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Technical Evaluation Report

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(Subject to Renew January 1, 2021 or next code cycle change)

EVALUATION SUBJECT: EVOLUTION STEEL FRAME SYSTEM – STAIRS STRINGERS MAX. SPAN

TER 17-5048b

REPORT HOLDER:
Fortress Building Products
1740 N 1st St
Garland, TX 75040
(972) 231 - 4001

SCOPE OF EVALUATION (compliance with the following codes):

THIS IS A STRUCTURAL PERFORMANCE EVALUATION ONLY. NO OTHER PERFORMANCE RATINGS OR CERTIFICATIONS ARE OFFERED OR IMPLIED HEREIN.

This Product Evaluation Report is being issued in accordance with the requirements of ASCE-7-05, ASCE 7-10, and the structural provisions of the 2009 and 2015 International Residential Code. The more stringent codes in either edition have been utilized. The product noted on this report has been evaluated as summarized herein.

IN ACCORDANCE WITH THESE CODES EACH OF THESE REPORTS MUST BEAR THE ORIGINAL SIGNATURE & RAISED SEAL OF THE EVALUATING ENGINEER.

SUBSTANTIATING DATA:

• Product Evaluation Documents
Substantiating documentation has been submitted to support this TER and is summarized in the sections that follow.

• Structural Engineering Calculations
Structural engineering calculations have been prepared which evaluate the product based on comparative and/or rational analysis to qualify the following design criteria:

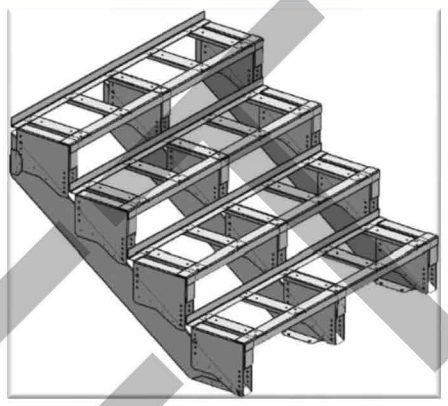
- Maximum allowable stringers span and connections integrity for 48 inches wide stairs based on 3 or 4 stringers configuration. The analysis does not take in consideration of treads and trays capacity and it shall be verified by others.

Calculation summary for this TER is provided in the maximum span summary table. No 33% increase in allowable stress has been used in the design of this product.

INSTALLATION:
The product(s) listed in this report shall be installed in strict compliance with this TER & manufacturer-provided model specifications.

The product components shall be of the material specified in the manufacturer-provided product specifications. All screws must be installed in accordance with the applicable provisions & anchor manufacturer's published installation instructions.

LIMITATIONS & CONDITIONS OF USE:
Use of this product shall be in strict accordance with this TER as noted herein. See final page for complete limitations and conditions of use.



NOTE: GRAPHICAL DEPICTIONS IN THIS REPORT ARE FOR ILLUSTRATIVE PURPOSES ONLY. ACTUAL SYSTEM MAY DIFFER SLIGHTLY IN APPEARANCE.

MATERIAL:
The Evolution Steel Stairs system is an assemblage of cold-formed steel components installed with metal connectors and fasteners. The steel components are fabricated from steel equivalent to ASTM A36 (China standard Q235b), with minimum yield stress Fy = 34 ksi and minimum tensile stress Fu = 54 ksi.

Steel beams are manufactured with proprietary exterior grade, baked on coating. See Figure Extrusion List section for section profiles.

See Infinity Decking technical guide published by Fortress for recommended installation.

All edges and holes to be galvanized after stamping and forming. Parts to be sandblasted and coated with a black sand powder coat by the manufacturer's proprietary process.

ORIGINAL SIGNATURE AND RAISED SEAL REQUIRED TO BE VALID PER CODE:

Frank L. Bennardo, P.E., SECB
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The FBC 14 defines APPROVED SOURCE (Section 202) as: "An independent person, firm or corporation, approved by the building official, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses." Engineering Express® professionals meet the competency requirements as defined in the FBC and can seal their work. Engineering Express® is regularly engaged in conducting and providing engineering evaluations of single-element and full-scale building systems.

PERFORMANCE CHARACTERISTICS:

Allowable maximum simple spans length for stringers are given in Table 1 and 2 with respect to 3 or 4 stringers configuration. See Figures 2 and 3 for definition of stringer span.

The outer steel stringers framing system are designed to resist a concentrated 200-lb or 50 lb/ft uniform safeguard-imposed loads for up to 38-inch high rail posts attached to the system.

INSTALLATION:

Installation parameters shall follow manufacturer specifications as well as the information provided herein. Where differences occur between this report and the manufacturer's installation instructions, this report shall govern.

Splicing of stringers is outside the scope of this report.

See page 3 for beam and component fastening schedules, and approved anchorage.

Decking framing anchorage for lateral loads is not included within the scope of this report. Deck boards shall be positively fastened to each stringer.

Fasteners for steel-to-steel connections shall be self-drilling tapping screws installed with an edge distance and center-to-center spacing of no less than 1/2-inch. Screws shall extend through the steel a minimum of three thread pitches. Compatibility of fasteners and other dissimilar materials, including those for use with chemically treated wood, shall be evaluated or protected from corrosion by the installer before construction.

LIMITATIONS OF USE:

Additional design and construction are required for anchorage of lateral loads to the primary framing and is not included within the scope of this report.

The EVOLUTION steel stairs framing system shall be limited to sites subjected to a maximum snow or wind load (in the gravity direction) of 150 psf. No further reductions in the wind load are permitted via additional load combinations. Uplift analysis and certification is not included within the scope of this report.

Stair and railing construction details are not included within the scope of this report and, where required by the building official, separate engineering calculations and details for these elements shall be provided.

Perforations of any elements contained herein, other than those noted, are outside the scope of this report.

This evaluation report provides structural analysis of the framing members for bending stress and deflection based on the given loads only. No lateral loads analysis is included on this report. Connection parameters are provided with certain limitations as described herein. Design of connections excluded herein shall be by a qualified engineer in accordance with the referenced codes. Where required by the building official for a site-specific application, engineering calculations shall verify that the anchorage complies with the building code for the type of framing and condition of the proposed construction.

The components of this framing system shall have an approved quality control system in place as provided by the manufacturer prior to sale for use as a building product.

