GREENSTONE
BUILDING PRODUCTS

DESIGN GUIDE









GREENSTONE ICE PANEL
QUICK REFERENCE GUIDE

1-Hour FRR (Load Bearing Pre-Fabricated Wall Assembly) • 2 layers Type X gypsum board (min 5/8") • 7.5" ICE Panel w/ 20ga studs @ 16" c/c (max) • 1 layer Exterior covering (see Greenstone QAI design listing B1122-1a for allowable types)	CAN/ULC S101-14/ASTM E119
2-Hour FRR (non-load Bearing Pre-Fabricated Wall Assembly) • 2 layers Type X gypsum board (min 5/8") • 2" offset z bar 20 ga @ 24" c/c (max) • 2" ComfortBoard 80 • 7.5" ICE Panel w/ 20 ga studs @ 16" c/c (max) • 1 layer Exterior Grade Type X gypsum board (min 5/8")	CAN/ULC S101-14/ASTM E119
STC Rating = 35	ASTM E 90-09, E413-10, 1332-10A
Flame Spread Index < 250	CAN/ULC S102.2-10
Smoke Developed Index > 500	CAN/ULC S102.2-10
Type 2 EPS	CAN/ULC S701
Vapour Barrier (when panel joints are sealed with approved caulking or tape)	CAN/ULC S701 Type 2
Structural Capacity • Standard 20 ga panels = 6,570 plf vertical load • HD panels = 21,350 plf vertical load • Basement wall panels = 6' burial depth	ASTM E72 - 2015
Gr 33 G90 Steel Studs and Connectors • minimum yield strength 39ksi	ASTM A653, G90 Galvanized
QAI Evaluation/Listing	Listing B1122-1

R-VALUES

Panel Thickness	5.5"		7.5"		9.25"		11.5"	
Core Material (**EPS**: Expanded Polystrene - Standard **GPS**: Graphite Polystyrene - Premium)	EPS	GPS	EPS	GPS	EPS	GPS	EPS	GPS
EPS R-Value (tested at 24.02°C)	22.91	25.85	31.24	35.25	38.53	43.475	46.00	55.20
THERM Analysis of ICE Panel Assembly	22.18	•	30.24	•	37.3	•	44.53*	•

**estimated based on THERM Analysis of 5.5"-9.25" ICE Panels*

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EPS vs GPS — YOU'VE GOT OPTIONS.

Greenstone Building Products offers two selections for the ICE Panel core. Our standard offering being **Expanded Polystyrene (EPS)** and a premium option – **Graphite Polystyrene (GPS)**.

Expanded Polystyrene (EPS) and Graphite Polystyrene (GPS) are Type 2 EPS options available for the core of the ICE Panel. Both options offer identical structural capacity (flexural strength minimums, compressive strength minimums, and density targets). This is set by the CAN/ULC S701.1 standard for EPS insulation.

The graphite does not change the burning behavior or finished foam density. As such, the fire-resistance rating, flame spread/smoke developed index, STC rating, and water vapour permeance remain the same.

WHAT'S THE DIFFERENCE?

Other than the difference in color of the resin bead, the main difference is the superior R-values offered by the GPS option. GPS includes graphite which increases the emissivity of the EPS over standard white EPS, making it more energy efficient. See the comparison chart below for reference.

	Expanded Polystyrene (EPS)	Graphite Polystyrene (GPS)
Bead Color	White	Grey
R-value per Inch	4.0	4.8

Connect with our customer service team to learn more about EPS vs GPS.
Send your emails to info@gsbp.ca or call us at 204-726-1426.

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INTRODUCTION TO GREENSTONE BUILDING PRODUCTS



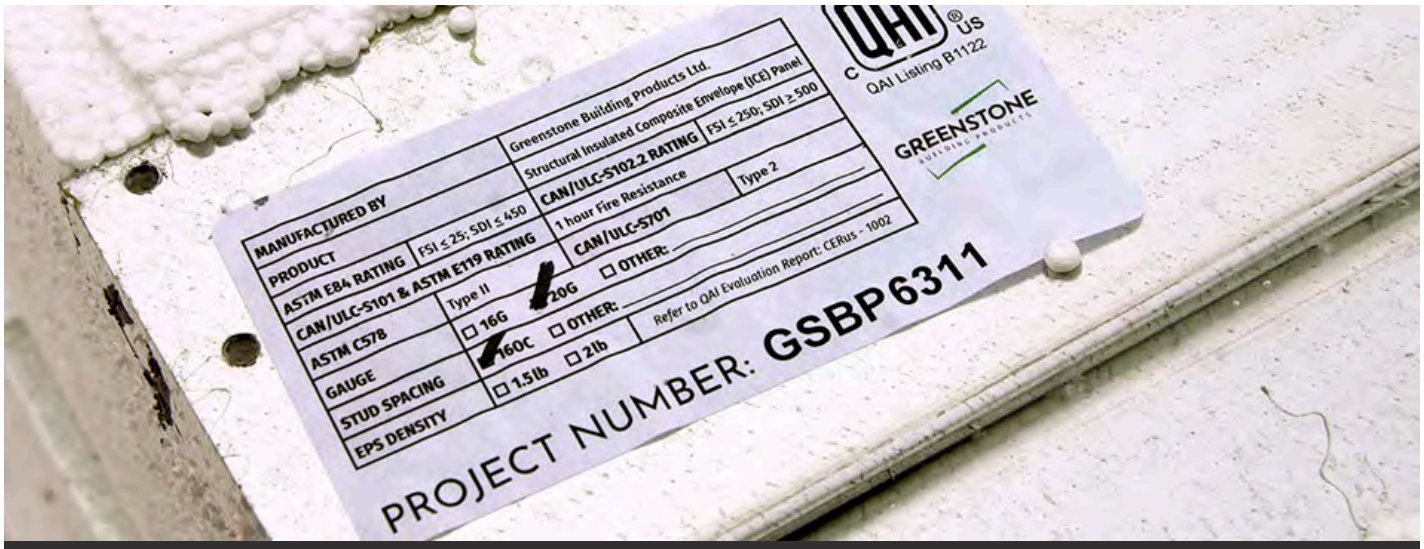
Greenstone Insulated Composite Envelope (ICE) Panels are an innovative and advanced structural building envelope technology that can be used in residential, commercial, and industrial projects as load-bearing exterior walls, floors, ceilings, and roof assemblies. They are significantly lighter, stronger, and more durable than traditional framing systems, allowing for broad design capabilities, unparalleled effective R-values, and considerably faster build times.

Greenstone utilizies the strength of a dual cold-formed steel frame (designed by a licensed P. Eng. in compliance with CSA S136) in composite with the superior insulating values of expanded polystyrene (EPS). Both materials are recyclable, will not warp, split or crack over time and have zero toxic gas emissions.

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TESTED TO THE HIGHEST STANDARDS



Greenstone's manufacturing and quality assurance process is inspected quarterly by a third-party inspection company known as QAI Laboratories Ltd. The Quality Control process includes approved raw material suppliers, in-process quality inspection and testing, as well as final product inspection and quality control tests. A finished product label is affixed to each Greenstone Panel to ensure identification and traceability of the finished product is maintained.

MADE IN MANITOBA

Greenstone ICE Panels are produced in a state-of-the-art manufacturing facility located in Brandon, Manitoba, Canada.







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TABLE OF CONTENTS

APPENDIX A: BROCHURES

ICE Panel Residential Brochure
ICE Panel Commercial Brochure
ICE Panel Packages Brochure
Green Building Guide – Green Globes V2
Green Building Guide – LEED V4 Building Design + Construction

APPENDIX B: STANDARD CONNECTION DETAILS

APPENDIX C: ACCESSORY CATALOGUE

APPENDIX D: SAMPLE PROJECTS

Davis Way Commercial Multi-Unit (Winnipeg, MB)
Obanye Residence (Quesnel, BC)
Black Wheat Brewery (Brandon, MB)
Rankin Inlet Mixed-Use Building (Rankin Inlet, NU)
Administrative Office Building (Sioux Valley Dakota Nation, MB)
18th Street Multi-Unit Building (Brandon, MB)
Agricultural Shop (Rivers, MB)
Rae Residence (Fairmont Hot Springs, BC)
Iqaluit Multi-Unit Building (Iqaluit, NU)
Home Hardware (Arviat, NU)
The Village at Pineridge Hollow (Oakbank, MB)
Park Avenue Commercial Space (Langham, SK)
Cevada Residence (Brampton, ON)
Franklin Street Residential Multi-Unit Buildings (Brandon, MB)
Braecrest Drive Residential Multi-Unit Buildings (Brandon, MB)
Strause Residence (Meridian Beach, AB)
Hunter Residence (Francois Lake, BC)

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TABLE OF CONTENTS

(continued from previous page)

APPENDIX E: ASSEMBLY MANUAL

APPENDIX F: TEST DATA

Engineering Evaluation | QAI Laboratories
Energuide Rating Report (Penner Residence) | Energuide
Energuide Rating Report (99 Dodds Residence) | Energuide
CoEfficient Building Science | Effective Rsi Calculation (THERM)

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APPENDIX A
BROCHURES

GREENSTONE
BUILDING PRODUCTS

RESIDENTIAL APPLICATIONS

GSBP.CA











ICE PANEL

WHAT ARE ICE PANELS?

INSULATED COMPOSITE ENVELOPE (ICE)

EXPANDED POLYSTYRENE (EPS & GPS)

GALVANIZED STEEL













BENEFITS OF ICE PANEL CONSTRUCTION

- ACCELERATED COMPLETION
- FINANCIAL FREEDOM
- SUSTAINABLE LIVING
- ENHANCED WELL-BEING
- ENGINEERED QUALITY
- PEACE OF MIND

SAVE MONEY BUILDING GREEN

Approximate Monthly Cost to Heat a 2000sqft Home



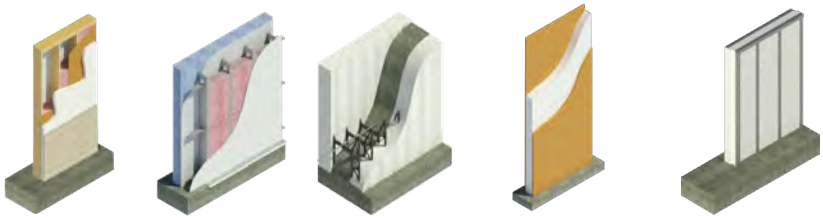


RESIDENTIAL PROJECT GALLERY

For more ICE Panel inspiration, go to **GSBP.CA/RESIDENTIAL-GALLERY/** or scan the QR code.

ICE PANELS vs COMPETITORS

HOW THE COMPETITION STACKS UP



	WOOD	STEEL STUD	ICF	SIPs	ICE PANEL
Single Step Building Envelope	–	–	–	✓	✓
Visible Structural Integrity	✓	✓	–	✓	✓
No Thermal Bridging	–	–	–	–	✓
Permanent R-Values (200+ Years)	–	–	✓	–	✓

WOOD-FRAMED HOMES

HEAT TRAPPED IN ATTIC

ENERGY LOSS AT EAVE

MULTIPLE STEPS REQUIRED TO CONSTRUCT BUILDING ENVELOPE

SPRAY FOAM INSULATION REQUIRED AT RIM JOIST

BASEMENT REQUIRES CONCRETE FLOOR AND WALLS

IN-FLOOR HEAT REQUIRED FOR COMFORT

ICE PANEL HOMES

FULLY INSULATED BUILDING ENVELOPE

INCREASED CEILING HEIGHT

FULLY INSULATED AT EAVE

NO VAPOUR BARRIER REQUIRED

FULLY INSULATED AT RIM JOIST

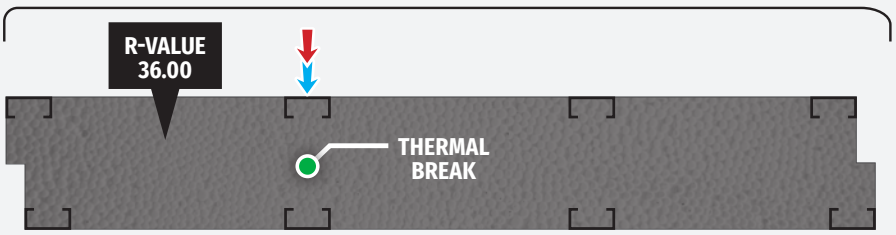
LARGER SPAN ON SHALLOWER JOIST

INSULATION IN PLACE OF CONCRETE



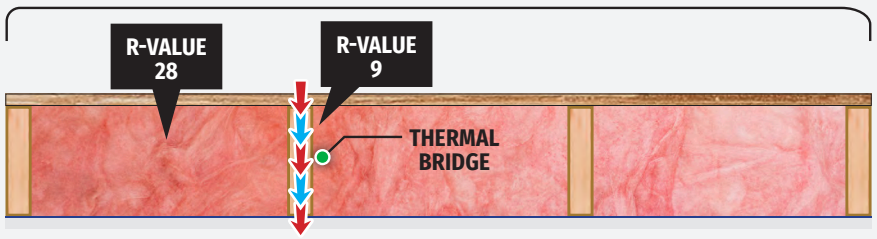
CONSISTENT R-VALUES IN YOUR WALLS

EFFECTIVE R-VALUE: 36.00



7.5" GPS ICE Panel

EFFECTIVE R-VALUE: 19.7



2" x 8" Wood-Framed Wall

Greenstone Building Products • 4000B Richmond Ave East • Brandon, MB R7A 7P8
204.726.1426 • info@gsbp.ca

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GREENSTONE
BUILDING PRODUCTS

COMMERCIAL APPLICATIONS

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ICE PANEL

WHAT ARE ICE PANELS?

INSULATED COMPOSITE ENVELOPE (ICE)

EXPANDED POLYSTYRENE (EPS & GPS)

GALVANIZED STEEL







EPS



GPS



ICE PANELS vs COMPETITORS

HOW THE COMPETITION STACKS UP







	WOOD	STEEL STUD	ICF	SIPs	ICE PANEL
Single Step Building Envelope	–	–	–	✓	✓
Visible Structural Integrity	✓	✓	–	✓	✓
No Thermal Bridging	–	–	–	–	✓
Permanent R-Values (200+ Years)	–	–	✓	–	✓







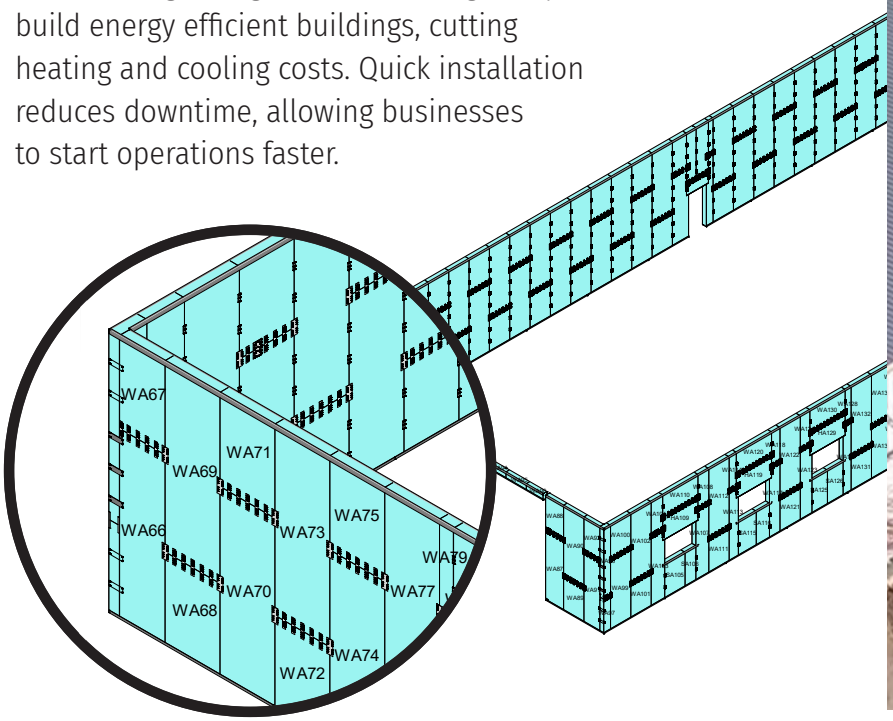
COMMERCIAL PROJECT GALLERY

For more ICE Panel inspiration, go to **GSBP.CA/COMMERCIAL-GALLERY/** or scan the QR code.

AGRICULTURAL SHOP

RIVERS, MANITOBA

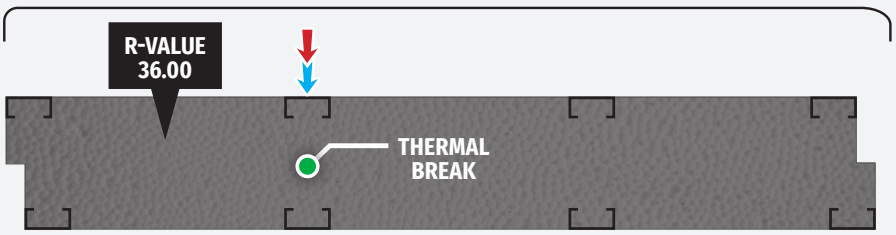
ICE Panels are a versatile solution for commercial use. Their lightweight, durable design helps build energy efficient buildings, cutting heating and cooling costs. Quick installation reduces downtime, allowing businesses to start operations faster.





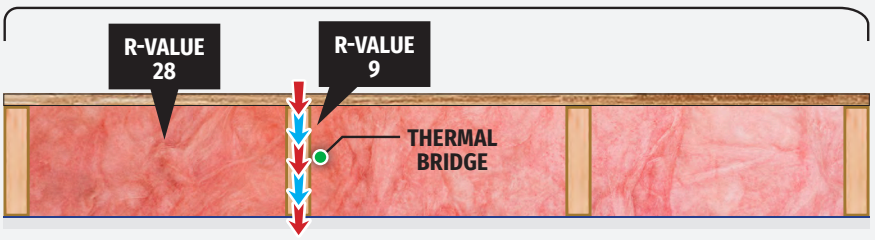
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2" x 8" Wood-Framed Wall

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ICE PANEL PACKAGES

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ICE PANEL

THE Concord



ROBINSON RESIDENTIAL
PERSONALIZING HOME DESIGN

INCLUDED IN THE PACKAGE

- Sealed Shop Drawings
- Joist and Truss Layout
- Rough Opening Schedule
- ICE Panel Connection Details
- Prefab Drawings







TAKE A
VIRTUAL TOUR





ARCHITECTURAL STYLE	Contemporary	**SQUARE FOOTAGE**	1533
BATH	3 Bathrooms	**STOREYS**	2 Storey
BED	3 Bedrooms	**WIDTH**	19ft-0in
GARAGE BAYS	0 Garage Bays	**FOUNDATION**	Slab or Crawlspace

THE Lynx



INCLUDED IN THE PACKAGE

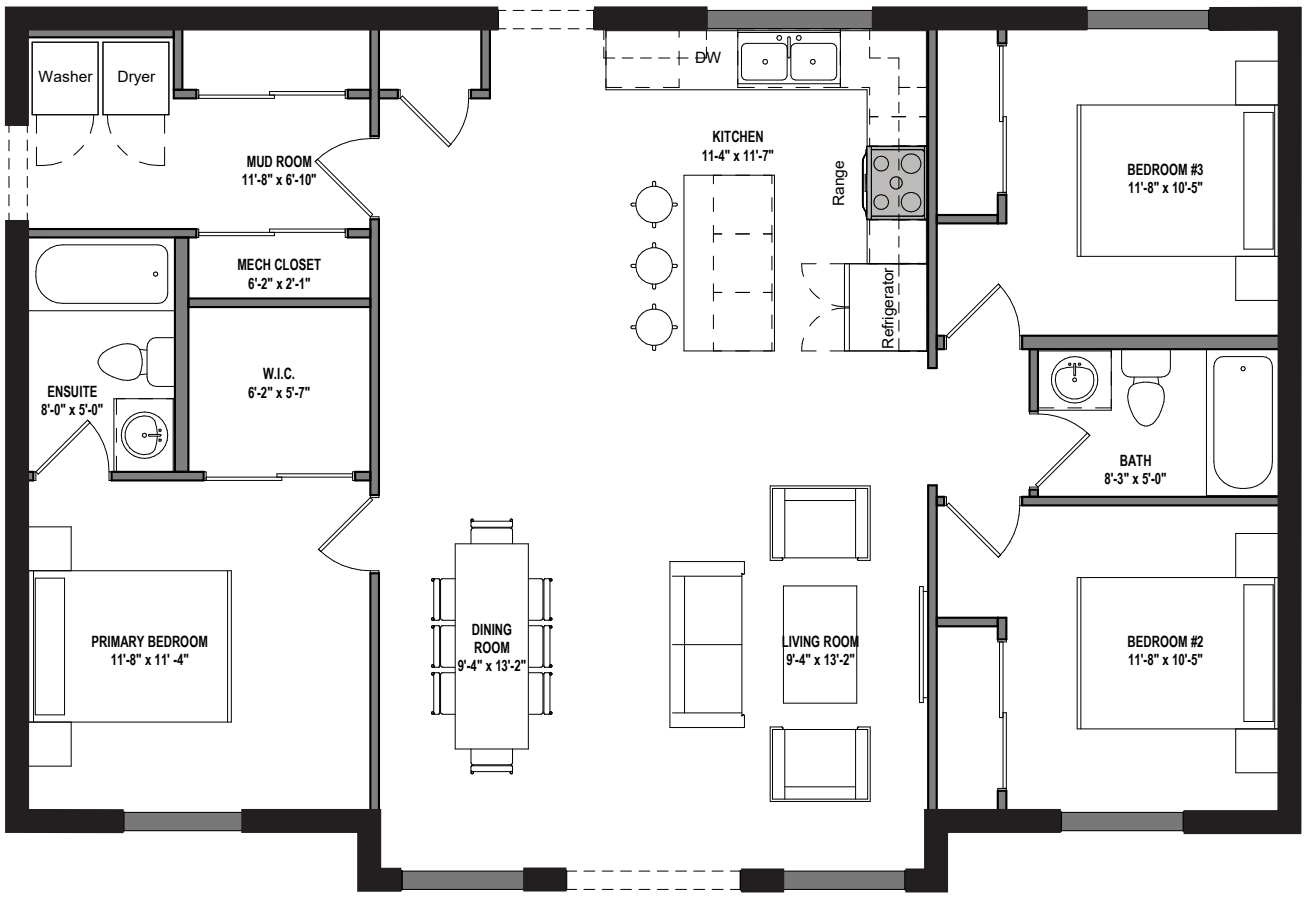
- Sealed Shop Drawings
- Joist and Truss Layout
- Rough Opening Schedule
- ICE Panel Connection Details
- Prefab Drawings







TAKE A VIRTUAL TOUR



ARCHITECTURAL STYLE	Cabin	**SQUARE FOOTAGE**	1272
BATH	2 Bathrooms	**STOREYS**	1 Storey
BED	3 Bedrooms	**WIDTH**	44ft-0in
GARAGE BAYS	0 Garage Bays	**FOUNDATION**	Slab or Crawlspace

SAVE MONEY BUILDING GREEN

Approximate Monthly Cost to Heat a 2000sqft Home



ICE PANEL COST COMPARISON

ICE PANEL CONSTRUCTION R36

$16.20/SQFT

PREFAB ASSEMBLY

SINGLE-STEP ASSEMBLY

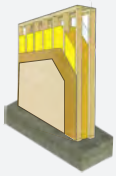


7.5" WALL THICKNESS

- 7.5" solid EPS core & double steel frame



R36 STICK FRAME CONSTRUCTION



$15.80/SQFT

PREFAB ASSEMBLY

MULTI-STEP ASSEMBLY

10.5" WALL THICKNESS

- Double 2" x 4" walls with 3.5" gap
- 2 layers of R22 fiberglass insulation
- 1/2" exterior sheating & 6 mil poly on interior

WHAT YOU'LL GET WITH ICE PANELS

- Accelerated completion
- Consistent R-value
- No organic materials
- Less risk for mould
- More square footage
- Airtight assembly
- Lightweight & strong
- Less labour required
- Rebate eligibility
- No on-site modifications

WHAT YOU'LL GET WITH STICK FRAME

- Longer construction timeline
- Organic materials
- High risk for mould
- On-site modifications
- Less square footage
- Inconsistent product
- Heavy product
- Labour intensive

FRAMING + INSULATION + VAPOUR BARRIER

BUILD FASTER WITH ICE PANELS



"This 3 storey multi-unit building in Rankin Inlet, Nunavut took a crew of 6 guys only 30 days to complete."

Cory Vrooman — Cutting Edge Construction



"ICE Panels are quick. Myself and one other person were able to stand 180 linear feet of ICE Panels in one 10 hour day."

Byron Jones — BGJ Construction Ltd.



Project built in Brandon, Manitoba, Canada

REDUCE THE IMPACT

THIS ICE PANEL PROJECT SAVED APPROXIMATELY

44 TREES FROM BEING CUT DOWN

FROM THE ARCTIC TO THE TROPICS

ICE Panels Are Ideal in Extreme Temperatures



Project built in Iqaluit, Nunavut, Canada





Project built in Treasure Cay, Bahamas

ICE PANEL TESTIMONIALS

"We want to build homes for the future, not just for today, and ICE Panels are a great way to achieve that. The ICE Panel has great insulation values and no thermal bridging. The panels feature an EPS core with steel studs, meaning your building envelope won't rot or fall apart – it's long lasting, and that's a great thing to have in a wall."



CARLO VLEEMING
VLEEMING CUSTOM HOMES | *LACOMBE, AB*

"ICE Panels save so much time; myself and one other person were able to stand 180 lineal feet of ICE Panels in one, ten-hour day. ICE Panels also help us meet the energy step codes in BC as they have no thermal bridging. I definitely recommend ICE Panels. They're fast, efficient, and they provide an excellent finished product – high R-value walls with 100% thermal break."



BYRON JONES
BGJ CONSTRUCTION | *KAMLOOPS, BC*

"One thing that people don't often think about is the cost of the utilities. Greenstone ICE Panels are really good at keeping your house comfortable and your utility bills affordable. The tenants are finding that the heating costs are super low. I would recommend ICE Panels because it's a great concept, tenants love them, and they're easy to lease."

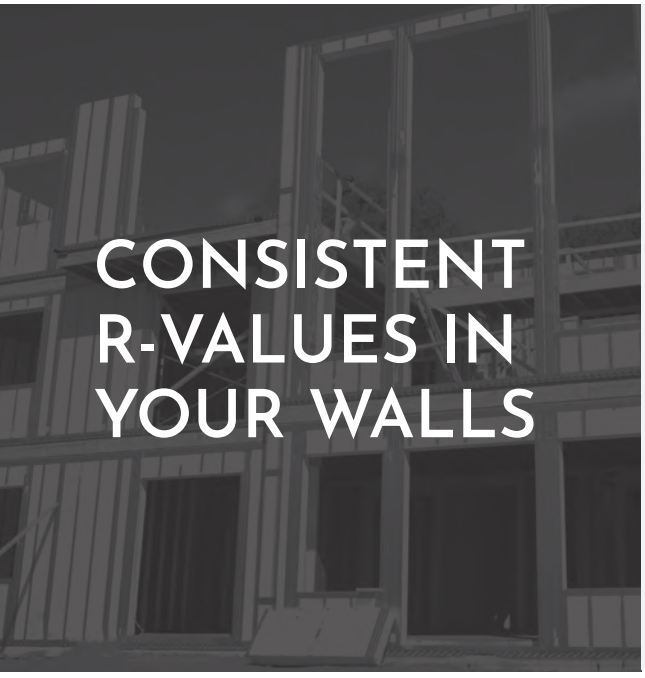


DANA EDMUNDSON
RHINO PROPERTY MANAGEMENT | *BRANDON, MB*

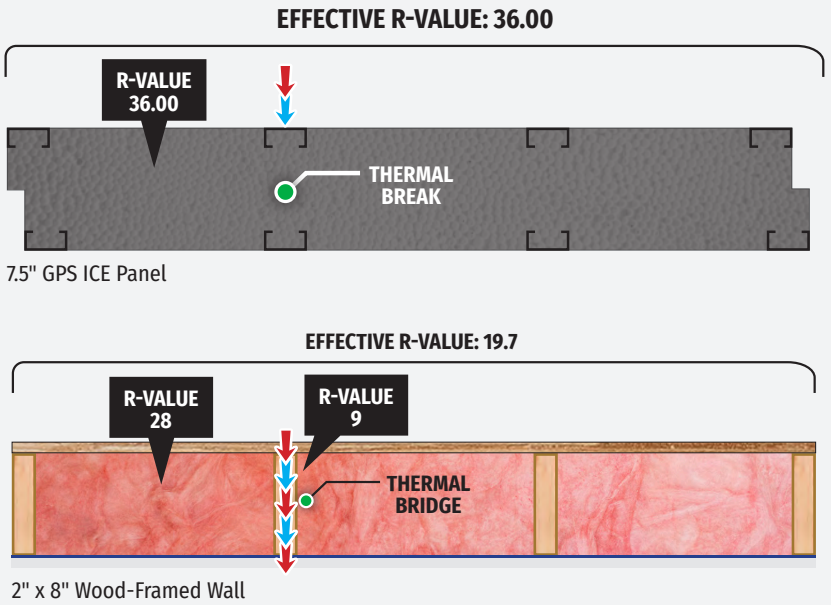
"From a construction standpoint, ICE Panels are prefabricated, pre-engineered and panelized, so they're very quick to erect. My design options were not limited at all with the ICE Panels, with Greenstone engineering the panels to accommodate my design goals. This product is fire-resistant and a true plumb straight panel. I would definitely use ICE Panels again."



LUIS CEVADA
HOMEOWNER | *BRAMPTON, ON*



CONSISTENT R-VALUES IN YOUR WALLS



ORDER YOUR PACKAGE NOW!

Start building with ICE Panels. Our knowledgeable project team is here for you. Connect with us to get started.

LEARN MORE AT: **GSBP.CA/PACKAGES** Email us at **info@gsbp.ca**

GREEN BUILDING GUIDE
GREEN GLOBES V2

GREENSTONE BUILDING PRODUCTS

Greenstone ICE Panels utilize galvanized steel and expanded polystyrene (EPS) to achieve a structurally insulated composite panel for exterior and below grade walls, interior partitions, floors, and roofs for all project types. The information provided in these charts is applicable throughout North America.

The use of this product can contribute to achieving points in the categories listed, however specifying this product does not guarantee point achievement or certification. The following product data has been evaluated and verified by an independent third party, EcoAmmo Sustainable Consulting Inc.

GREEN GLOBES V2 NEW CONSTRUCTION CANADA

ENERGY

Energy is the most heavily weighted category in Green Globes v2; ICE Panels contribute to the overall energy efficiency of the building, benefiting the point count in the Energy category. ICE Panels provide thermally broken structural framing, insulation, and a vapour barrier in one. The R-value is 34.56 for the 7.5" ICE Panel.

Energy Performance (Up to 150 points)
Energy Demand (4 to 8 points)
Building Opaque Envelope (Up to 30 points)

MATERIALS & RESOURCES

Resource Conservation: Multi-Functional Assemblies
(1 point)

ICE Panels are an assembly that performs multiple functions, acting as a thermally broken structural framing, insulation, and a vapour barrier in one. Additionally, it provides pest proofing and reduction of sound transmission.

Resource Conservation : Minimized Use of Raw Materials
(Up to 2 points)

ICE Panels are prefabricated offsite, reducing the use of raw materials when compared with typical construction practices.

Resource Conservation: Envelope Barriers
(Up to 4 points)

The ICE Panels acts as an air barrier and a vapour barrier which helps to increase the performance and durability of the structure.

INDOOR ENVIRONMENT

Leakage, Condensation and Humidity (Up to 2 points)

ICE Panels are resistant to mould growth in spaces that generate high humidity.

GREEN BUILDING GUIDE
LEED VERSION 4

GREENSTONE BUILDING PRODUCTS

LEED VERSION 4 BUILDING DESIGN & CONSTRUCTION

ENERGY & ATMOSPHERE (EA)

Greenstone ICE Panels provide thermally broken structural framing, insulation, and a vapour barrier in one. For example the R-value is 34.56 for 7.5" ICE Panels, contributing to the overall energy efficiency of the building envelope.

Minimum Energy Performance (Prerequisite)
Credit Optimize Energy Performance (up to 18 points)

R-VALUES AT 40°F / 4.4°C*		
Panel Thickness	**hr•ft²•F/BTU**	**m²•k/w**
3.5"/89mm	16.13	2.84
5.5"/140mm	25.34	4.47
7.5"/190mm	34.56	6.09
9.25"/235mm	42.62	7.51
11.5"/292mm	52.99	9.34

R-VALUES AT 75°F / 24°C*		
Panel Thickness	**hr•ft²•F/BTU**	**m²•k/w**
3.5"/89mm	14.56	2.57
5.5"/140mm	22.91	4.03
7.5"/190mm	31.24	5.50
9.25"/235mm	38.53	6.78
11.5"/292mm	47.89	8.43

**Based on ASTM C518-15, "Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus".*

MATERIALS & RESOURCES (MR)

Building Product Disclosure and Optimization Sourcing of Raw Materials Option 2: Recycled Content (Up to 2 points)

Products made up of multiple materials are called an "assembly" and contributing value is based on weight. 50% of an ICE Panel (by weight) is steel containing:

- Post-consumer recycled content = 19.8%
- Pre-consumer recycled content = 14.4%

Construction and Demolition Waste Management (Up to 2 points)

Each ICE Panel is factory designed and manufactured for the project's specific measurements meaning NO WASTE is generated on the construction site.

INDOOR ENVIRONMENTAL QUALITY (EQ)

Leakage, Condensation and Humidity (Up to 2 points)

ICE Panels are resistant to mould growth in spaces that generate high humidity.

APPENDIX B

STANDARD CONNECTION DETAILS

GREENSTONE
BUILDING PRODUCTS



ICE PANEL

STANDARD CONNECTION DETAILS

UPDATED AS OF 2025.03.04

TABLE OF CONTENTS

RESIDENTIAL STANDARD DETAILS

GENERAL DETAILS

101. 5 1/2" GS PANEL WITH O/C STUD SPACING OPTIONS
102. 7 1/2" GS PANEL WITH O/C STUD SPACING OPTIONS
103. 9 1/4" GS PANEL WITH O/C STUD SPACING OPTIONS
104. 11 1/2" GS PANEL WITH O/C STUD SPACING OPTIONS
120. TYP. GS PANEL - INSTALLED (PERSPECTIVE)
122. GS WALL ASSEMBLY W X-BRACING (PERSPECTIVE)
123. GS WALL ASSEMBLY W SHEATHING (PERSPECTIVE)

GS WALL BASE & GS FLOOR ATTACHMENT DETAILS

201. GS FOUNDATION DETAIL (SHALLOW BURIAL 0’ TO 4’ DEPTH) [SECTION]
202. GS FOUNDATION DETAIL (DEEP BURIAL 4’-1” TO 8’) [SECTION]
203. GS FLOOR INSTALLATION ONTO CONC. FOOTING [SECTION]
204. GS FOUND. WALL & THICKENED EDGE SLAB [SECTION]
205. GS BASE INSTALLATION ONTO CONC. SLAB [SECTION]
206. GS WALL TO CONC. SLAB CONNECTION WITH LBC [SECTION]
207. GS SPLIT TRACK ON DOUBLE PT PLATE INSTALLATION ONTO CONC. SLAB [SECTION]
208. GS FOUNDATION & GS FLOOR ABOVE CONC. FOOTING [SECTION]
210A. GS FLOOR INSTALLATION ONTO CONC. FOOTING WITH ICF FND [SECTION]
210B. GS FLOOR INSTALLATION ONTO CONC. FOOTING WITH ICF FND [SECTION]
212. GS WALL ASSEMBLY ONTO FOUNDATION BEAM (@ EXT. WALL) [SECTION]
222. GS SPLIT TRACK ON PT PLATE INSTALLATION ONTO ICF [SECTION]
223. GS SPLIT TRACK ON PT PLATE INSTALLATION ONTO ICF [SECTION]
241. GS ASSEMBLY ONTO TRIODETIC FOUNDATION (@ EXT. WALL WITH CONTINUOUS SUBFLOOR)
242. GS ASSEMBLY ONTO TRIODETIC FOUNDATION (FLOOR BUTT JOINT) [SECTION]
243. GS ASSEMBLY ONTO TRIODETIC FOUNDATION (SHIP-LAP JOINT) [SECTION]
250. GS ASSEMBLY ONTO FOUNDATION BEAM (@ EXT. WALL W CONTINUOUS SUBFLOOR) [SECTION]
251. GS ASSEMBLY ONTO FOUNDATION BEAM (@ FLOOR PANEL BREAK) [SECTION]

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RESIDENTIAL STANDARD DETAILS *(continued from previous page)*

252. GS ASSEMBLY ONTO FOUNDATION BEAM (@ FLOOR PANEL SPLIT) [SECTION]
253. GS ASSEMBLY ONTO FOUNDATION BEAM (@ FLOOR PANEL BUTT JOINT) [SECTION]
255. GS FLOOR PANEL CONNECTION TO STEEL BEAM [SECTION]
256. GS ASSEMBLY W/ RIM BOARD ALL AROUND ONTO FND BEAM (@ EXT. WALL W/ CONTD SUBFLOOR) [SECTION]
260. GS WALL & FLOOR ASSEMBLIES ON TOP CHORD BEARING FLOOR JOISTS & FOUNDATION [SECTION]

GS WALL PANEL DETAILS

301. TYP. EXT. FACE OF GS WALL PANEL @ CORNER (PERSPECTIVE)
302. TYP. INT. FACE OF GS WALL PANEL @ CORNER (PERSPECTIVE)
303. 90° CORNER (PLAN)
304. VARIABLE ANGLE CORNER (PLAN)
306. GS WALL INTERSECTION (PLAN)
308. WALL THICKNESS CHANGE CONNECTON (PLAN)
310. GS WALL BRACING SUGGESTED METHOD [SECTION]
311A. GS WALL INTERIOR BRACING SUGGESTED METHOD (SECTION)
311B. GS WALL INTERIOR BRACING SUGGESTED METHOD (SECTION)
311C. GS WALL INTERIOR BRACING SUGGESTED METHOD (SECTION)
311D. GS WALL INTERIOR BRACING SUGGESTED METHOD (SECTION)
320. LBC INSTALLATION (PERSPECTIVE)
321. LBC INSTALLATION [SECTION]
322. LBC CORNER MODIFICATION (PERSPECTIVE)
323. LBC CORNER MODIFICATION [SECTION]
340. WINDOW ROUGH OPENING (EXT.) [PERSPECTIVE]
341. WINDOW ROUGH OPENING (INT.) [PERSPECTIVE]
342. DOOR ROUGH OPENING (EXT.) [PERSPEVTIVE]
344. GS HEADER PANEL (PERSPECTIVE)
345. GS TRANSOM PANEL (PERSPECTIVE)
346. GS HEADER WITH INTEGRAL LVL (EXT.) [PERSPECTIVE]
347. GS HEADERS ON COLUMN (PERSPECTIVE)
349. GS PANELIZING CLIP FLAT MODIFICATION (PERSPECTIVE)
351. GS TRANSOM PANEL (VERTICAL) [PERSPECTIVE]

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RESIDENTIAL STANDARD DETAILS *(continued from previous page)*

354. GARAGE SLAB THICKENING @ GARAGE DOOR WITH GS FOUNDATION [SECTION]
360. TALL WALL (EXT.) [ELEVATION]
361. TALL WALL (INT.) [ELEVATION]
362. TALL WALL W ROUGH OPENING PANELIZING CLIP LOCATIONS (EXT.) [PERSPECTIVE]
381. WALL WIDTH ADJUSTMENT (ELEVATION)
382. GS WALL ASSEMBLY @ INTERSECTING COLUMN (ELEVATION)
390. HORIZONTAL FOUNDATION PANEL (PERSPECTIVE)
391. HORIZONTAL FOUNDATION PANEL WITH LEDGE (PERSPECTIVE)

GS WALL TOP ATTACHMENT DETAILS

401. FULL BEAM POCKET [SECTION]
402. FULL BEAM POCKET (PLAN)
403. PARTIAL BEAM POCKET [SECTION]
404. PARTIAL BEAM POCKET (PLAN)
405. HANGING BEAM [SECTION]
406. HANGING BEAM (PLAN)
420. FULL BEARING FLOOR [SECTION]
421. FULL THICKNESS BEARING (TOP CHORD BEARING) [SECTION]
422. FULL THICKNESS BEARING WITH STRAPPING (TOP CHORD BEARING) [SECTION]
423. FULL BEARING FLOOR WITH SILL PLATE [SECTION]
424. LEDGER BEARING FLOOR [SECTION]
426. IMPERMEABLE MEMBRANE INSTALLATION [SECTON]
430. FLOOR LEDGE (BOTTOM CHORD BEARING) [SECTION]
431. FLOOR LEDGE (TOP CHORD BEARING) [SECTION]
432. STAIRWELL WALL BREAK (LOW) [SECTION]
433. STAIRWELL WALL BREAK (HIGH) [SECTION]
434. STAIRWELL WALL BREAK (FOUNDATION) [SECTION]
435. REMOVABLE GS WALL INSTALLATION [SECTION]
441. GS BASE INSTALLATION LOWER GS WALL (CONTINUOUS) [SECTION]

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RESIDENTIAL STANDARD DETAILS *(continued from previous page)*

442. GS BASE INSTALLATION LOWER GS WALL (CONTINUOUS) [SECTION]
450. GS WALL ASSEMBLY WITH BOTTOM LEDGE [SECTION]
451. GS WALL ASSEMBLY WITH BOTTOM LEDGE @ CORNERS [SECTION]
452. CANTILEVER INSULATION WITH EXT. STRAPPING FOR SIDING [SECTION]
460. LEDGER BOARD INSTALLATION [SECTION]
461. GS TO TIMBER FRAME FASTENING [SECTION]

GS ROOF & CEILING ATTACHMENT DETAILS

501. GS ROOF ON ENG. ROOF TRUSS @ EAVES (NON-GS O/H) [SECTION]
503. GS ROOF ON ENG. ROOF TRUSS @ EAVES (NO O/H) [SECTION]
504. GS ROOF ON RECESSED ENG. ROOF TRUSS @ EAVES (NON-GS O/H) [SECTION]
506. GS ROOF ON RECESSED ENG. ROOF TRUSS @ EAVES (NO O/H) [SECTION]
507. GS ROOF REINFORCEMENT ON RECESSED ENG. ROOF TRUSS @ EAVES (C/W O/H) [SECTION]
508. FULL BEARING ROOF WITH SILL PLATE [SECTION]
509. GS ROOF ON ENG. PARALLEL CHORD ROOF JOIST @ EAVES (NO OVERHANG) [SECTION]
510. GS ROOF ON ENG. ROOF TRUSS @ GS GABLE WALL [SECTION]
511. GS ROOF ON ENG. ROOF TRUSS @ GABLE STUD WALL [SECTION]
513. GS ROOF ON ENG. ROOF TRUSS @ GS GABLE WALL (NO O/H) [SECTION]
514. GS ROOF @ EAVES ON BEAM [SECTION]
515. GS ROOF @ EAVES ON BEAM (SHIP-LAP JOINT) [SECTION]
516. GS STRUCTURAL ROOF BETWEEN BEAMS @ EAVES (NO OVERHANG) [SECTION]
520. GS ROOF PANEL SEALING [SECTION]
521. GS ROOF PANEL BUTT JOINT (SECTION)
522. GS NON-STRUCTURAL ROOF WITH ROOFING MEMBRANES (SECTION)
523. GS STRUCTURAL ROOF WITH ROOFING MEMBRANES (SECTION)
524. GS ROOF PANEL SHIP-LAP JOINT (BEAM) [SECTION]
525. GS ROOF PANEL BUTT JOINT (BEAM) [SECTION]
530. GS ROOF PEAK STRAPPING (OVER TRUSSES) [PLAN]
531. GS ROOF ON ENG. ROOF TRUSS @ GS GABLE WALL (NO O/H) [ELEVATION]
538A. GS ROOF @ EAVES (GS O/H) [SECTION]

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RESIDENTIAL STANDARD DETAILS *(continued from previous page)*

538B. GS ROOF @ EAVES (GS O/H) [SECTION]
538C. "NET-ZERO" GS ROOF @ EAVES (GS O/H) [SECTION]
538D. "NET-ZERO" GS ROOF @ EAVES (GS O/H) [SECTION]
539A. GS ROOF SHIP-LAP @ EAVES (GS O/H) [SECTION]
539B. GS ROOF SHIP-LAP @ EAVES (GS O/H) [SECTION]
539C. "NET-ZERO" GS ROOF SHIP-LAP @ EAVES (GS O/H) [SECTION]
539D. "NET-ZERO" GS ROOF SHIP-LAP @ EAVES (GS O/H) [SECTION]
540A. GS ROOF BUTT JOINT @ EAVES (GS O/H) [SECTION]
540B. GS ROOF BUTT JOINT @ EAVES (GS O/H) [SECTION]
540C. "NET-ZERO" GS ROOF BUTT JOINT @ EAVES (GS O/H) [SECTION]
540D. "NET-ZERO" GS ROOF BUTT JOINT @ EAVES (GS O/H) [SECTION]
541. GS CLERESTORY WALL & ROOF ASSEMBLY (SECTION)
542. GS ROOF @ EAVES (NO O/H) [SECTION]
543. GS ROOF @ MID-SPAN BEAM [SECTION]
544. GS ROOF @ RIDGE (SECTION)
545. GS ROOF @ EAVES (GS O/H) [SECTION]
546. GS ROOF ON TIMBER BEAM @ EAVES TIE-DOWN (SECTION)
548. GS ROOF ATTACHMENT ONTO TIMBER STRUCTURE (SECTION)
549. GS ROOF ATTACHMENT ONTO TIMBER STRUCTURE @ GABLE WALL (SECTION)
551. GS STRUCTURAL ROOF @ CROSS SLOPE (PERSPECTIVE)
553. GS ROOF ON RECESSED ENG. ROOF TRUSS @ EAVES (WITH OVERHANG) [SECTION]
554A. ROUGH FASCIA ATTACHMENT ONTO GS ROOF [SECTION]
554B. ROUGH FASCIA ATTACHMENT ONTO GS ROOF [SECTION]
554C. ROUGH FASCIA ATTACHMENT ONTO GS ROOF [SECTION]
554D. ROUGH FASCIA ATTACHMENT ONTO GS ROOF [SECTION]
560. GS CEILING PANELS (SECTION)
611. SITE CUT ELECTRICAL CHASE (PERSPECTIVE)
612. SITE CUT PLUMBING CHASE (PERSPECTIVE)
614A. PEEL & STICK INSTALLATION (PERSPECTIVE)

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RESIDENTIAL STANDARD DETAILS *(continued from previous page)*

614B. PEEL & STICK INSTALLATION (PERSPECTIVE)
614C. PEEL & STICK INSTALLATION (PERSPECTIVE)
614D. PEEL & STICK INSTALLATION (PERSPECTIVE)

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GREENSTONE ICE PANEL
DESIGN PARAMETERS

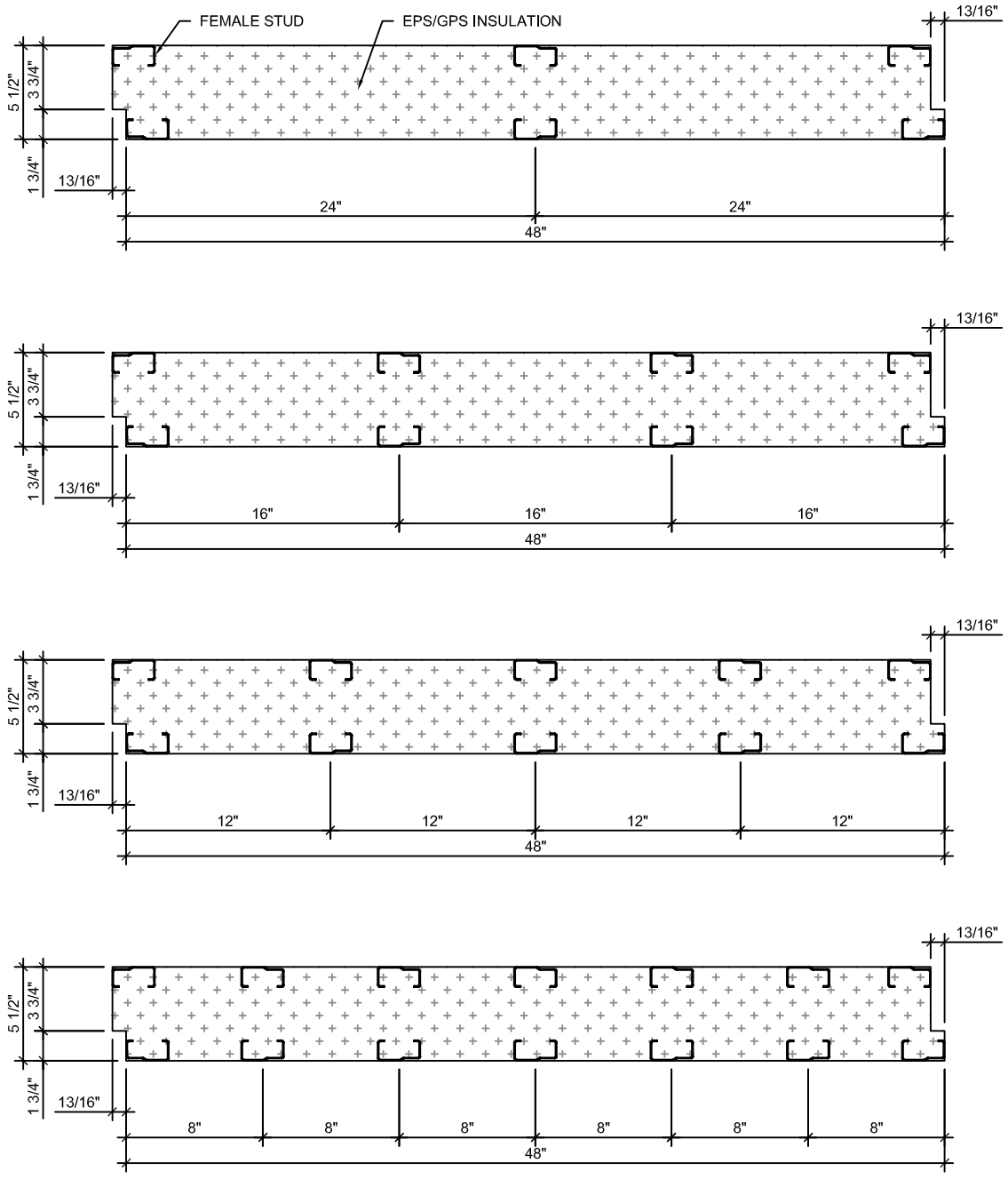
The following design parameters are required to streamline Greenstone's Design and Production Process. Designs outside of the below list will be considered complex and will require additional design, drafting and production fees and time lines.

