicable, 22A for steel. Provisions for non-participating supported components in Section 12.12 of ASCE/SEI 7 shall apply. As applicable, column bases to concrete and masonry shall be designed and detailed to preclude brittle failure and, as applicable, designed to eliminate the effects of oversized holes in accordance with 2025 CBC Sections 2215.1.1 or 2201A.5.1, or 2022 CBC Sections 2212.1.1 or 2204A.4.

3.3 Fabrication: The DuraFuse Frames shall be manufactured by an approved fabricator in accordance with Section 1704.2.5.1 of the CBC. All welders, tack welders, and welding operators shall be qualified in conformance with AWS D1.1, Clause 4, Part C. Welders and welding operators performing welds, as described in AWS D1.8 Clause 5.1.1, shall be subjected to Supplemental Welder Qualification Testing in accordance with AWS D1.8 Chapter 5.

Welding shall be performed under a Welding Procedure Specification (WPS) in accordance with AWS D1.1, which shall be prepared for every different welding application, including welding position, welding process, electrode manufacturer, filler metal trade name for the electrode type selected, and other essential variables as defined in AWS D1.1. In addition, for demand-critical welds, supplemental requirements in Clause 6.1 of AWS D1.8 apply.

3.4 Erection: Erection of the DuraFuse Frames shall be in accordance with Chapter M of AISC 360, AISC 303, Chapter I of AISC 341, and Chapters 22 and, as applicable, 22A of the CBC.

Shims with a maximum overall thickness of ¼ inch (6.4 mm) may be used between the top plates and bars or beams and between the fuse plate and bars or beams. Shims, if required, may be finger shims or may be made with drilled or punched holes.

Standard hardened washers are permitted for all locations, including oversized and long-slotted holes. Plate washers, oversized hardened washers, or extra-thick hardened washers are not required at any location.

3.5 Quality Control and Quality Assurance: A quality assurance plan conforming to Sections 1704.2.5.1, 1705.2, and, as applicable, 1705A.2 of the CBC shall be included in the structural design by the registered design professional and approved by the building official.

Special inspections, tests, and structural observations shall comply with the applicable requirements in Chapters 17 and, as applicable, 17A of the CBC, Chapter N of AISC 360, Chapter J of AISC 341, provisions within AISC 303, and Clause 7 of AWS D1.8.

4.0 PRODUCT DESCRIPTION

4.1 General: The DuraFuse Frames Technology complies with Sections E2, E3, and K1 of AISC 341-22 or AISC 341-16. DuraFuse Frames Technology is permitted for use in special moment frame (SMF) and intermediate moment frame (IMF) beam-to-column connections.

The DuraFuse Frames products compliant with the scope of this report may also occur under the following commercial names: DuraFuse Frames TRU, DuraFuse Frames ARW, and DuraFuse Frames EDG.

4.2 Materials: Materials shall comply with Section 4.2 of IAPMO UES ER-610 except as specifically noted in this section, as follows:

4.2.1 Structural Shapes: No changes to Section 4.2.1 of IAPMO UES ER-610.

4.2.2 Plates: Section 4.2.2 of IAPMO UES ER-610 shall be replaced with the following:

All fuse plates shall be fabricated from structural steel complying with ASTM A572/A572M Grade 50 steel. Fuse plates shall be fabricated from plates with a mill-certified tensile strength less than or equal to 85 ksi (586 MPa)

unless independent material testing determines that the tensile strength is less than or equal to 85 ksi (586 MPa). All other plates, including but not limited to external continuity plates, cover plates, top plates, and shear tabs shall be fabricated from structural steel that complies with ASTM A572 Gr. 50, 55, 60, 65, and/or ASTM A709 Gr. 70. Plates that are thicker than 2 in. (50 mm) shall have a minimum Charpy V-notch (CVN) toughness of 20 ft-lb (27 J) at 70°F (21°C) in accordance with Section A3.3 of AISC 341.

4.2.3 Welds: Section 4.2.3 of IAPMO UES ER-610 shall be replaced with the following:

All welding shall be performed using E70 electrodes. The weld filler metal and associated welding process for all fillet welds shall comply with the requirements of any of the following:

- E70T-6, E7IT-8, or E70TG-K2 for flux-cored arc welding (FCAW)
- E7XT-9 for flux-core arc welding (FCAW) with gas shielding
- F7A2-EXXX for submerged arc welding (SAW)
- E7018 stick electrode for shielded metal arc welding (SMAW)
- ER70S-X, E70C-XM, or E70C-XC for gas metal arc welding, except for short circuit transfer.

All weld filler material shall satisfy the requirements specified in Clause 6.3 of the Structural Welding Code-Seismic Supplement (AWS D1.8/D1.8M), including the minimum Charpy V-notch (CVN) toughness of 20 ft-lb (27 J) at a temperature lower than 0°F (-18°C) as indicated in Section A3.4 of AISC 341.

4.2.4 Bolts, Nuts, and Washers: No changes to Section 4.2.4 of IAPMO UES ER-610.

LOS ANGELES SUPPLEMENT

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DURAFUSE FRAMES TECHNOLOGY

CSI Section:
05 12 00 Structural Steel Framing

1.0 RECOGNITION

The DuraFuse Frames Technology described in IAPMO UES ER-0610, the California Supplement to IAPMO UES ER-610, and this supplemental report has been evaluated for use as beam-to-column connections with Special Moment Frames (SMF) and Intermediate Moment Frames (IMF). The DuraFuse Frames Technology has been evaluated for structural performance properties, subject to the requirements in IAPMO UES ER-610, the California Supplement to IAPMO UES ER-610, and this supplemental report. The DuraFuse Frames Technology was evaluated for compliance with the following codes and regulations:

- 2026 and 2023 City of Los Angeles Building Code (LABC)

2.0 LIMITATIONS

Use of the DuraFuse Frames Technology recognized in this supplement is subject to the following limitations:

2.1 The DuraFuse Frames Technology shall comply with the provisions in IAPMO UES ER-610 and the California supplement applicable to the 2025 CBC for use under the 2026 LABC.

The DuraFuse Frames Technology shall comply with the provisions in IAPMO UES ER-610 and the California supplement applicable to the 2022 CBC for use under the 2023 LABC.

2.2 All connections and details of the DuraFuse Frames shall be designed by, and design documents prepared, stamped, and signed by a California registered design professional working on behalf of DuraFuse Frames. The design documents shall be submitted to the project's registered design professional (engineer of record) for acceptance and to the City of Los Angeles for approval as described in Section 3.2.10 of IAPMO UES ER-610.

2.3 Design, installation, and inspection shall be in accordance with Chapters 16, 17, and 22 of the LABC, as applicable, due to local amendments to these chapters.

2.4 Continuous inspections shall be provided by the Registered Deputy Inspector in accordance with Sections 1704 and 1705 of the LABC, as applicable, during the installation of the DuraFuse Frames Technology.

2.5 Special inspections, tests, and structural observations shall comply with the applicable requirements in Chapter 17 of the LABC, Chapter N of AISC 360, Chapter J of AISC 341, provisions within AISC 303, and Clause 7 of AWS D1.8.

2.6 Fabrication of the DuraFuse Frames Technology shall be performed in the shop of a fabricator licensed by the City of Los Angeles Building Department.

2.7 This supplement expires concurrently with IAPMO UES ER-610.

For additional information about this evaluation report please visit www.uniform-es.org or email us at info@uniform-es.org