PARTS SHOWN

1. Stair Strap
2. Evolution 2”x6” Joist or 2”x11” Beam
3. Stair Stringer Anchor Bracket
4. Preset 7”/11” Stair Bracket (not pictured)
5. Preset 7 ¾”/11” Stair Bracket (not pictured)
6. Adjustable Bracket
7. Stair Tray

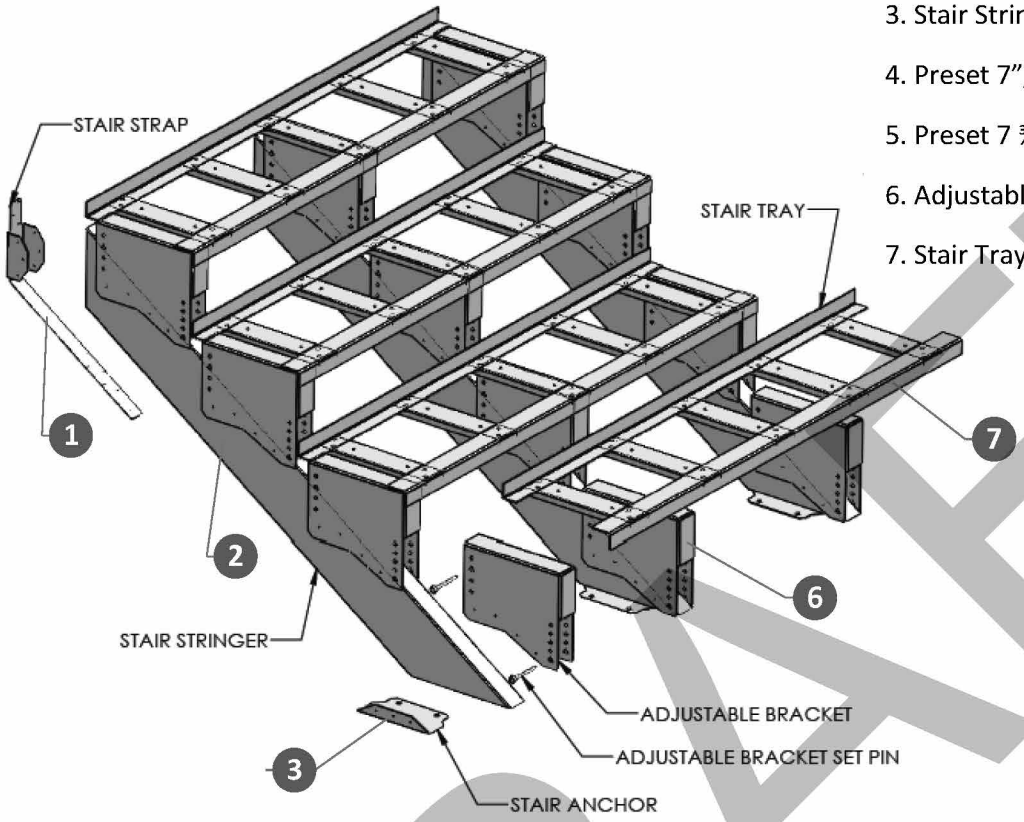


Figure 1: EVOLUTION Steel Stairs Framing (Diagram)

SYSTEM COMPONENTS:

1. Deck joists (host structure)
   A. 2”x6”x0.052” beam Fy= 34 ksi
   B. 2”x11”x0.064” built-up beam Fy= 34 ksi
2. Attach stringers to host structure with FF-Evolution Stair Strap (Part #2 see strap detail on page 7) with (6) #10-16 SMS screws SAE gr. 5 to header and (7) #10-16 SMS screws SAE gr. 5 to stringer
3. Steel Stringers. Use with 3 or 4 stringers configuration.
   A. 2”x6”x0.052” beam Fy= 34 ksi (Part #3a)
   B. 2”x11”x0.064” built-up beam Fy= 34 ksi (Part #3b)
4. Pre-set stair bracket (Part #4 and Part #5) fastened to stringer at each side with (3) #10-16 SMS screws SAE gr. 5.
5. Bottom connection:
   A. To 3ksi concrete slab: Stair anchor connector (Part #4) to host structure with pre-drilled holes. Attach clip to stringer with (3) #10-16 SMS screws SAE gr. 5 and (2) 1/4” dia. Elco Ultracon or equivalent, 1-3/4” embed. into concrete, 2-1/2” minimum from any concrete face.
   B. To Evolution Steel Deck Framing: F50 Bracket fastened at ends with (3) #10-16 SMS screws SAE gr. 5 on each side.