1	Rough Openings (RO's) require a plywood sub-frame/rough buck – please specify if they are ¾" or 1.5".
2	RO's must be a minimum of 5 ¾" from inside corners minimum and 6 ½" between adjacent RO.
3	Greenstone headers require a minimum 8" clearance above, and can not span more than an 11' RO*.
4	Ledge cuts should only be on the bearing wall, and not the walls parallel to main joist runs.
5	5.5" walls are limited to 10' high, beyond which, they must be upgraded to 7.5" wall minimum.
6	After 12' of wall height, there is a cost increase for tall walls.
7	Foundations are limited to 6' backfill pressure maximum from top of basement floor to top of backfill.
8	Heights of walls to be supplied by Greenstone must be clearly dimensioned, especially tall walls and rake walls in vaulted ceiling areas, either to truss or to ladder.
9	Both structural faces of the wall must bear down on a load bearing surface.
10	Top plates can be beneficial in most applications. They are required for RTM foundations.
11	Compound notches on panels are highly complex and will delay time lines and increase cost.

***** Engineered headers can be used to span larger spaces if needed. Product supplied by third party supplier.

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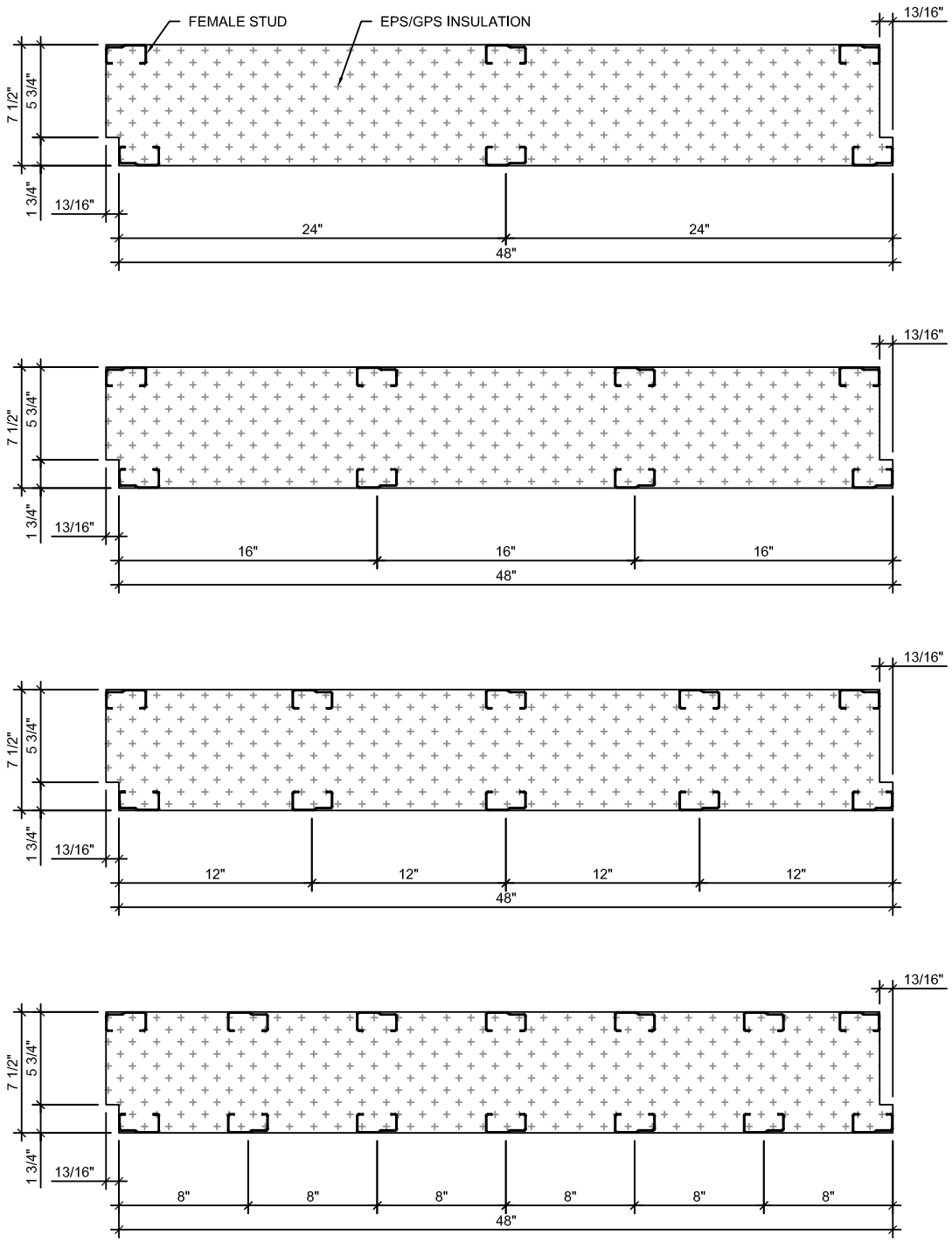
5 1/2" GS PANEL W
O/C STUD SPACING OPTIONS

N.T.S.

101

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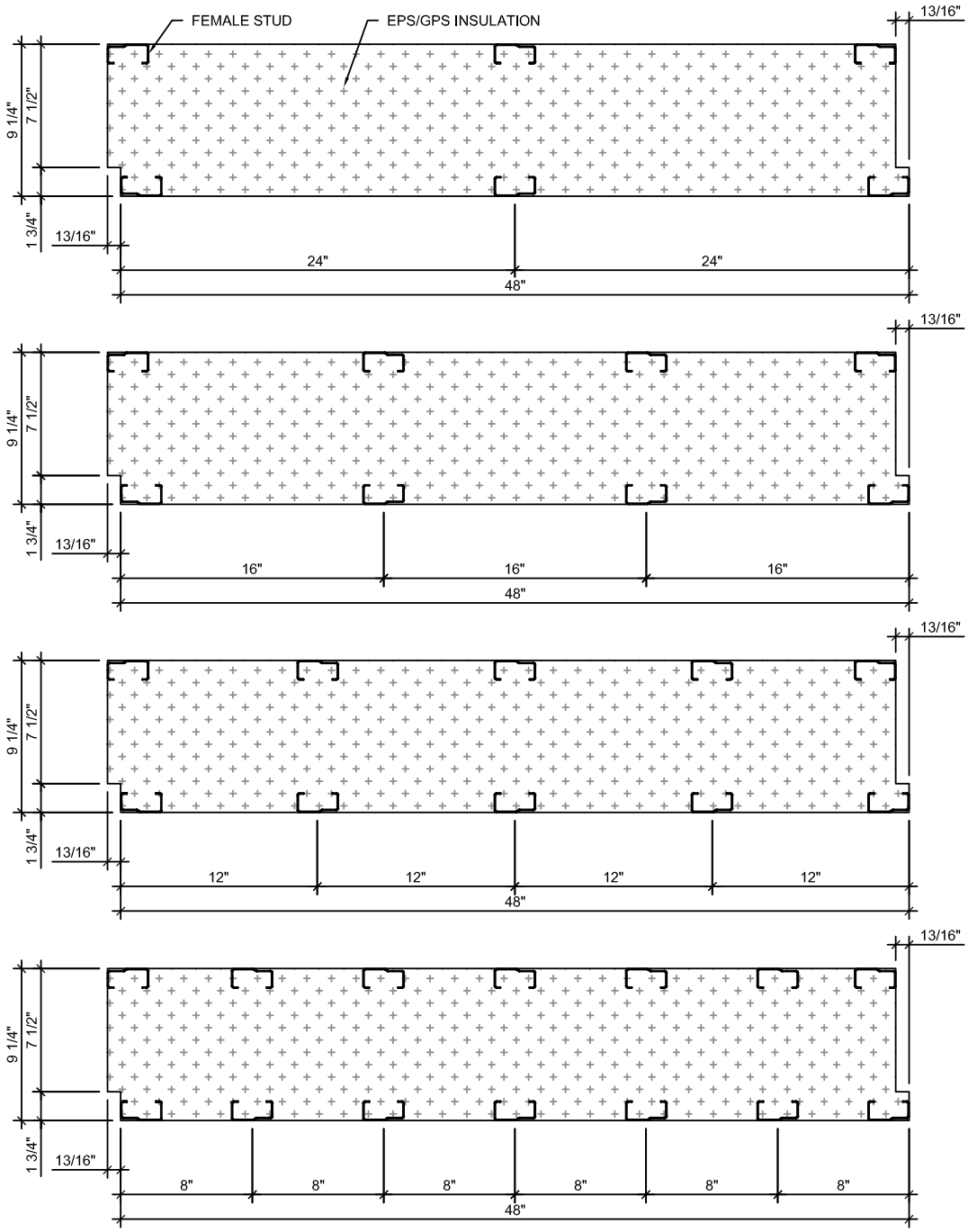
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7 1/2" GS PANEL W
O/C STUD SPACING OPTIONS
N.T.S.
102

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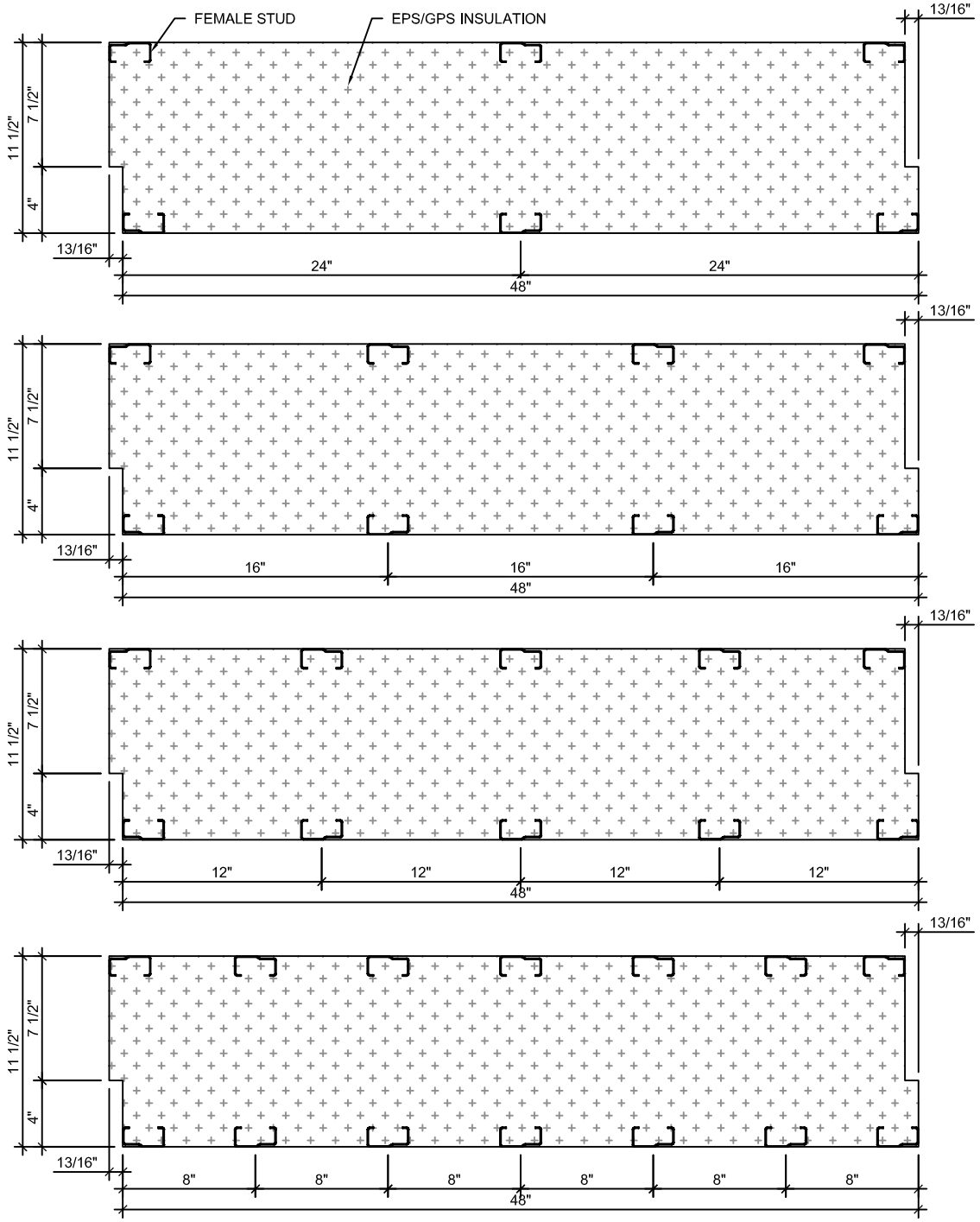
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9 1/4" GS PANEL W
O/C STUD SPACING OPTIONS
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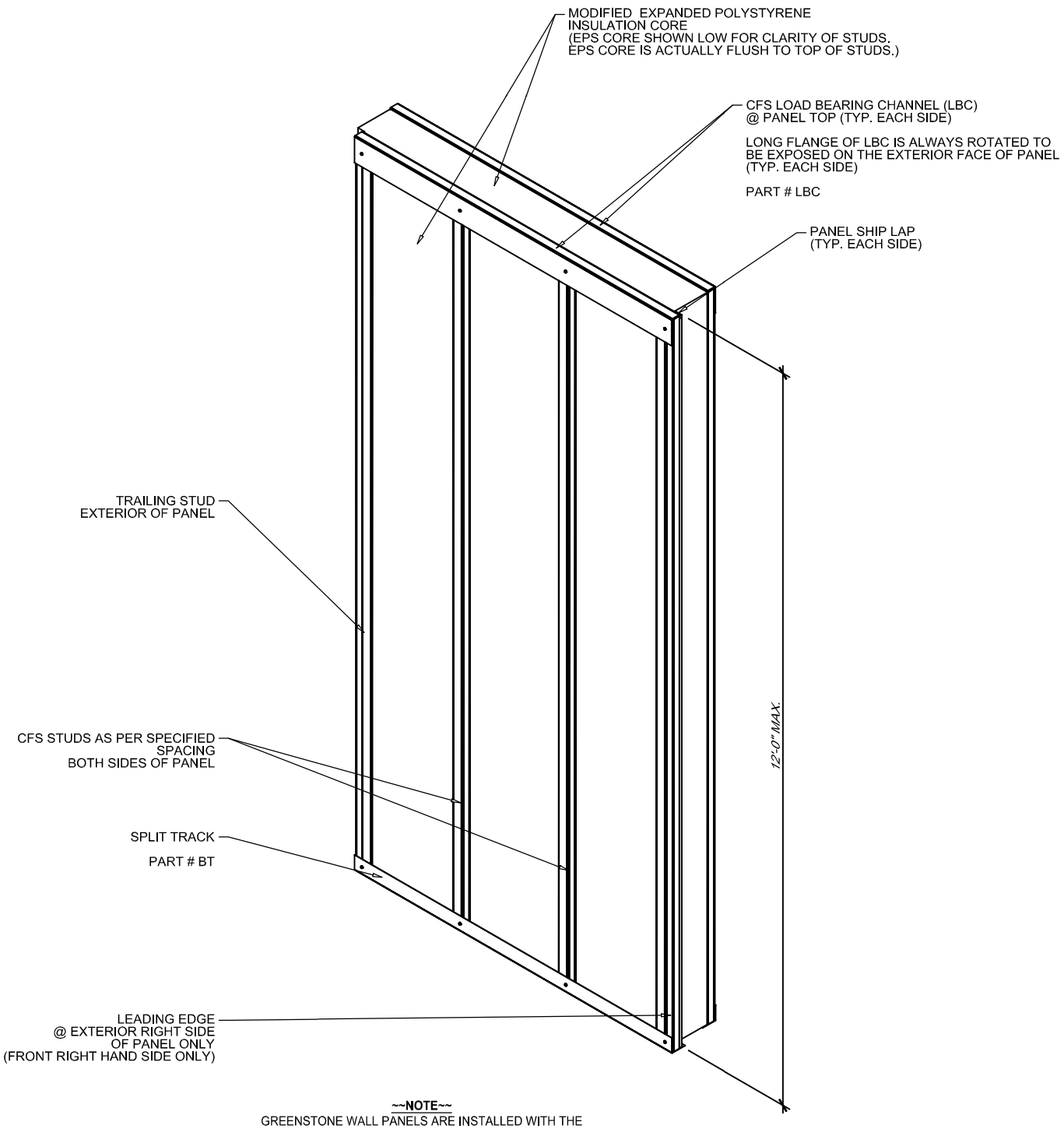
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11 1/2" GS PANEL W
O/C STUD SPACING OPTIONS
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104

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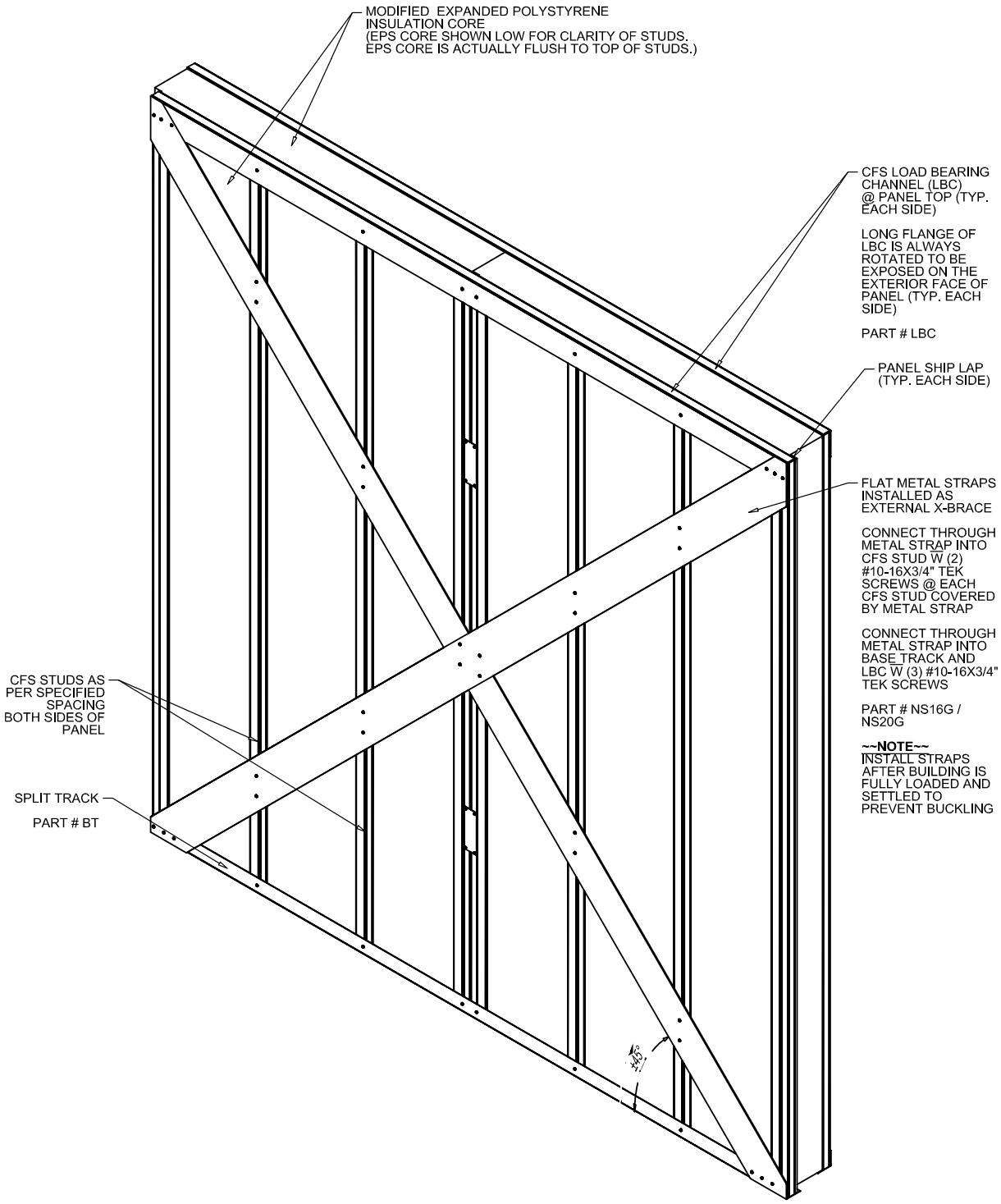
~~NOTE~~
GREENSTONE WALL PANELS ARE INSTALLED WITH THE
"FRONT OF PANEL" FACING THE OUTSIDE OF THE STRUCTURE
AND THE LEADING EDGE TO THE RIGHT

TYP. GS PANEL - INSTALLED (PERSPECTIVE)

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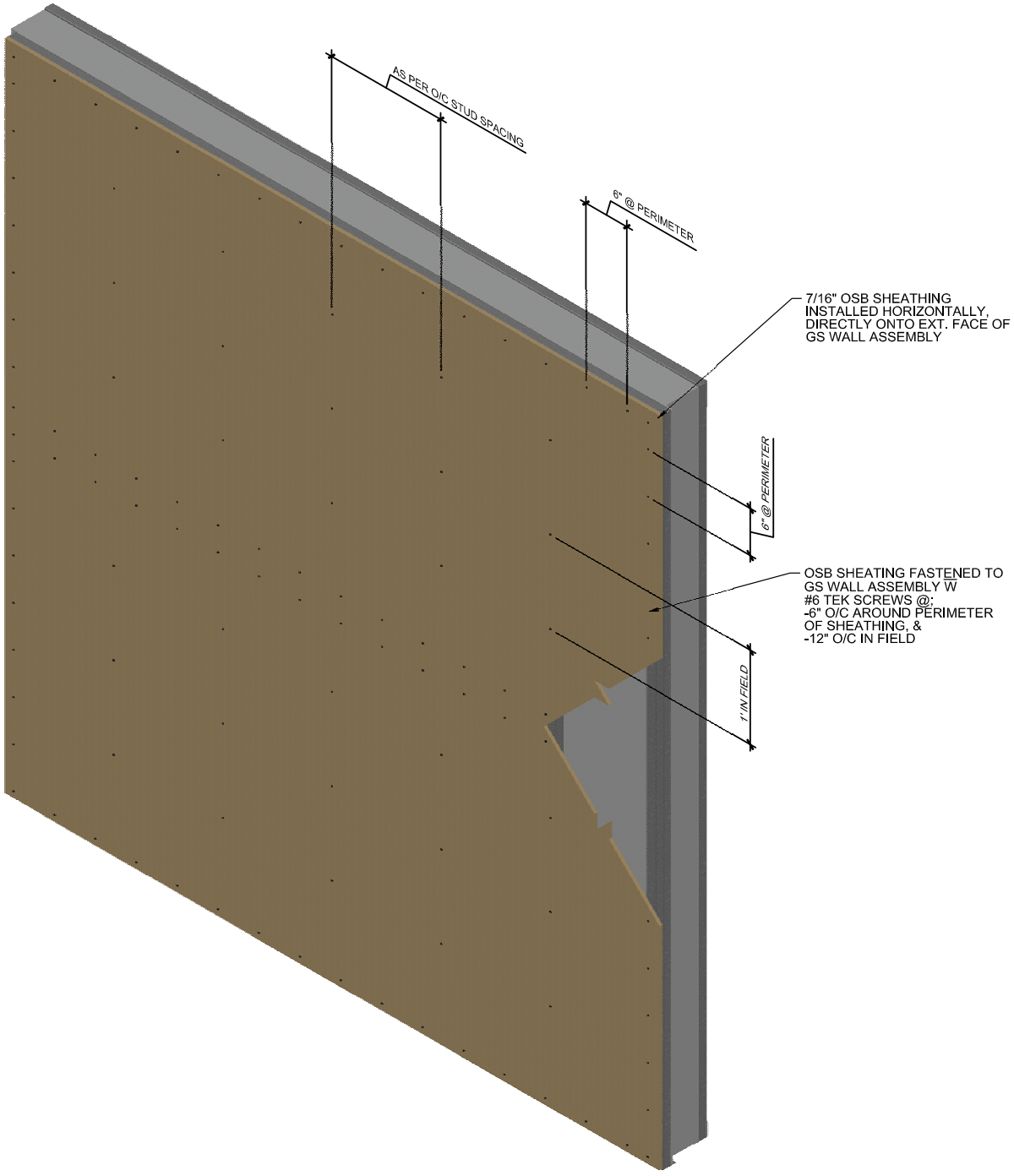
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GS WALL ASSEMBLY W
X-BRACING (PERSPECTIVE) 122
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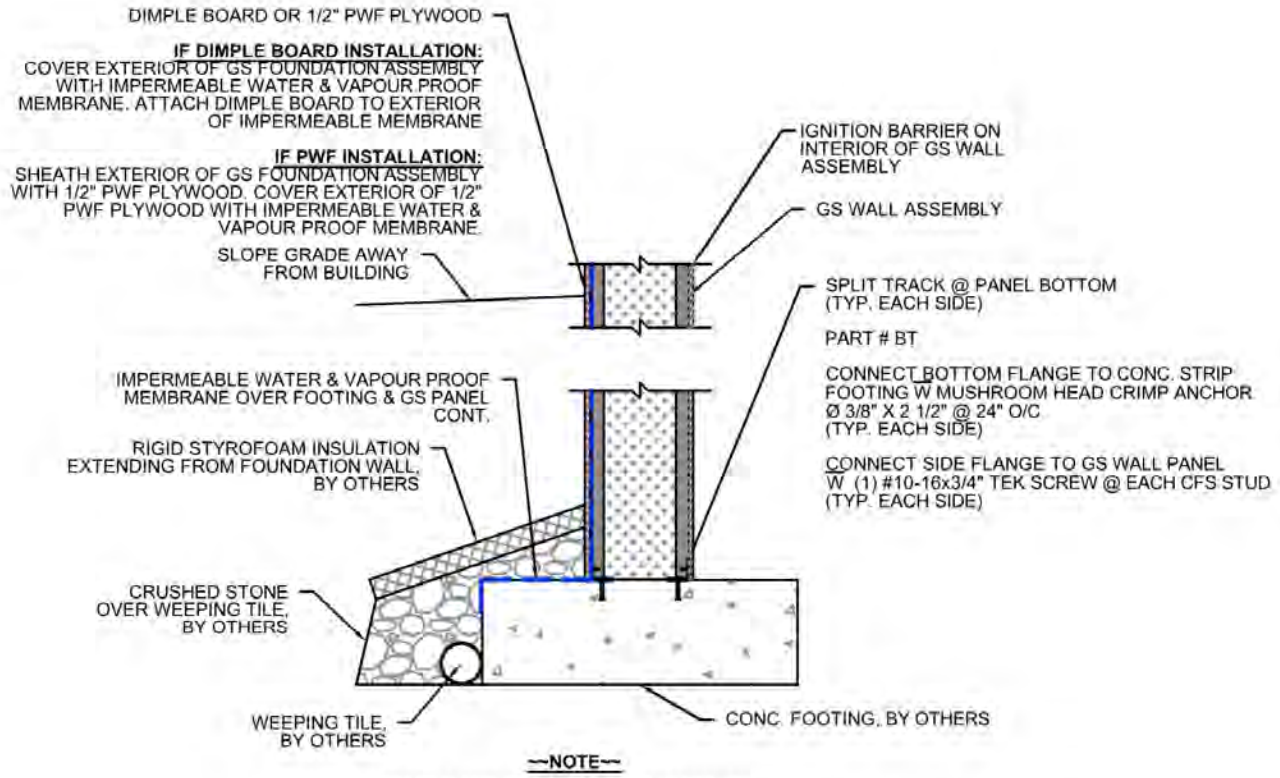
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GS WALL ASSEMBLY $\overline{W}$
SHEATHING (PERSPECTIVE) 123
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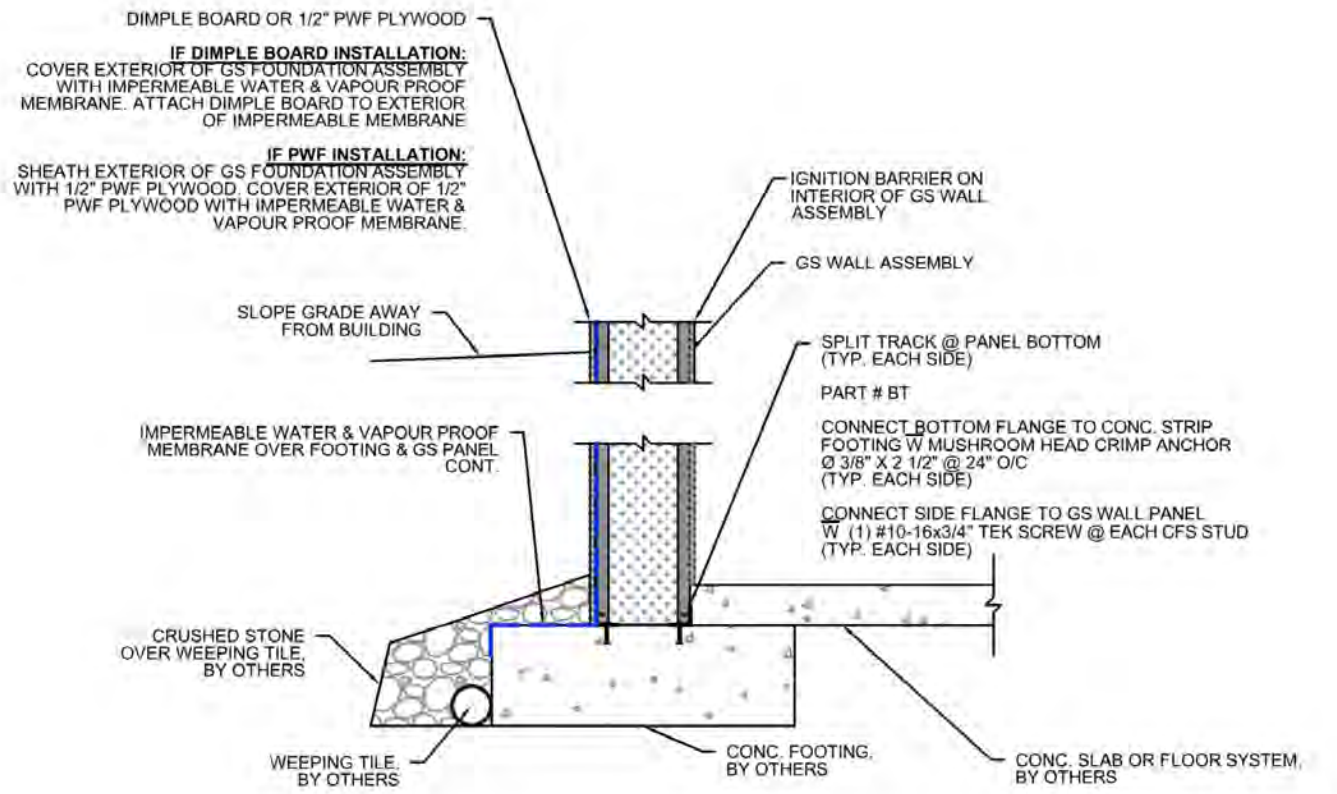
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2. PLEASE REFER TO GREENSTONE BUILDING PRODUCTS "STANDARD PANEL ASSEMBLY MANUAL" FOR CONSTRUCTION METHODS.
3. **INSTALL CONNECTION PLATES IMMEDIATELY ABOVE BASE TRACK.**
4. MITRE CUT TRACK @ CORNERS
5. FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C).
6. EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

GS FOUNDATION DETAIL (SHALLOW BURIAL 0' TO 4' DEPTH) [SECTION]

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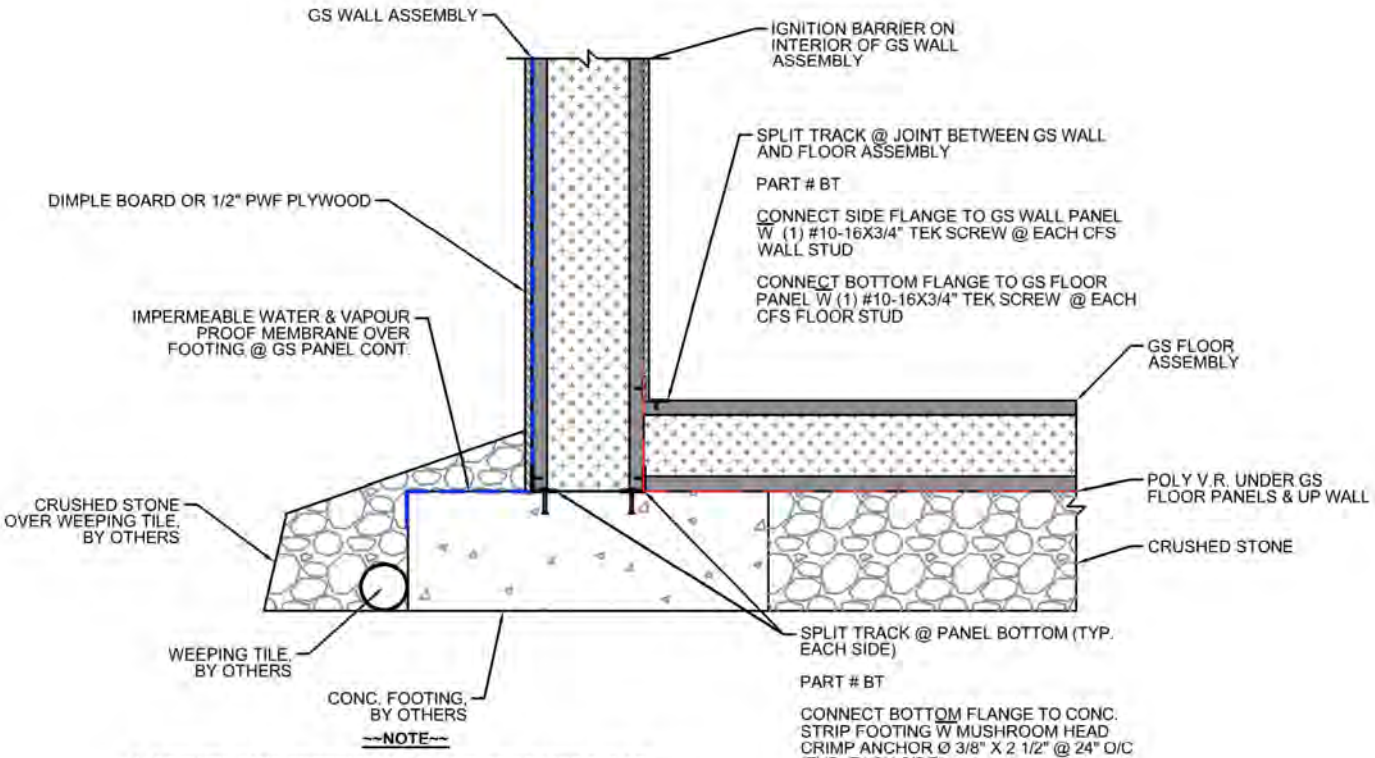
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2. PLEASE REFER TO GREENSTONE BUILDING PRODUCTS "STANDARD PANEL ASSEMBLY MANUAL" FOR CONSTRUCTION METHODS.
3. **INSTALL CONNECTION PLATES IMMEDIATELY ABOVE BASE TRACK.**
4. MITRE CUT TRACK @ CORNERS
5. FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C).
6. EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

GS FOUNDATION DETAIL (DEEP BURIAL 4'-1" TO 8' DEPTH) [SECTION]

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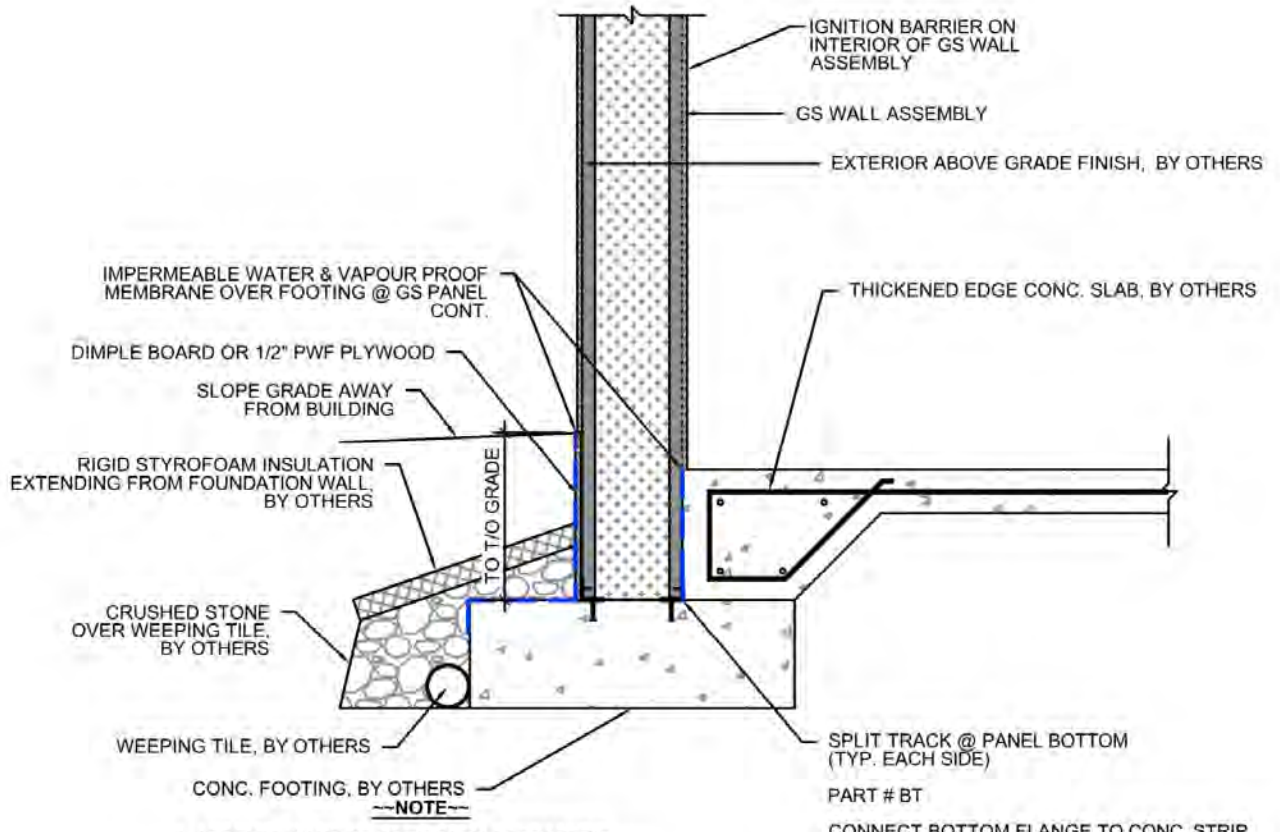
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2. PLEASE REFER TO GREENSTONE BUILDING PRODUCTS "STANDARD PANEL ASSEMBLY MANUAL" FOR CONSTRUCTION METHODS.
3. **INSTALL CONNECTION PLATES IMMEDIATELY ABOVE BASE TRACK.**
4. MITRE CUT TRACK @ CORNERS
5. FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C).
6. EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

GS FLOOR INSTALLATION ONTO CONC. FOOTING (SECTION)

N.T.S. 203

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~~NOTE~~

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2. PLEASE REFER TO GREENSTONE BUILDING PRODUCTS "STANDARD PANEL ASSEMBLY MANUAL" FOR CONSTRUCTION METHODS.

3. **INSTALL CONNECTION PLATES IMMEDIATELY ABOVE BASE TRACK.**

4. MITRE CUT TRACK @ CORNERS

5. FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C).

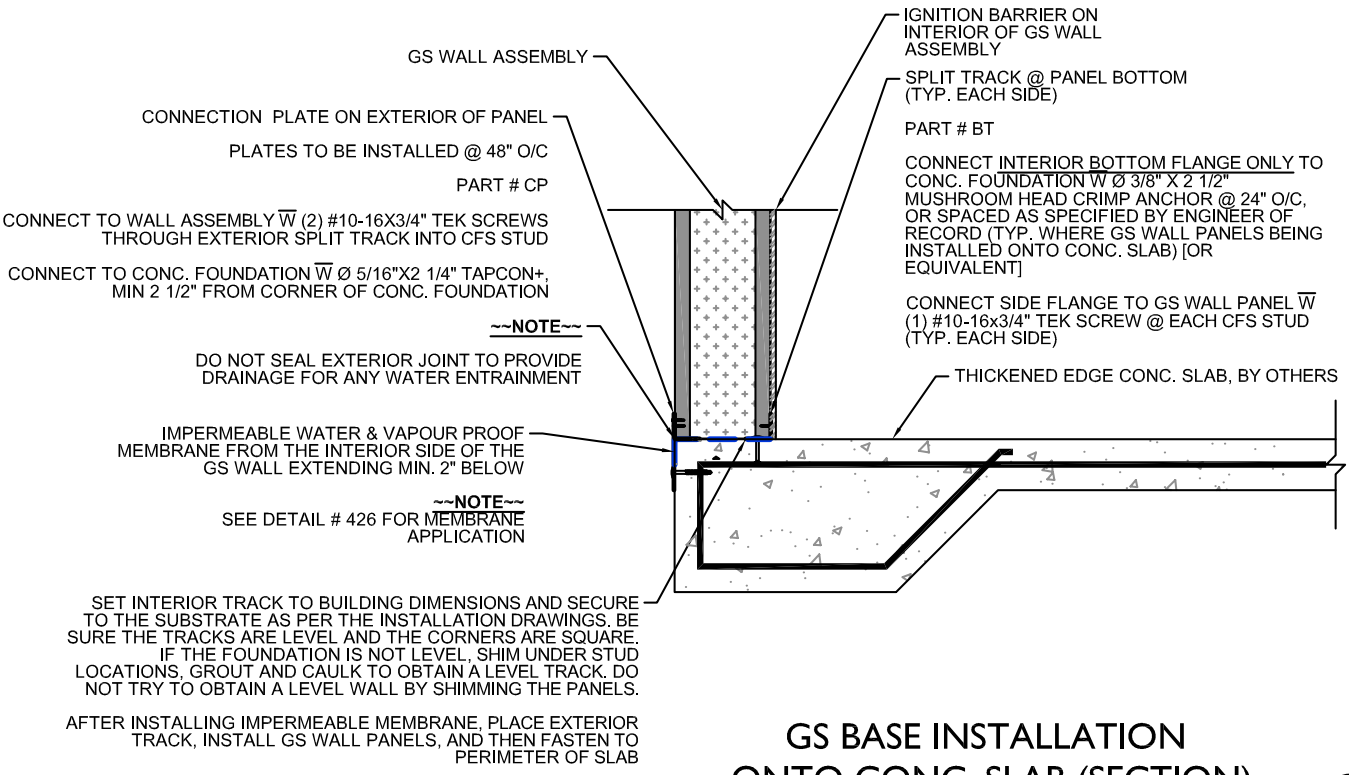
6. EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

GS FOUND. WALL & THICKENED EDGE SLAB (SECTION)

N.T.S. 204

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GS BASE INSTALLATION ONTO CONC. SLAB (SECTION)

N.T.S.

205

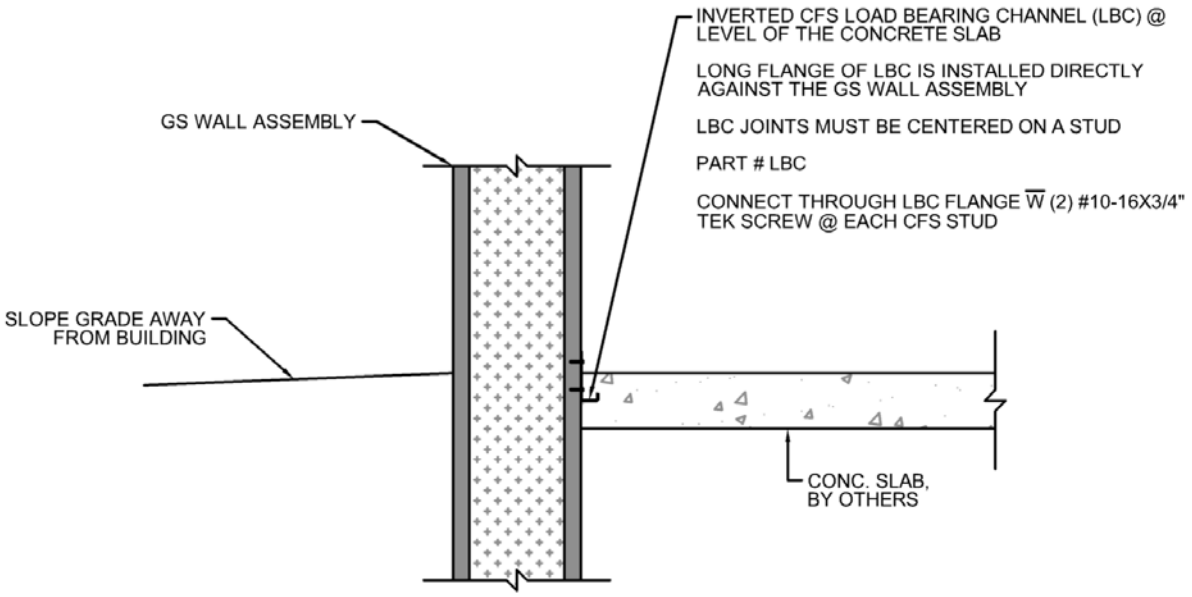
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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GS WALL TO CONCRETE SLAB CONNECTION WITH LBC (SECTION)

N.T.S. 206

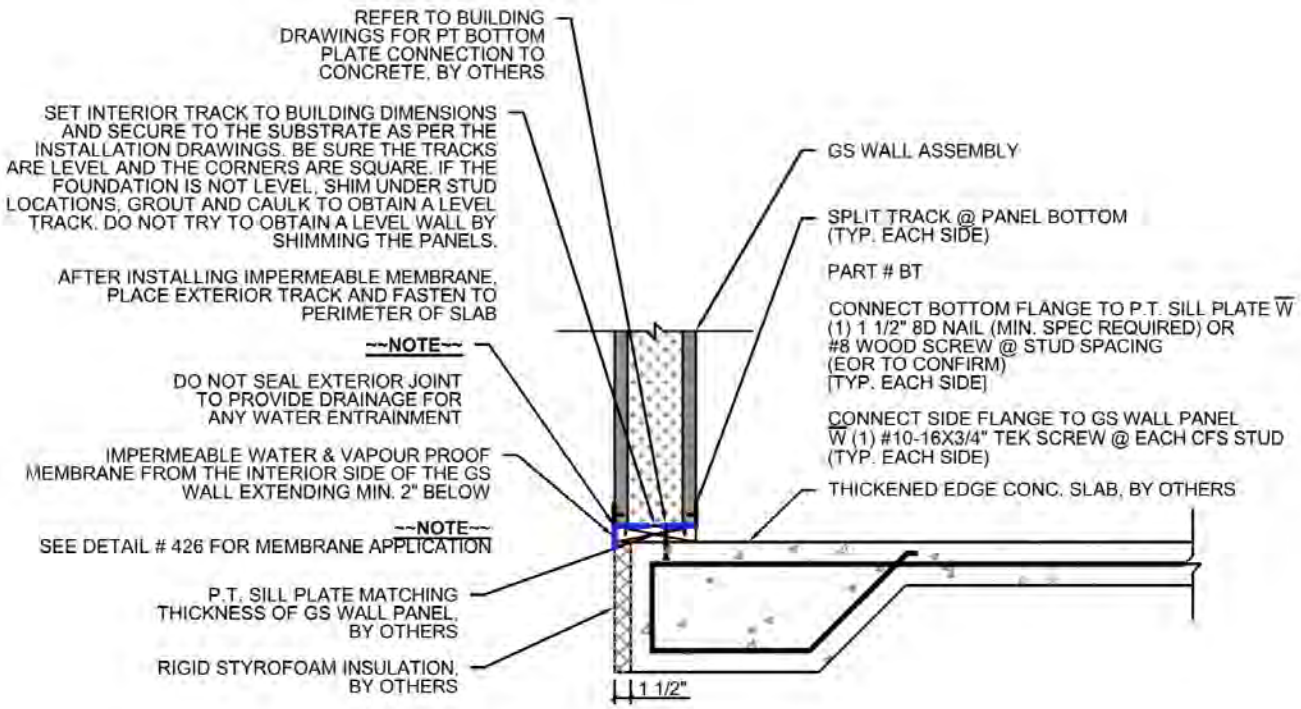
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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GS SPLIT TRACK ON PT PLATE INSTALLATION ONTO CONC. SLAB (SECTION)

N.T.S. 207

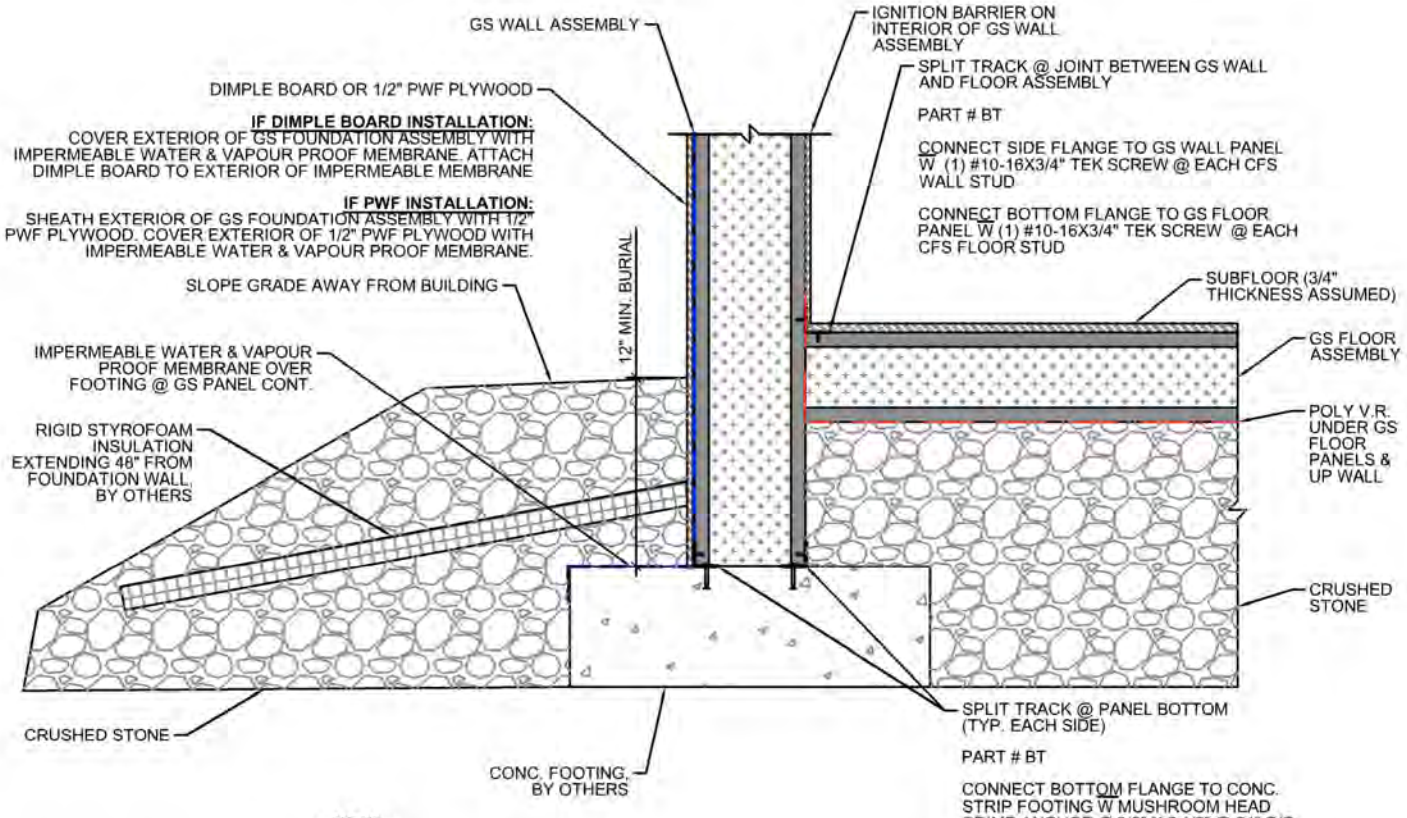
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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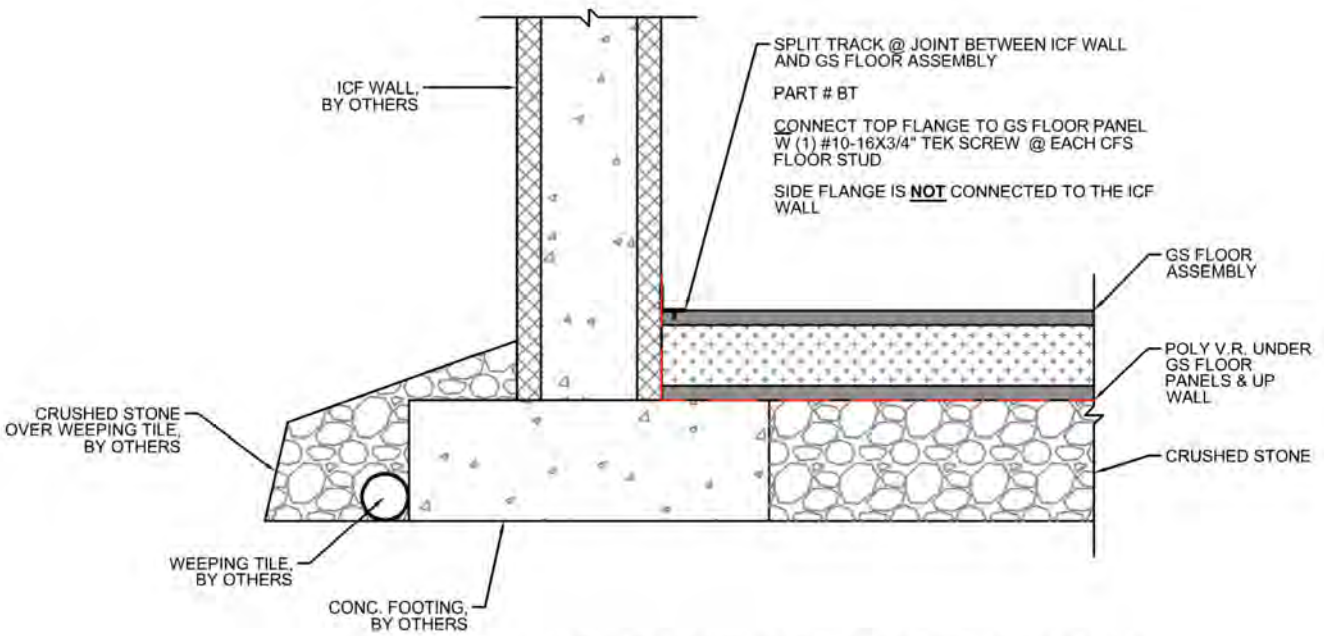
GS FOUNDATION AND GS FLOOR ABOVE CONC. FOOTING (SECTION)

N.T.S.

208

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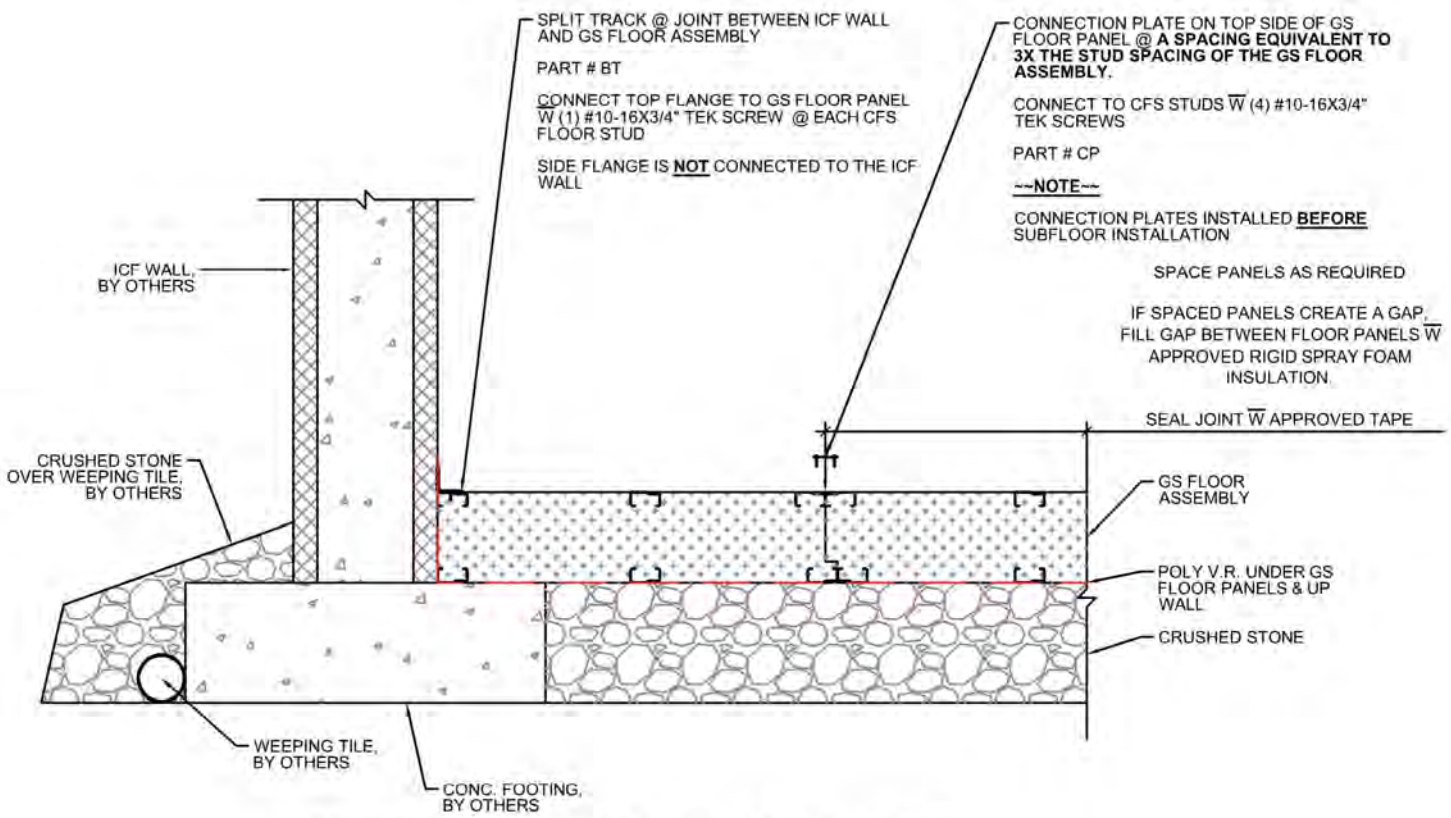


GS FLOOR INSTALLATION ONTO CONC. FOOTING W ICF FND (SECTION)

N.T.S. 210A

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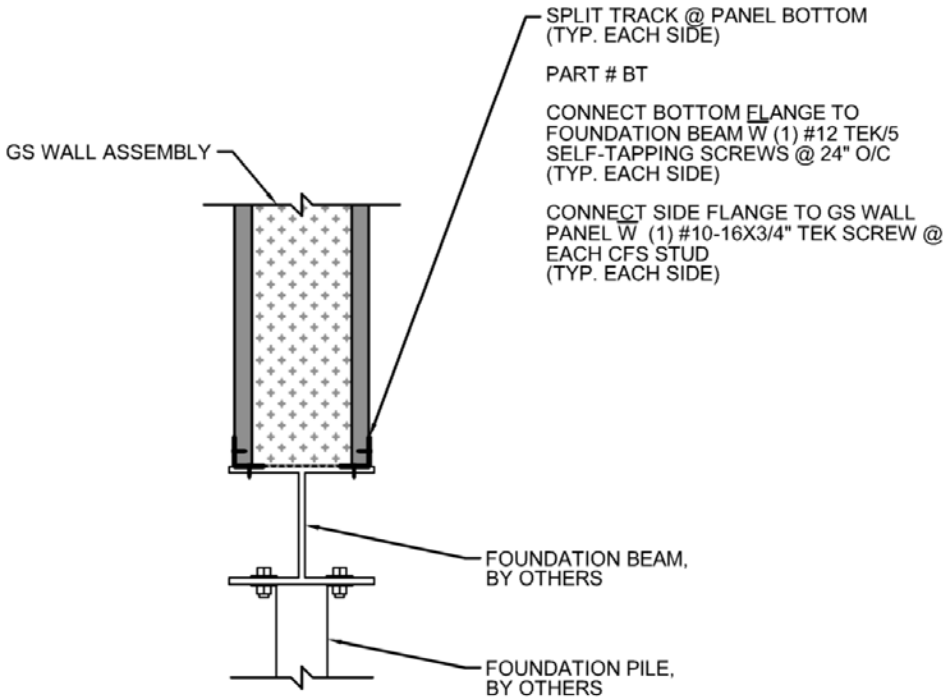


GS FLOOR INSTALLATION ONTO CONC. FOOTING W ICF FND (SECTION)

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GS WALL ASSEMBLY ONTO FOUNDATION BEAM (@ EXT. WALL) [SECTION]

N.T.S. 212

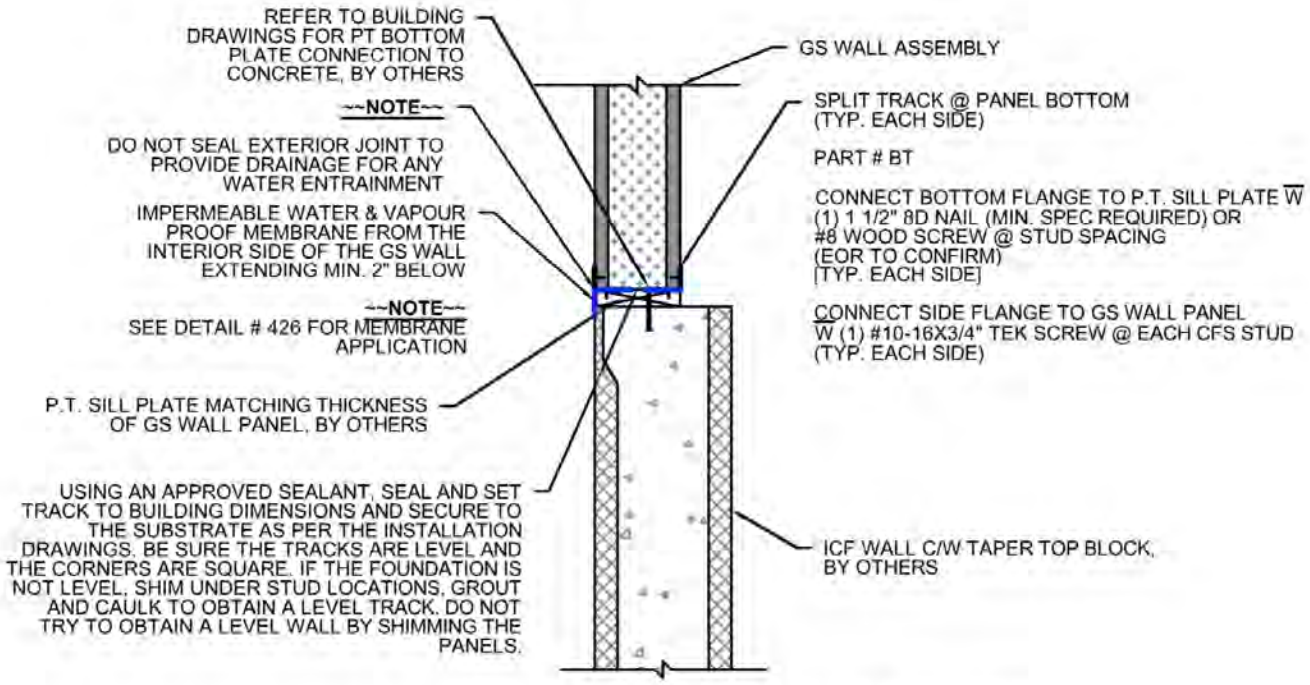
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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GS SPLIT TRACK ON PT PLATE INSTALLATION ONTO ICF (SECTION) 222

N.T.S.

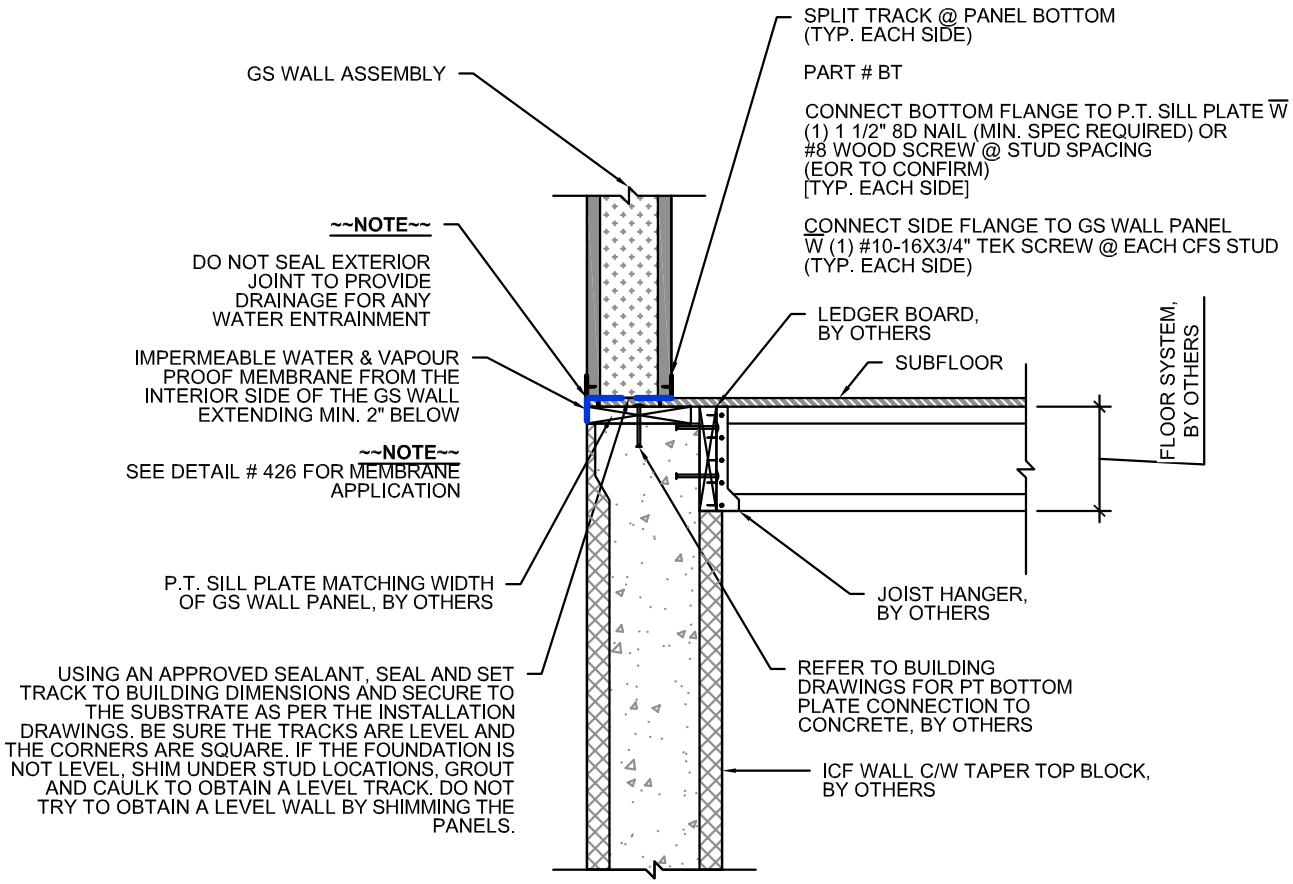
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GS SPLIT TRACK ON PT PLATE INSTALLATION ONTO ICF (SECTION) 223

N.T.S.

~~NOTE~~

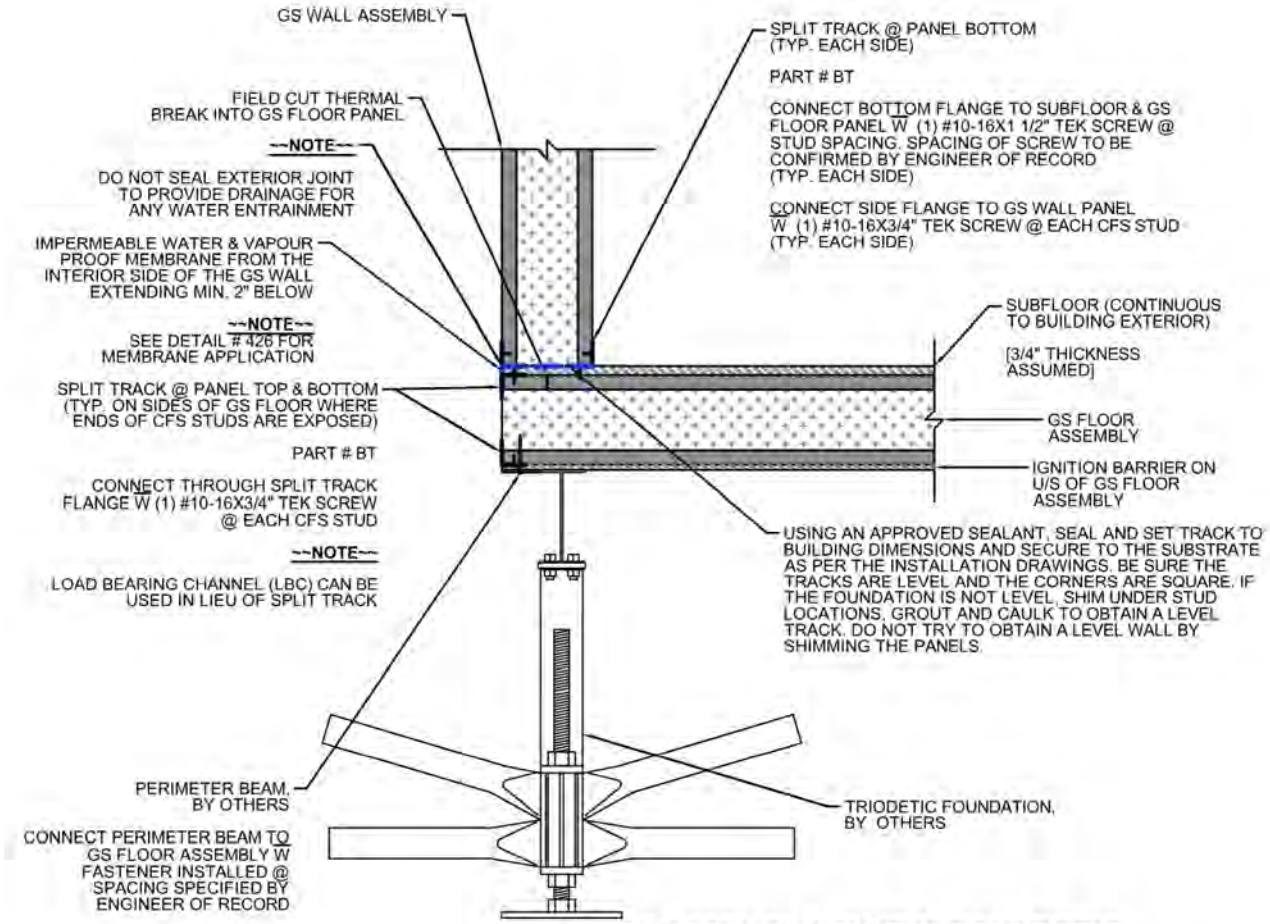
FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

EOR TO CONFIRM CONNECTORS AND FASTENERS MEET DESIGN INTENT AND CAN TRANSFER APPLIED LOADS AS REQUIRED.

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GS ASSEMBLY ONTO TRIODETIC FOUNDATION (@ EXT. WALL W CONTINUOUS SUBFLOOR) [SECTION] 241

N.T.S.

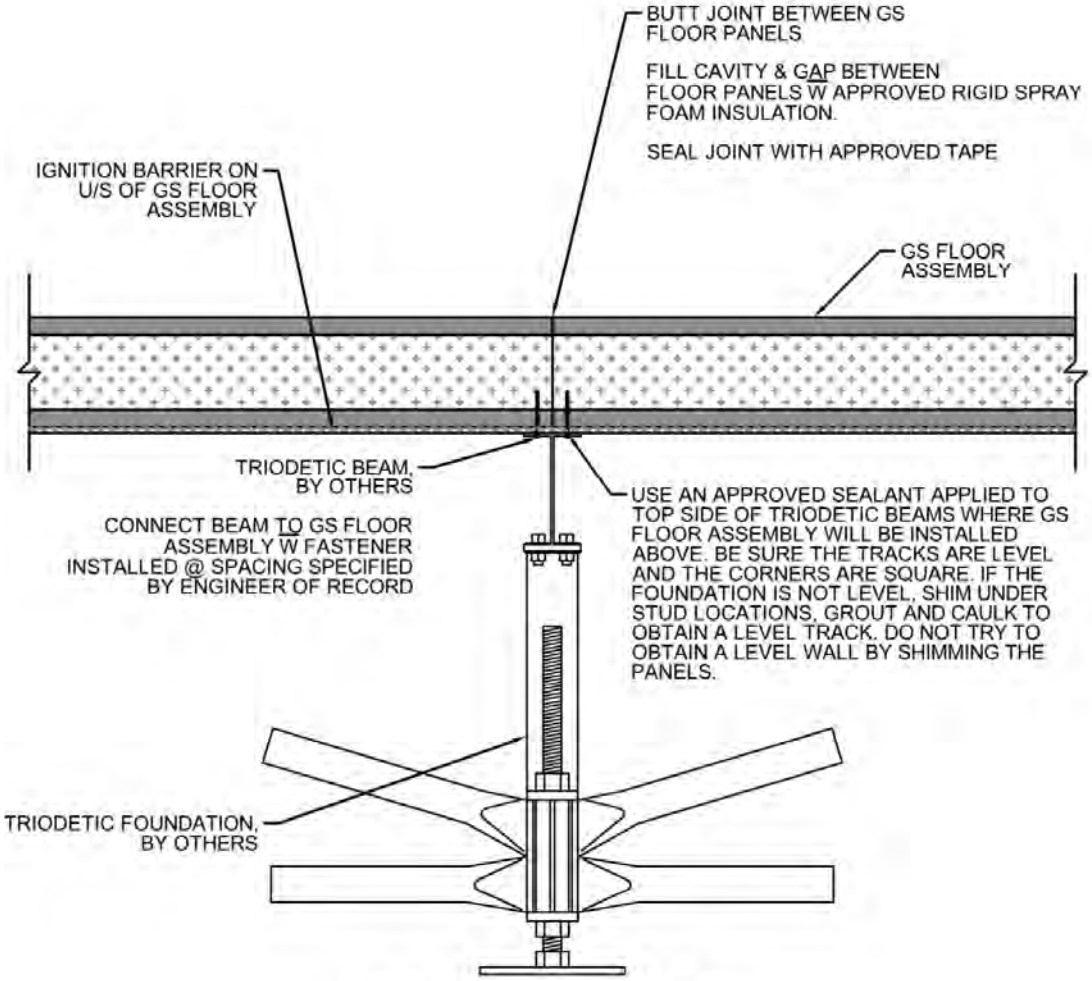
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GS ASSEMBLY ONTO TRIODETIC FOUNDATION (FLOOR BUTT JOINT) [SECTION]

N.T.S. 242

~~NOTE~~

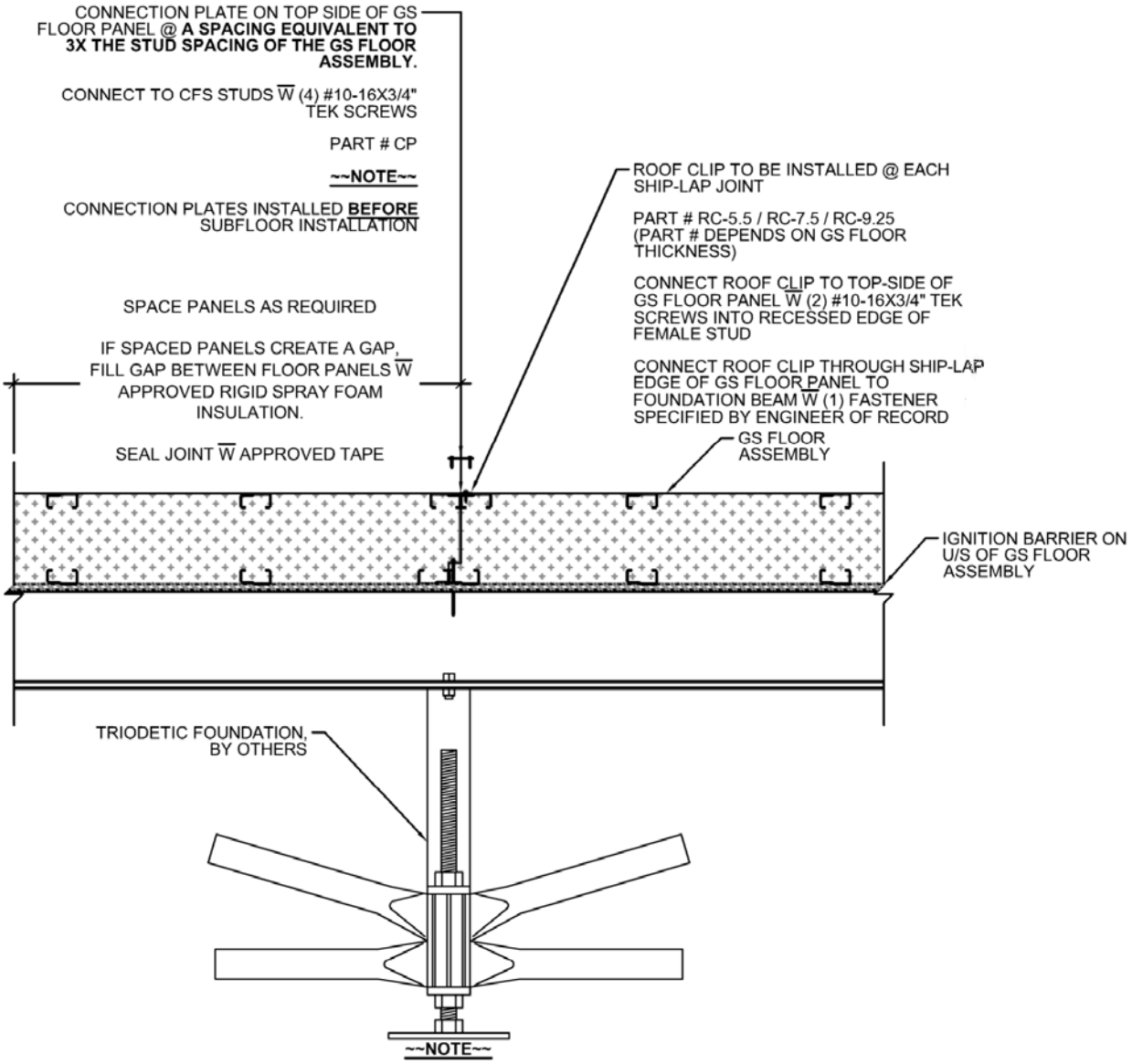
WHEN INSTALLING SUBFLOOR ON TOP OF GS FLOOR PANEL ASSEMBLY, STAGGER THE GS FLOOR PANEL JOINTS AND THE SUBFLOOR JOINTS

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

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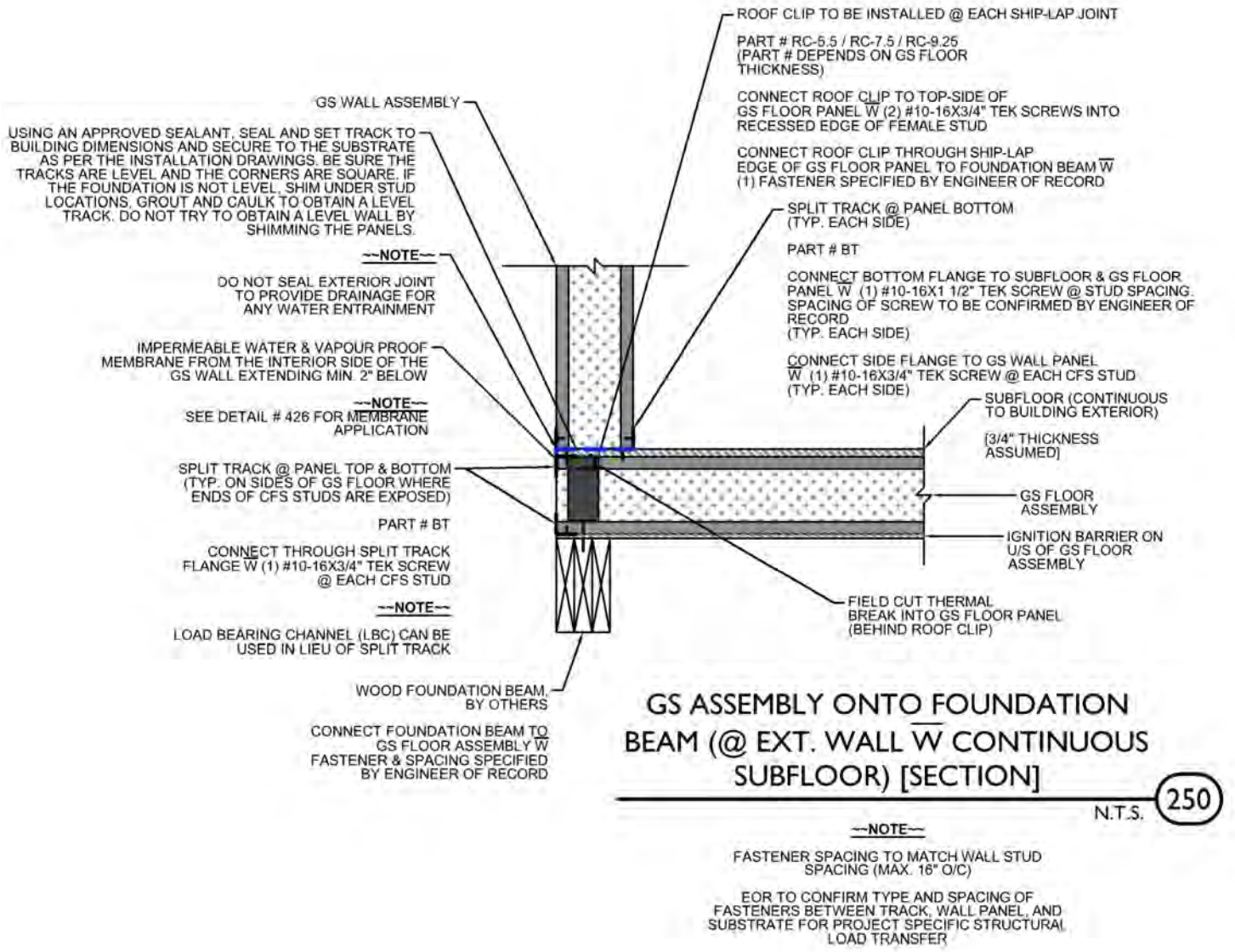


GS ASSEMBLY ONTO TRIODETIC FOUNDATION (SHIP-LAP JOINT) [SECTION]

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GS ASSEMBLY ONTO FOUNDATION BEAM (@ EXT. WALL W CONTINUOUS SUBFLOOR) [SECTION]

N.T.S. 250

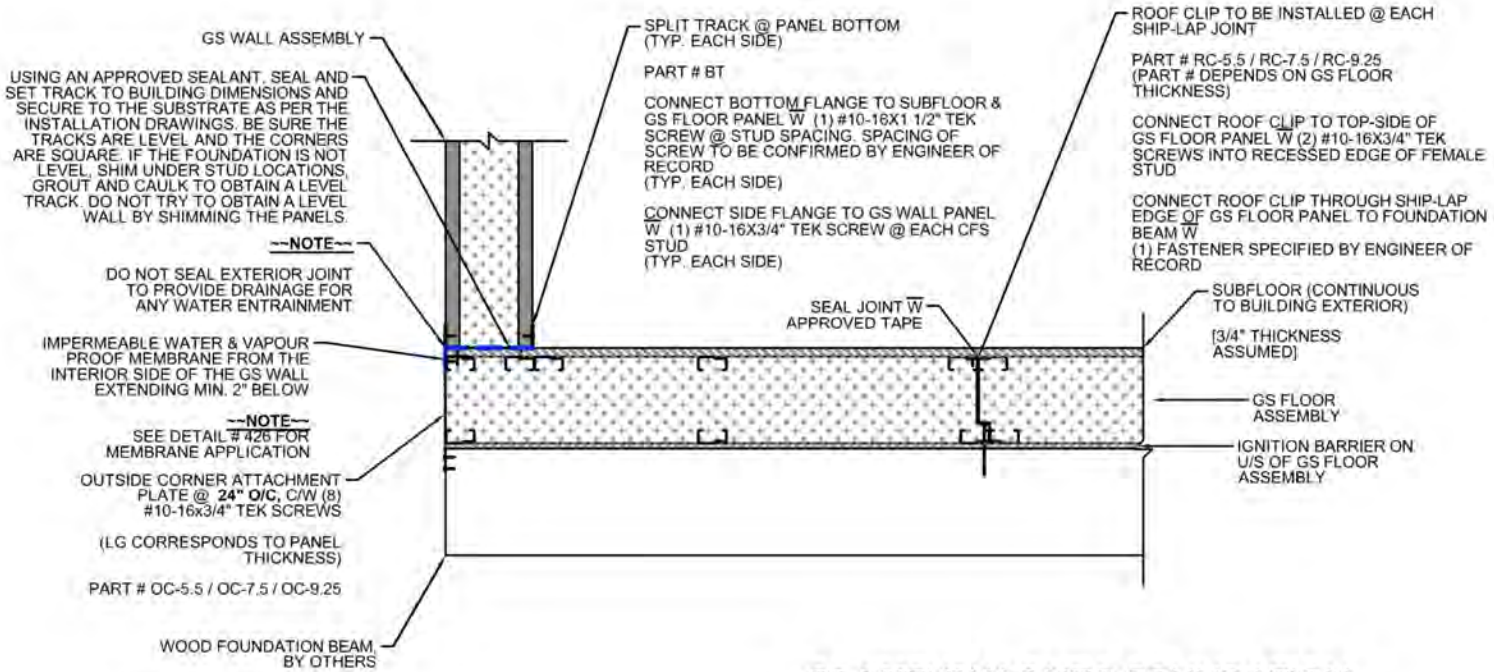
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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GS ASSEMBLY ONTO FOUNDATION BEAM (@ FLOOR PANEL BREAK) [SECTION]

N.T.S. 251

~~NOTE~~

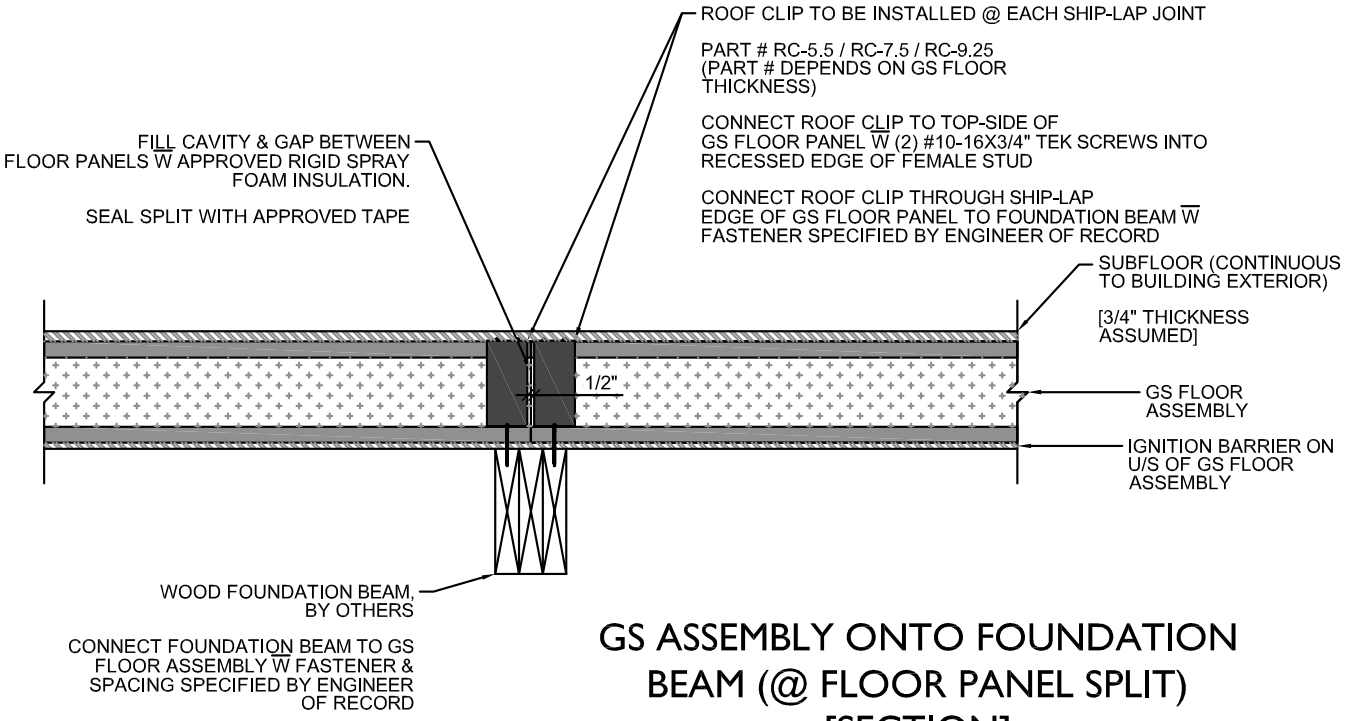
WHEN INSTALLING SUBFLOOR ON TOP OF GS FLOOR PANEL ASSEMBLY, STAGGER THE GS FLOOR PANEL JOINTS AND THE SUBFLOOR JOINTS

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

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GS ASSEMBLY ONTO FOUNDATION BEAM (@ FLOOR PANEL SPLIT) [SECTION]

N.T.S. 252

~~NOTE~~

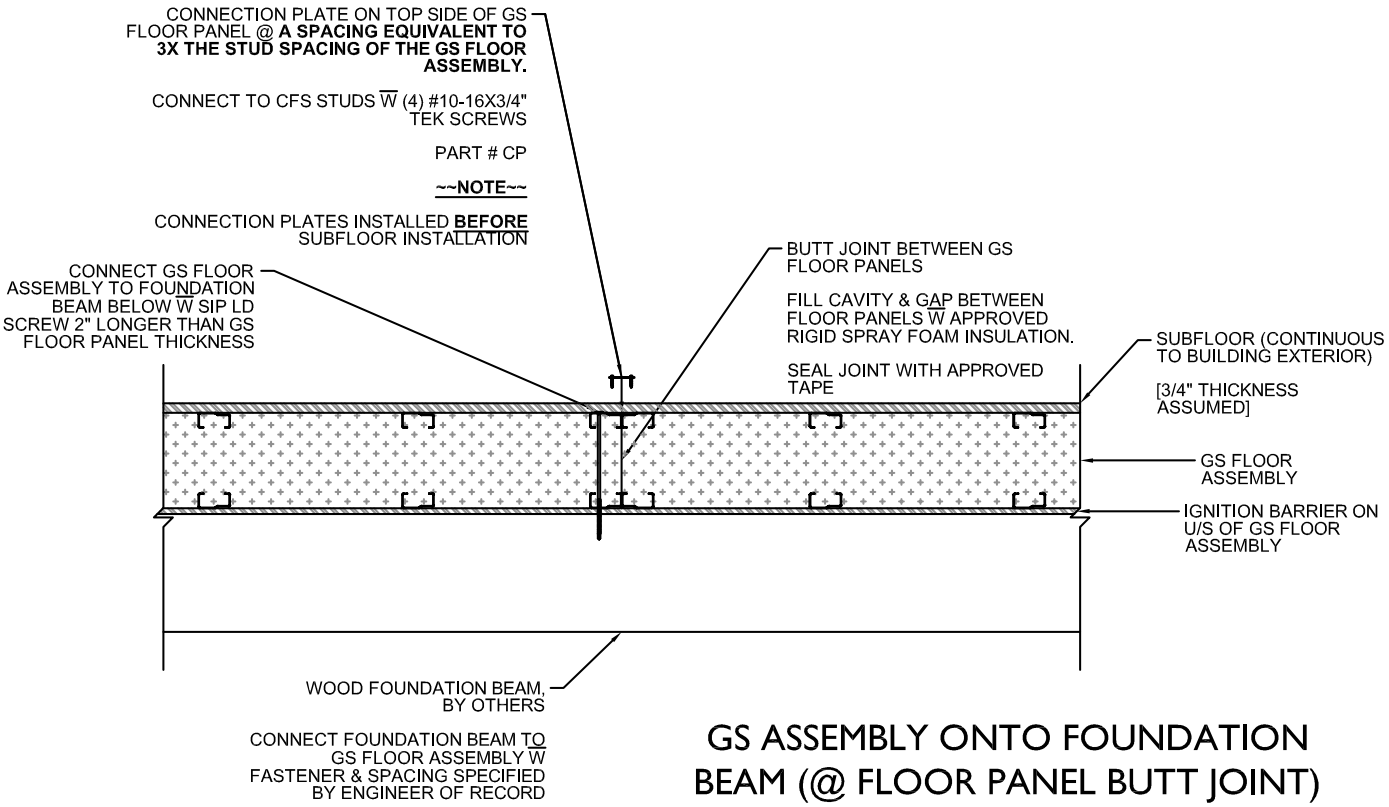
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GS ASSEMBLY ONTO FOUNDATION BEAM (@ FLOOR PANEL BUTT JOINT) [SECTION]

N.T.S. 253

~~NOTE~~

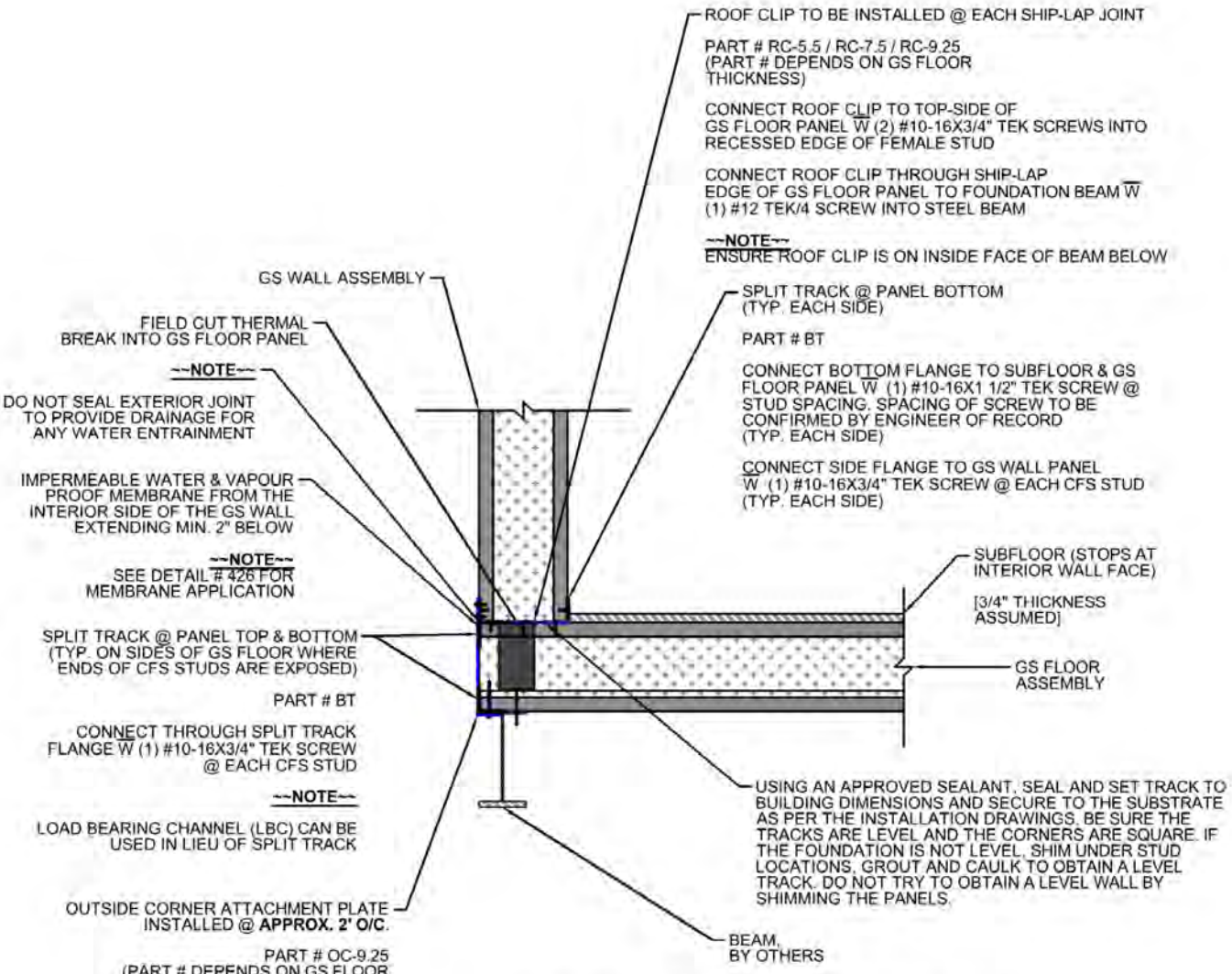
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GS FLOOR PANEL CONNECTION TO STEEL BEAM [SECTION]

N.T.S. 255

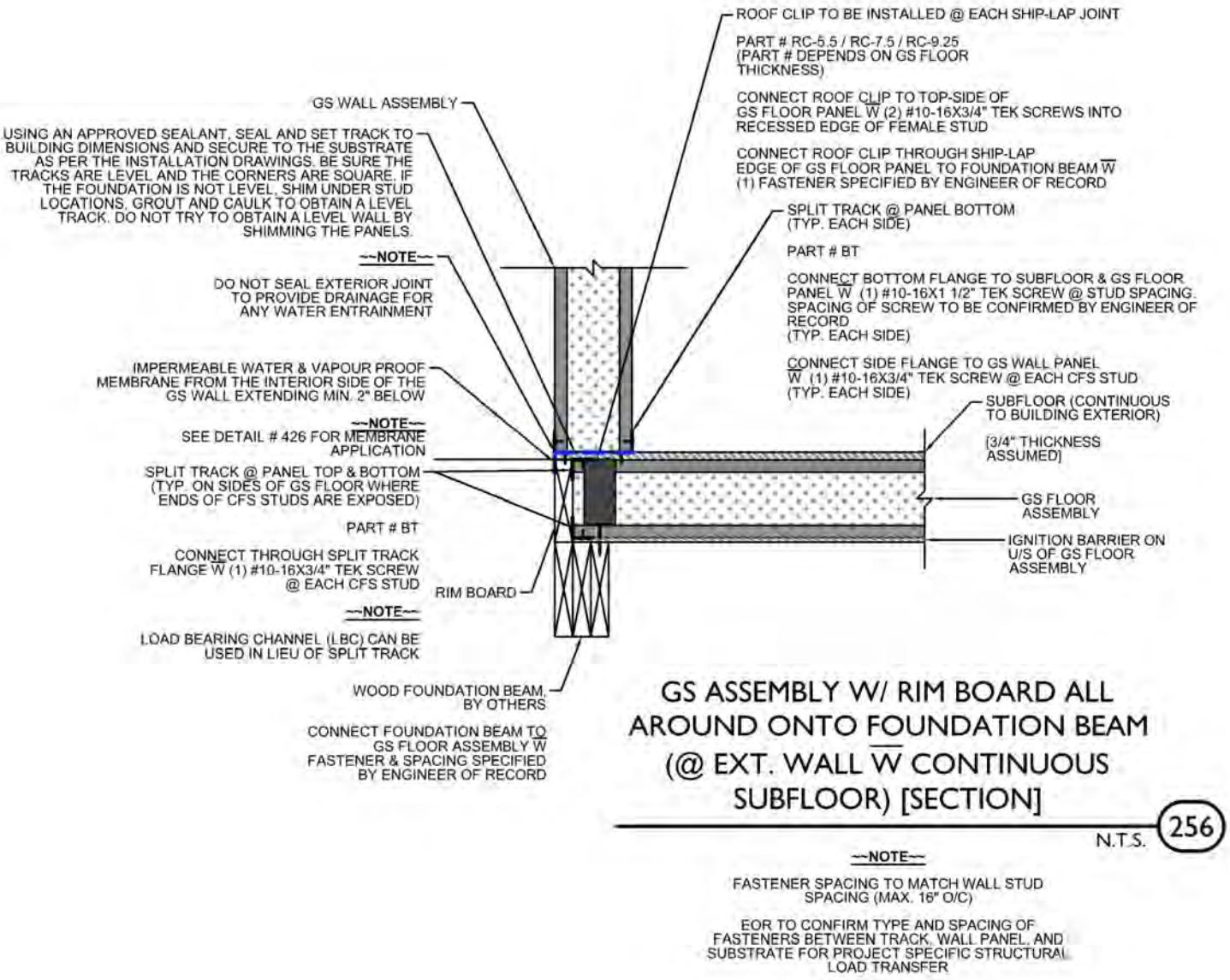
~~NOTE~~

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GS ASSEMBLY W/ RIM BOARD ALL AROUND ONTO FOUNDATION BEAM (@ EXT. WALL W CONTINUOUS SUBFLOOR) [SECTION]