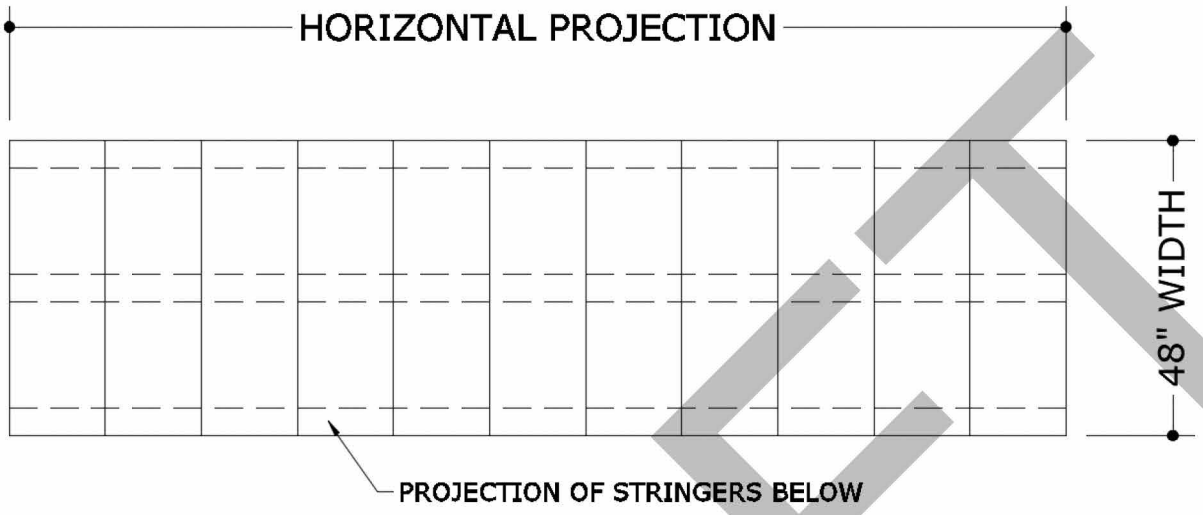


Figure 2: Top View

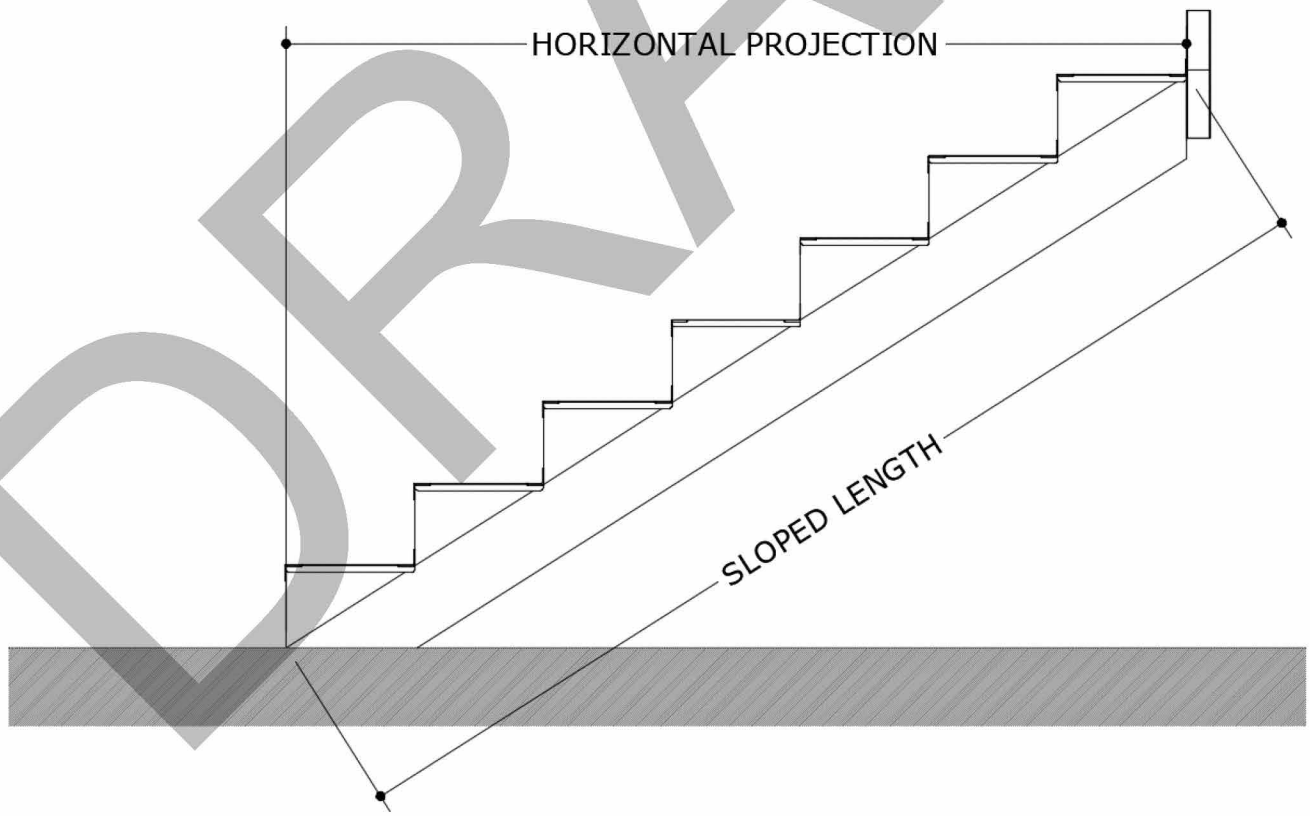


Figure 3: Side View

TABLE USE INSTRUCTIONS:

1. Confirm the appropriate combined load and configuration factors based on site specific requirements; see respective table's general notes for load and span considerations.
2. Utilize tables 1 & 2 to verify the allowable span of either 3 or 4 stringers configuration.
3. Provide posts and safeguard and ledger as per separate certification.

Table 1: Allowable 2x6 Joist Spans

Total Load Combined	48" Wide Stairs			
	3 Stringers Allowable Spans		4 Stringers Allowable Spans	
	Horiz. Projection	Sloped Length	Horiz. Projection	Sloped Length
50 PSF	11.92 FT	14.58 FT	13.37 FT	16.35 FT
75 PSF	9.65 FT	11.80 FT	11.92 FT	14.58 FT
100 PSF	8.28 FT	10.13 FT	10.26 FT	12.55 FT
125 PSF	7.34 FT	8.98 FT	9.12 FT	11.16 FT
150 PSF	6.39 FT	7.82 FT	8.28 FT	10.13 FT