N.T.S. 256

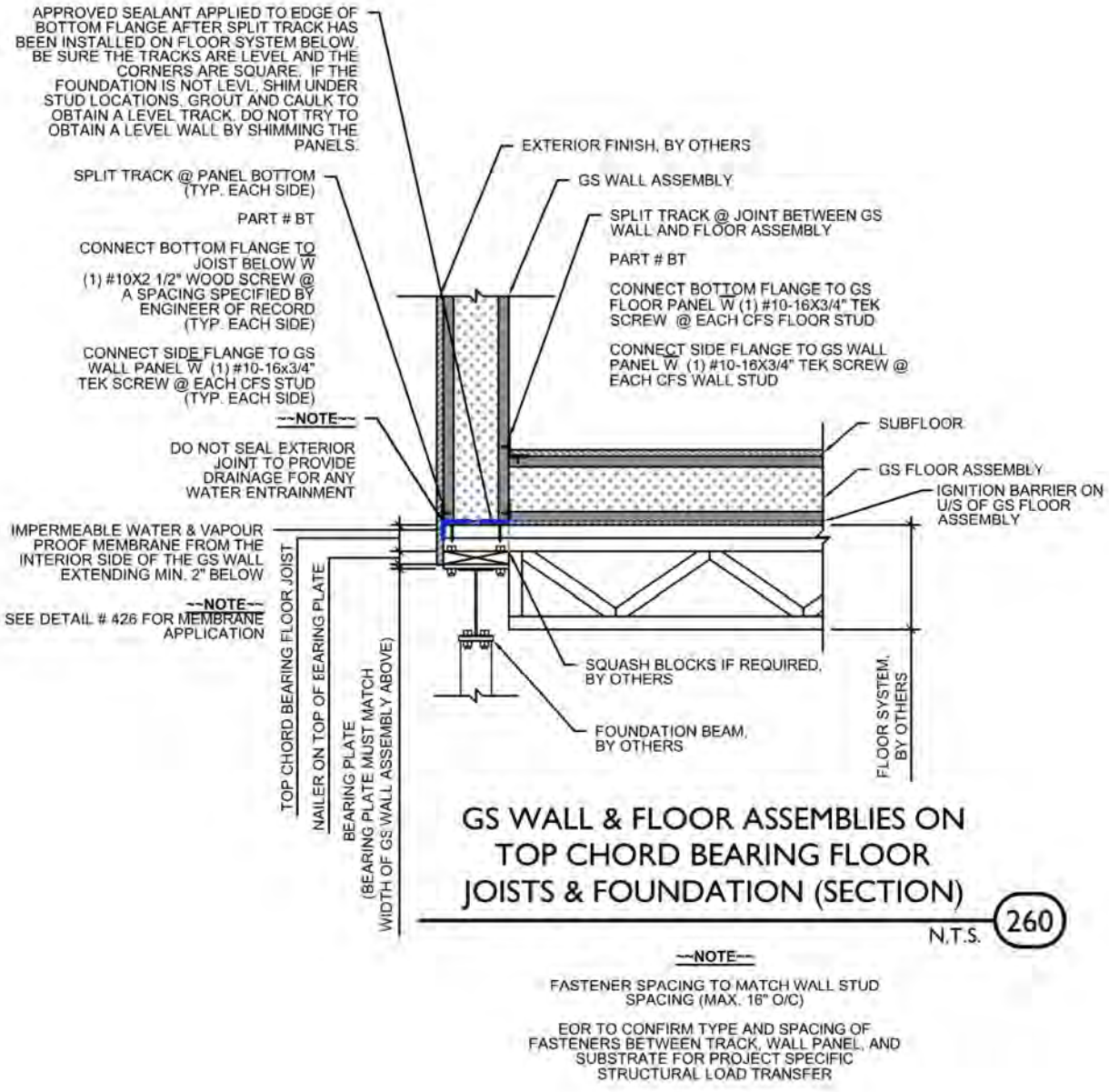
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GS WALL & FLOOR ASSEMBLIES ON TOP CHORD BEARING FLOOR JOISTS & FOUNDATION (SECTION)

N.T.S. 260

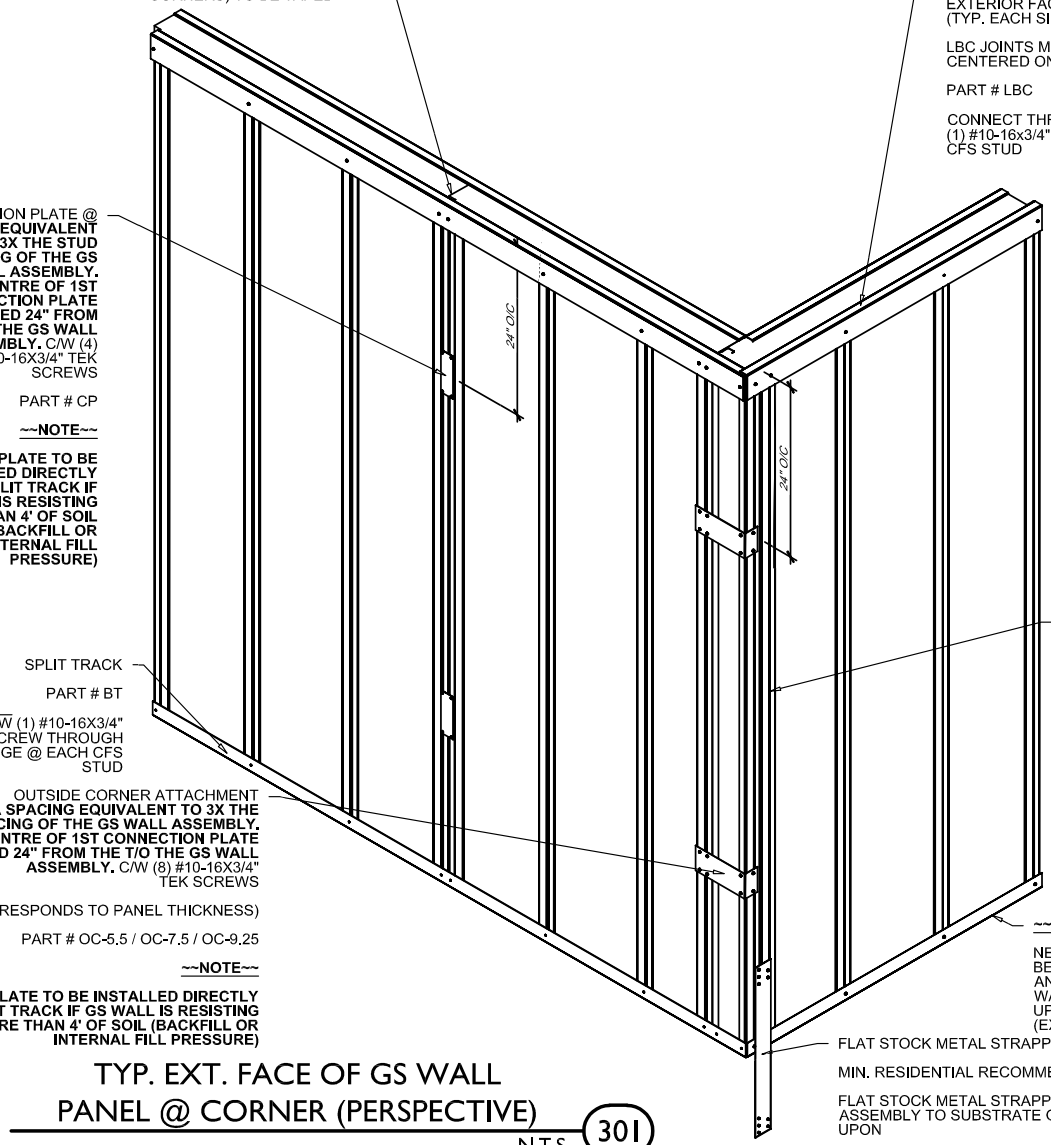
~~NOTE~~

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TYP. EXT. FACE OF GS WALL PANEL @ CORNER (PERSPECTIVE)

N.T.S.

301

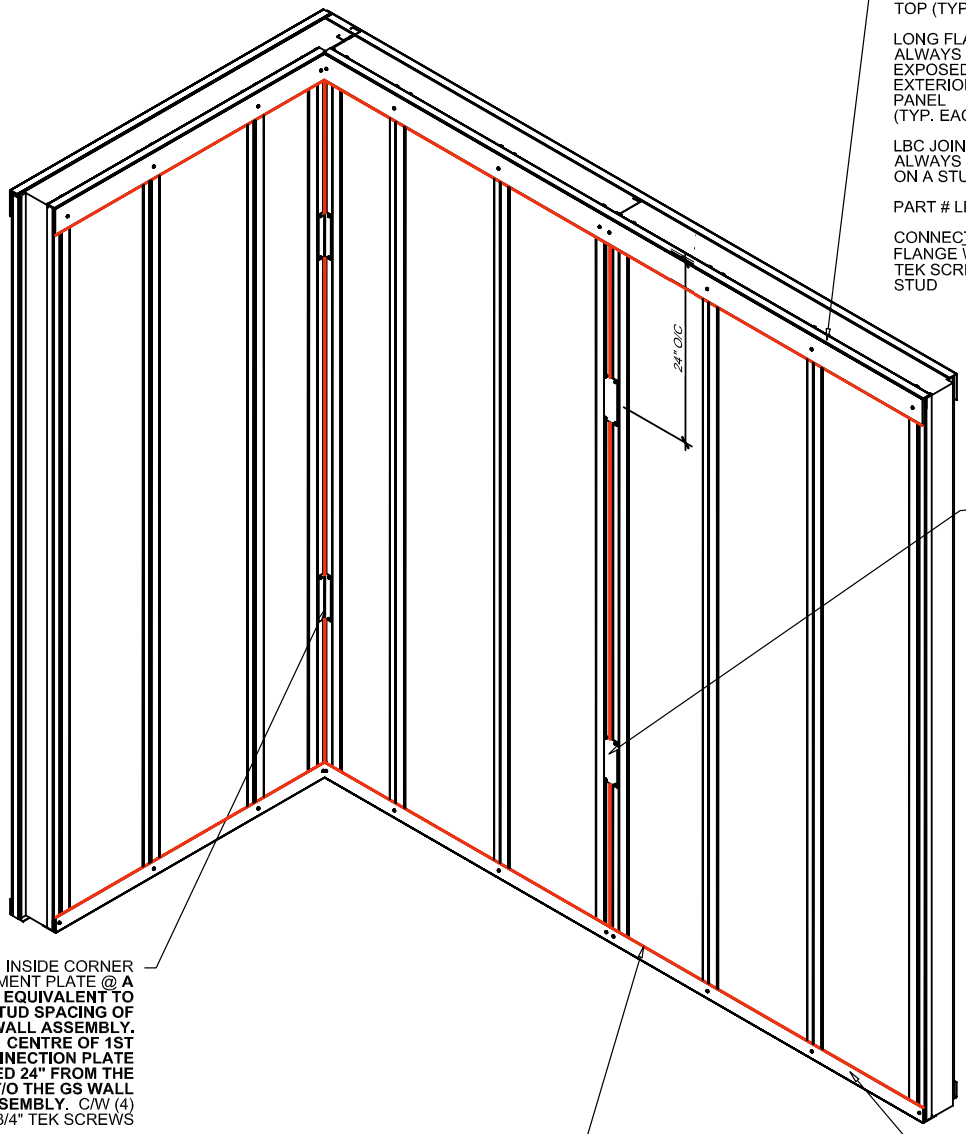
~~NOTE~~

1. GREENSTONE WALL PANELS ARE INSTALLED WITH THE "FRONT OF PANEL" FACING THE OUTSIDE OF THE STRUCTURE.

2. **IF GS WALLS ARE RESISTING MORE THAN 4' OF SOIL (BACKFILL OR INTERNAL FILL PRESSURE), ALL CONNECTION PLATES MUST BE INSTALLED @ 24" O/C**

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CFS LOAD BEARING CHANNEL (LBC) @ PANEL TOP (TYP. EACH SIDE)

LONG FLANGE OF LBC IS ALWAYS ROTATED TO BE EXPOSED ON THE EXTERIOR FACE OF PANEL (TYP. EACH SIDE)

LBC JOINTS MUST ALWAYS BE CENTERED ON A STUD

PART # LBC

CONNECT THROUGH LBC FLANGE W (1) #10-16x3/4" TEK SCREW @ EACH CFS STUD

CONNECTION PLATE @ **A SPACING EQUIVALENT TO 3X THE STUD SPACING OF THE GS WALL ASSEMBLY. CENTRE OF 1ST CONNECTION PLATE INSTALLED 24" FROM THE T/O THE GS WALL ASSEMBLY.** C/W (4) #10-16X3/4" TEK SCREWS

PART # CP

~~NOTE~~

EXTRA PLATE TO BE INSTALLED DIRECTLY ABOVE SPLIT TRACK IF GS WALL IS RESISTING MORE THAN 4' OF SOIL (BACKFILL OR INTERNAL FILL PRESSURE)

INSIDE CORNER ATTACHMENT PLATE @ **A SPACING EQUIVALENT TO 3X THE STUD SPACING OF THE GS WALL ASSEMBLY. CENTRE OF 1ST CONNECTION PLATE INSTALLED 24" FROM THE T/O THE GS WALL ASSEMBLY.** C/W (4) #10-16X3/4" TEK SCREWS

PART # IC

~~NOTE~~

EXTRA PLATE TO BE INSTALLED DIRECTLY ABOVE SPLIT TRACK IF GS WALL IS RESISTING MORE THAN 4' OF SOIL (BACKFILL OR INTERNAL FILL PRESSURE)

APPROVED VAPOUR BARRIER TAPE AT ALL SEAMS INCLUDING BASE TRACK & LBC

SPLIT TRACK

PART # BT

CONNECT W (1) #10-16X3/4" TEK SCREW THROUGH TRACK FLANGE @ EACH CFS STUD

~~NOTE~~

1. GREENSTONE WALL PANELS ARE INSTALLED WITH THE "FRONT OF PANEL" FACING THE OUTSIDE OF THE STRUCTURE.

2. **IF GS WALLS ARE RESISTING MORE THAN 4' OF SOIL (BACKFILL OR INTERNAL FILL PRESSURE), ALL CONNECTION PLATES MUST BE INSTALLED @ 24" O/C**

3. SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

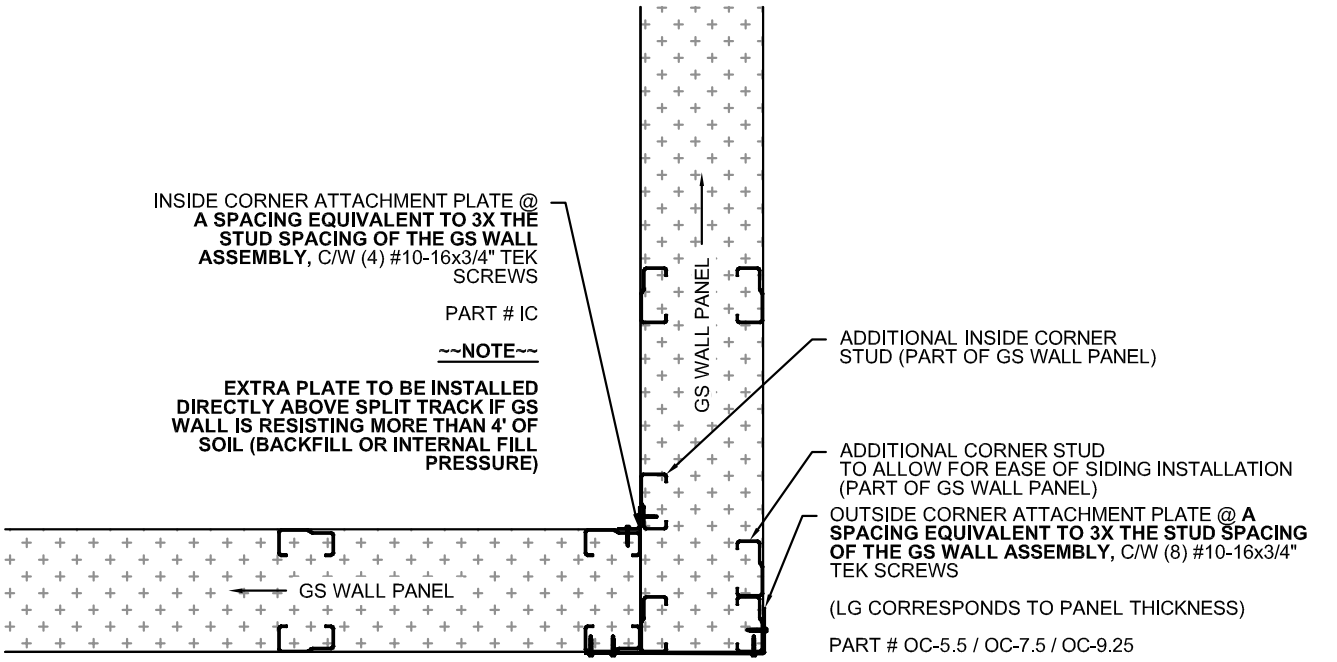
TYP. INT. FACE OF GS WALL PANEL @ CORNER (PERSPECTIVE)

N.T.S.

302

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~~NOTE~~

1. IF GS WALLS ARE RESISTING MORE THAN 4' OF SOIL (BACKFILL OR INTERNAL FILL PRESSURE), ALL CONNECTION PLATES MUST BE INSTALLED @ 24" O/C

2. SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

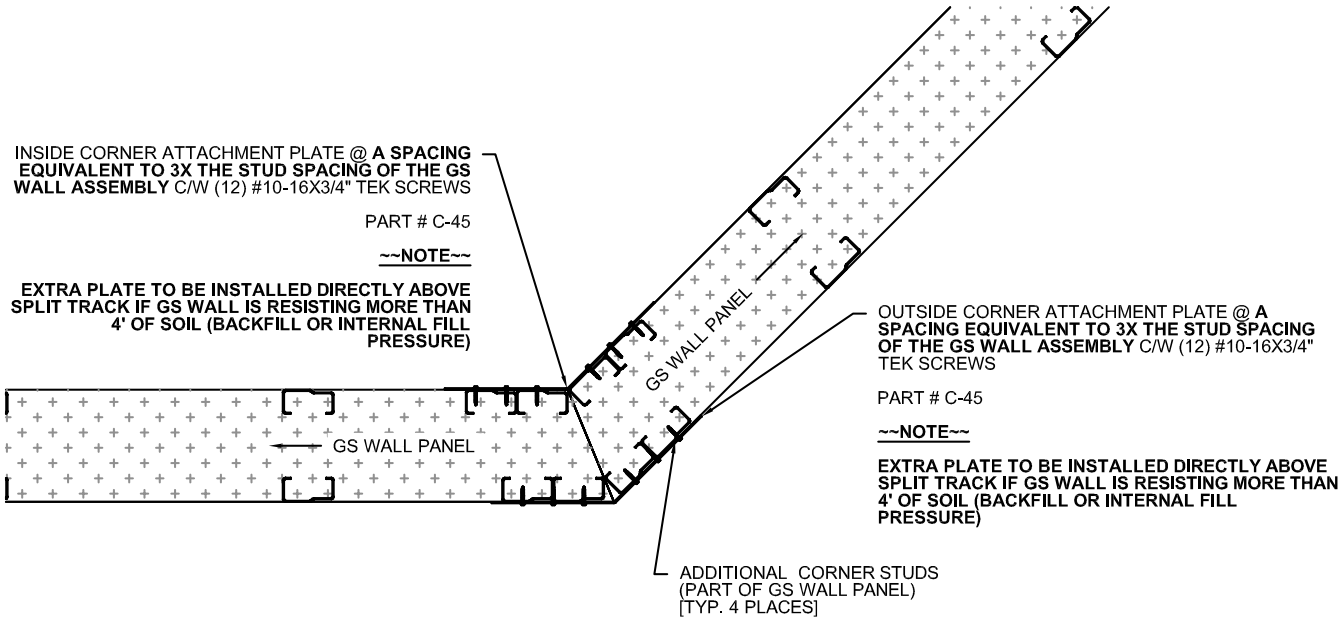
90° CORNER (PLAN)

N.T.S.

303

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~~NOTE~~

1. IF GS WALLS ARE RESISTING MORE THAN 4' OF SOIL (BACKFILL OR INTERNAL FILL PRESSURE), ALL CONNECTION PLATES MUST BE INSTALLED @ 24" O/C

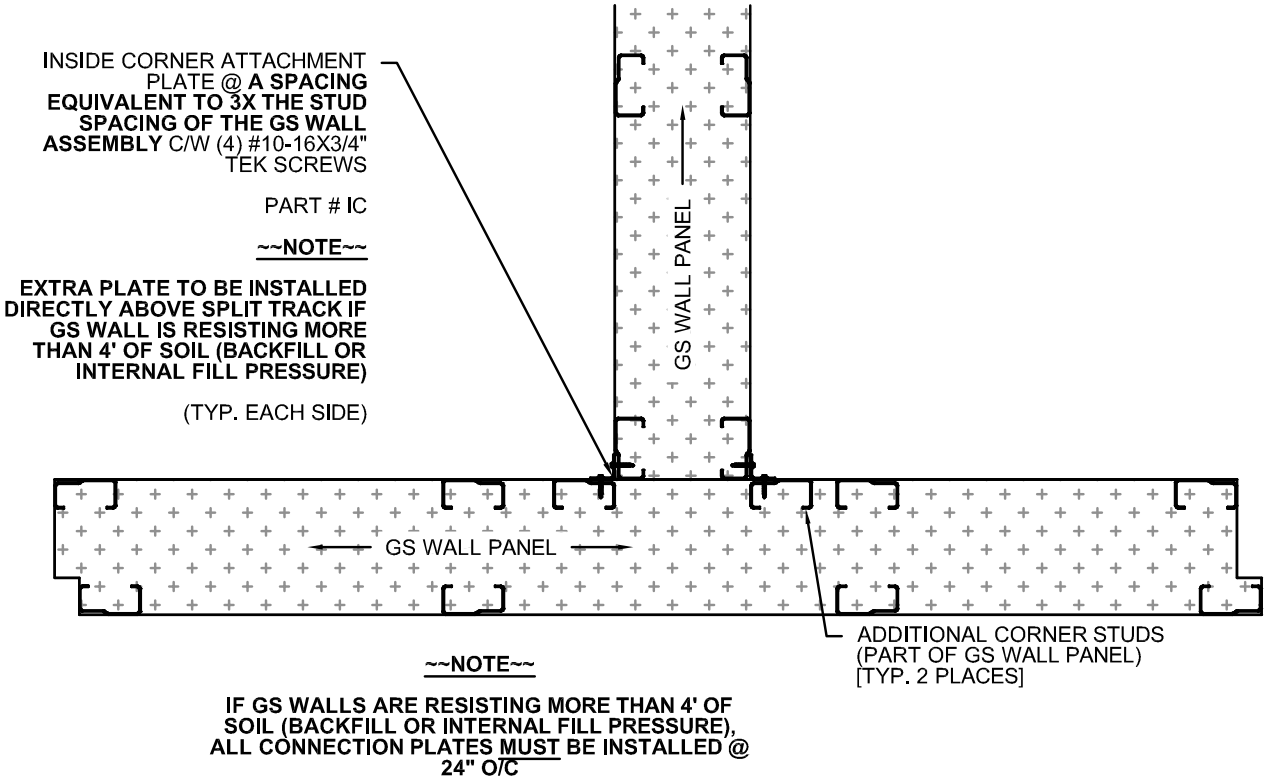
2. SINGLE COMPONENT URETHANE FOAM IS NOT APPROVED TO SEAL AIR/VAPOUR AND NOT TO BE CONSIDERED AIR TIGHT

VARIABLE ANGLE CORNER (PLAN)

N.T.S. 304

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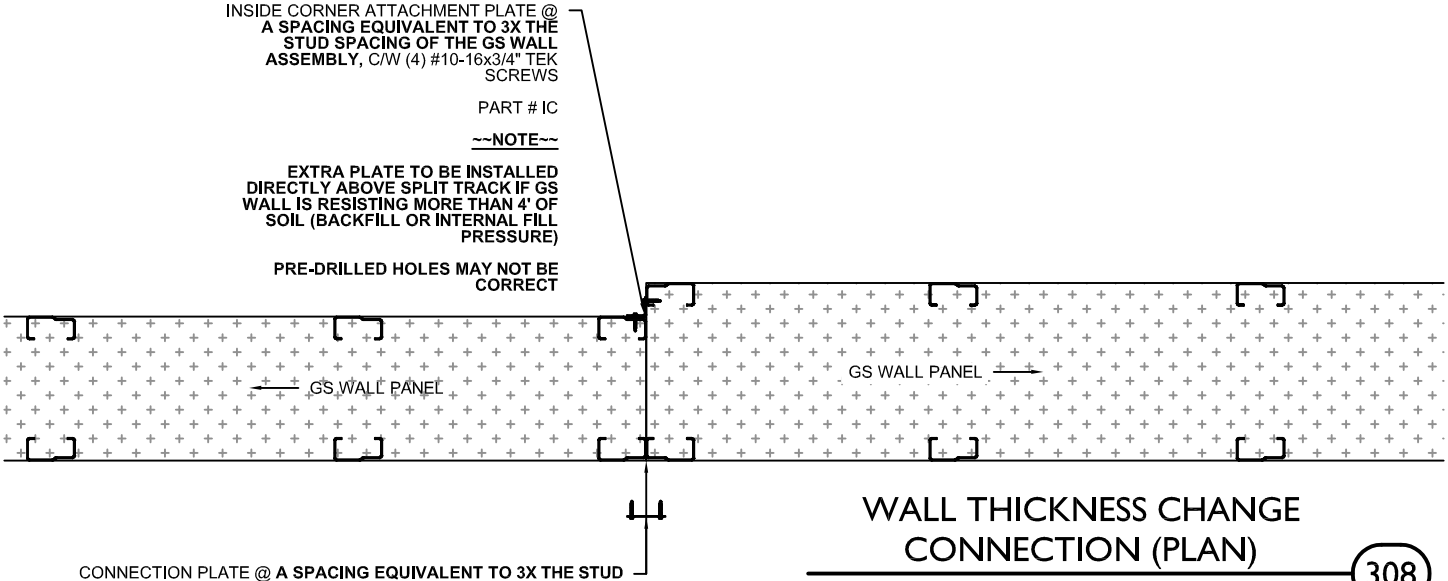
GS WALL INTERSECTION (PLAN)

N.T.S.

306

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WALL THICKNESS CHANGE CONNECTION (PLAN)

N.T.S.

308

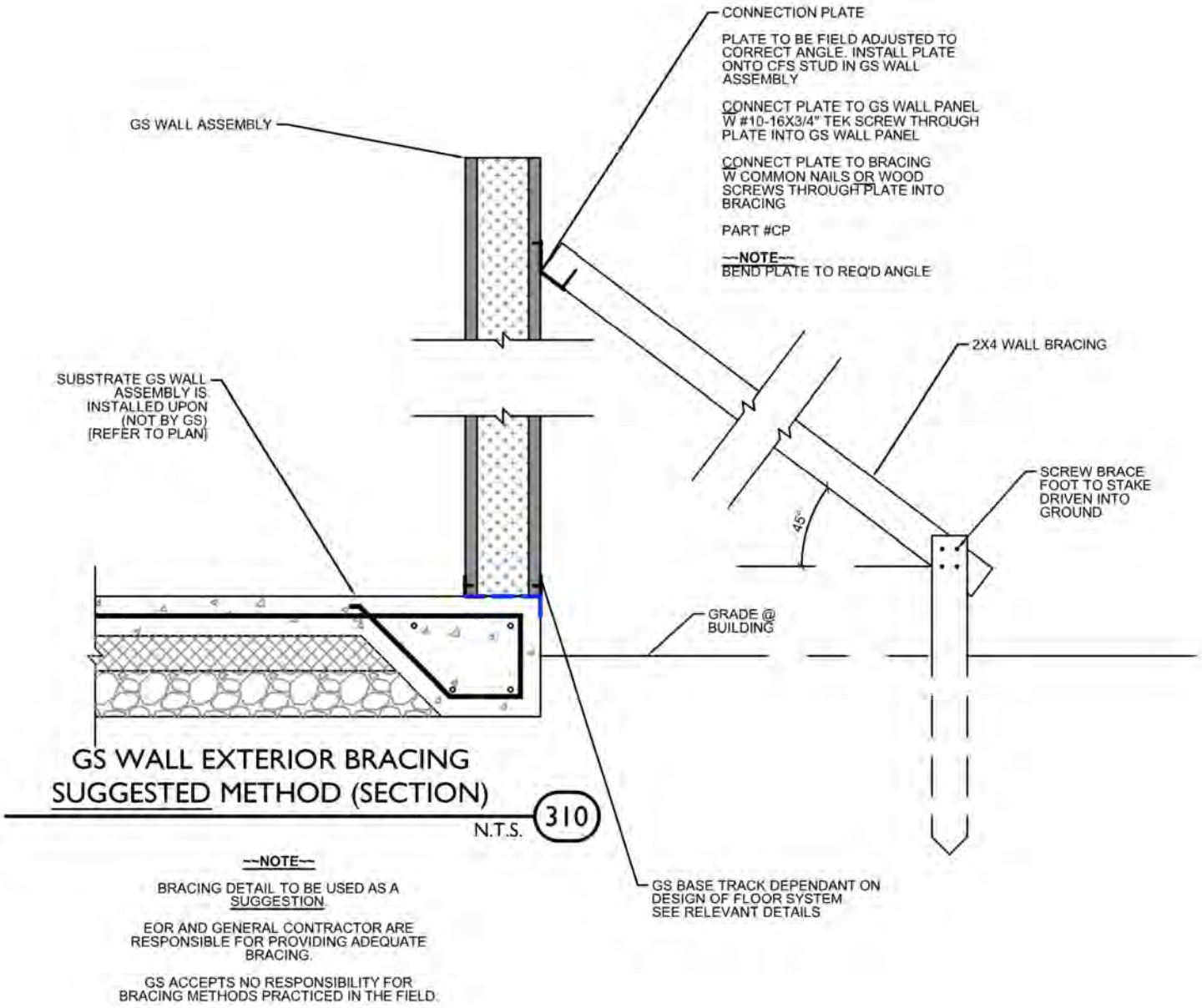
~~NOTE~~

1. IF GS WALLS ARE RESISTING MORE THAN 4' OF SOIL (BACKFILL OR INTERNAL FILL PRESSURE), ALL CONNECTION PLATES MUST BE INSTALLED @ 24" O/C

2. SINGLE COMPONENT URETHANE FOAM IS NOT APPROVED TO SEAL AIR/VAPOUR AND NOT TO BE CONSIDERED AIR TIGHT

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GS WALL EXTERIOR BRACING SUGGESTED METHOD (SECTION)

N.T.S. 310

--NOTE--

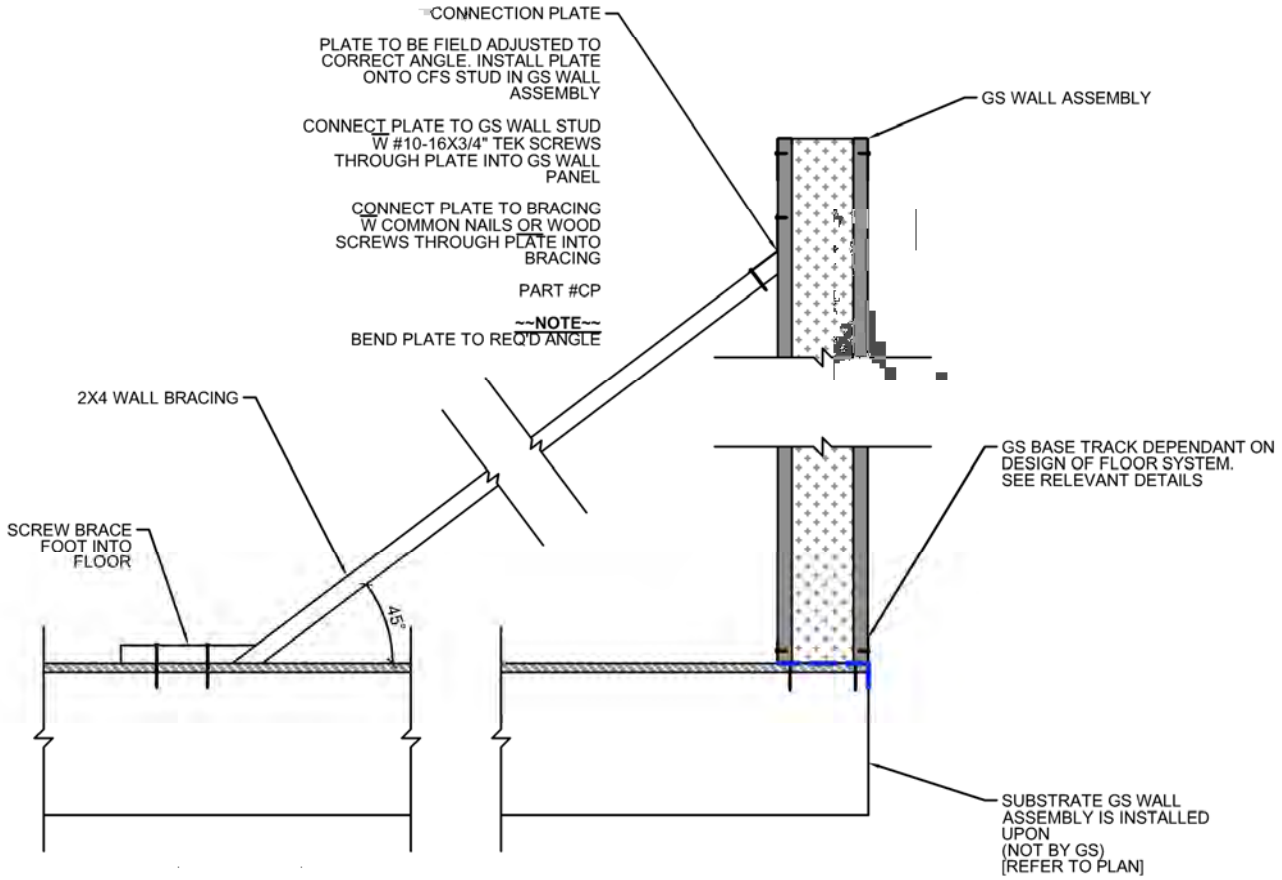
BRACING DETAIL TO BE USED AS A SUGGESTION.

EOR AND GENERAL CONTRACTOR ARE RESPONSIBLE FOR PROVIDING ADEQUATE BRACING.

GS ACCEPTS NO RESPONSIBILITY FOR BRACING METHODS PRACTICED IN THE FIELD.

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GS WALL INTERIOR BRACING SUGGESTED METHOD (SECTION)

N.T.S. 311A

~~NOTE~~

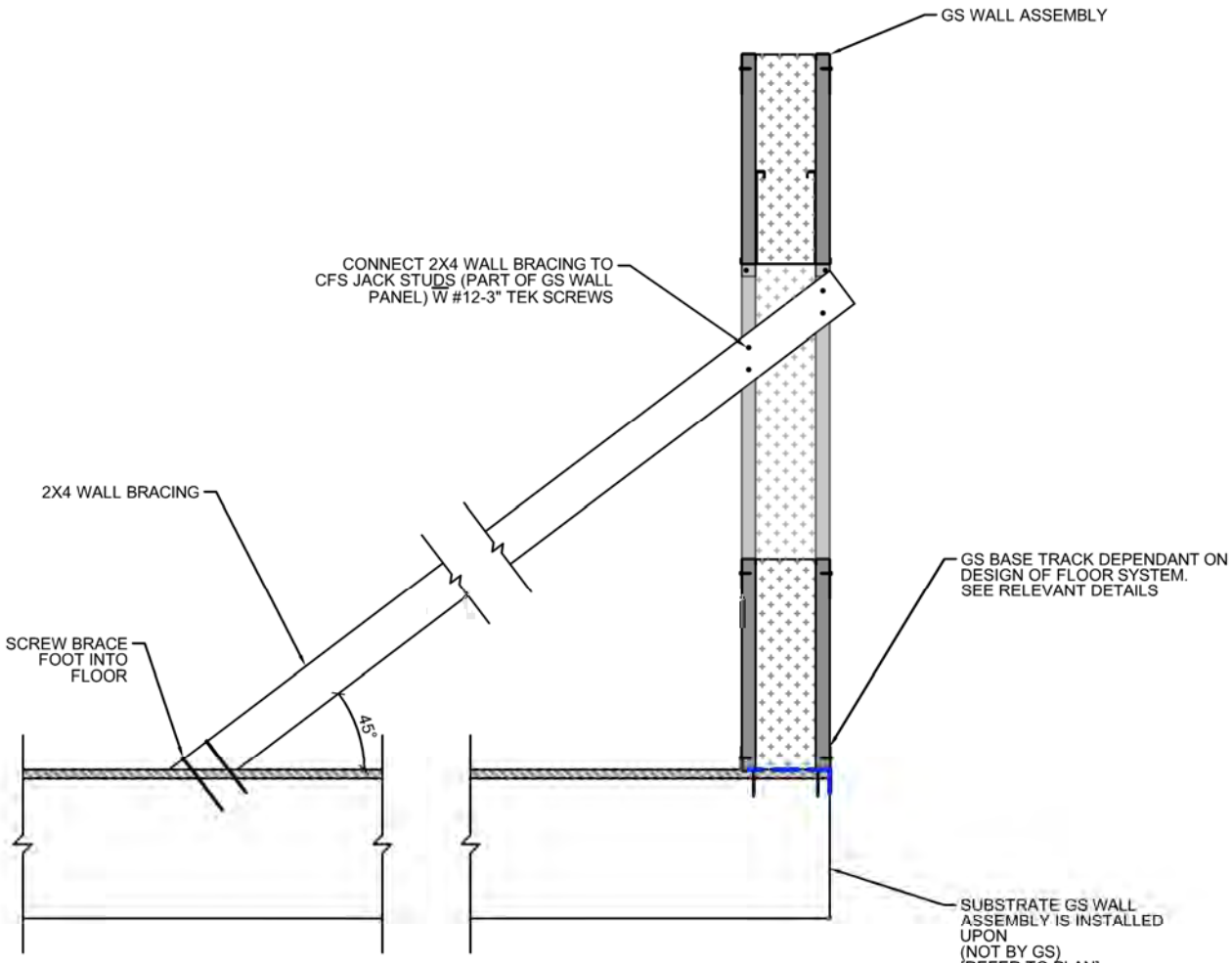
BRACING DETAIL TO BE USED AS A SUGGESTION.

EOR AND GENERAL CONTRACTOR ARE RESPONSIBLE FOR PROVIDING ADEQUATE BRACING.

GS ACCEPTS NO RESPONSIBILITY FOR BRACING METHODS PRACTICED IN THE FIELD.

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GS WALL INTERIOR BRACING SUGGESTED METHOD (SECTION)

N.T.S. 311B

~~NOTE~~

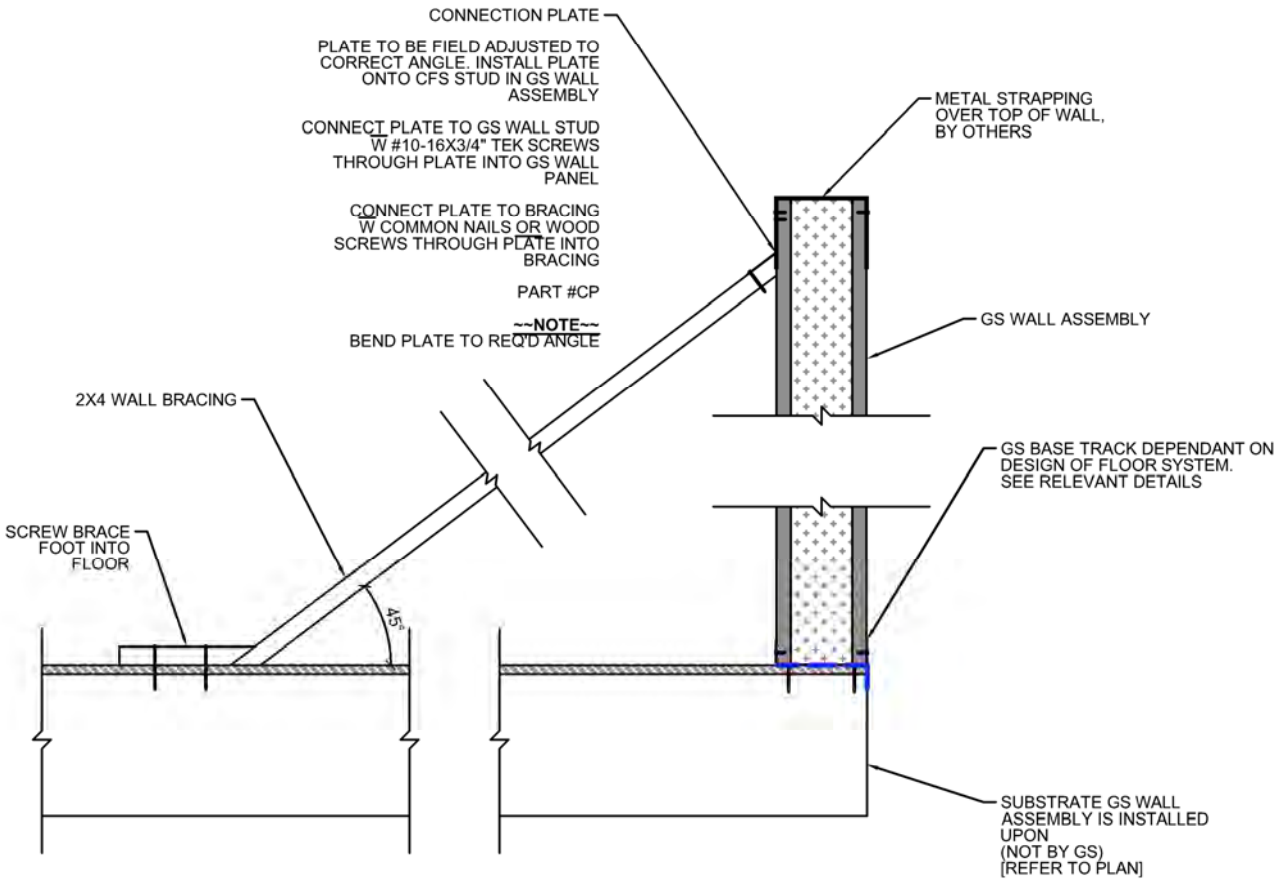
BRACING DETAIL TO BE USED AS A SUGGESTION.

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GS WALL INTERIOR BRACING SUGGESTED METHOD (SECTION)

N.T.S. 311C

~~NOTE~~

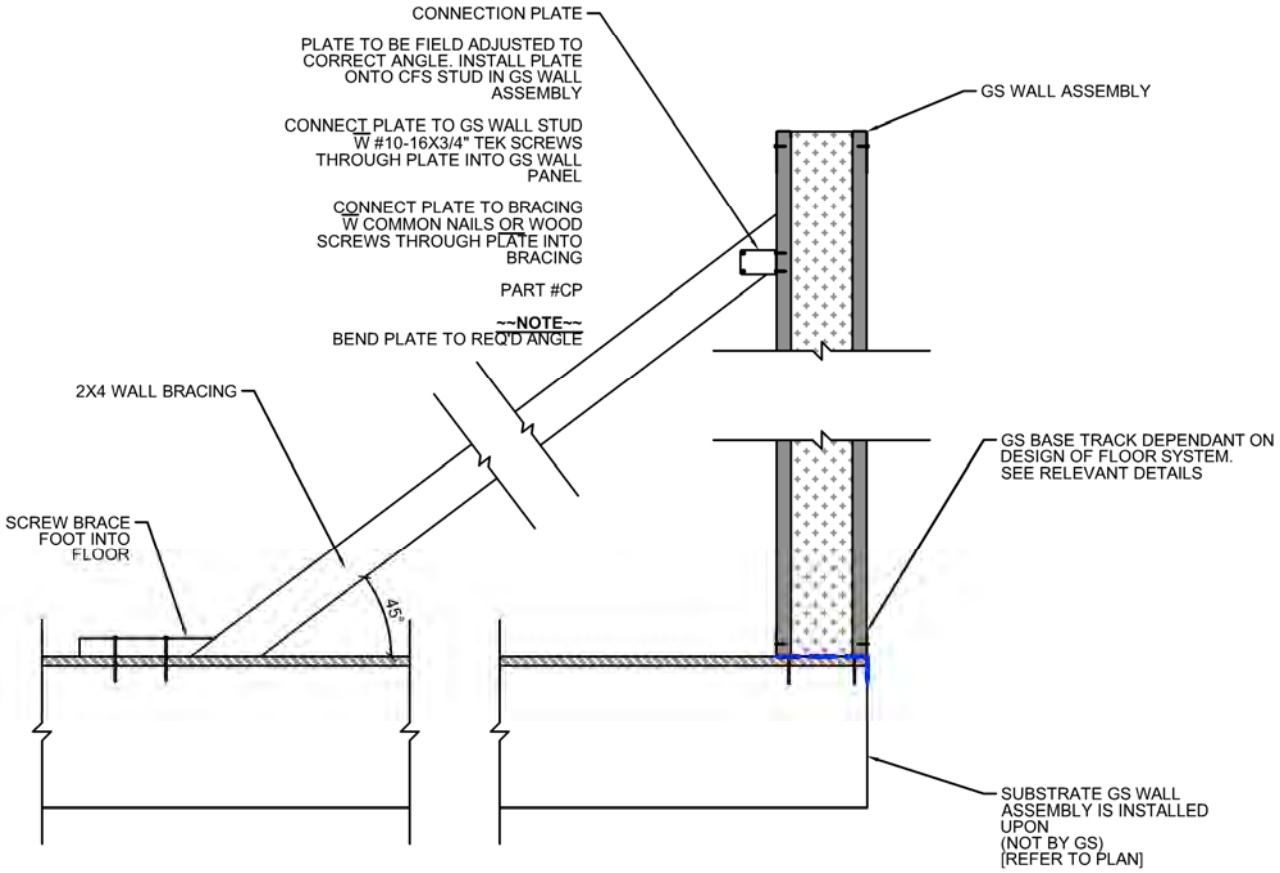
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GS WALL INTERIOR BRACING SUGGESTED METHOD (SECTION)

N.T.S. 311D

~~NOTE~~

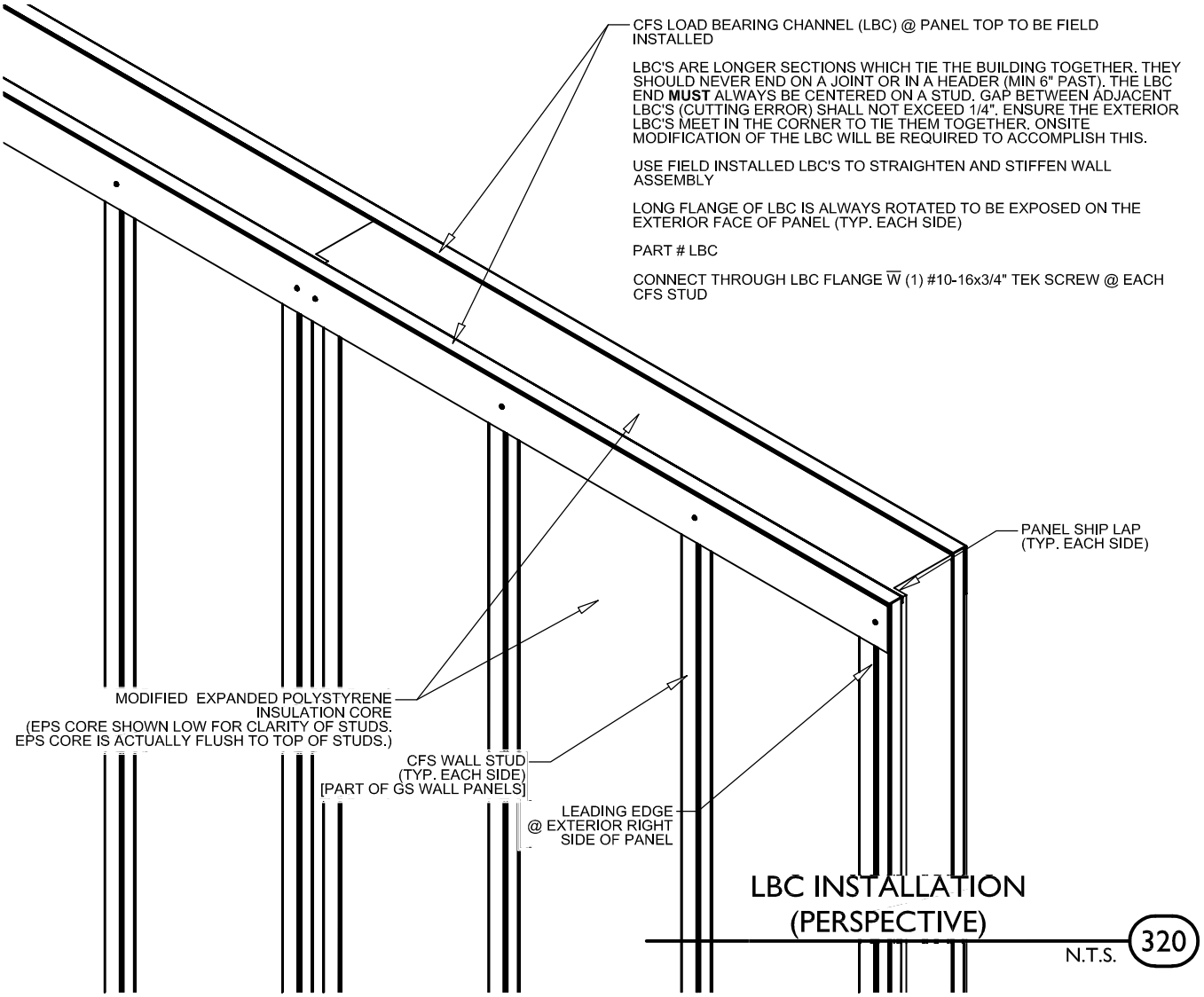
BRACING DETAIL TO BE USED AS A SUGGESTION.