Table 2: Allowable 2x11 Beam Spans

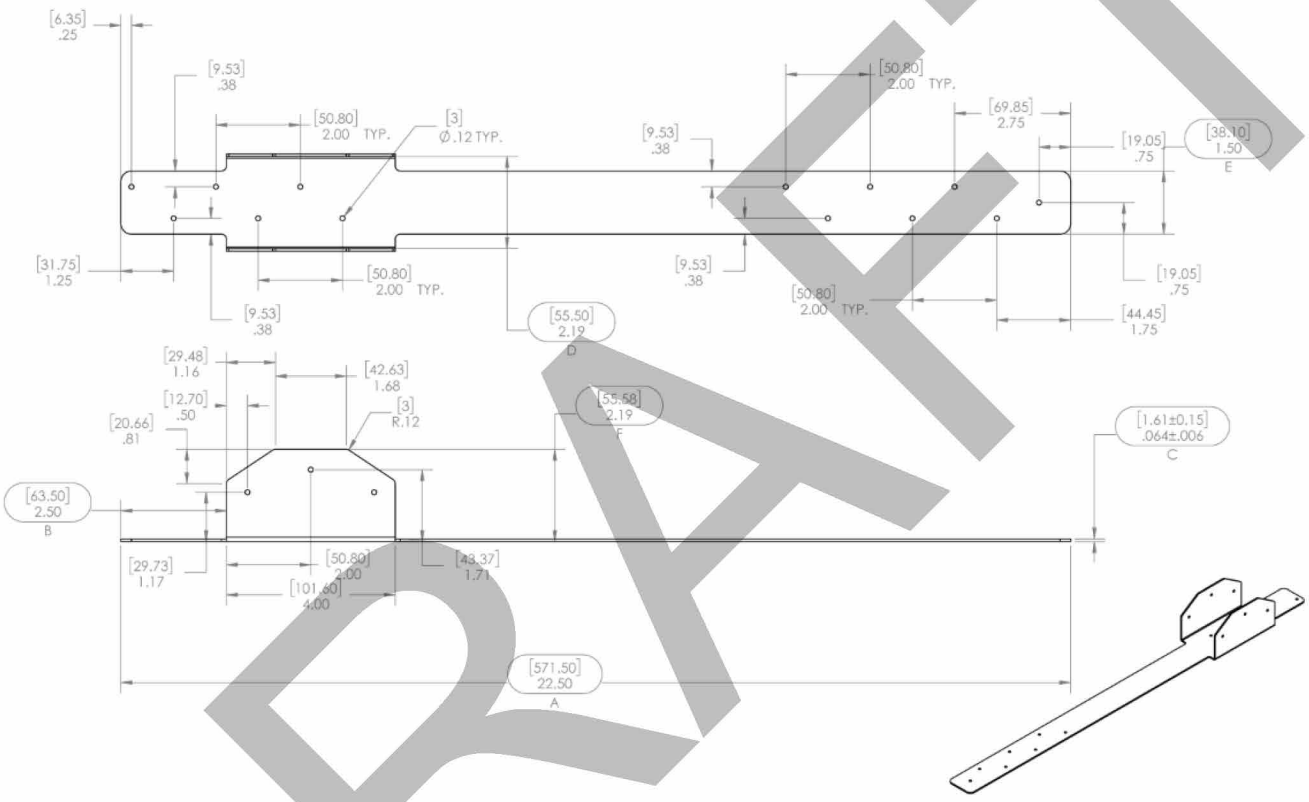
Total Load Combined	48" Wide Stairs			
	3 Stringers Allowable Spans		4 Stringers Allowable Spans	
	Horiz. Projection	Sloped Length	Horiz. Projection	Sloped Length
50 PSF	16.35 FT	20.00 FT	16.35 FT	20.00 FT
75 PSF	12.79 FT	15.64 FT	16.35 FT	20.00 FT
100 PSF	9.59 FT	11.73 FT	14.38 FT	17.60 FT
125 PSF	7.67 FT	9.38 FT	11.51 FT	14.08 FT
150 PSF	6.39 FT	7.82 FT	9.59 FT	11.73 FT

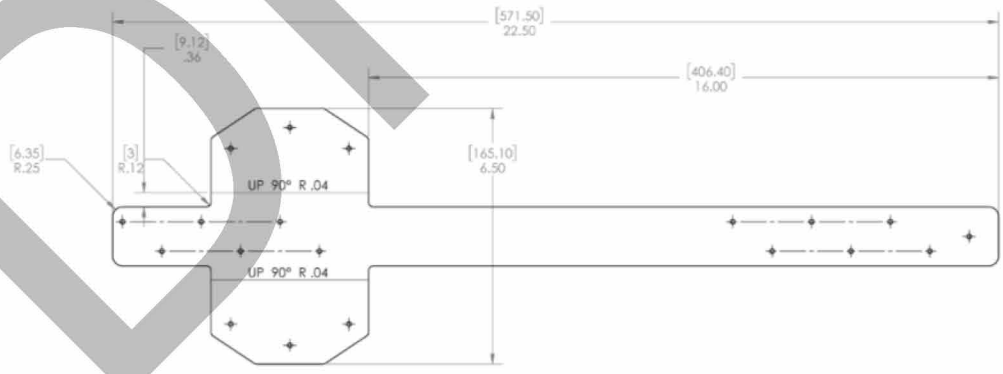
GENERAL NOTES:

1. All loads and load combinations are determined using ASCE 7-10. DL = Dead Load, LL = Live Load, SL = Snow Load and WL = Wind Load.
2. Maximum total load (TL) determined from the governing case of the following:
   TL = DL + LL
   TL = DL + WL
   TL = DL + SL
   TL = DL + 0.75*LL+0.75*SL+0.75WL
   TL = 0.6DL – WL (uplift)
3. Deflection limits for stringers are determined as base on L/180 maximum deflection.
4. Stringers beam capacities are determined using AISC 360-10 Manual of Steel Construction (ASD method).
5. Stringer beam yield stress utilized was 34 ksi (235 MPa) conform to China Q235b standard.
6. A minimum wind load of 100 psf should be considered in hurricane-prone regions. No lateral loads were included to determine the allowable spans above.

EXTRUSION DIAGRAMS

(All units are in inches unless noted otherwise. For some dimensions not shown, refer to manufacturer's proprietary documentation)

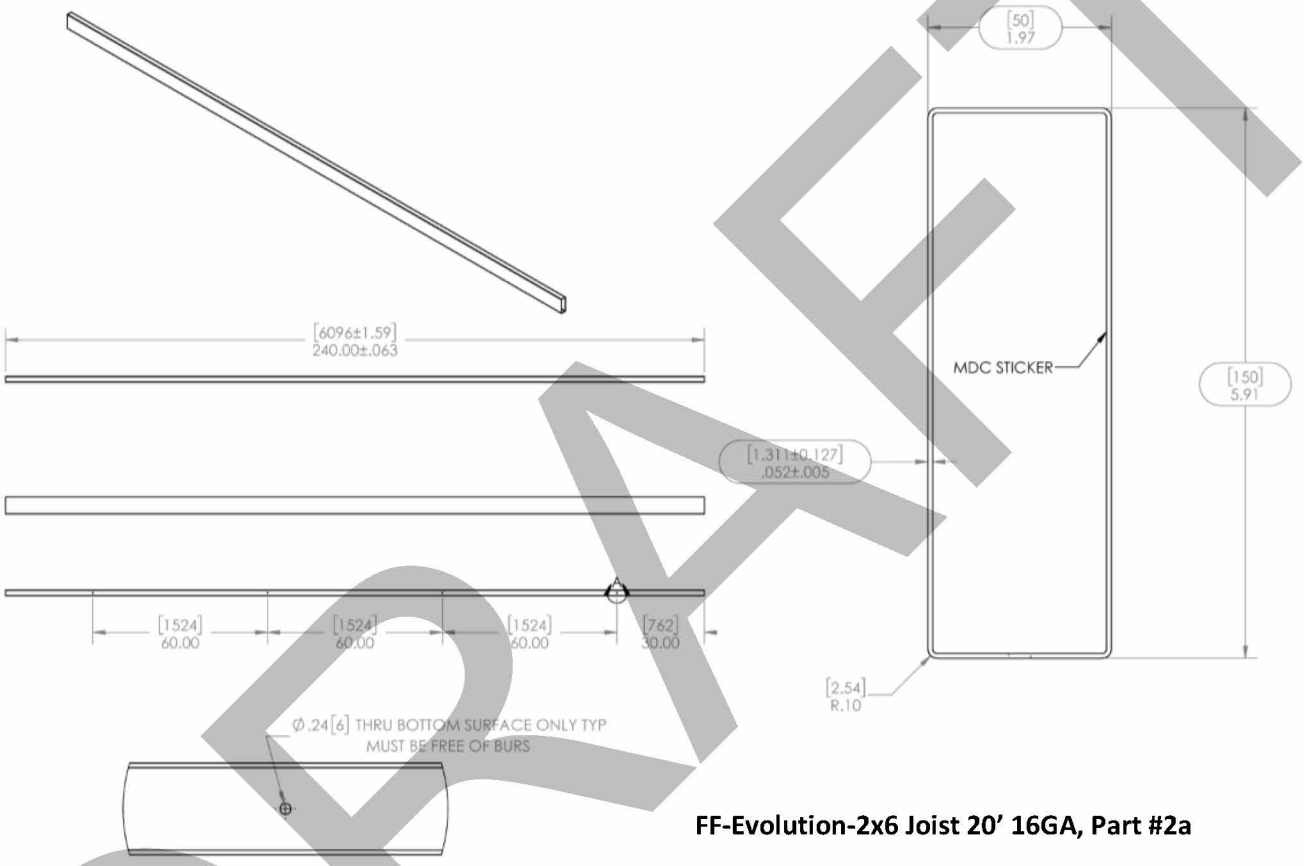




FF-Evolution Stair Strap, Part #1

EXTRUSION DIAGRAMS

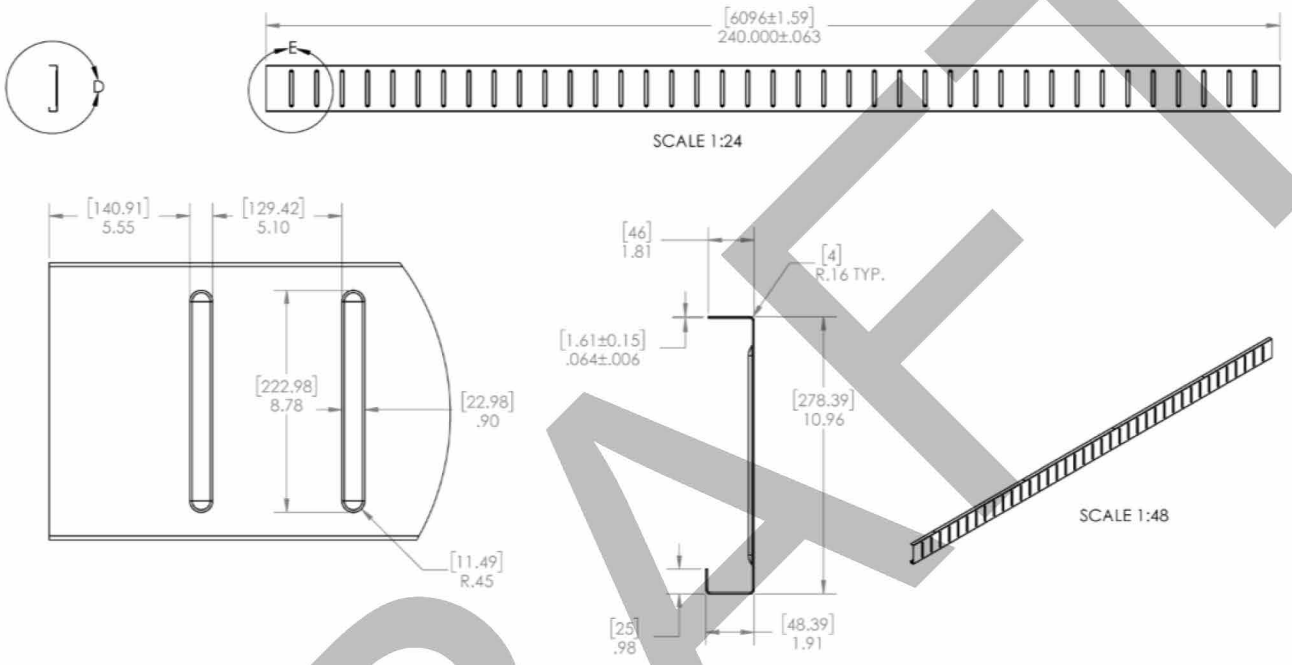
(All units are in inches unless noted otherwise. For some dimensions not shown, refer to manufacturer's proprietary documentation)