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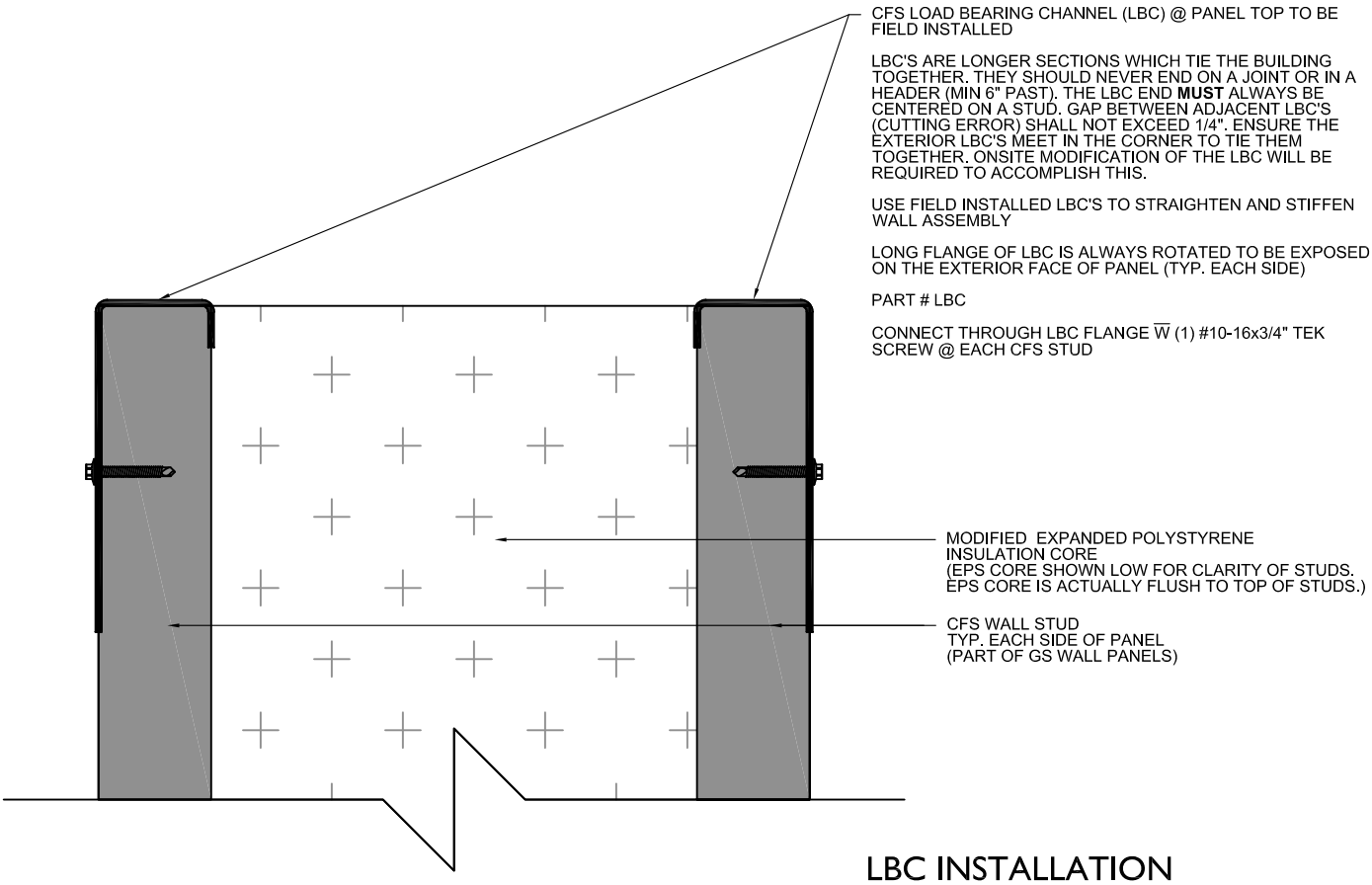
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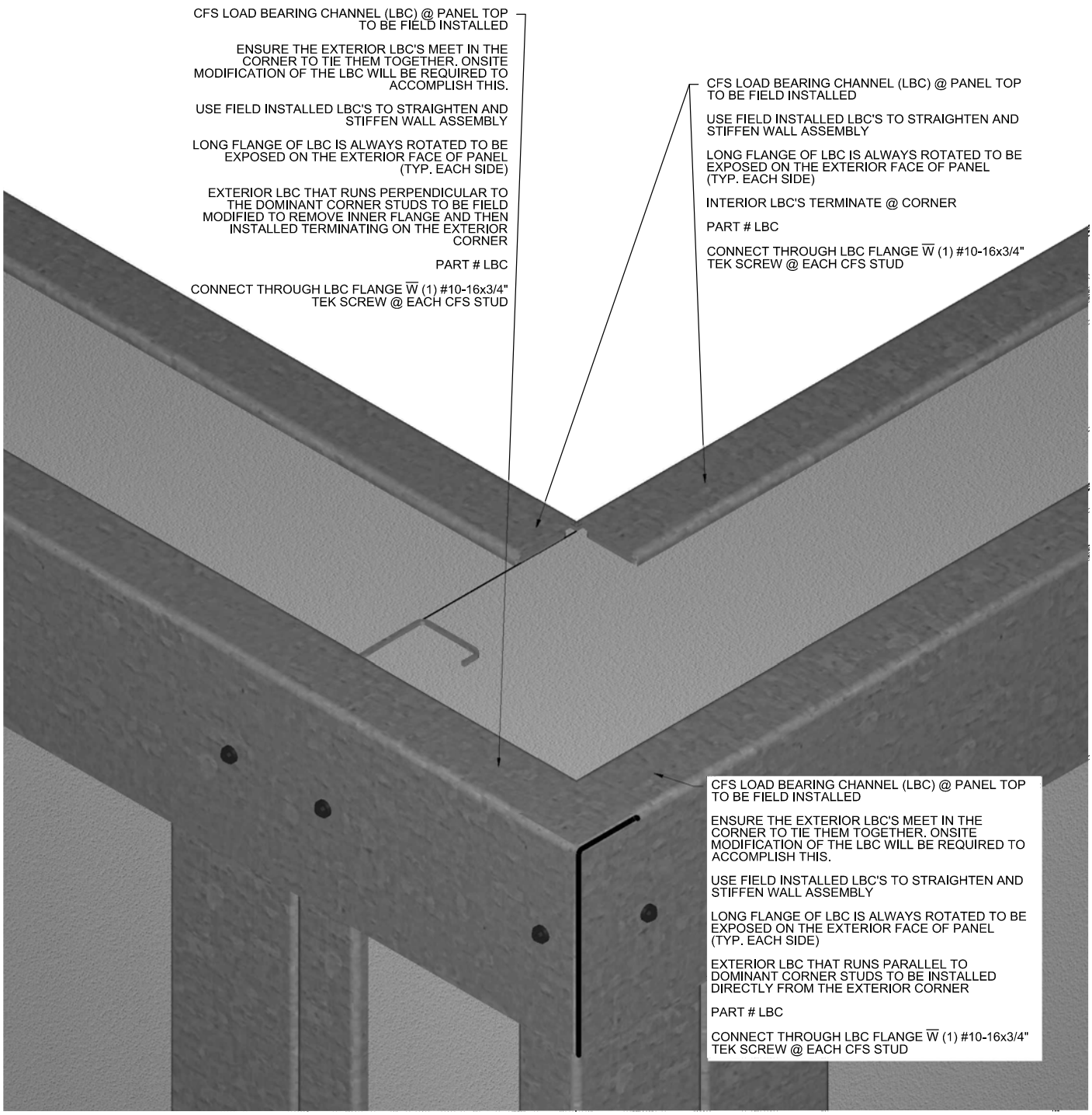
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LBC INSTALLATION
(SECTION)
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321

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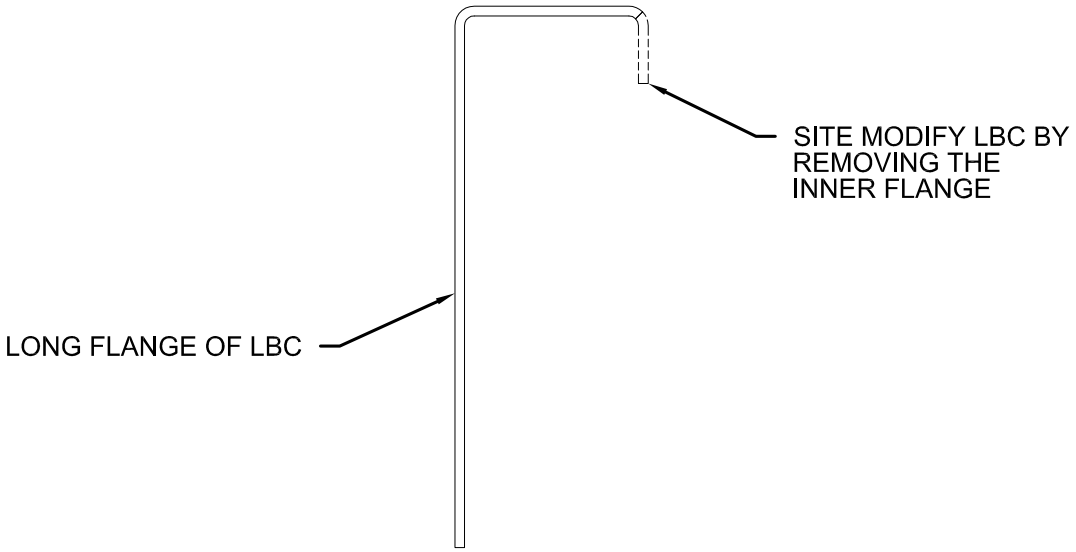
LBC CORNER MODIFICATION (PERSPECTIVE)

N.T.S.

322

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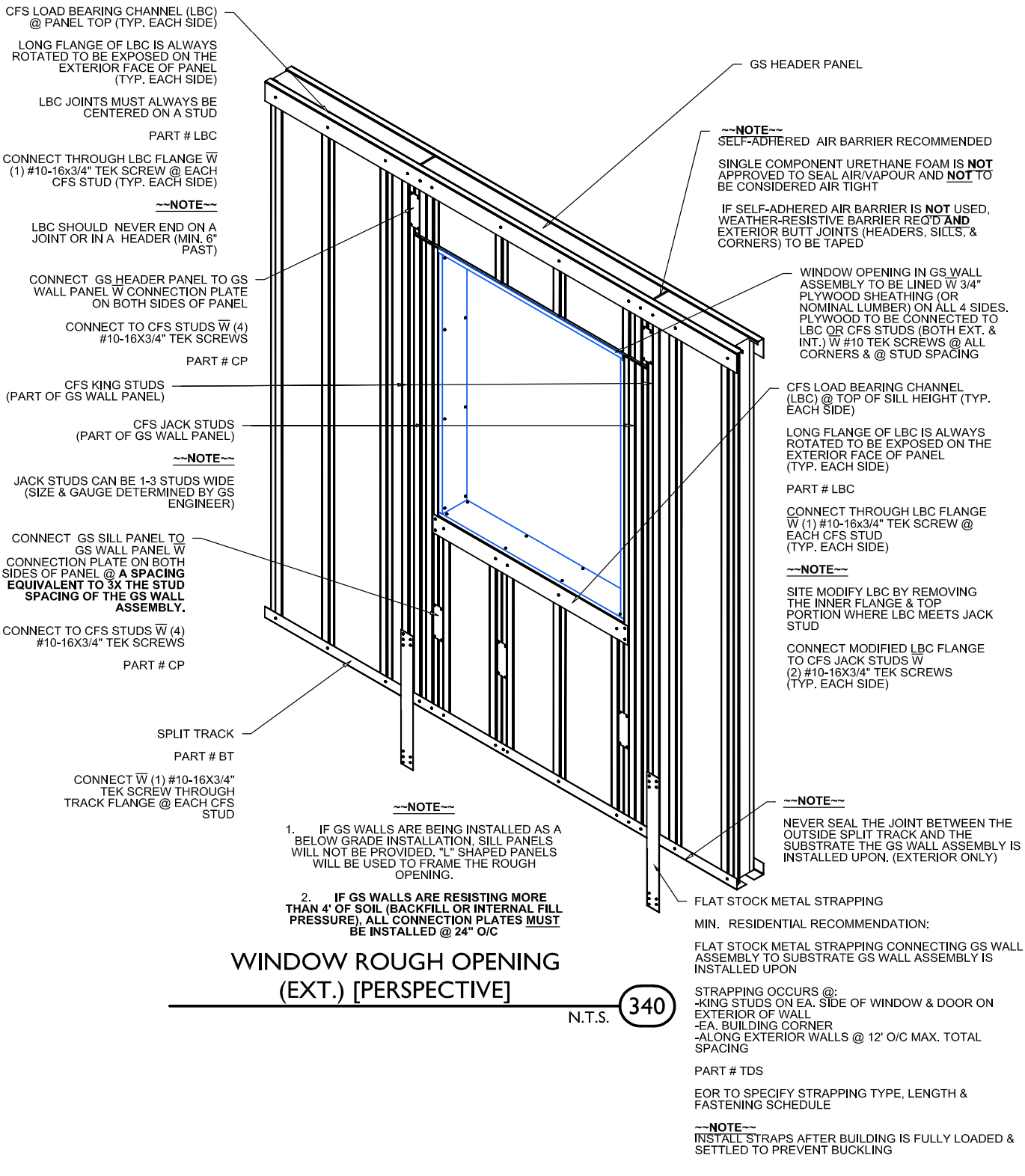


LBC CORNER MODIFICATION (SECTION)

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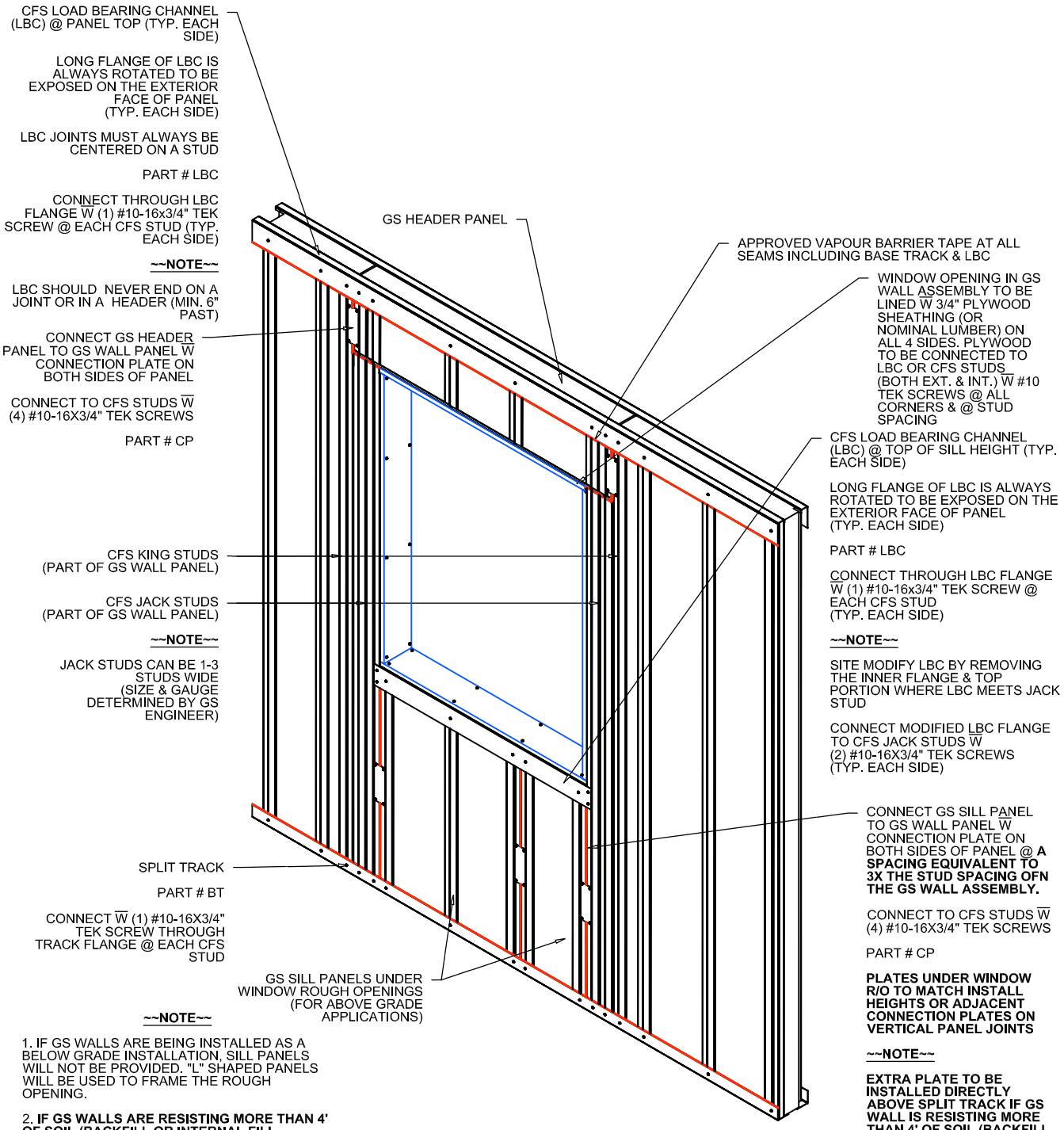


WINDOW ROUGH OPENING (EXT.) [PERSPECTIVE]

N.T.S. 340

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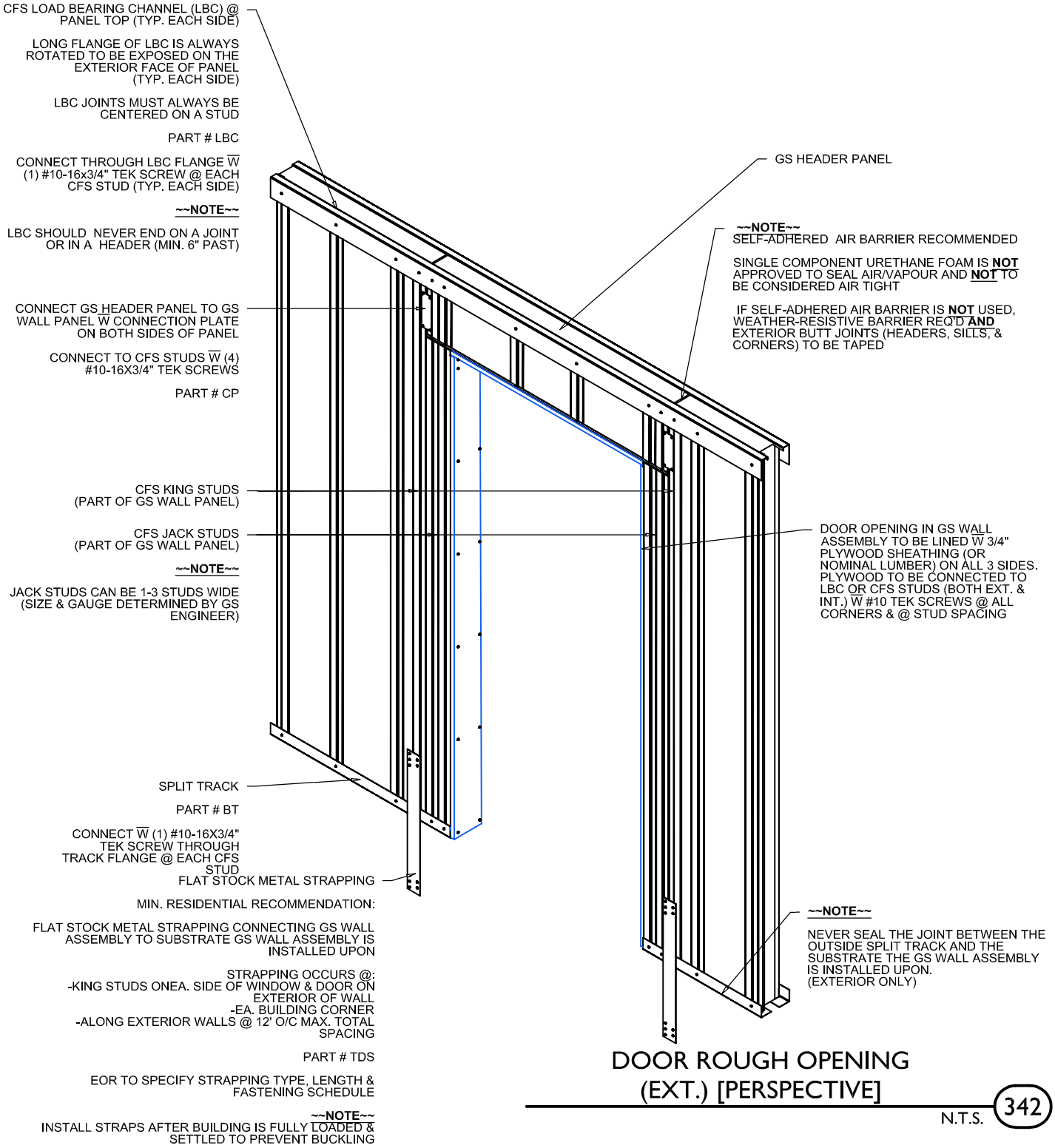


WINDOW ROUGH OPENING (INT.) [PERSPECTIVE]

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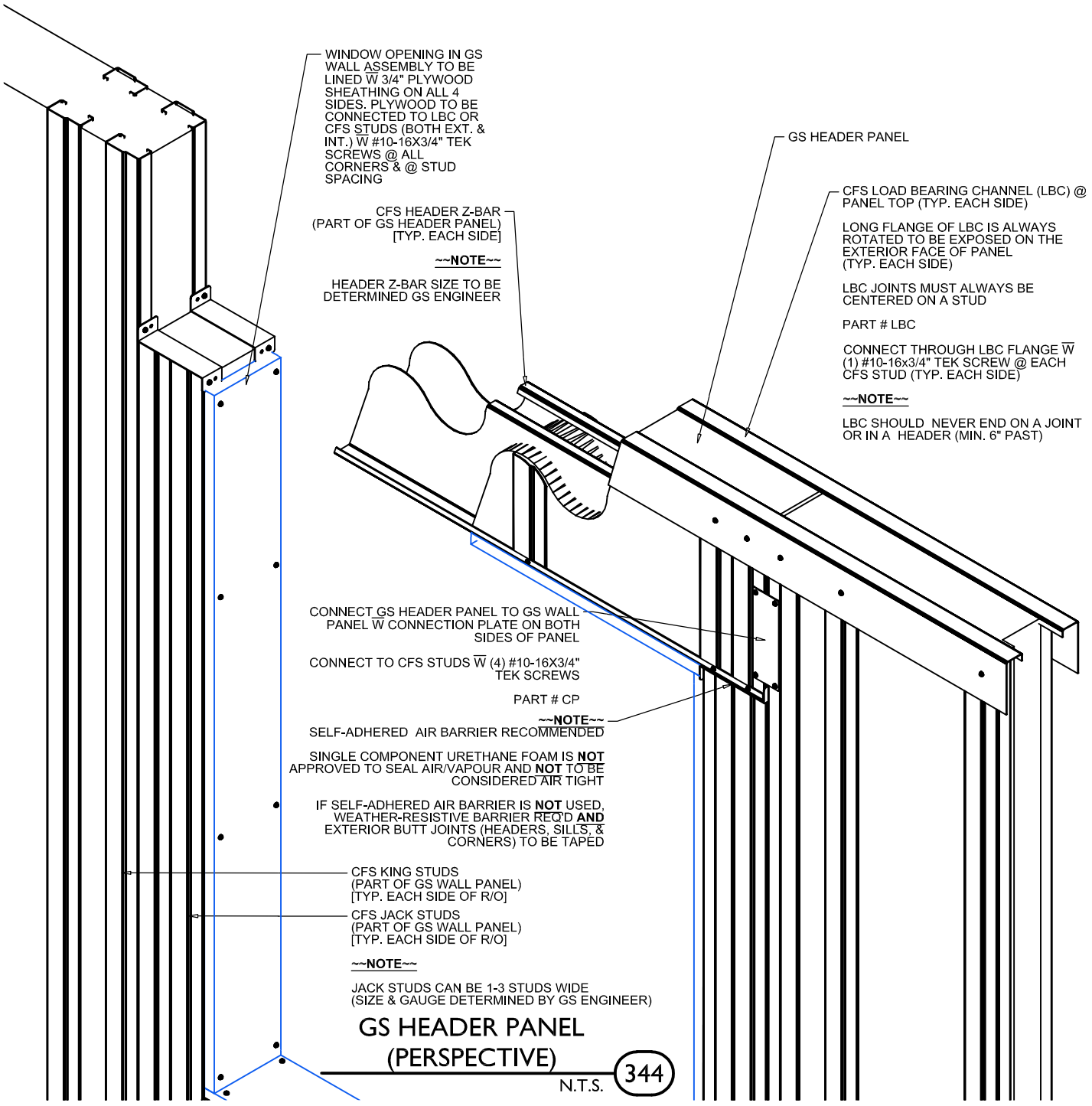
DOOR ROUGH OPENING (EXT.) [PERSPECTIVE]

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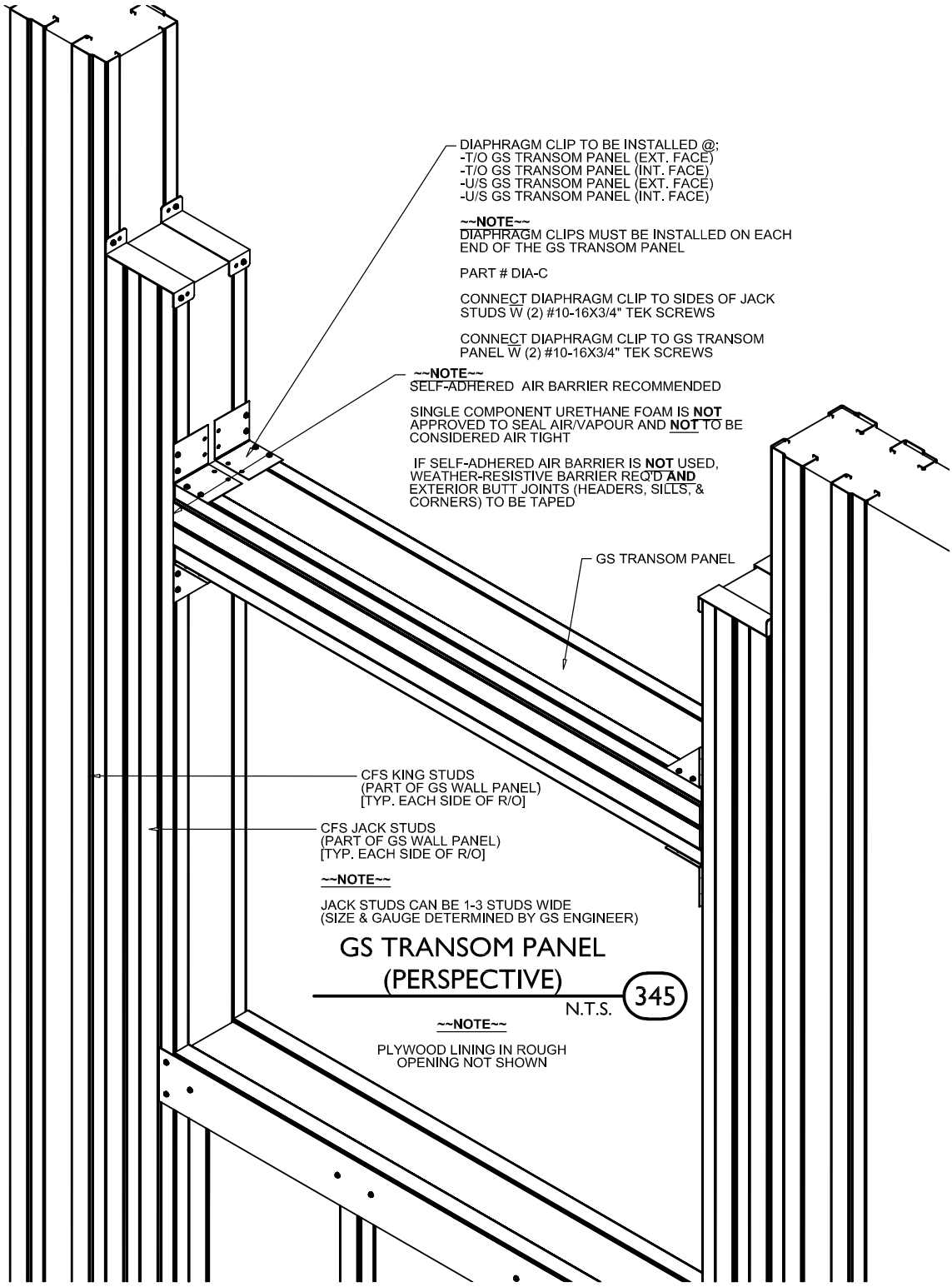
GS HEADER PANEL (PERSPECTIVE)

N.T.S.

344

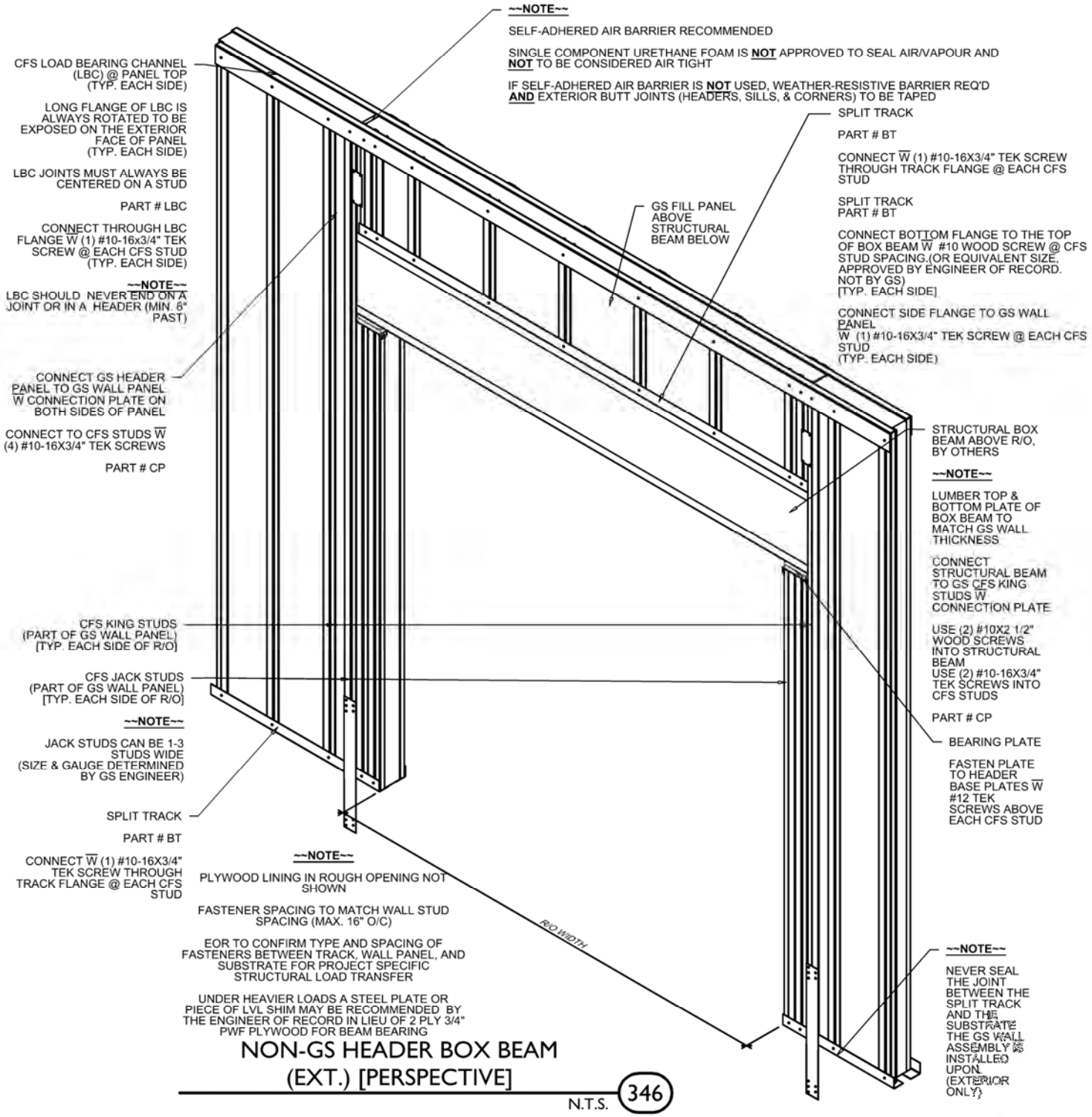
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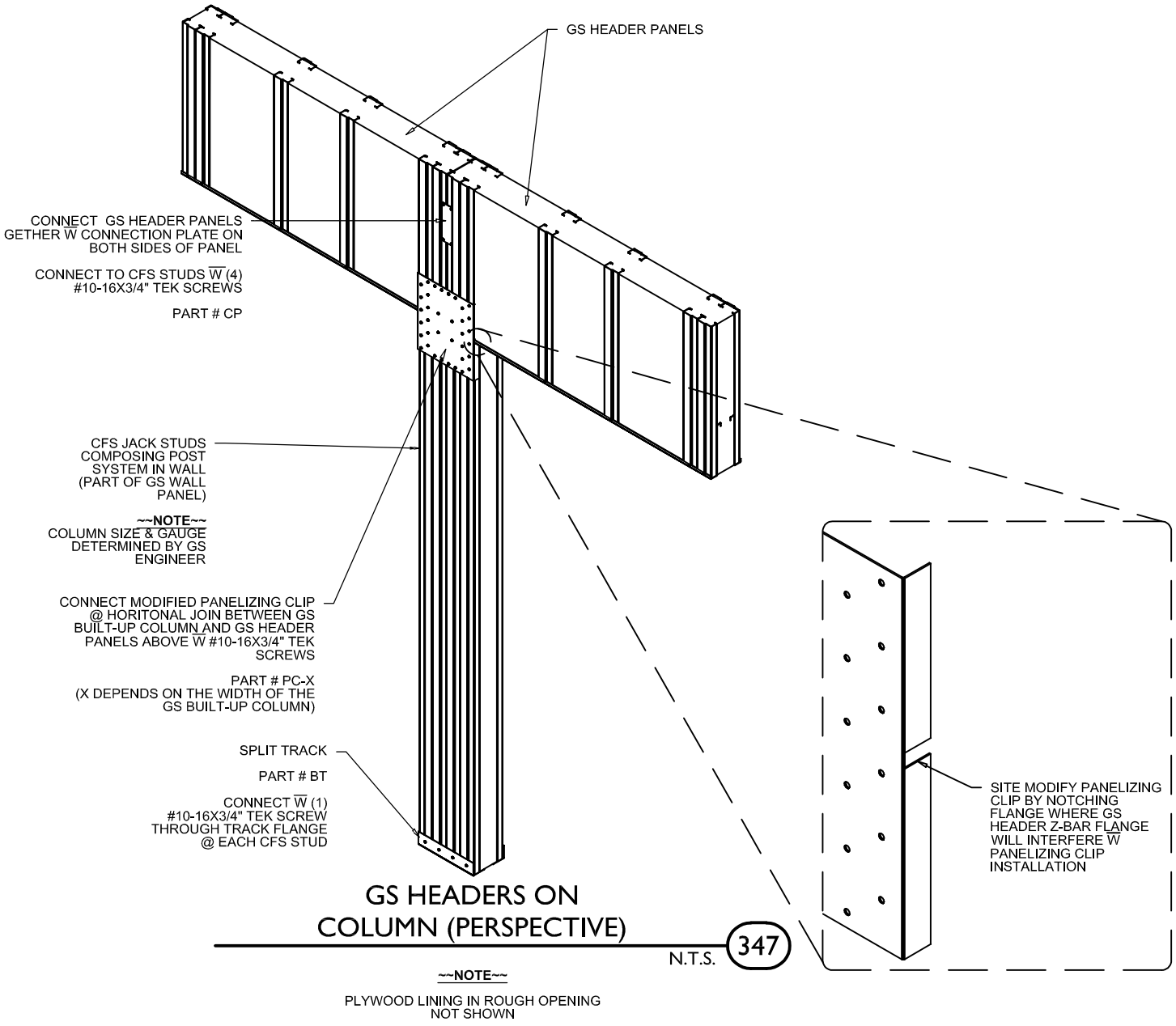


NON-GS HEADER BOX BEAM (EXT.) [PERSPECTIVE]

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GS HEADERS ON COLUMN (PERSPECTIVE)

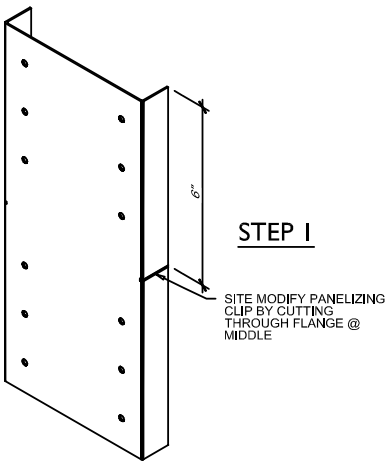
N.T.S. 347

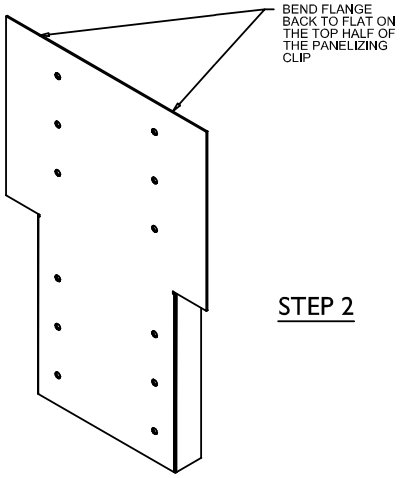
~~NOTE~~

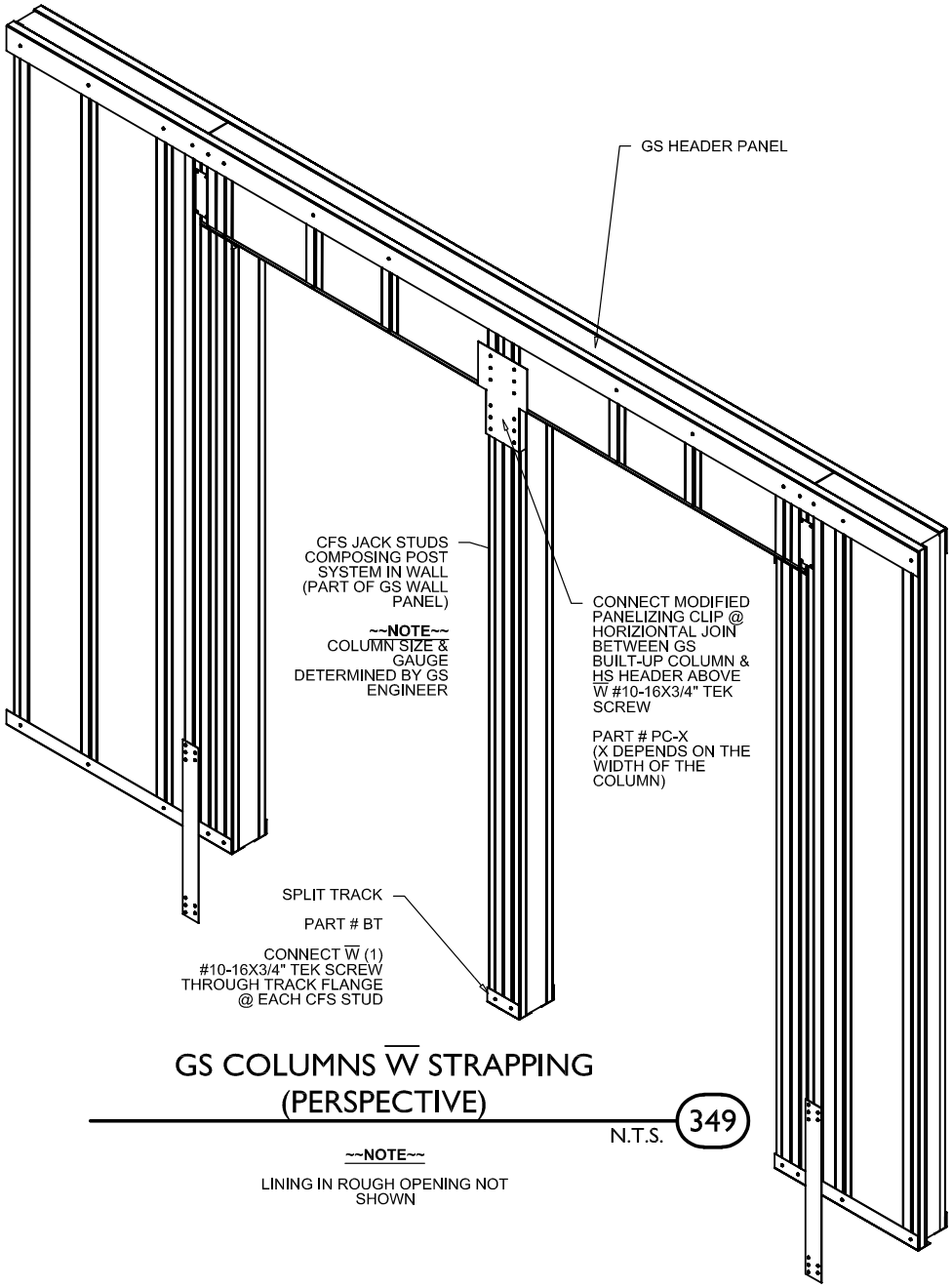
PLYWOOD LINING IN ROUGH OPENING NOT SHOWN

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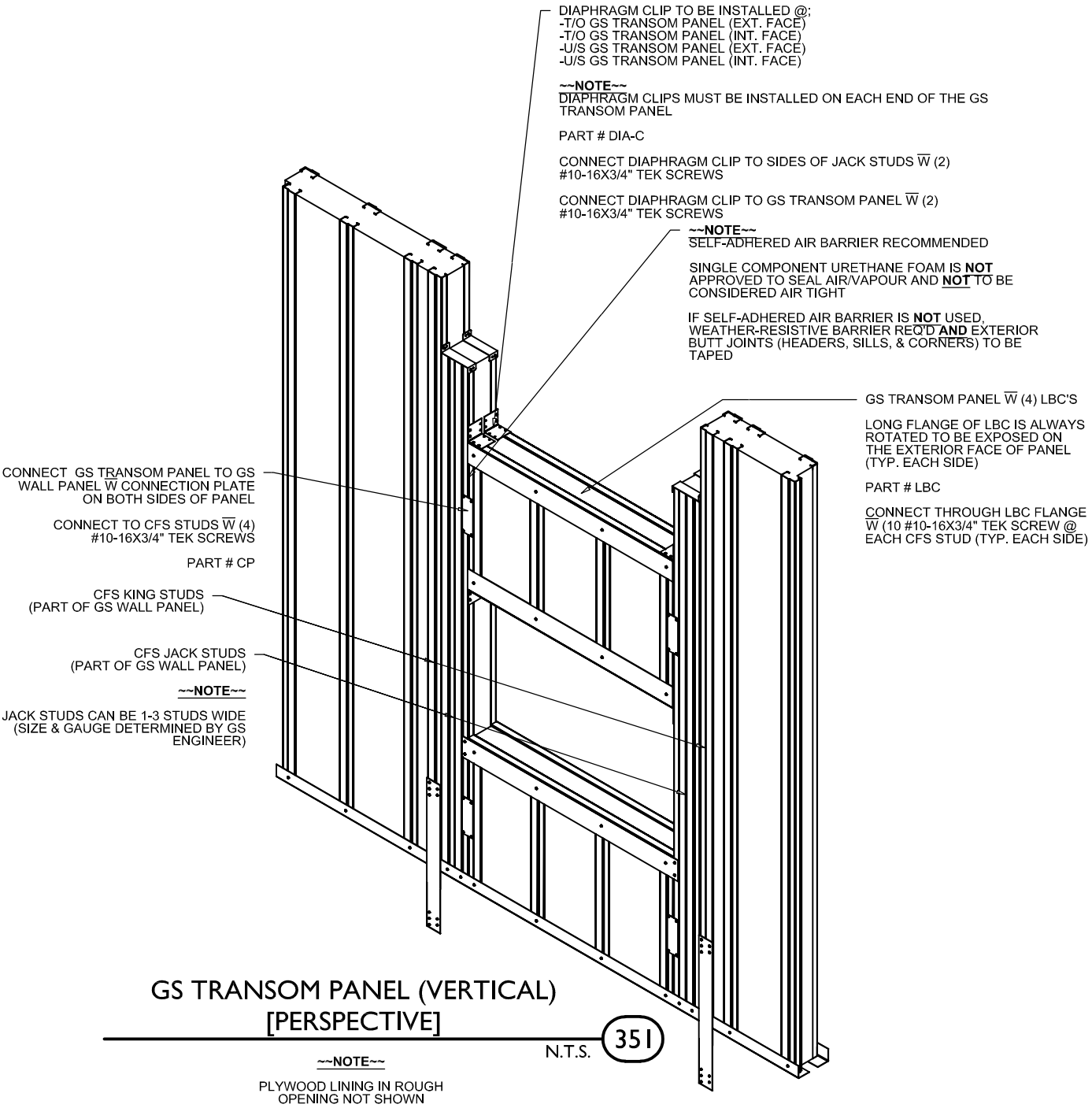


GS COLUMNS W STRAPPING (PERSPECTIVE) 349
N.T.S.

~~NOTE~~
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GS TRANSOM PANEL (VERTICAL) [PERSPECTIVE]

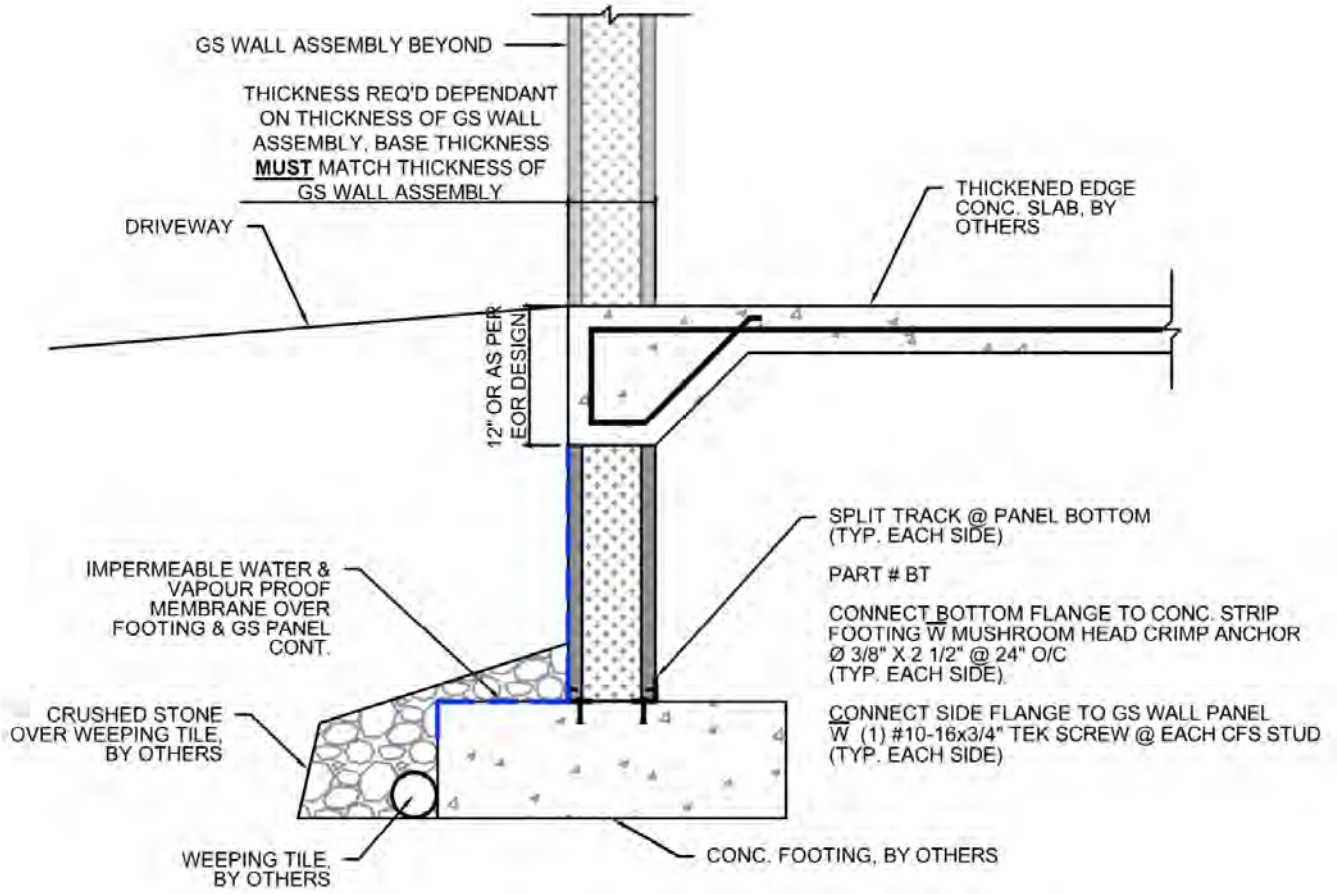
N.T.S. 351

~~NOTE~~

PLYWOOD LINING IN ROUGH OPENING NOT SHOWN

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GARAGE SLAB THICKENING @ GARAGE DOOR W GS FOUNDATION (SECTION)

N.T.S. 354

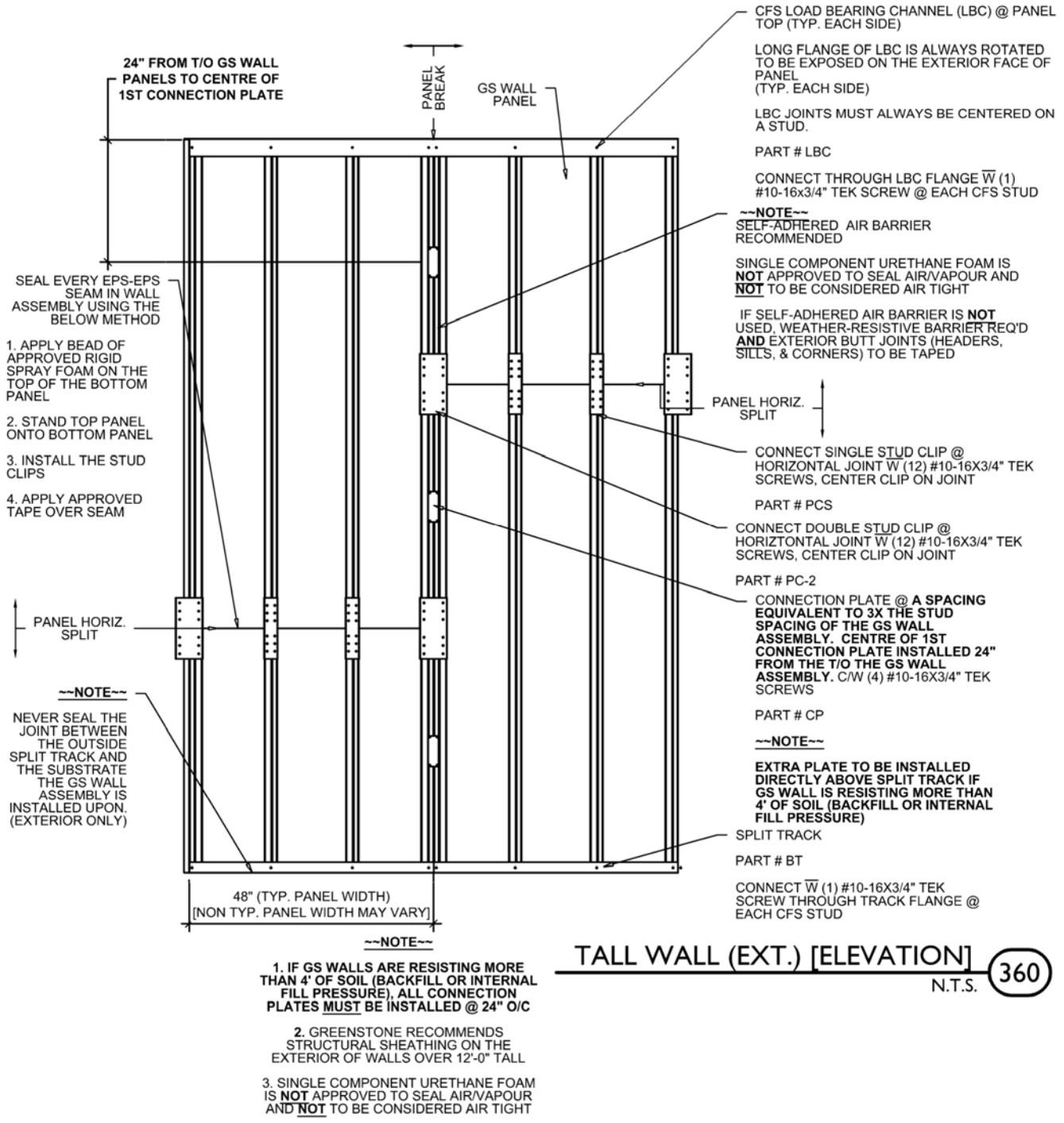
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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~~NOTE~~

1. IF GS WALLS ARE RESISTING MORE THAN 4' OF SOIL (BACKFILL OR INTERNAL FILL PRESSURE), ALL CONNECTION PLATES MUST BE INSTALLED @ 24" O/C

2. GREENSTONE RECOMMENDS STRUCTURAL SHEATHING ON THE EXTERIOR OF WALLS OVER 12'-0" TALL

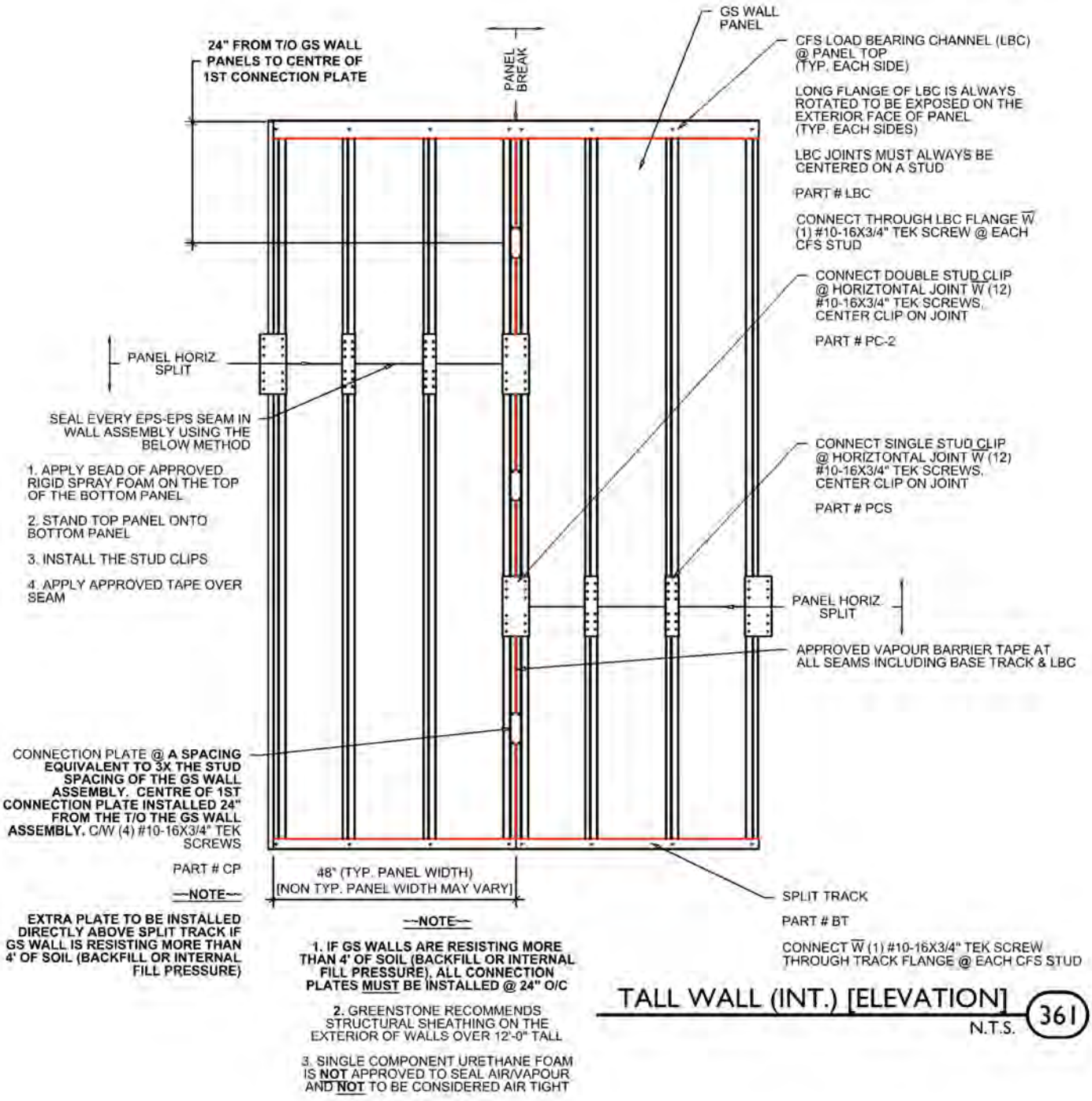
3. SINGLE COMPONENT URETHANE FOAM IS NOT APPROVED TO SEAL AIR/VAPOUR AND NOT TO BE CONSIDERED AIR TIGHT

TALL WALL (EXT.) [ELEVATION] 360

N.T.S.