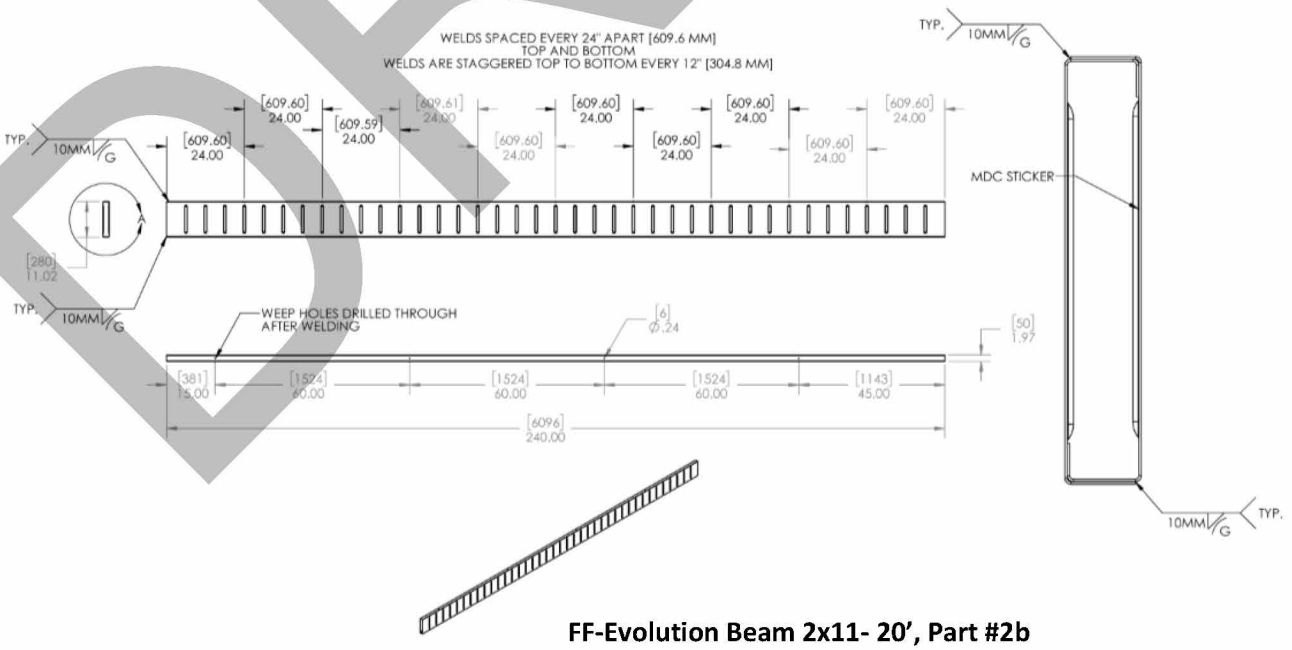
FF-Evolution-2x6 Joist 20' 16GA, Part #2a

EXTRUSION DIAGRAMS

(All units are in inches unless noted otherwise. Some dimensions not shown; refer to manufacturer's proprietary documentation)



FF-Evolution-J-Channel 2x11 - 20'

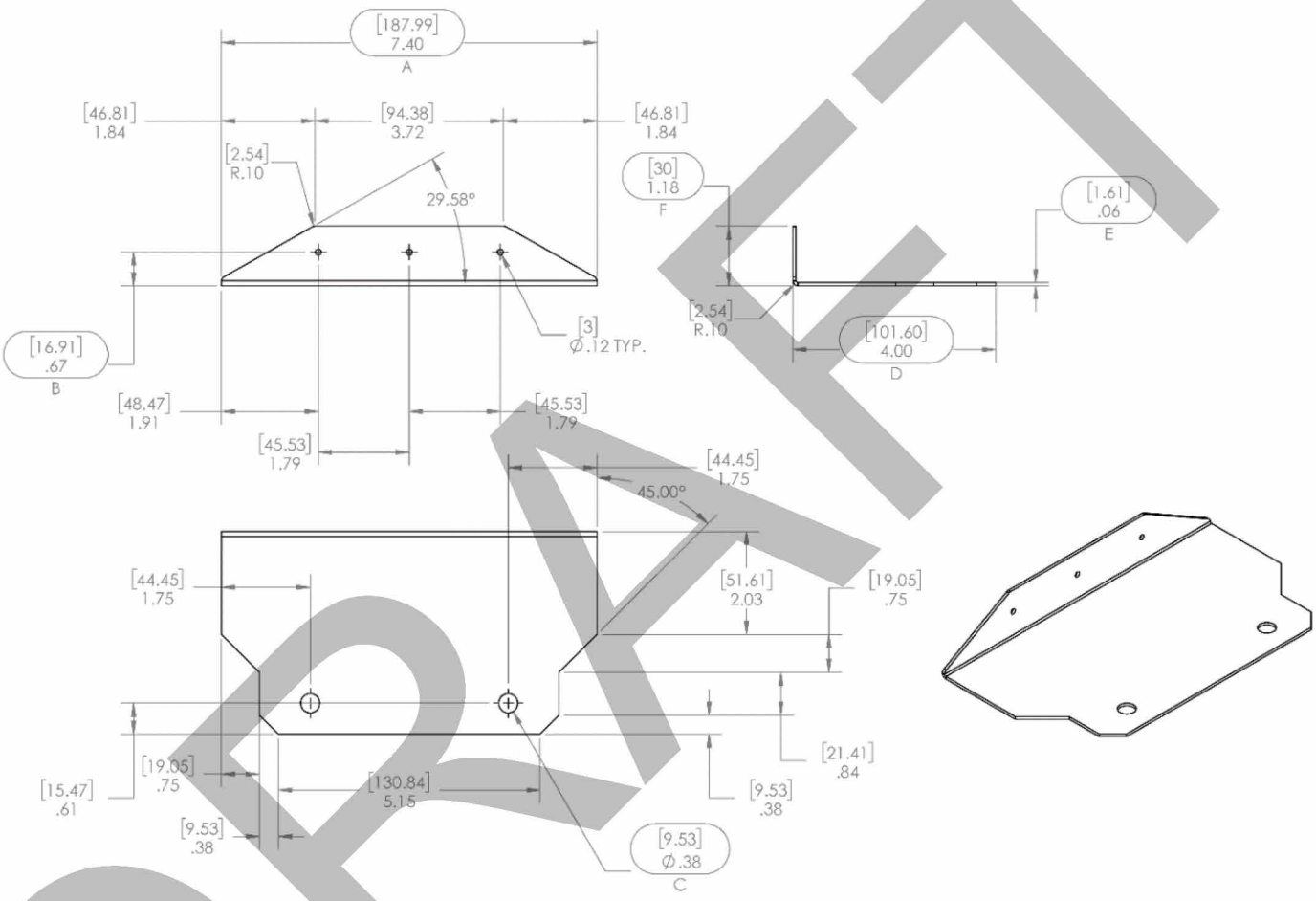


FF-Evolution Beam 2x11- 20', Part #2b

EXTRUSION DIAGRAMS

STAIR STRINGER ANCHOR CLIP

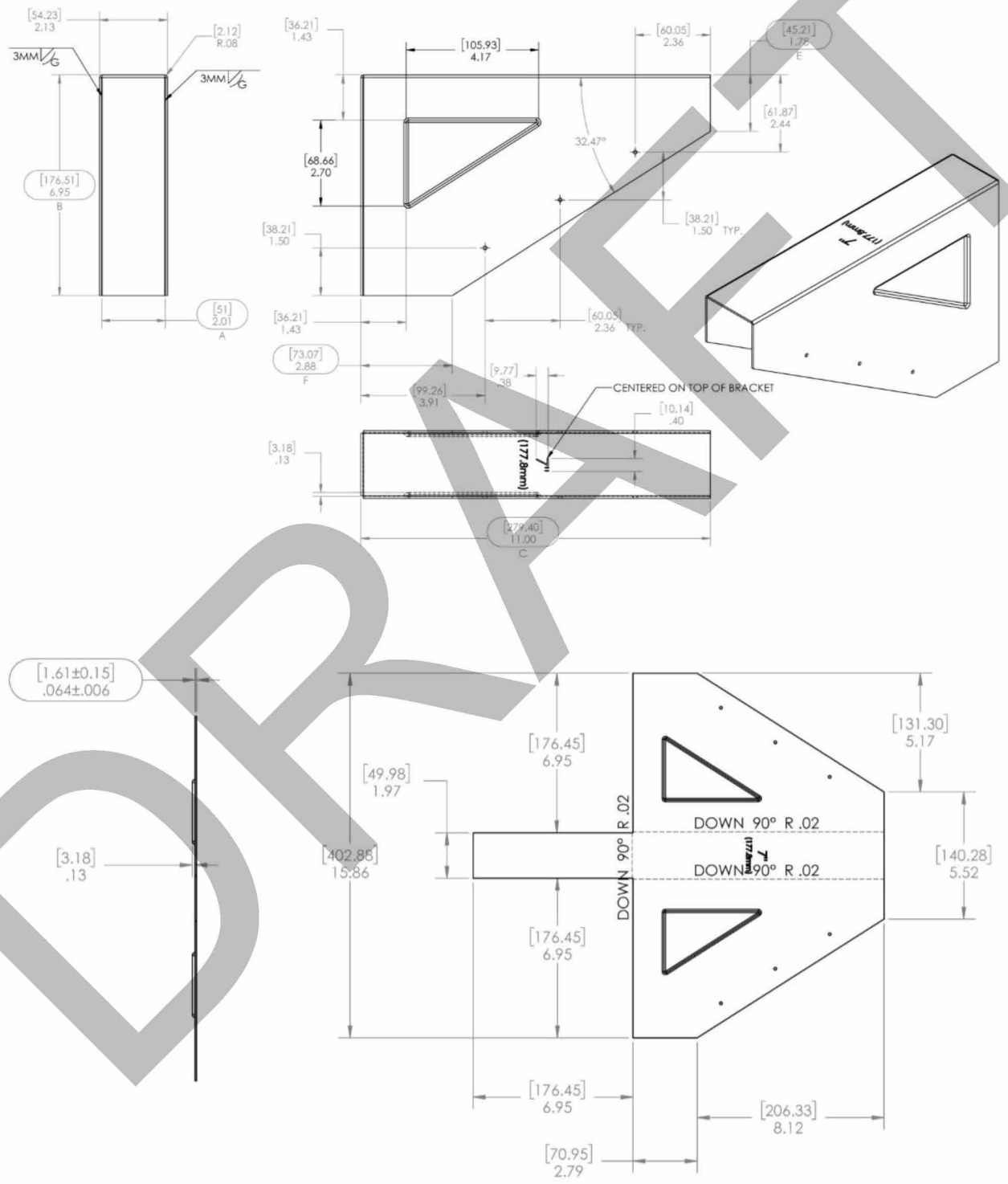
(All units are in inches unless noted otherwise. For some dimensions not shown, refer to manufacturer's proprietary documentation)



FF-Evolution Anchor Bracket, Part #3

EXTRUSION DIAGRAMS

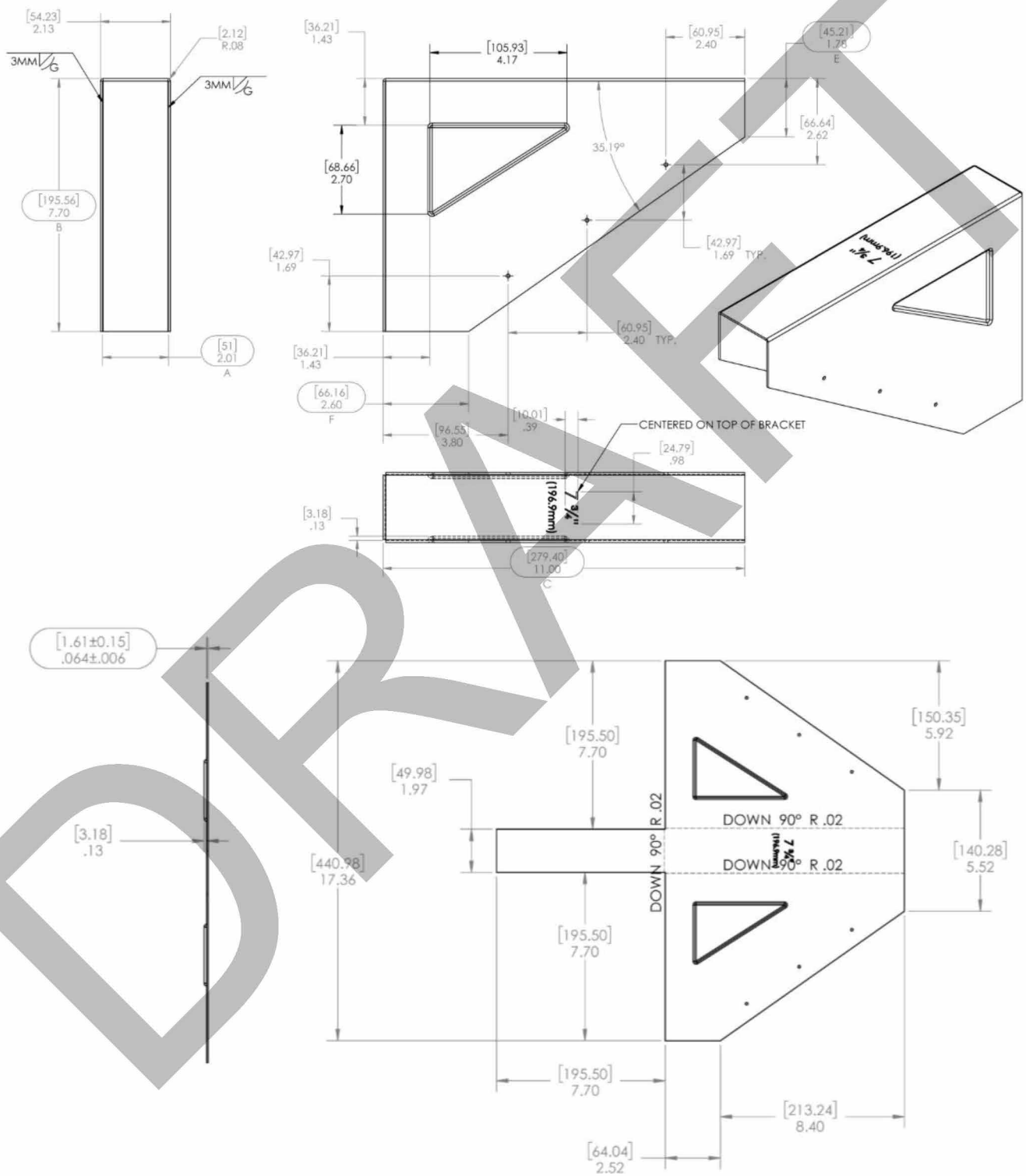
(All units are in inches unless noted otherwise. Some dimensions not shown; refer to manufacturer's proprietary documentation)