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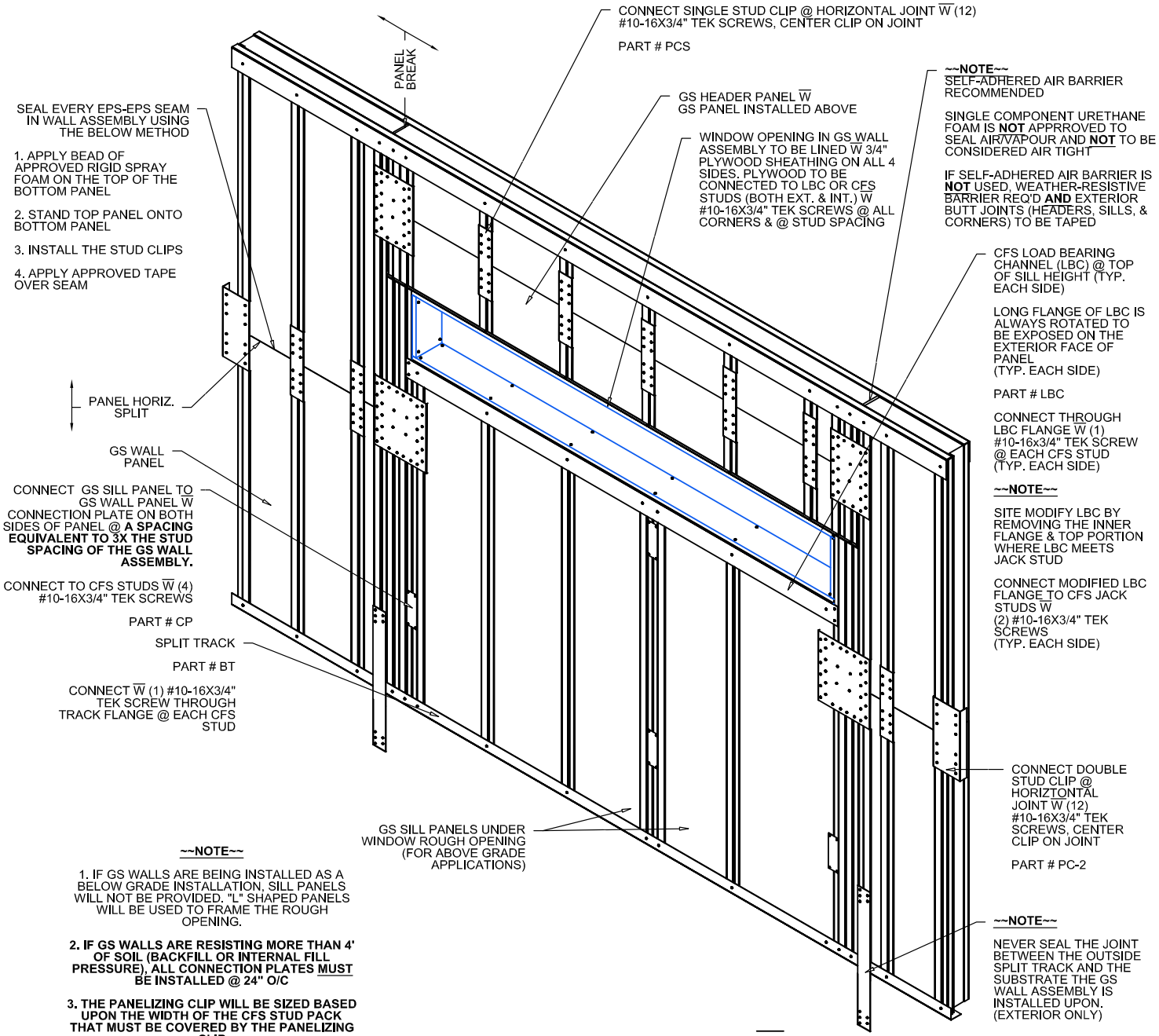


TALL WALL (INT.) [ELEVATION] 361

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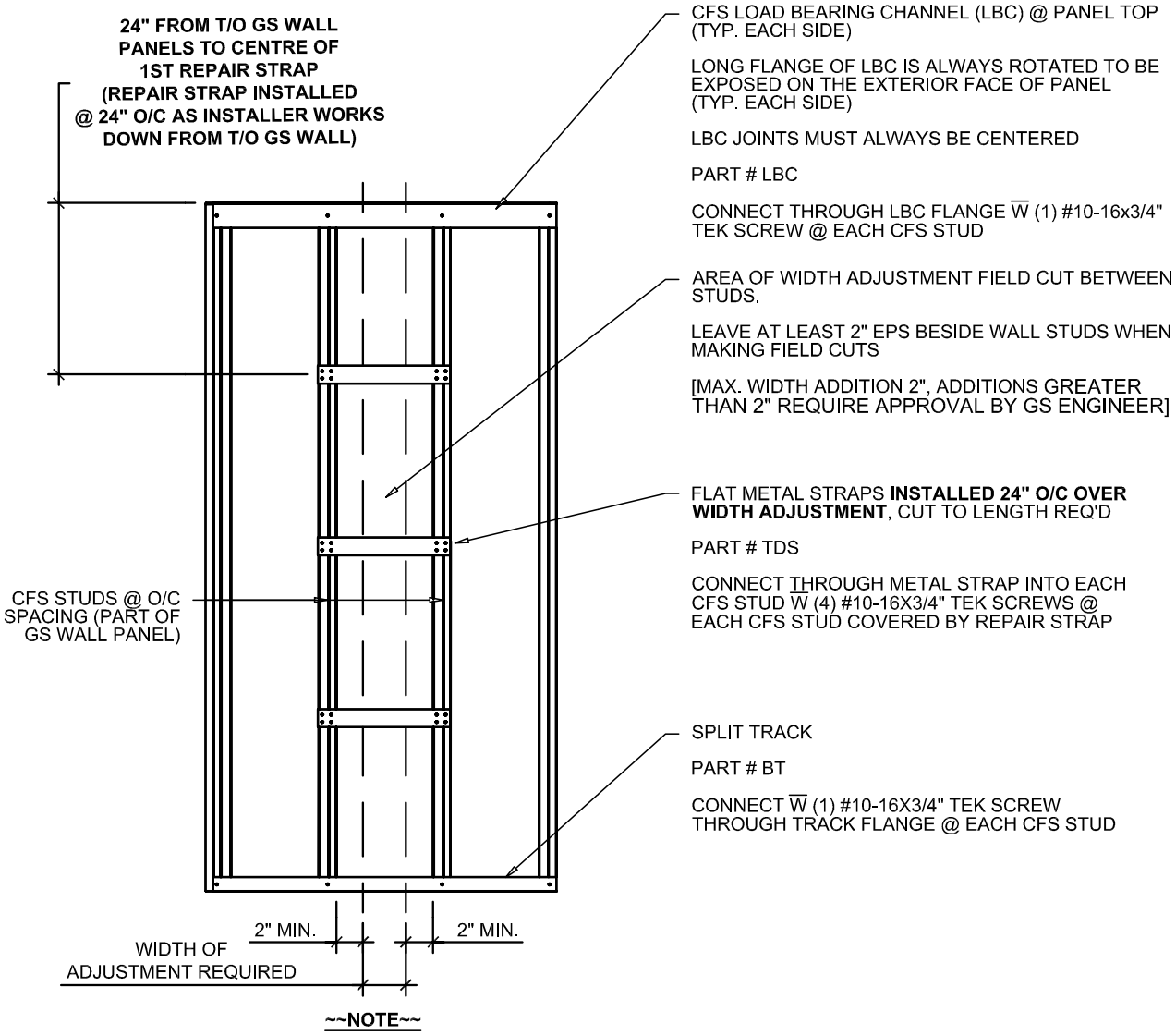


TALL WALL W ROUGH OPENING PANELIZING CLIP LOCATIONS (EXT.) [PERSPECTIVE]

N.T.S. 362

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~~NOTE~~

1. IF GS WALL DOES NOT RUN THE CORRECT WIDTH OF WALL REQUIRED BY CLIENT, MAKE A 2ND CUT BETWEEN ADJACENT STUDS AND SPLIT THE ADDITIONAL WIDTH IN 2 PLACES

2. THE JOINT OF THE FIELD CUT MUST BE SEALED WITH APPROVED TAPE

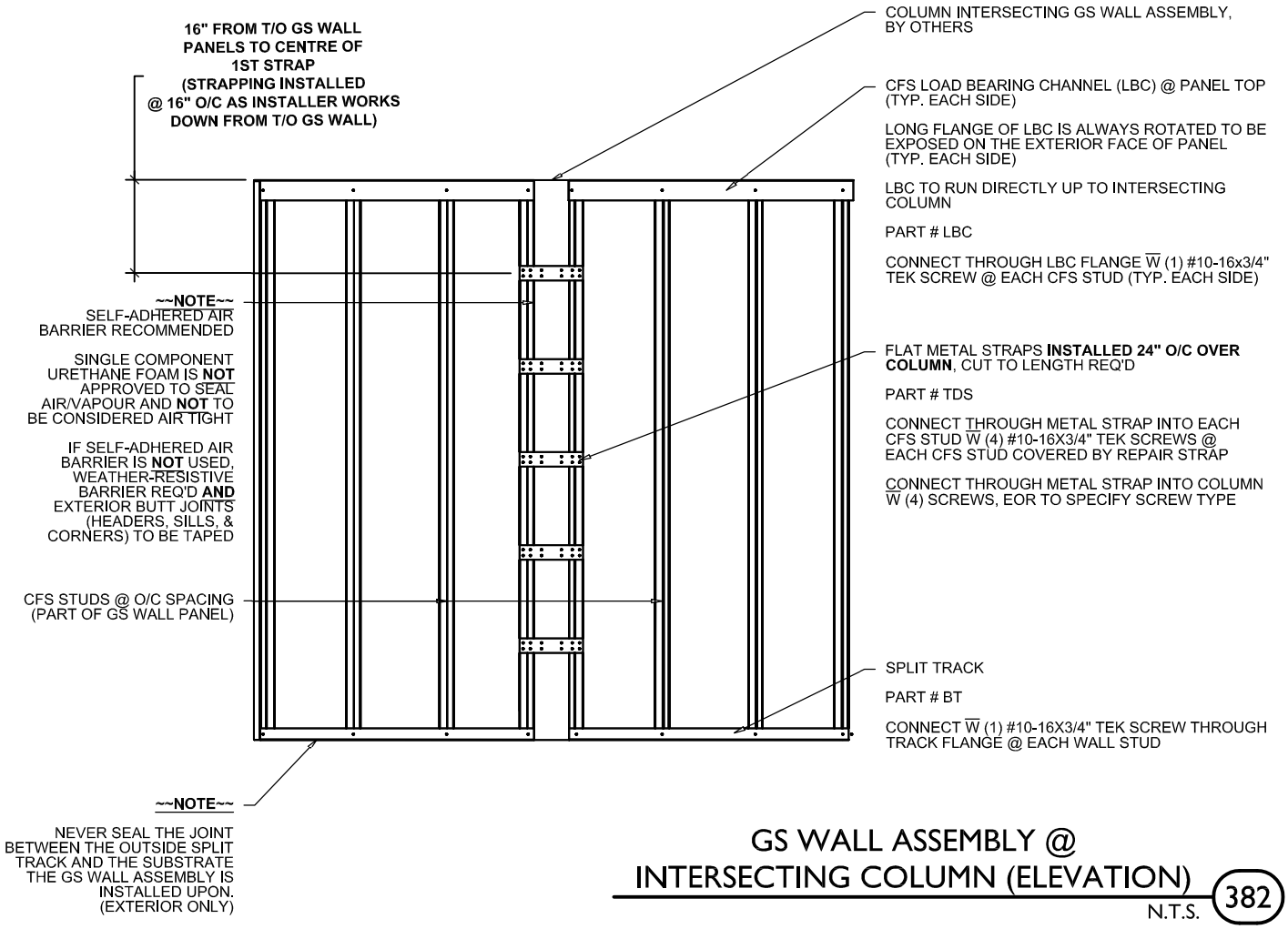
WALL WIDTH ADJUSTMENT (ELEVATION)

N.T.S.

381

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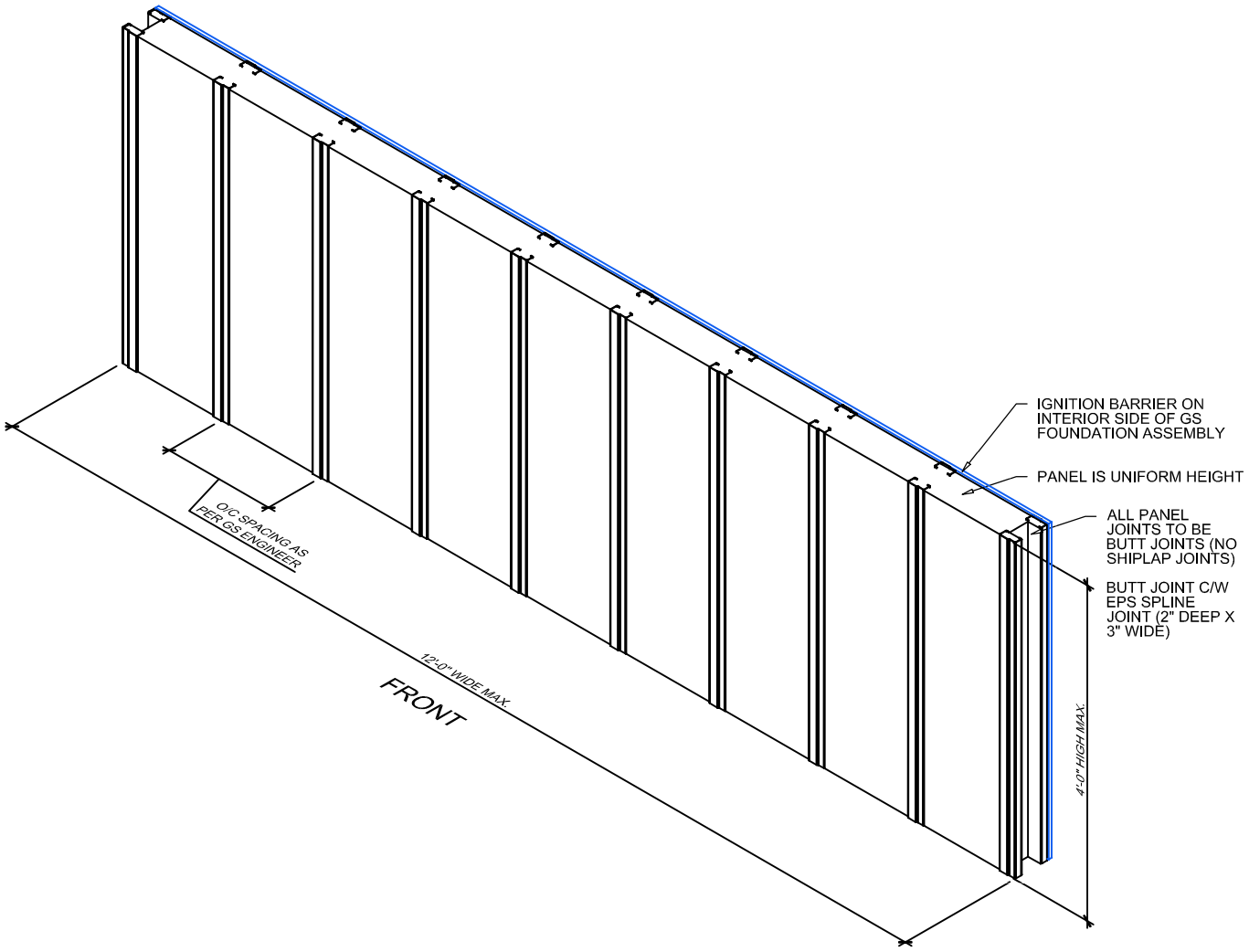
GS WALL ASSEMBLY @ INTERSECTING COLUMN (ELEVATION)

N.T.S.

382

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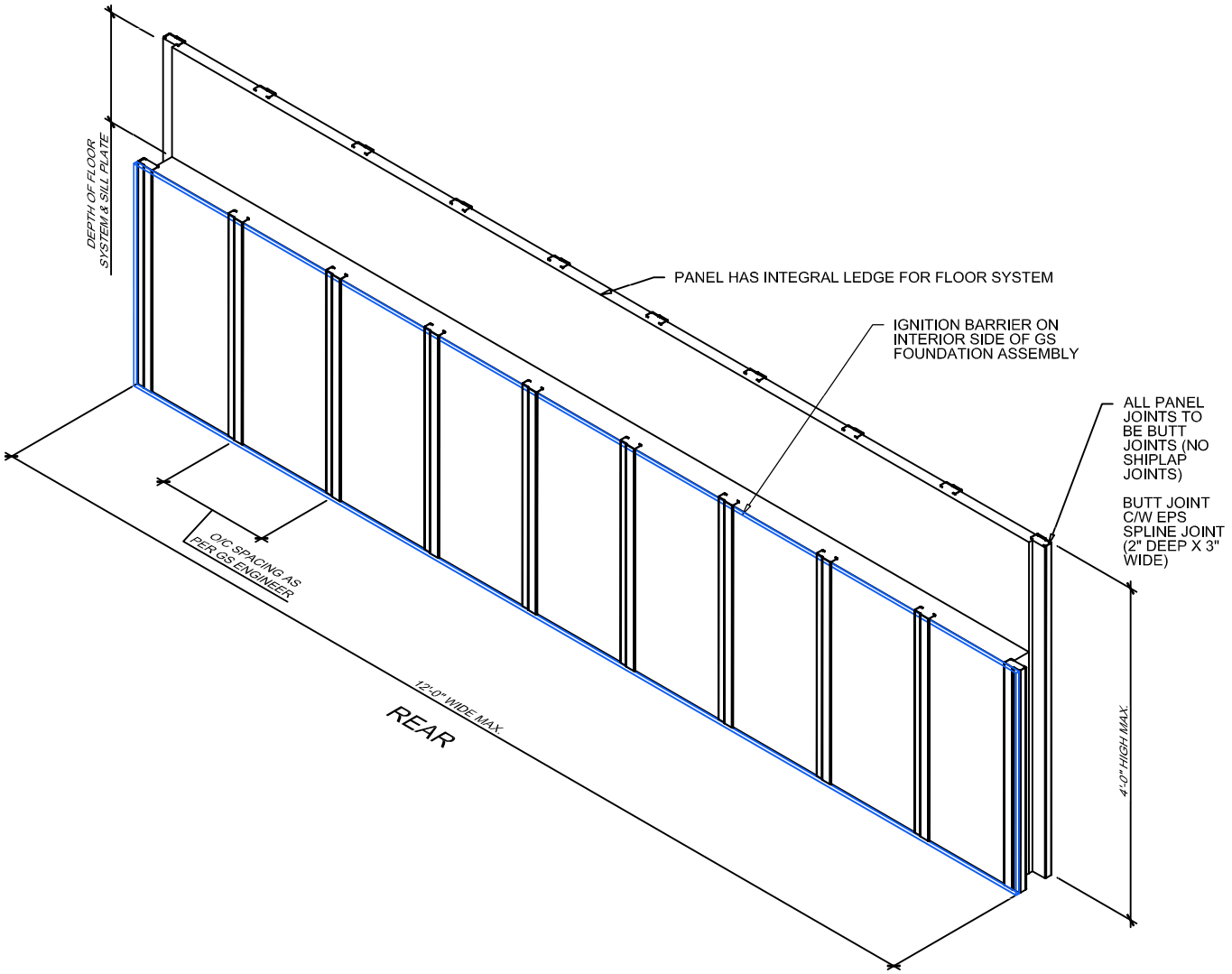
HORIZONTAL FOUNDATION PANEL (PERSPECTIVE)

N.T.S.

390

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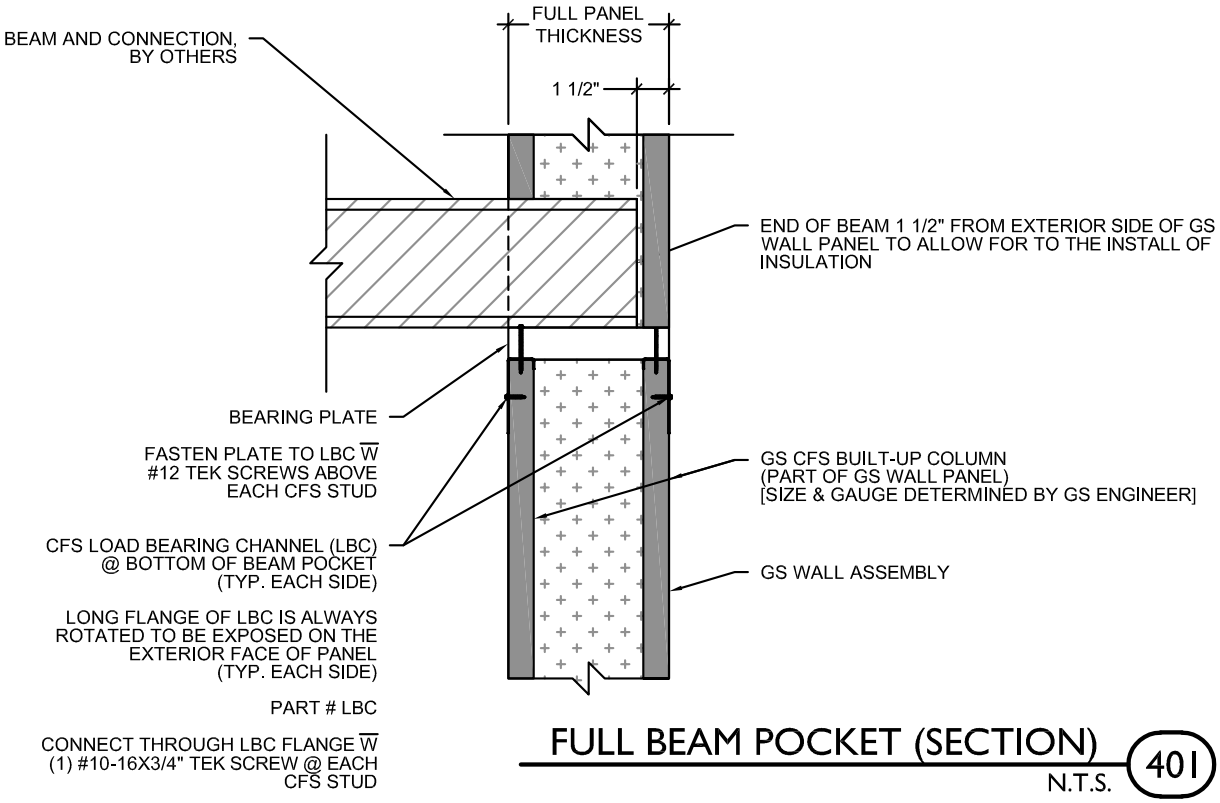


HORIZONTAL FOUNDATION PANEL WITH LEDGE (PERSPECTIVE) 391

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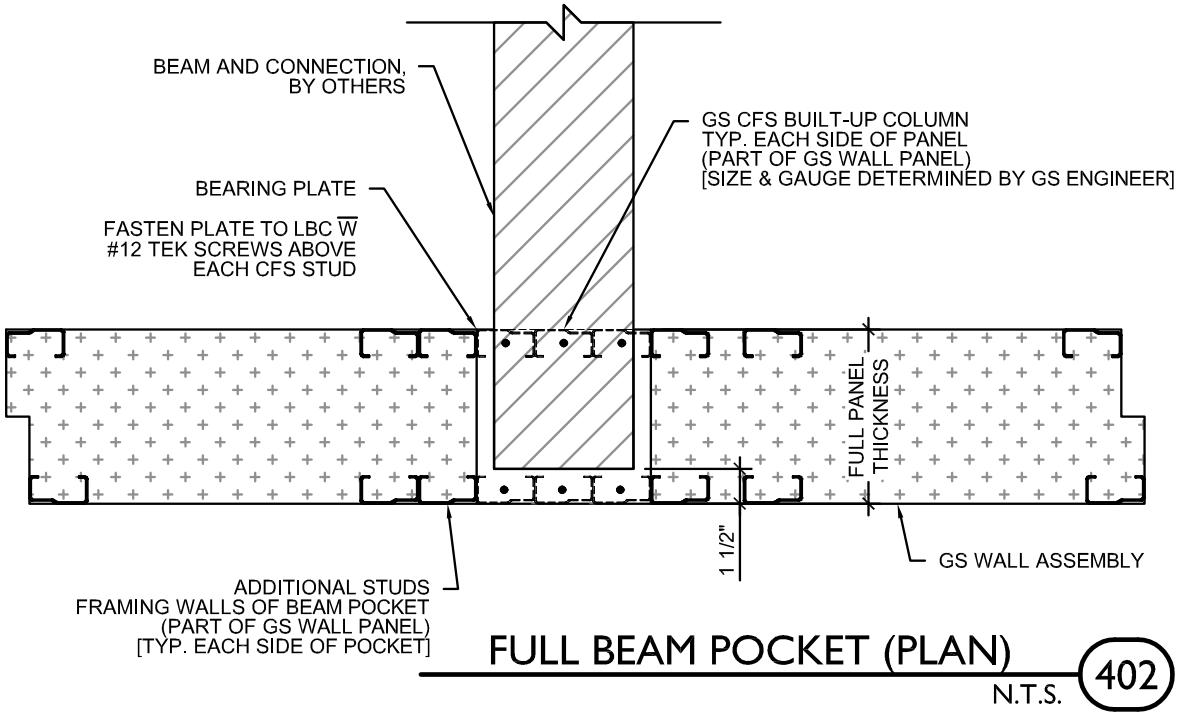
FULL BEAM POCKET (SECTION) 401

N.T.S.

BEARING PLATE SELECTION GUIDE	
BEAM MATERIAL	BEARING PLATE MATERIAL
NOMINAL LUMBER	(2) PLY 3/4" PLYWOOD PLATE
ENGINEERED LUMBER	(1) PLY 1 3/4" LVL PLATE
STEEL	1/4" STEEL PLATE, PREDRILLED FOR #12 TEK SCREWS CXN

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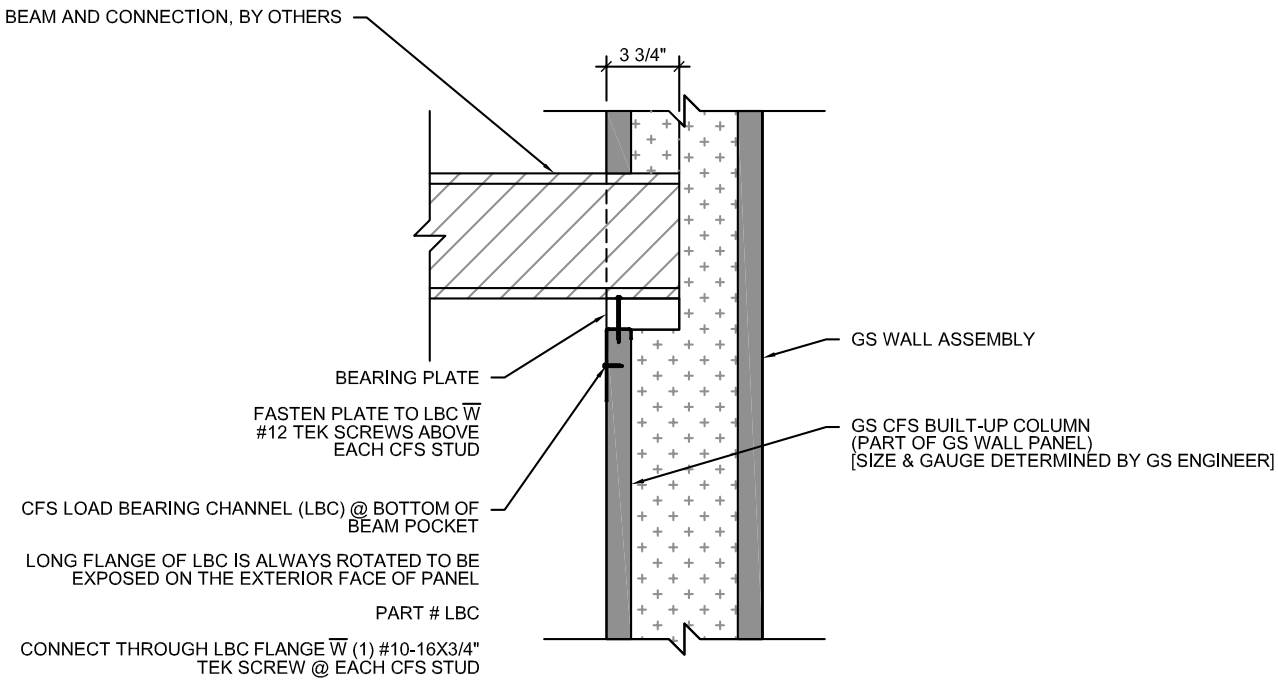
FULL BEAM POCKET (PLAN) 402

N.T.S.

BEARING PLATE SELECTION GUIDE	
BEAM MATERIAL	BEARING PLATE MATERIAL
NOMINAL LUMBER	(2) PLY 3/4" PLYWOOD PLATE
ENGINEERED LUMBER	(1) PLY 1 3/4" LVL PLATE
STEEL	1/4" STEEL PLATE, PREDRILLED FOR #12 TEK SCREWS CXN

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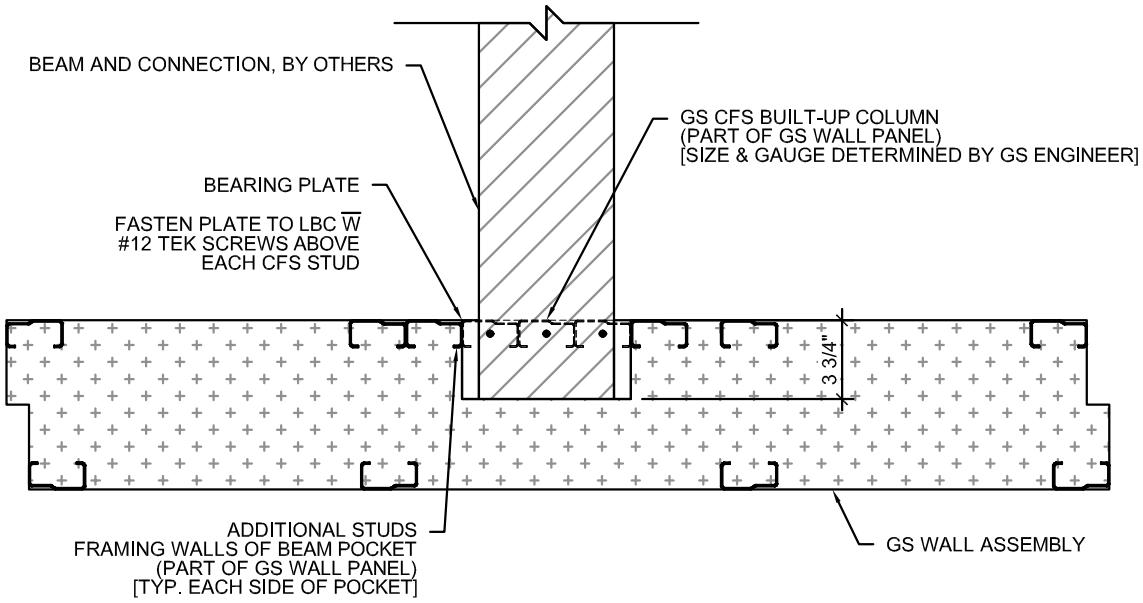
PARTIAL BEAM POCKET (SECTION) 403

N.T.S.

BEARING PLATE SELECTION GUIDE	
BEAM MATERIAL	BEARING PLATE MATERIAL
NOMINAL LUMBER	(2) PLY 3/4" PLYWOOD PLATE
ENGINEERED LUMBER	(1) PLY 1 3/4" LVL PLATE
STEEL	1/4" STEEL PLATE, PREDRILLED FOR #12 TEK SCREWS CXN

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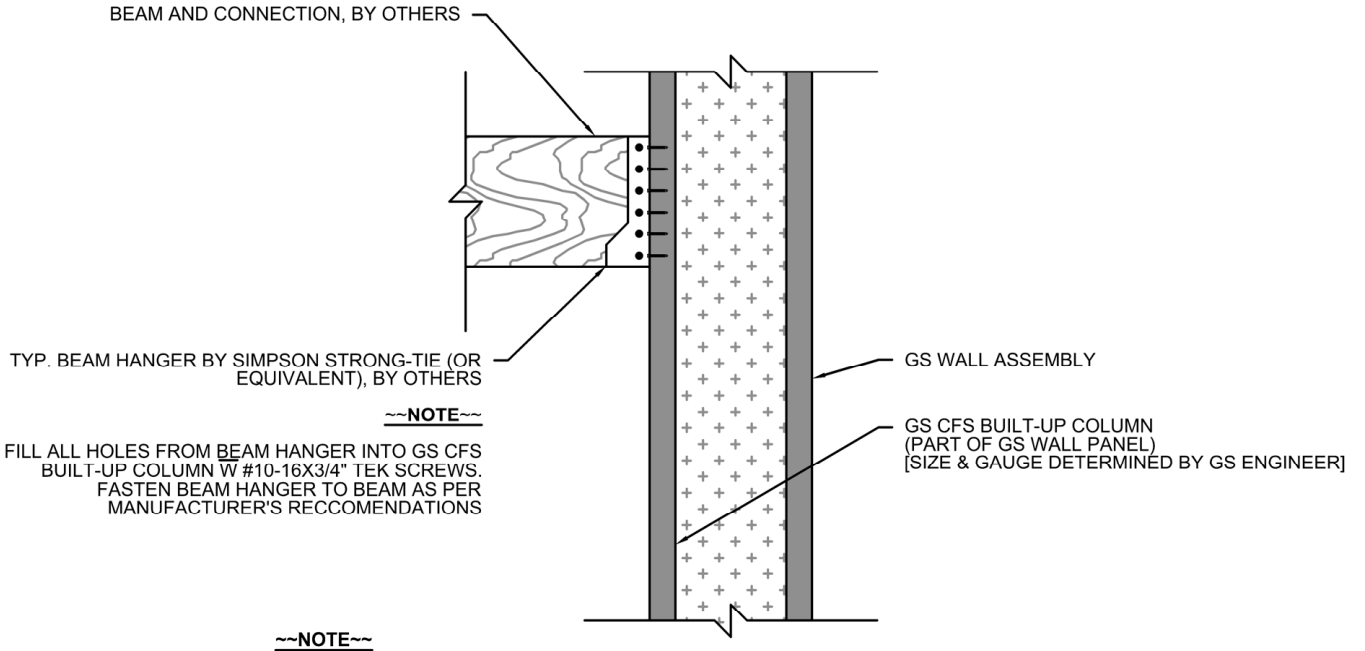


PARTIAL BEAM POCKET (PLAN) 404
N.T.S.

BEARING PLATE SELECTION GUIDE	
BEAM MATERIAL	BEARING PLATE MATERIAL
NOMINAL LUMBER	(2) PLY 3/4" PLYWOOD PLATE
ENGINEERED LUMBER	(1) PLY 1 3/4" LVL PLATE
STEEL	1/4" STEEL PLATE, PREDRILLED FOR #12 TEK SCREWS CXN

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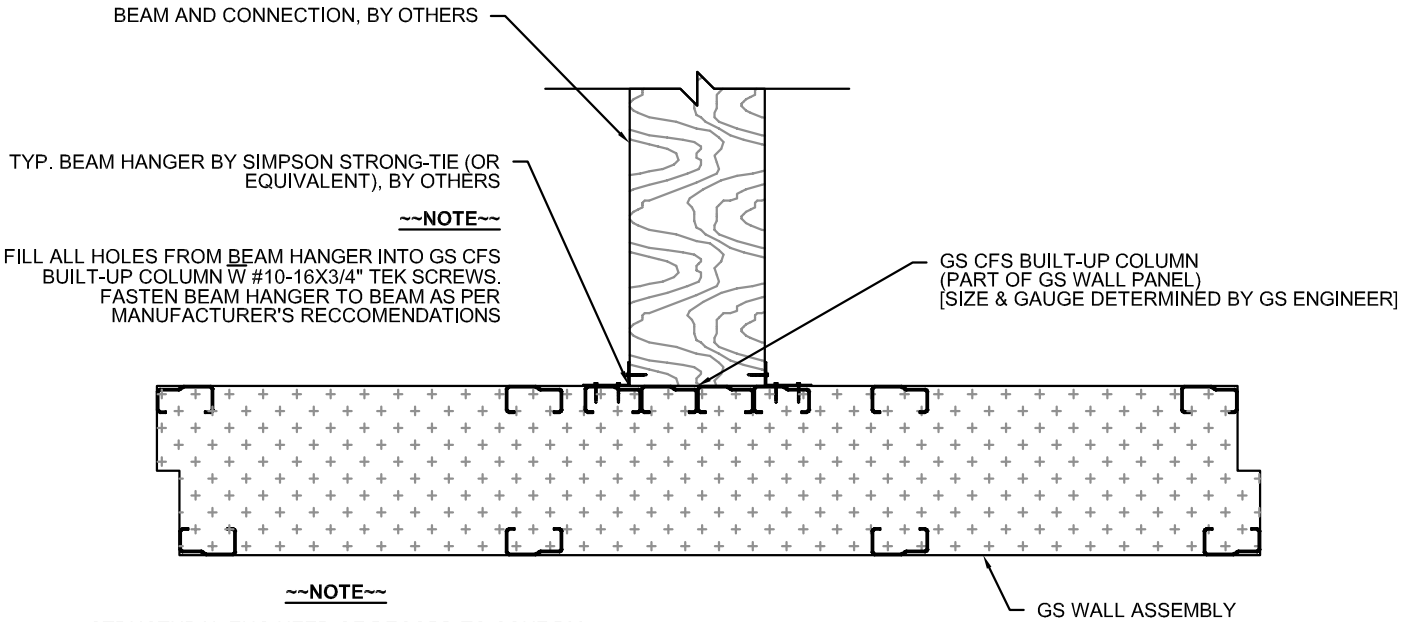


HANGING BEAM (SECTION) 405

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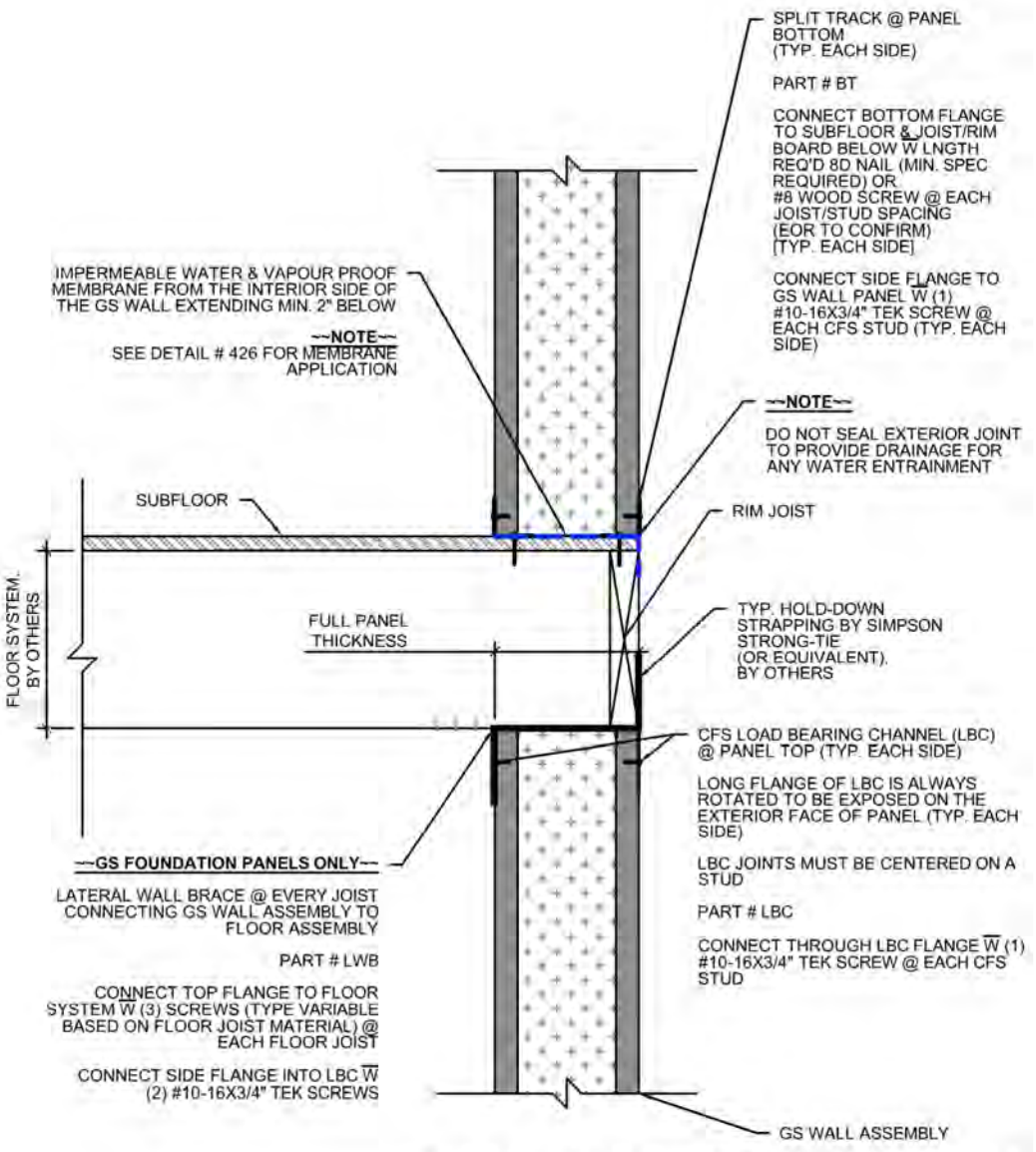


HANGING BEAM (PLAN) 406

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FULL BEARING FLOOR (SECTION) 420

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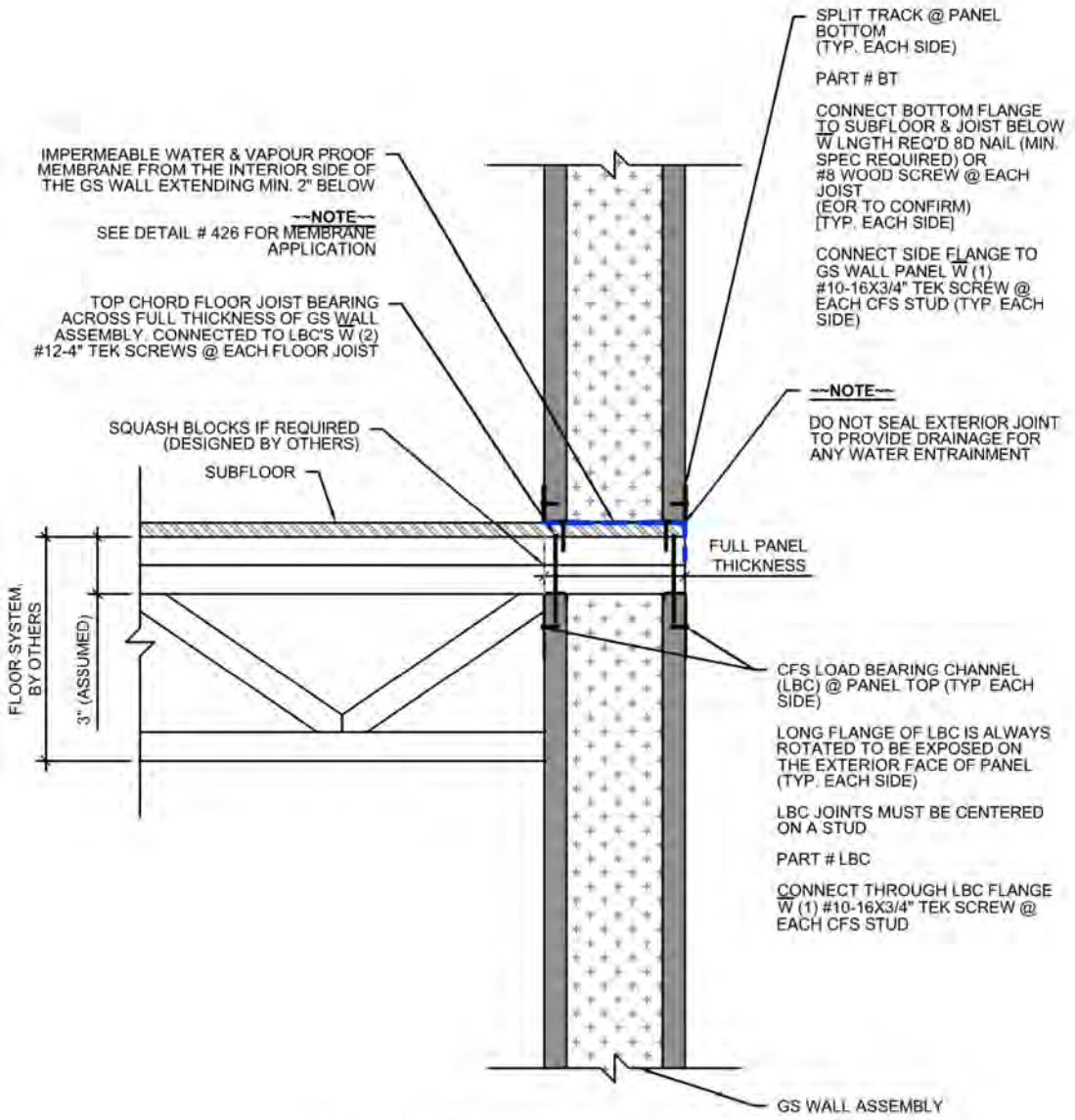
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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FULL THICKNESS BEARING (TOP CHORD BEARING) [SECTION] 421

N.T.S.

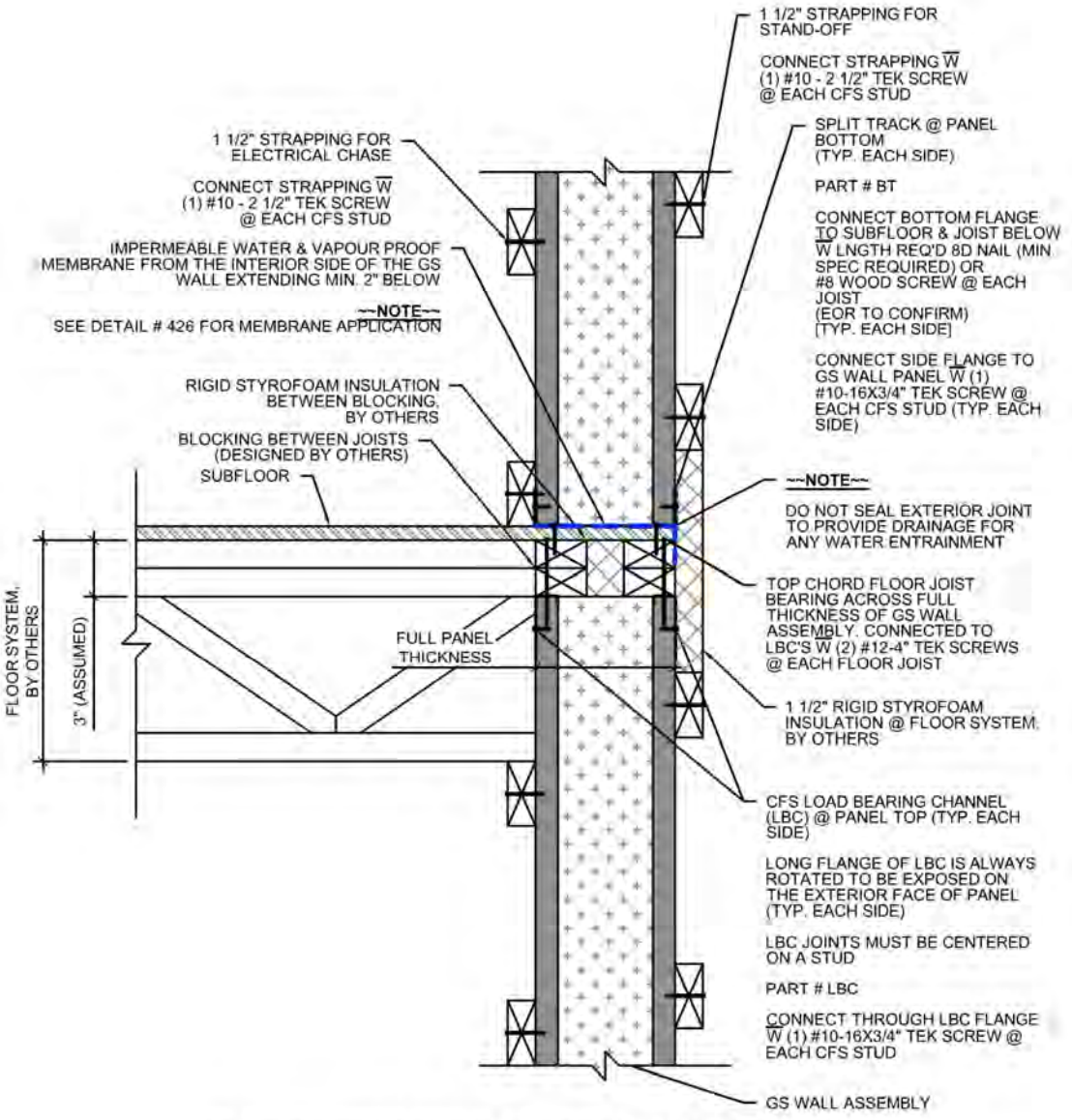
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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FULL THICKNESS BEARING W STRAPPING (TOP CHORD BEARING) [SECTION]

N.T.S. 422

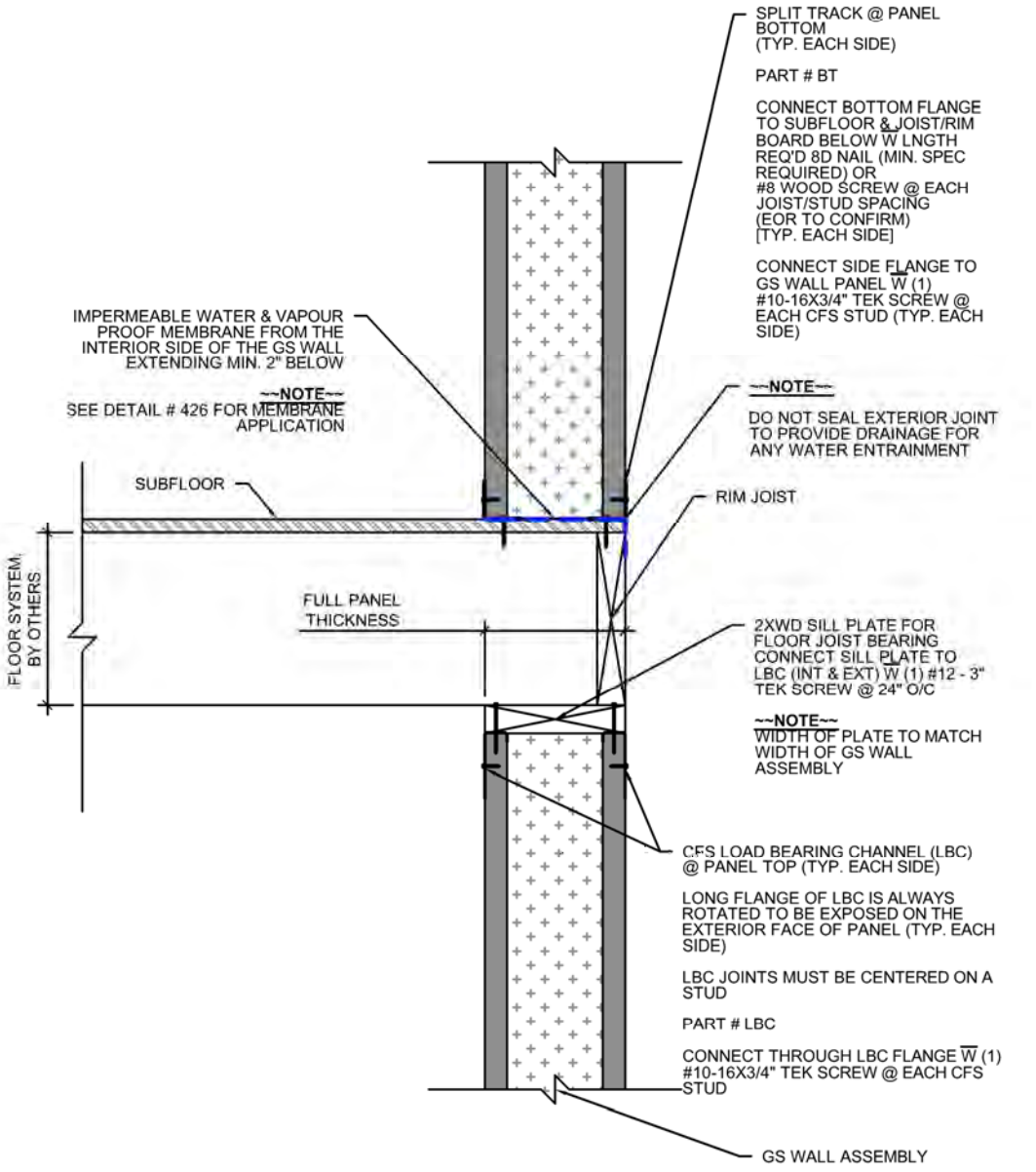
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

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FULL BEARING FLOOR W SILL PLATE (SECTION)

423

N.T.S.

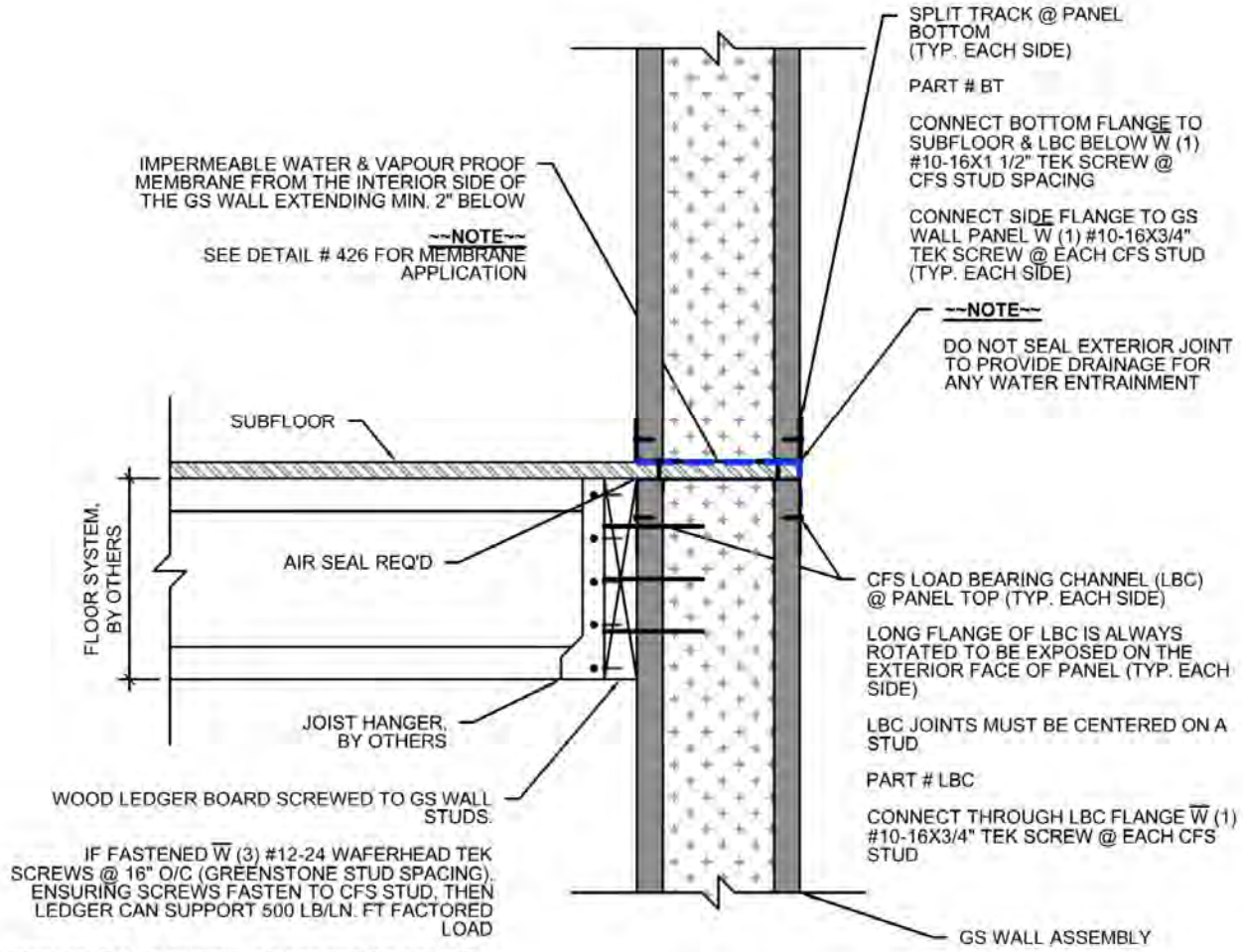
~~NOTE~~

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LEDGER BEARING FLOOR (SECTION)

N.T.S. 424

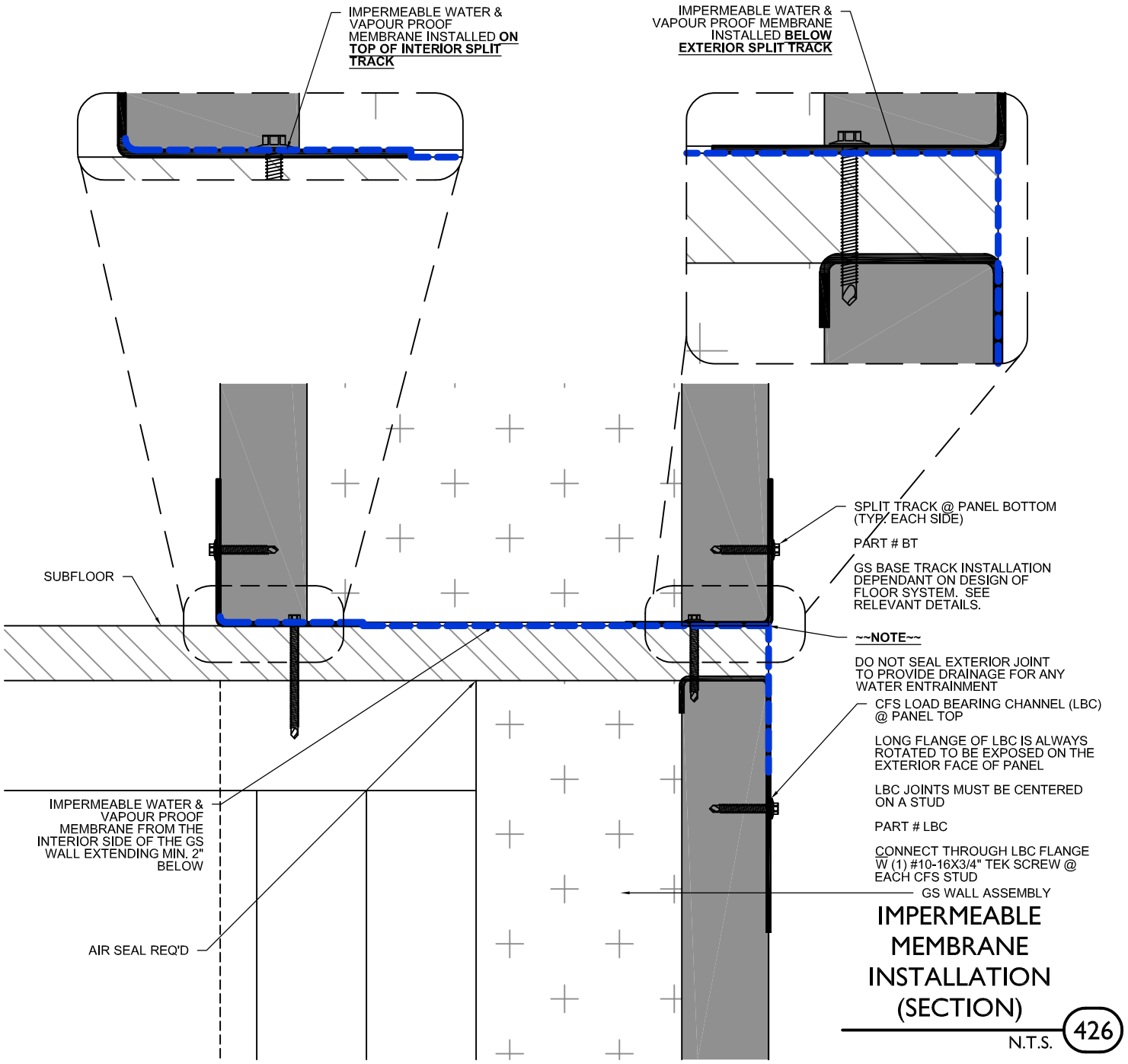
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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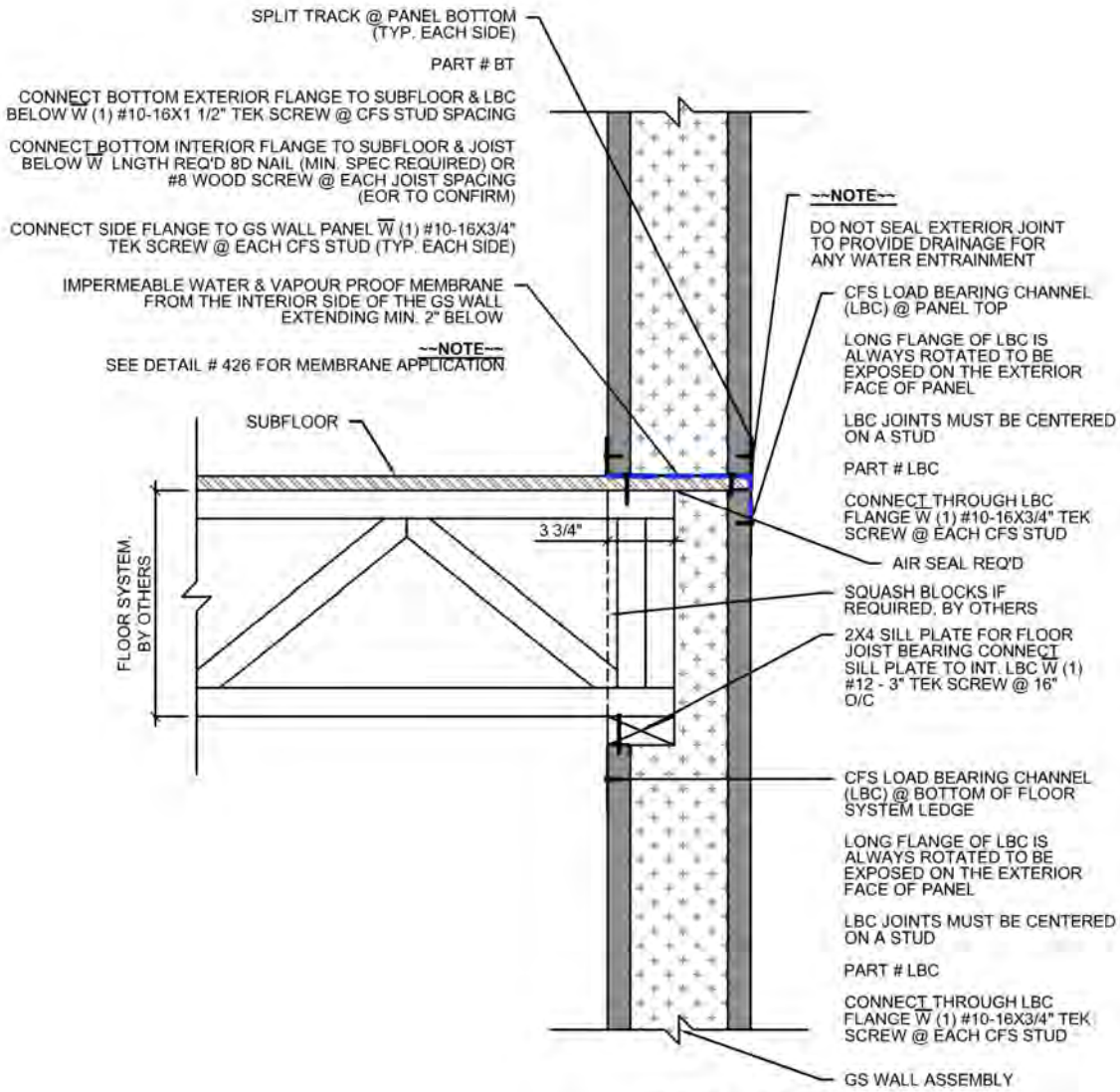
IMPERMEABLE MEMBRANE INSTALLATION (SECTION)

N.T.S.

426

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FLOOR LEDGE (BOTTOM CHORD BEARING) [SECTION]

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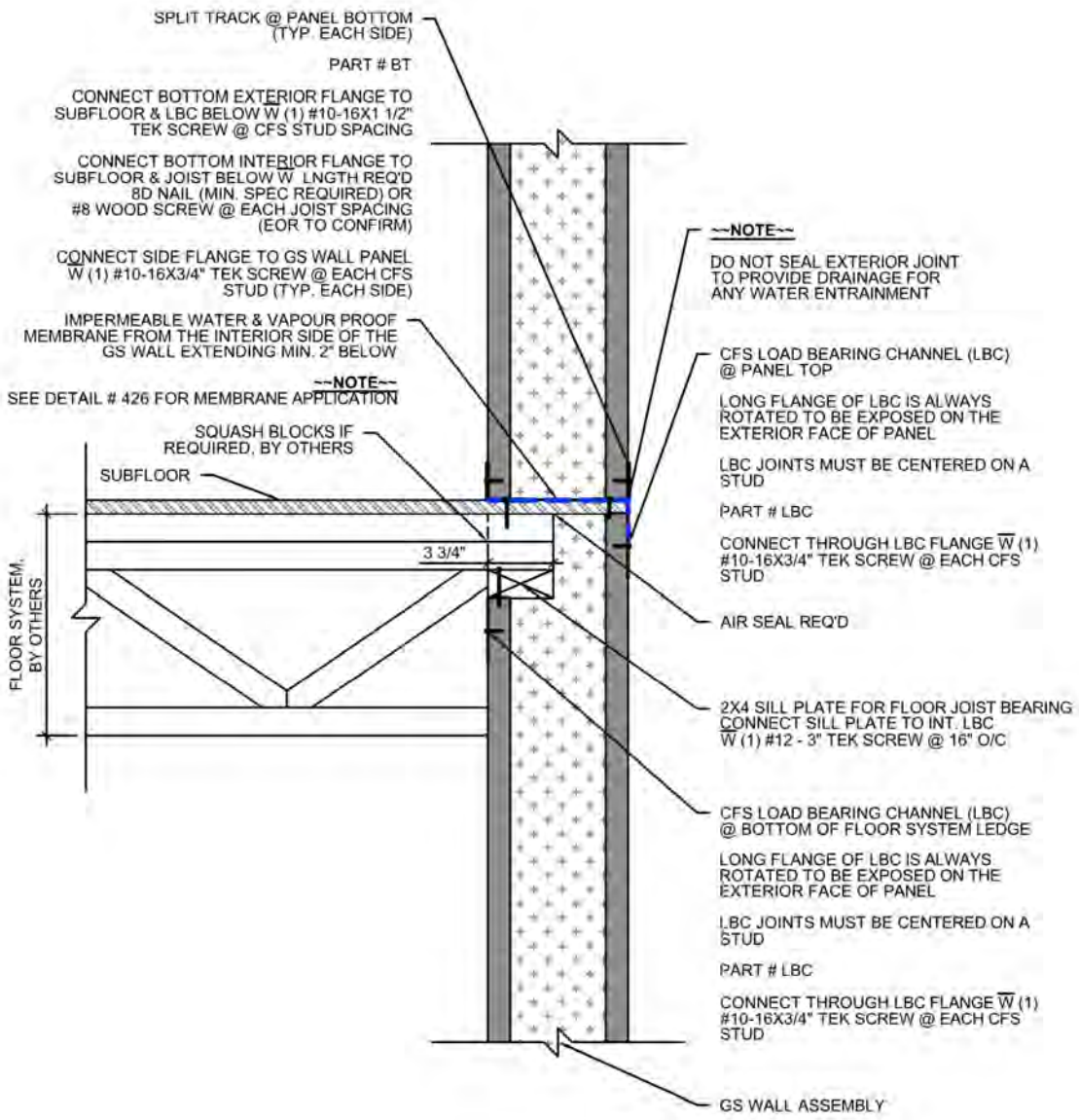
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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FLOOR LEDGE (TOP CHORD BEARING) [SECTION]

N.T.S. 431

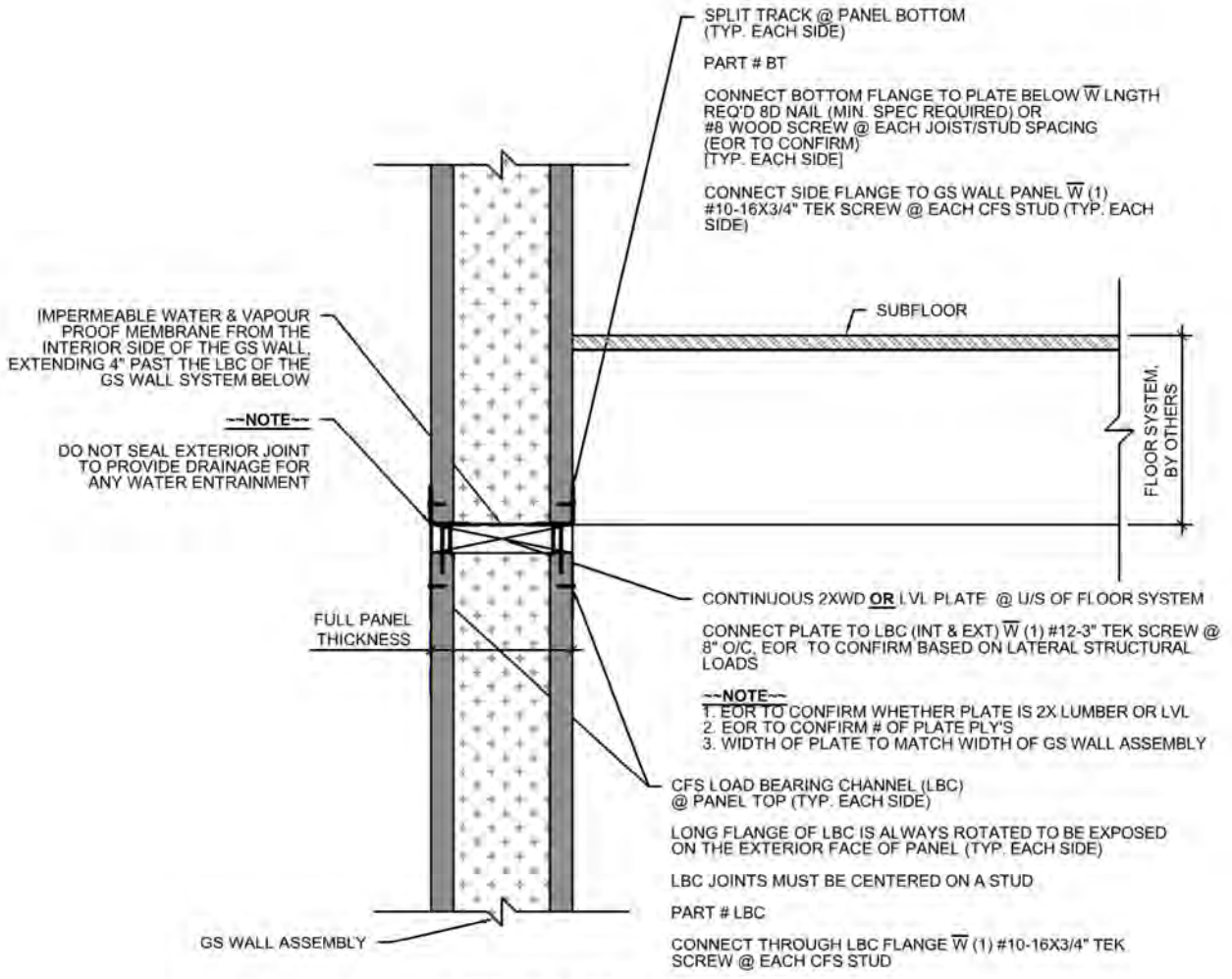
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

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STAIRWELL WALL BREAK (LOW) [SECTION]

N.T.S. 432

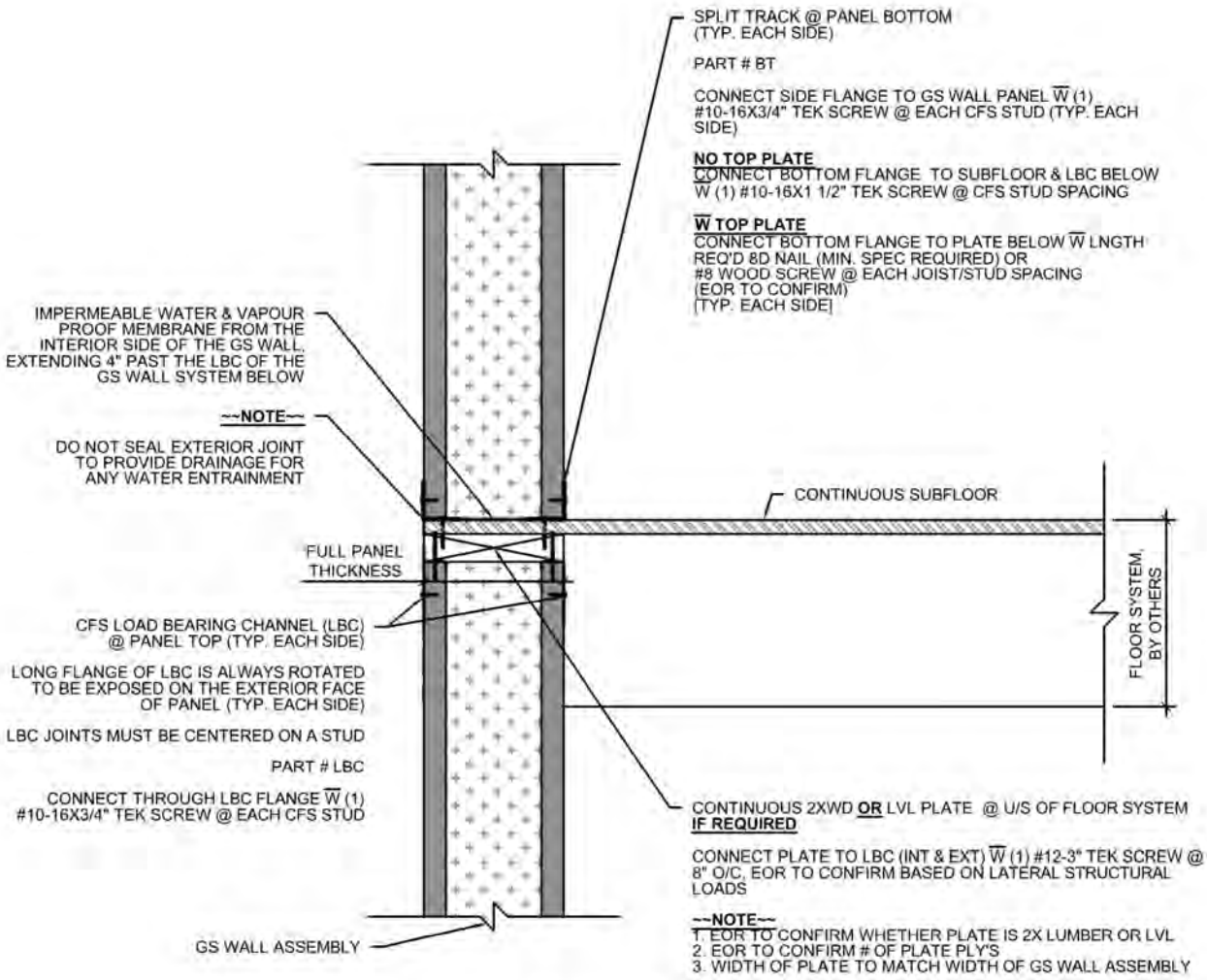
~~NOTE~~

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STAIRWELL WALL BREAK (HIGH) [SECTION]

N.T.S. 433

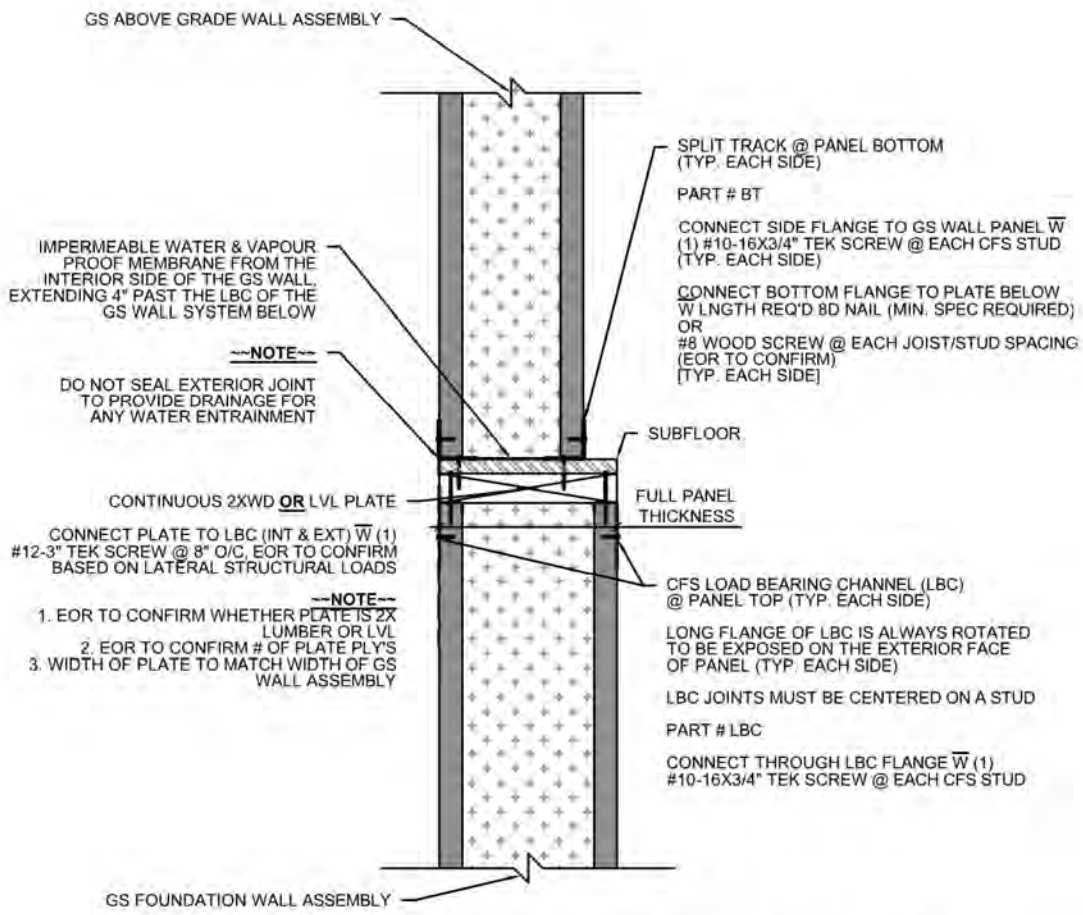
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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STAIRWELL WALL BREAK (FOUNDATION) [SECTION]

N.T.S. 434

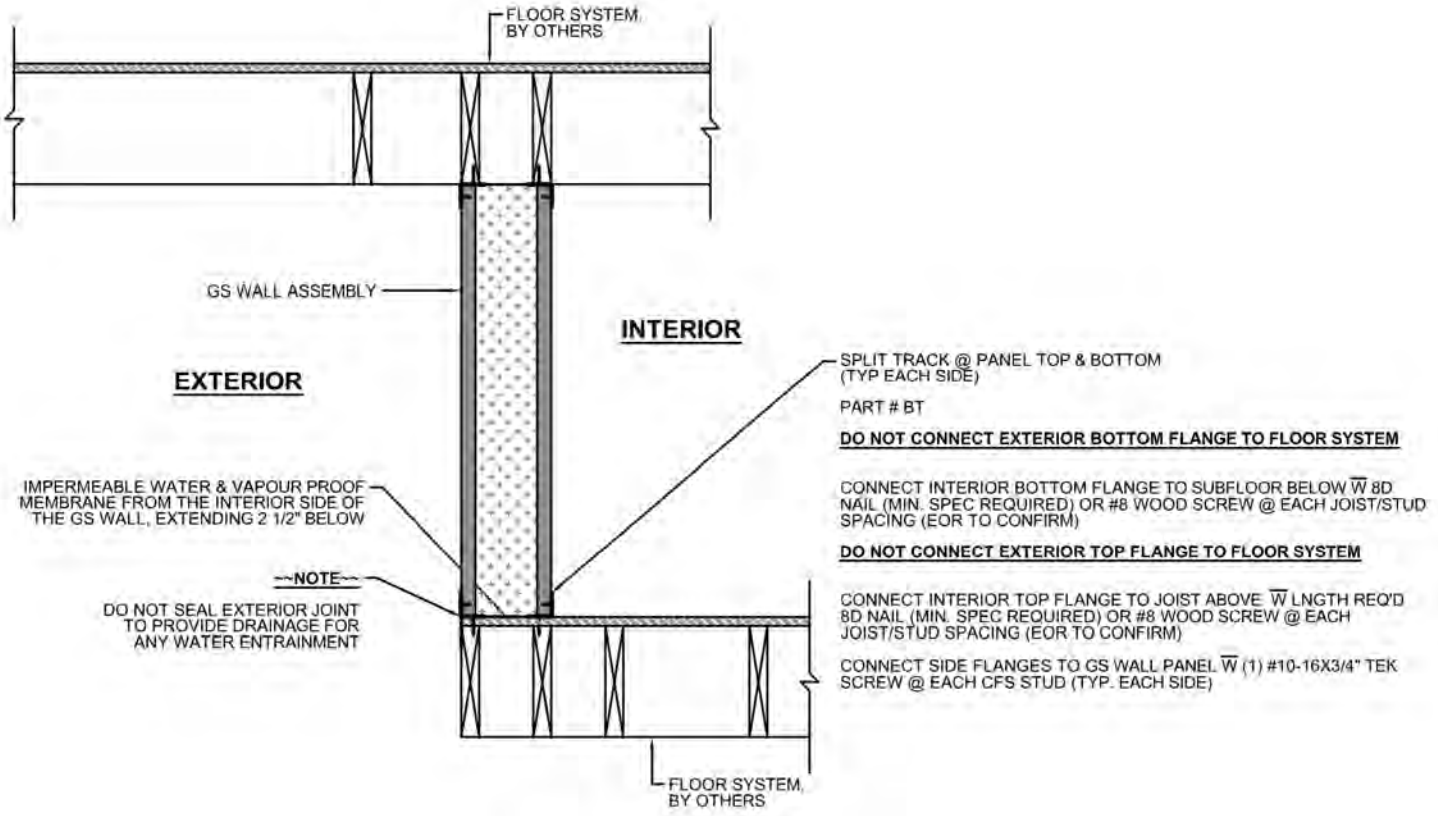
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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REMOVABLE GS WALL INSTALLATION [SECTION]

N.T.S. 435

~~NOTE~~

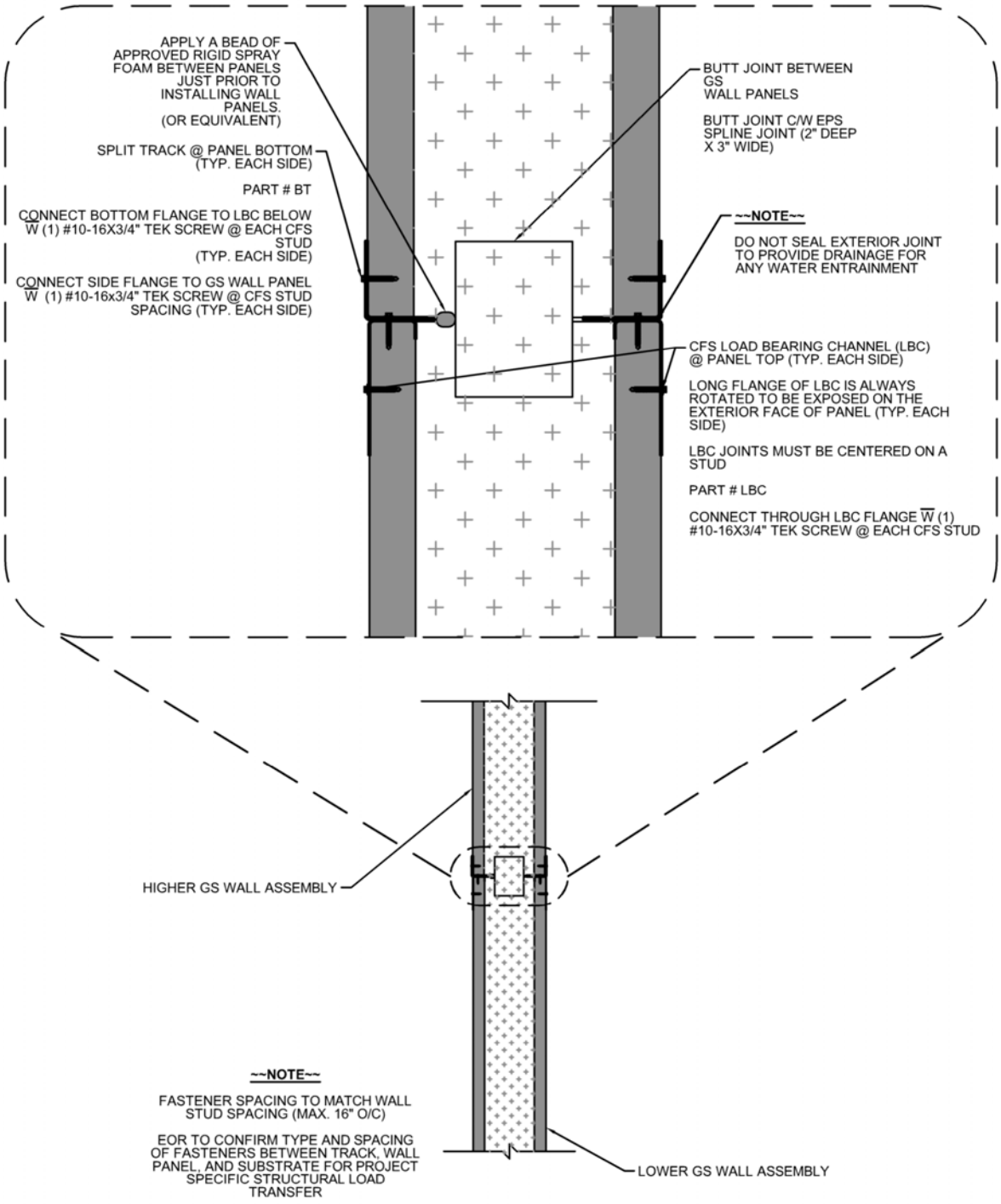
FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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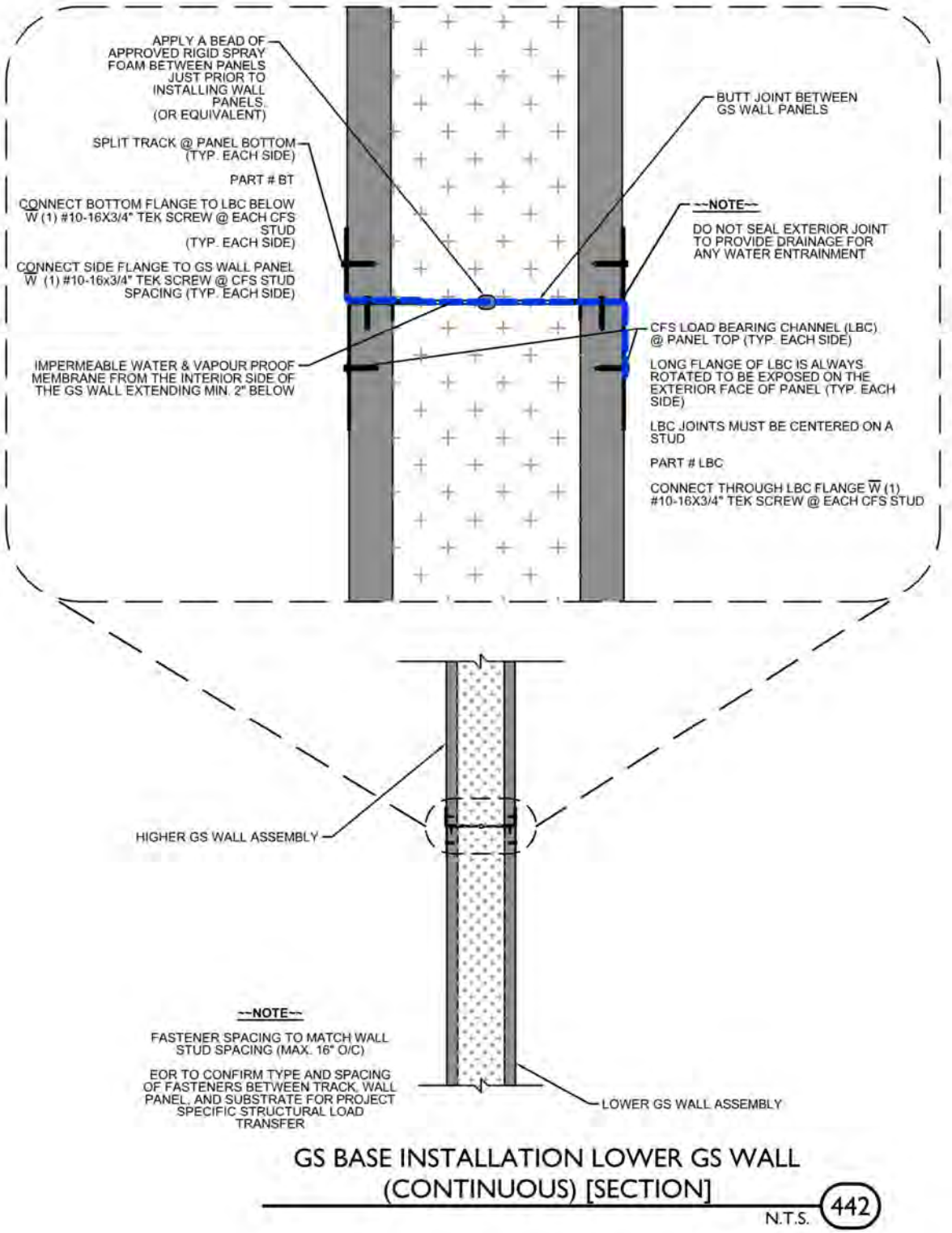
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GS BASE INSTALLATION LOWER GS WALL (CONTINUOUS) [SECTION] 441
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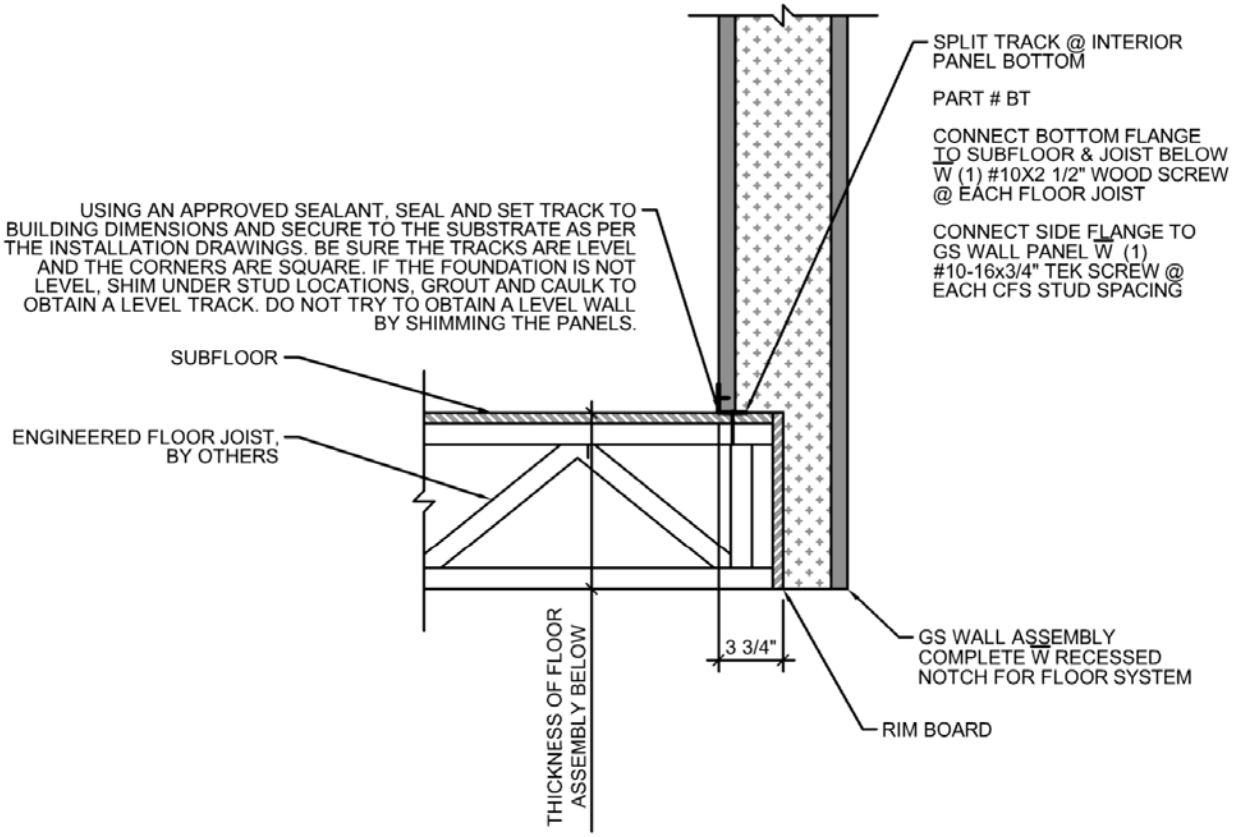


GS BASE INSTALLATION LOWER GS WALL (CONTINUOUS) [SECTION]

N.T.S. 442

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GS WALL ASSEMBLY W BOTTOM LEDGE (SECTION)

N.T.S. 450

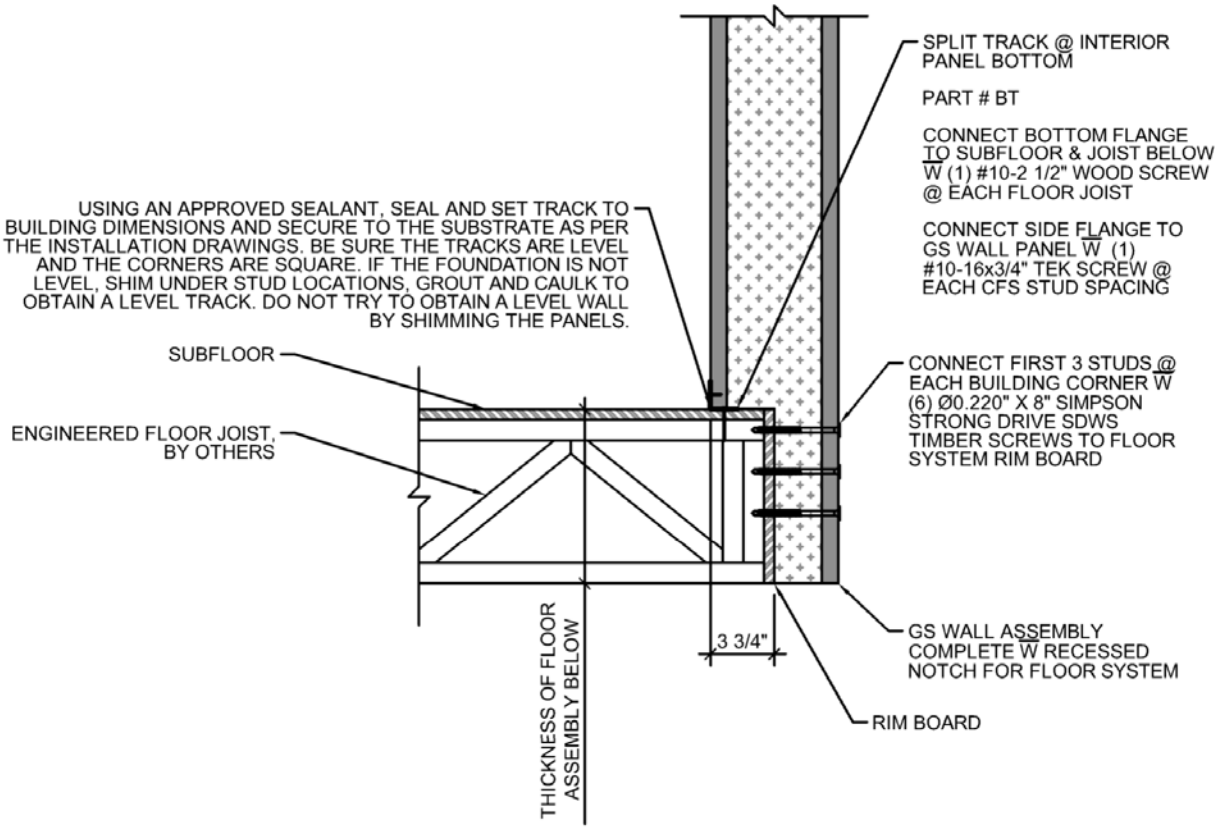
~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

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GS WALL ASSEMBLY W BOTTOM LEDGE @ CORNERS (SECTION) 451

N.T.S.