FF-Evolution Pre-Set 7"x11" Stair Bracket Part #4

EXTRUSION DIAGRAMS

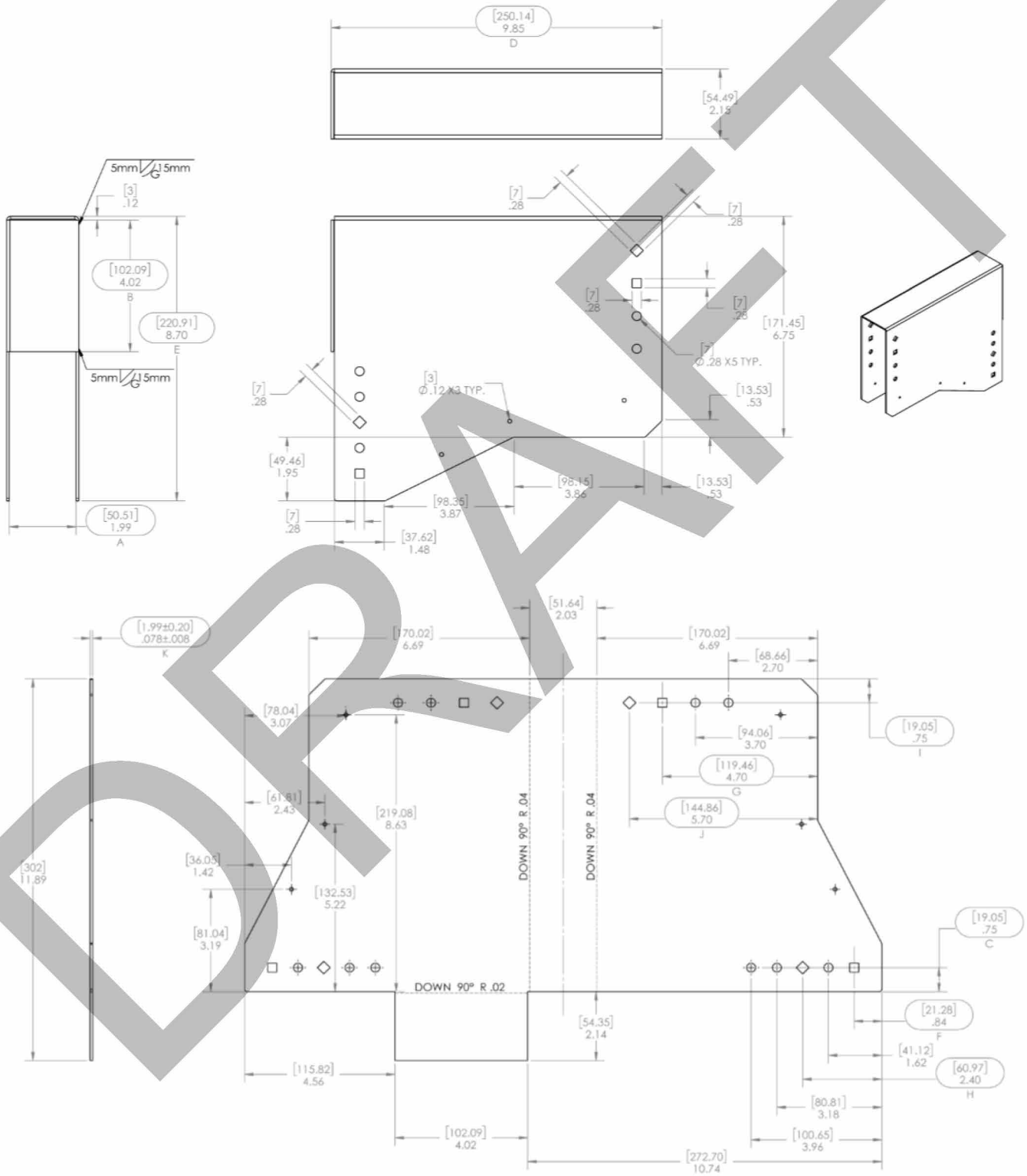
(All units are in inches unless noted otherwise. Some dimensions not shown; refer to manufacturer's proprietary documentation)



FF-Evolution Pre-Set 7 ¾"x11" Stair Bracket, Part #5

EXTRUSION DIAGRAMS

(All units are in inches unless noted otherwise. Some dimensions not shown; refer to manufacturer's proprietary documentation)



FF-Evolution Adjustable Stair Bracket Part #6