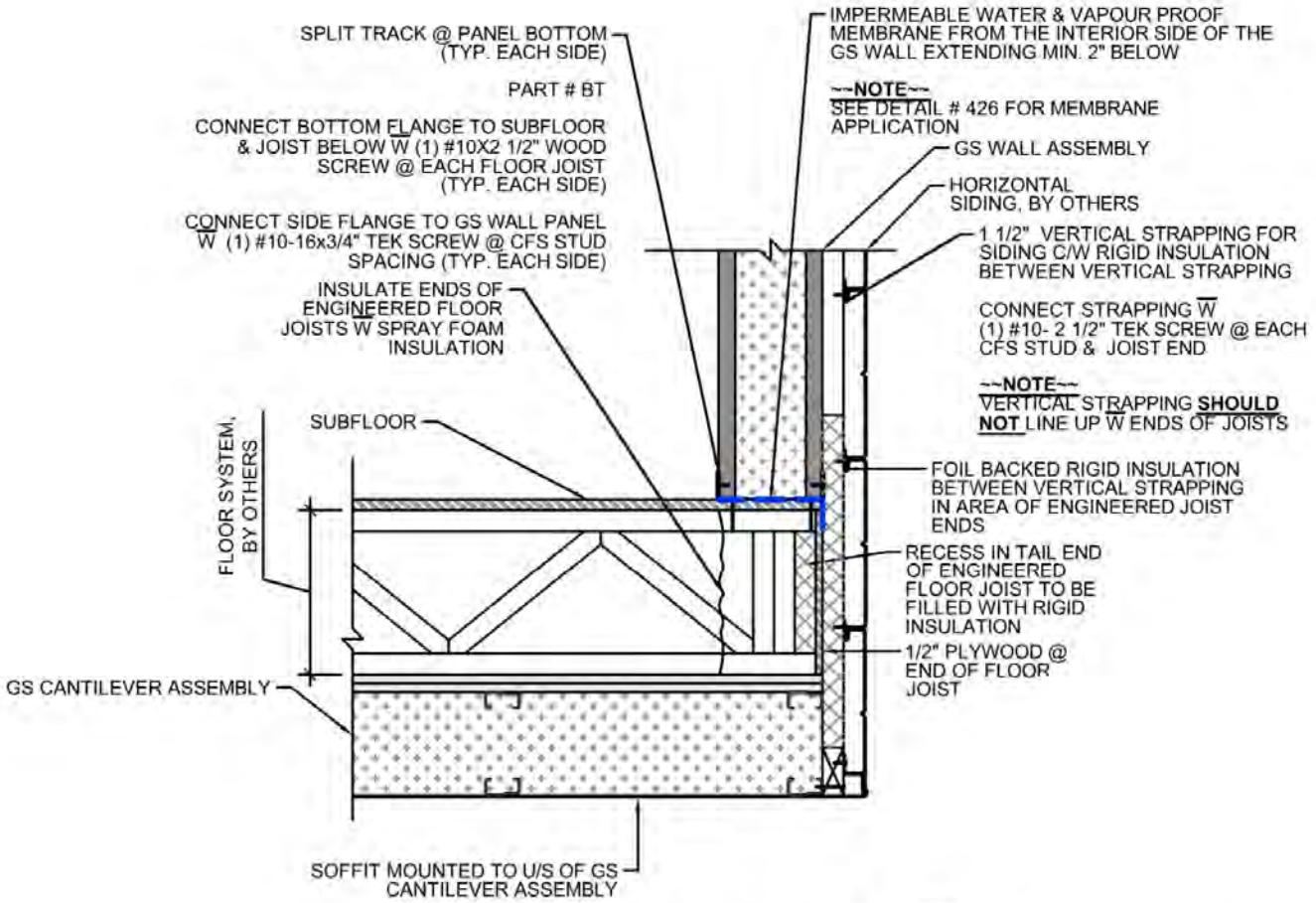
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CANTILEVER INSULATION W EXT. STRAPPING FOR SIDING

N.T.S. 452

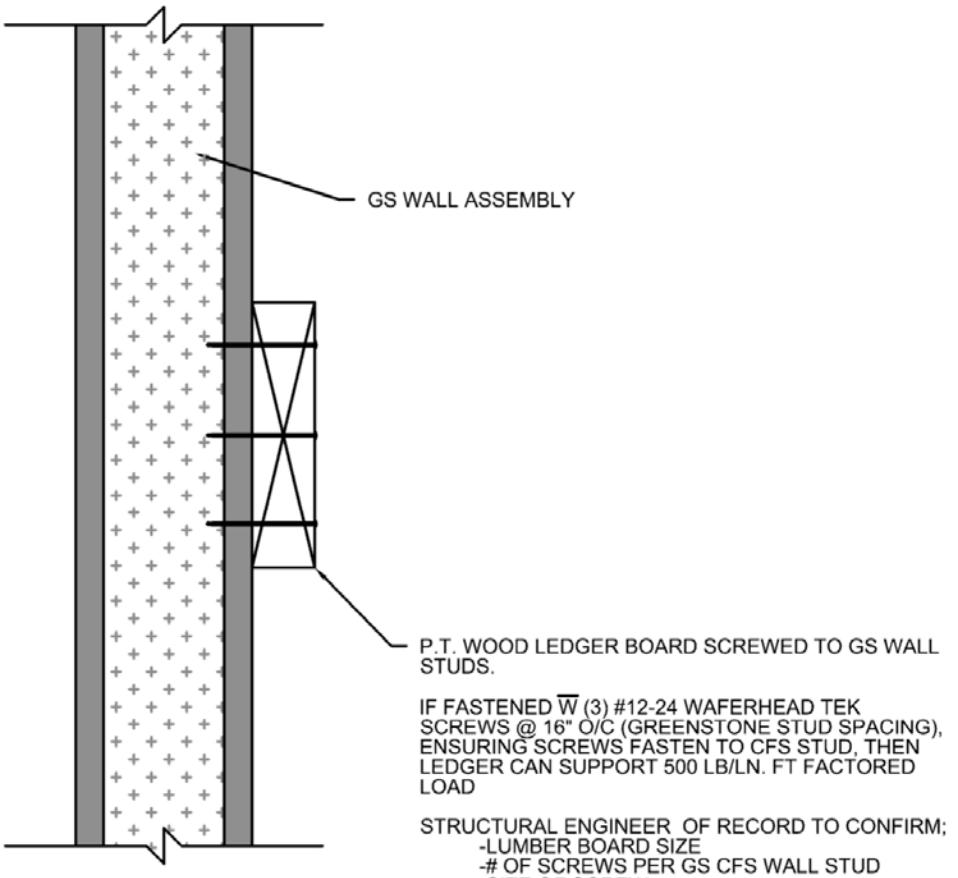
~~NOTE~~

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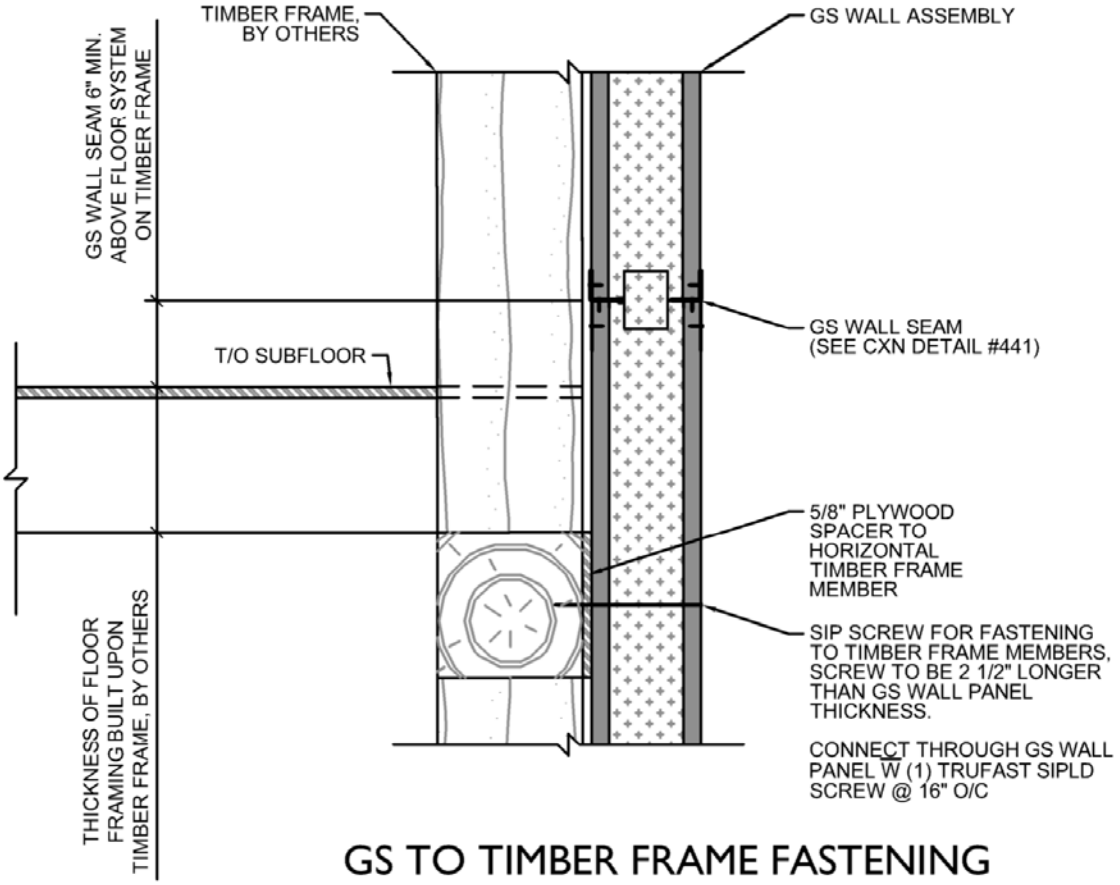
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LEDGER BOARD INSTALLATION (SECTION) 460
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GS TO TIMBER FRAME FASTENING [SECTION]

N.T.S. 461

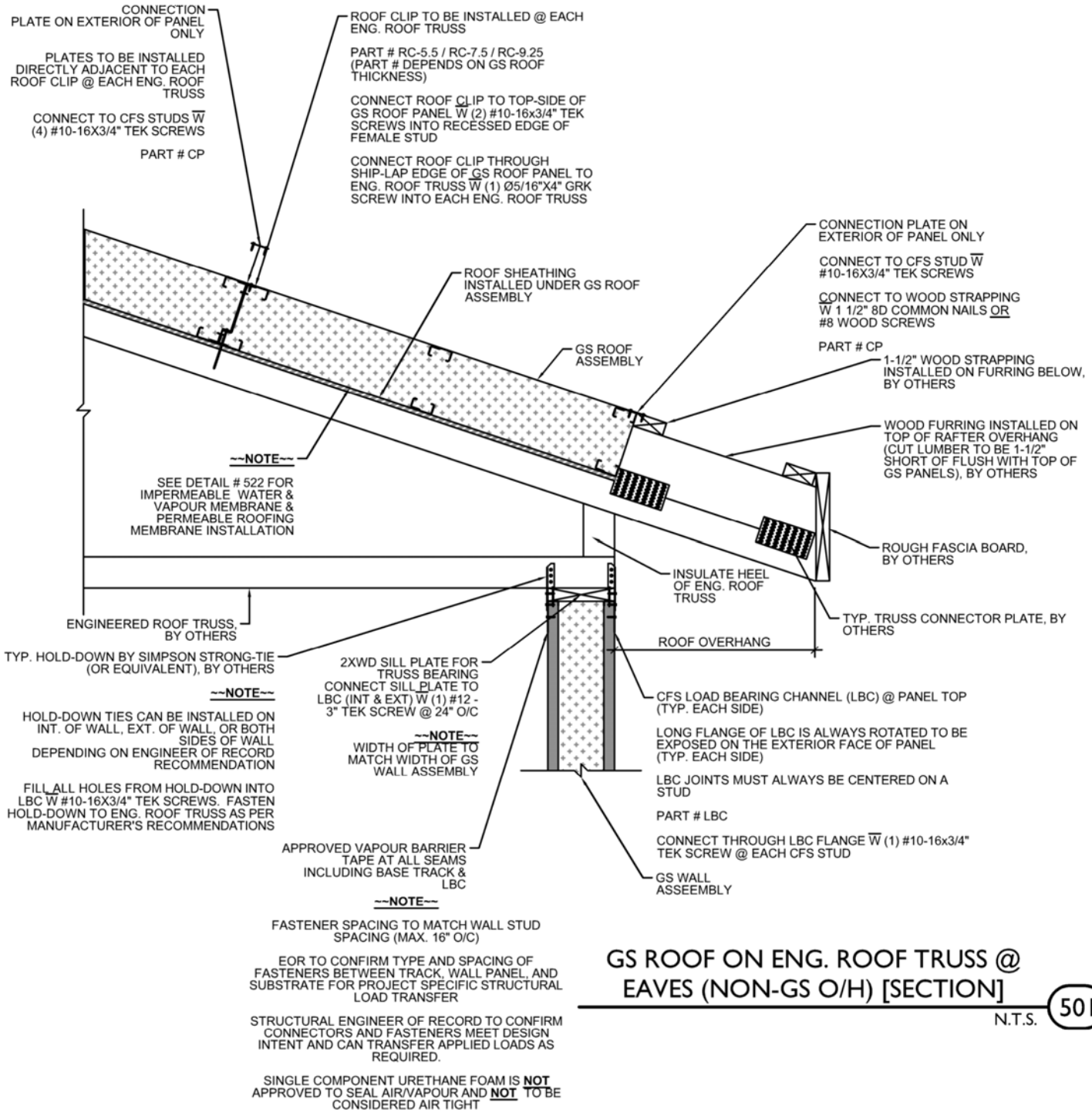
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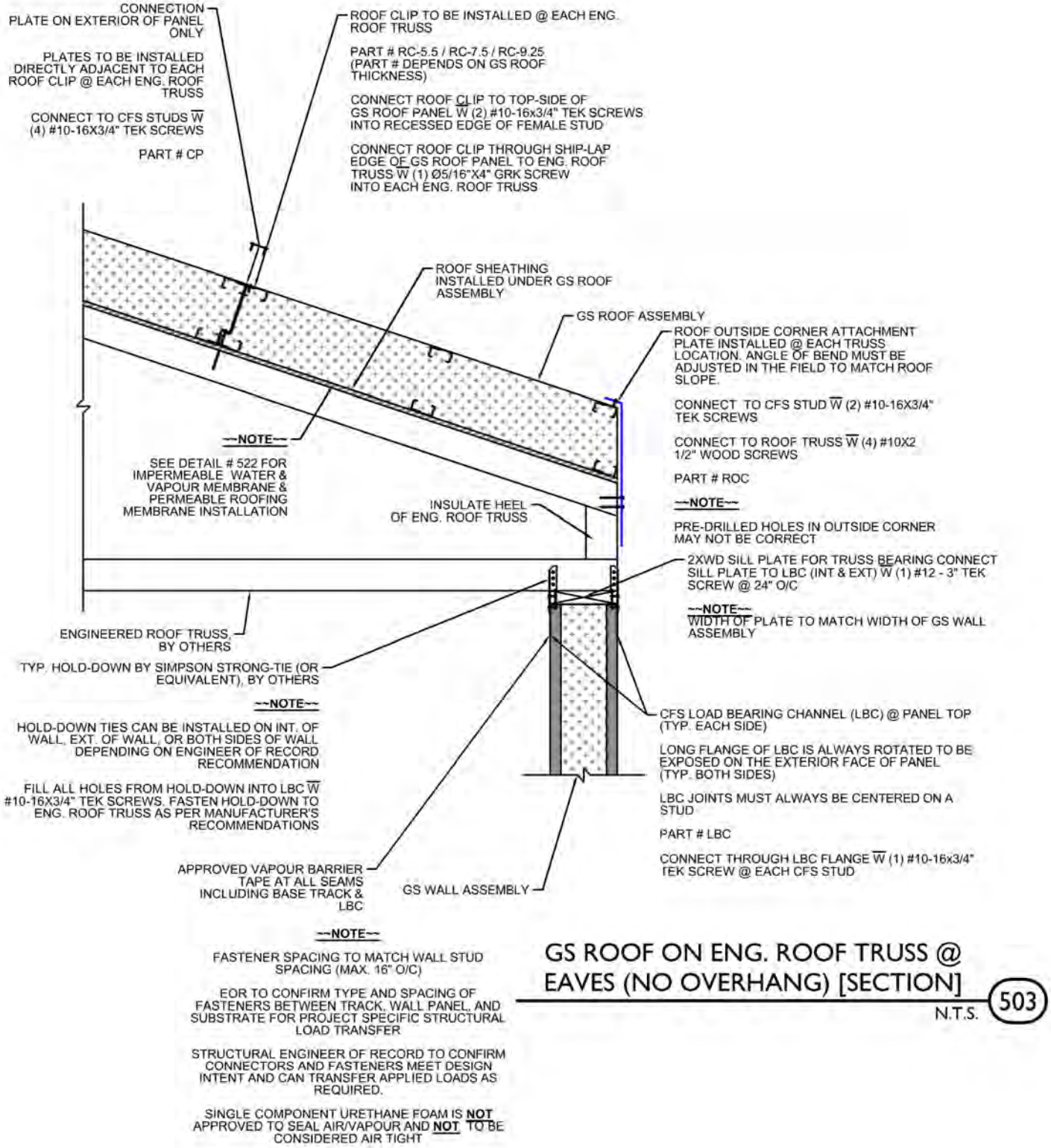


GS ROOF ON ENG. ROOF TRUSS @ EAVES (NON-GS O/H) [SECTION]

N.T.S. 501

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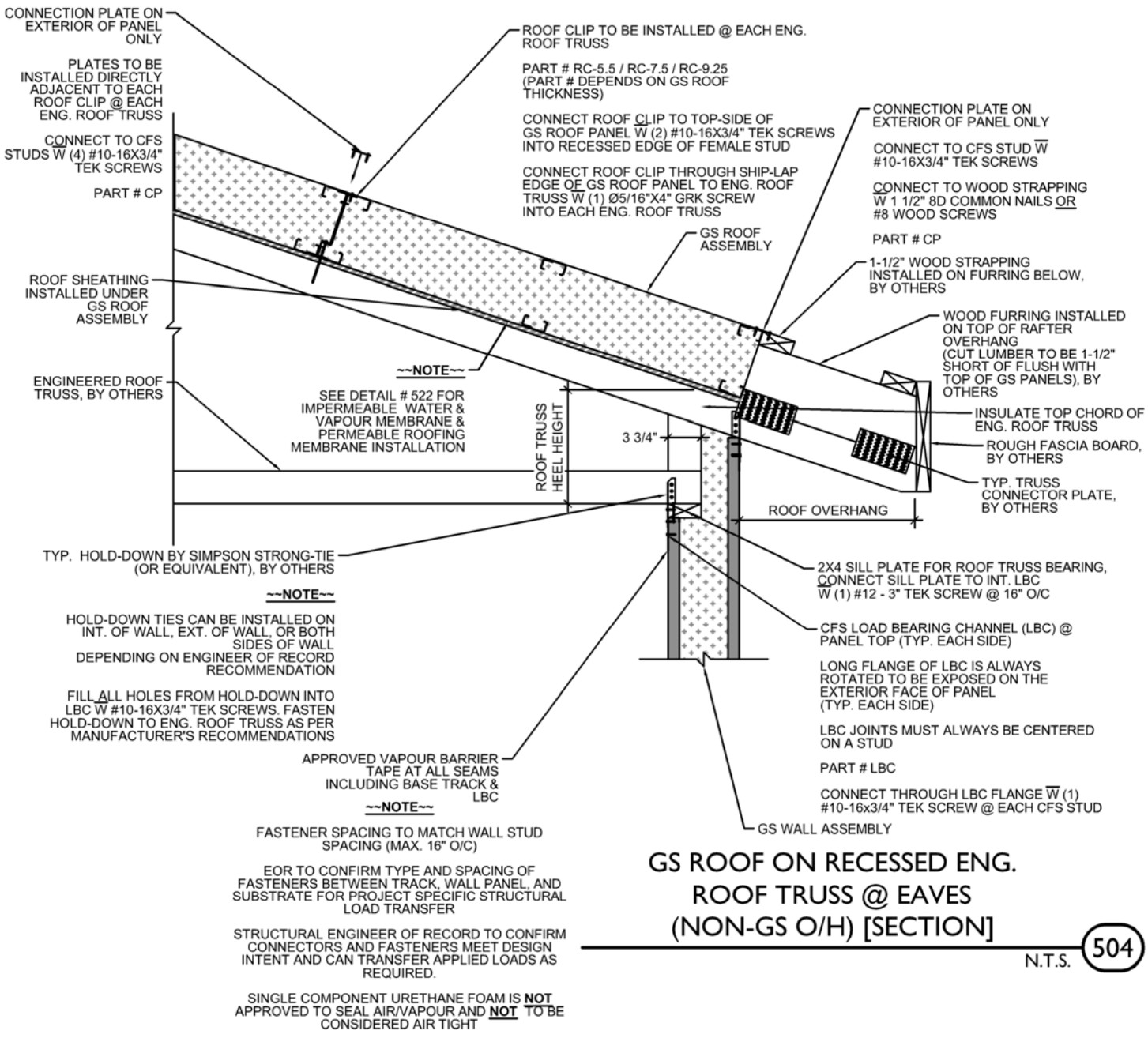
GS ROOF ON ENG. ROOF TRUSS @ EAVES (NO OVERHANG) [SECTION]

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503

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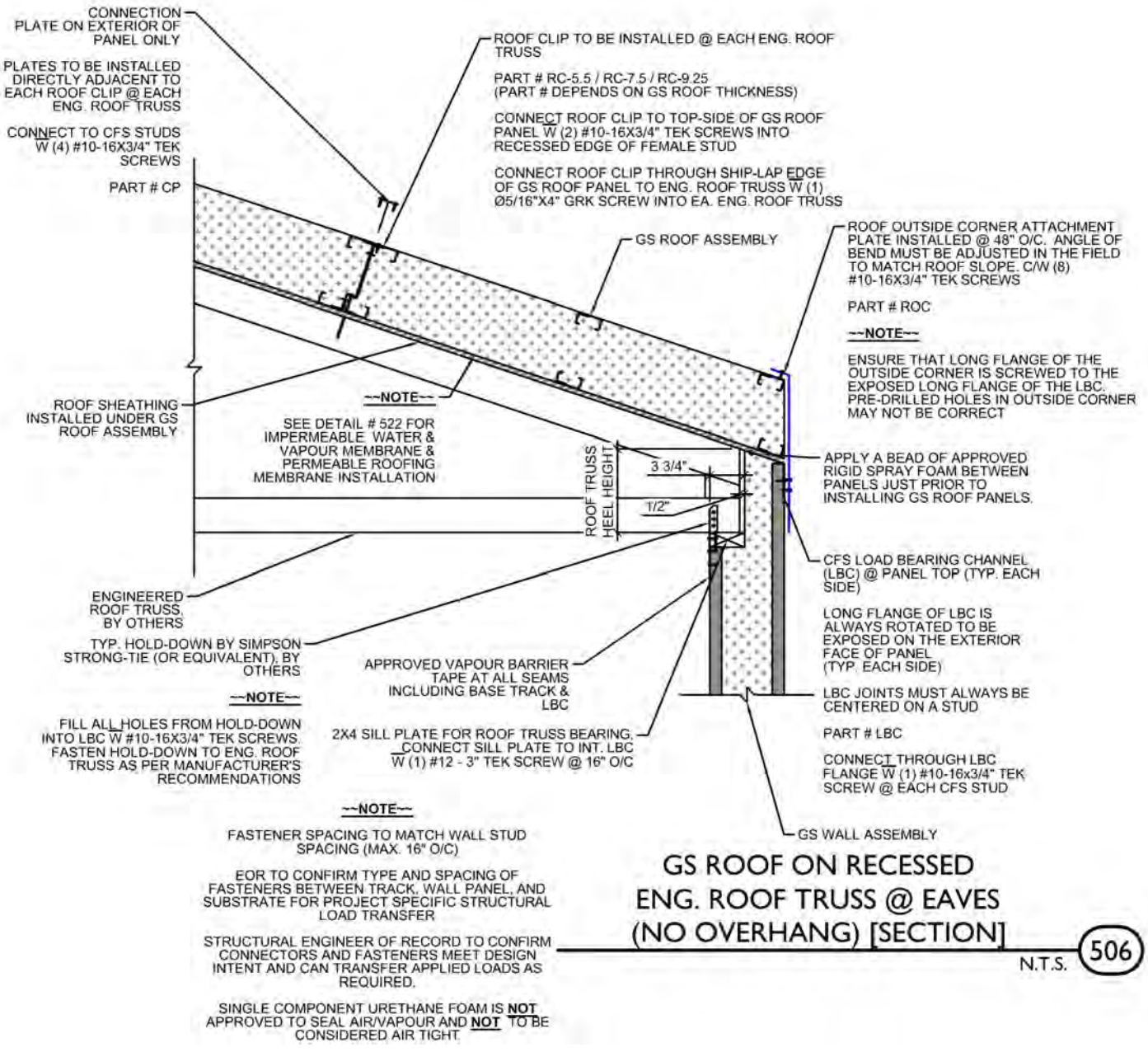


GS ROOF ON RECESSED ENG. ROOF TRUSS @ EAVES (NON-GS O/H) [SECTION]

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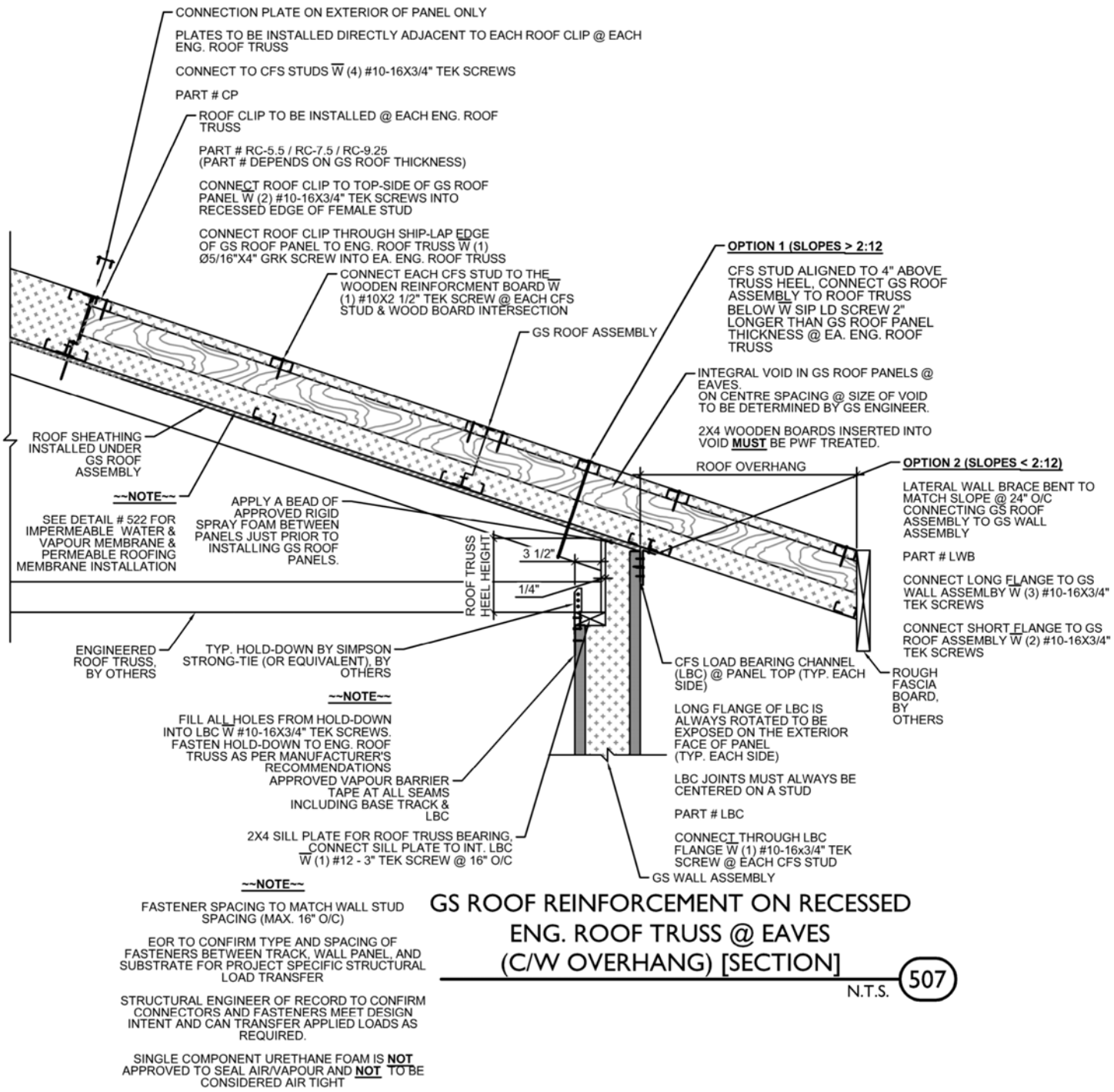


GS ROOF ON RECESSED ENG. ROOF TRUSS @ EAVES (NO OVERHANG) [SECTION]

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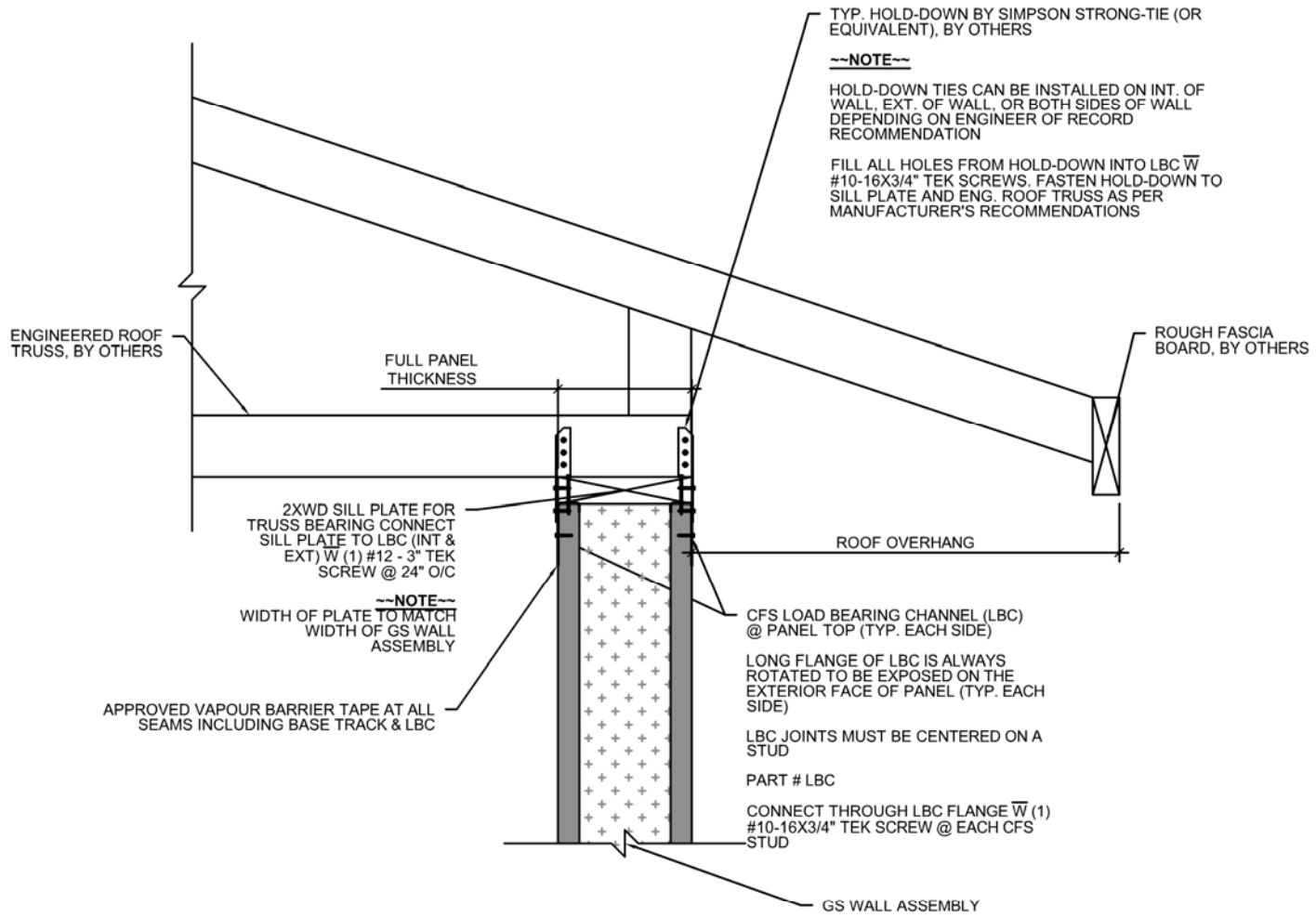


GS ROOF REINFORCEMENT ON RECESSED ENG. ROOF TRUSS @ EAVES (C/W OVERHANG) [SECTION]

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FULL BEARING ROOF W SILL PLATE (SECTION)

N.T.S. 508

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

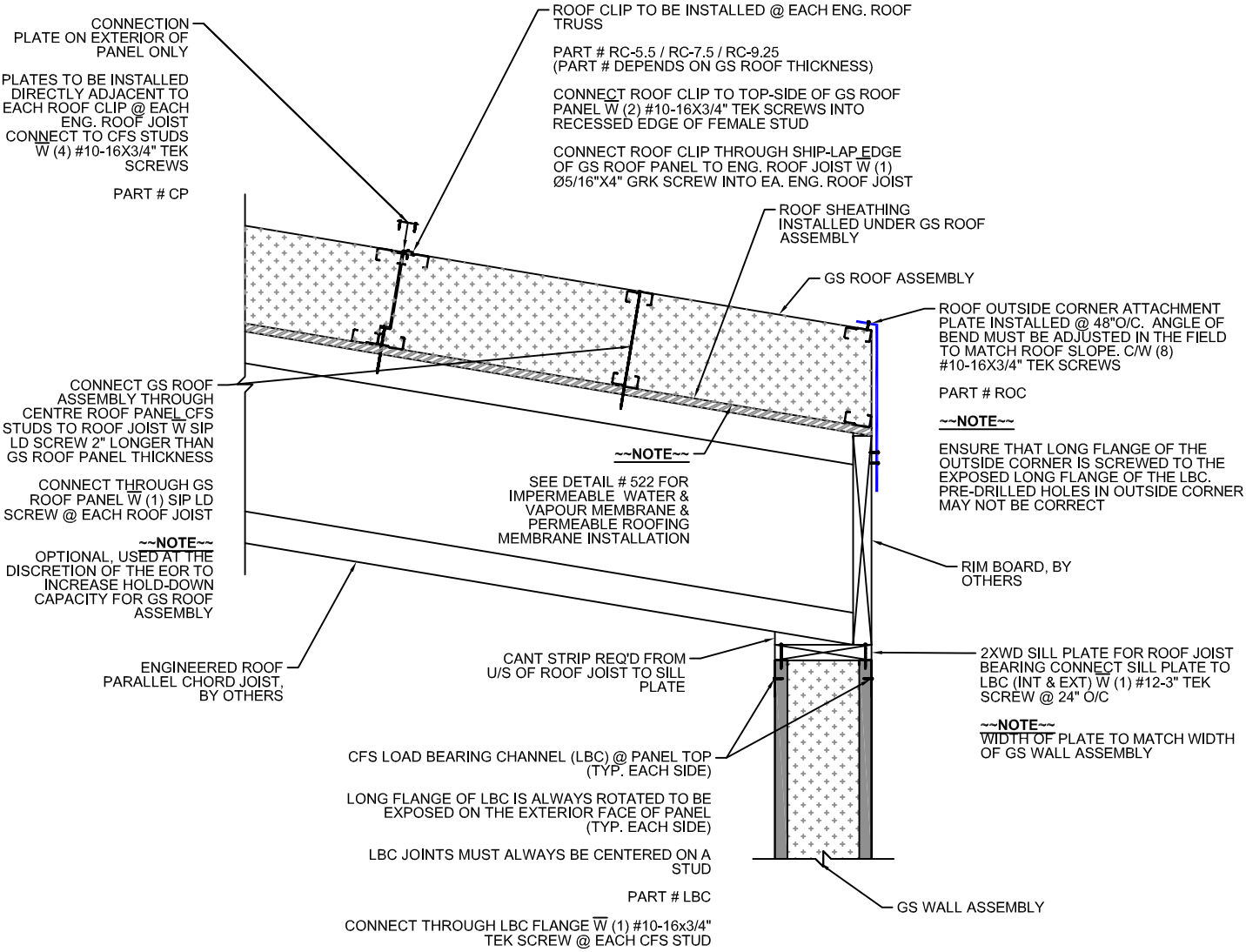
EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

STRUCTURAL ENGINEER OF RECORD TO CONFIRM CONNECTORS AND FASTENERS MEET DESIGN INTENT AND CAN TRANSFER APPLIED LOADS AS REQUIRED.

SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

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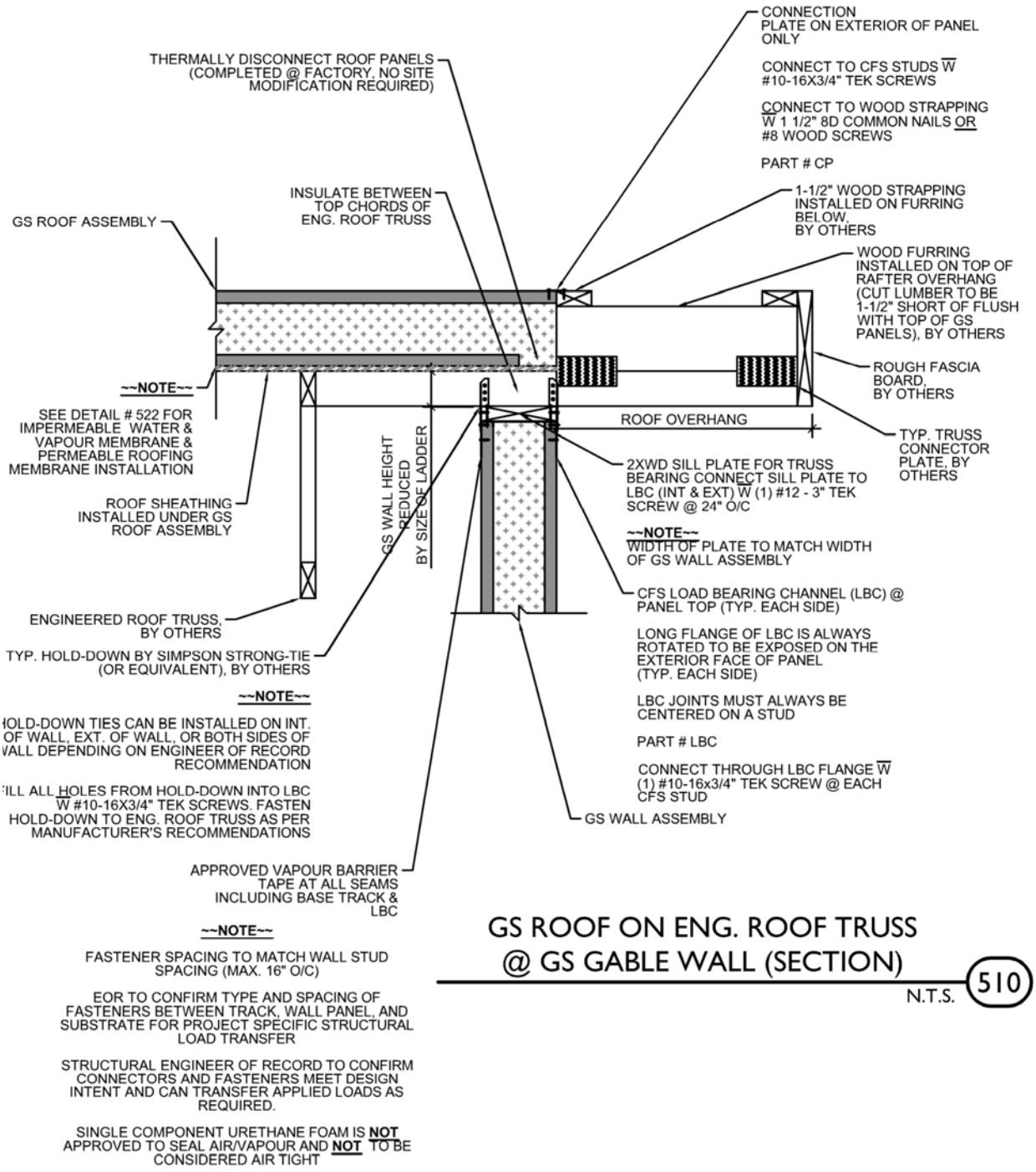
SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

GS ROOF ON ENG. PARALLELL CHORD ROOF JOIST @ EAVES (NO OVERHANG) [SECTION]

N.T.S. 509

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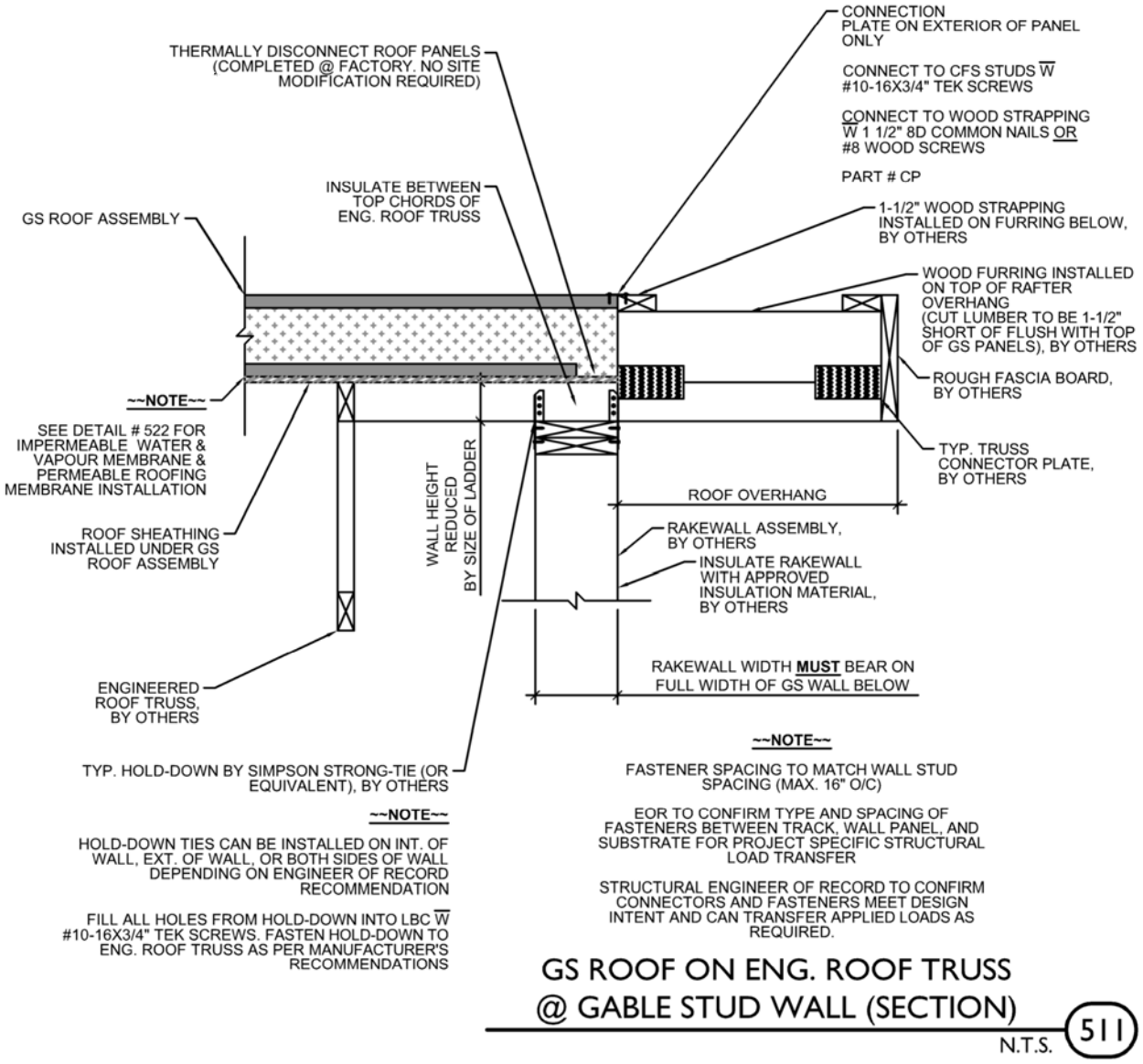


GS ROOF ON ENG. ROOF TRUSS @ GS GABLE WALL (SECTION)

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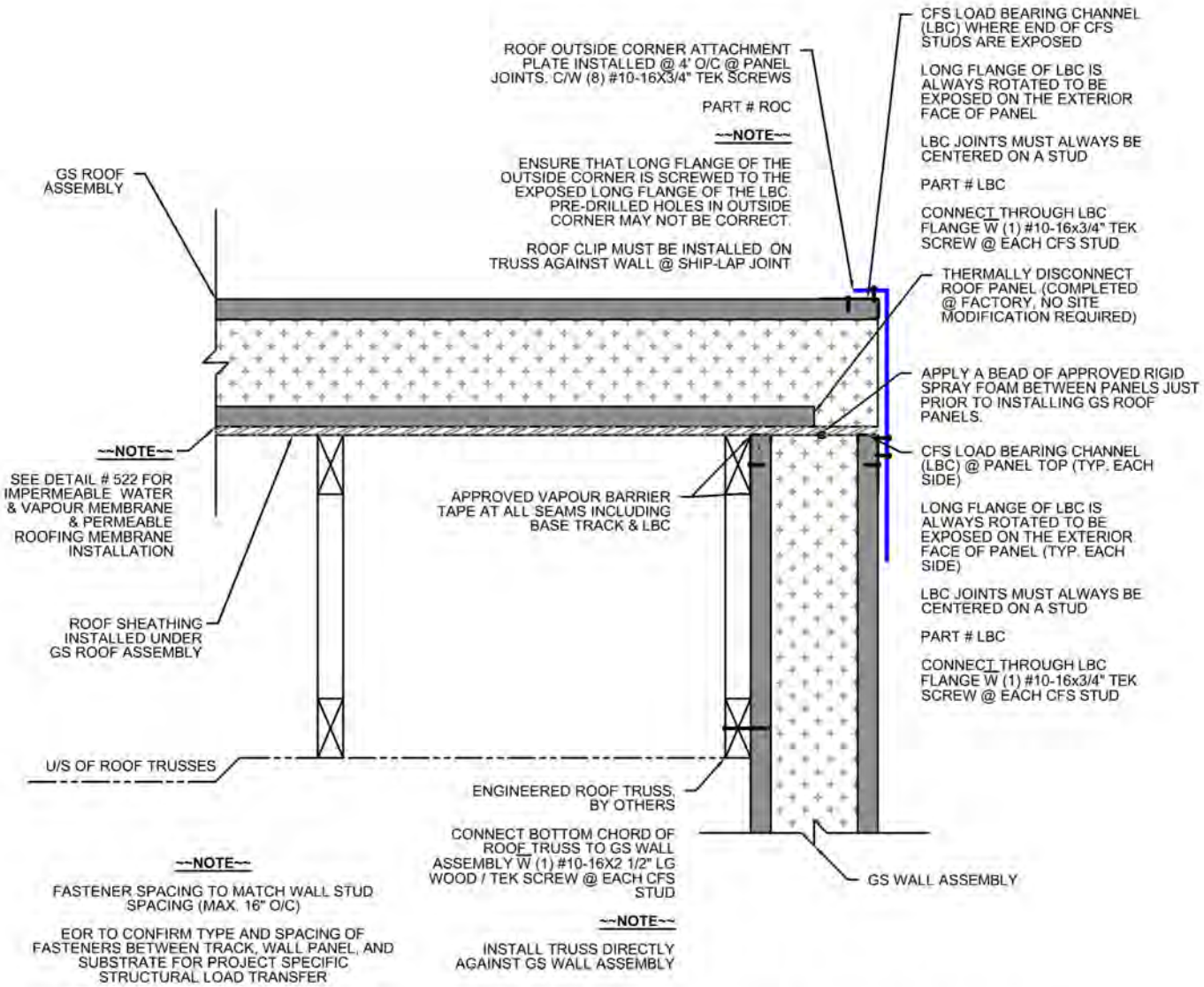


GS ROOF ON ENG. ROOF TRUSS @ GABLE STUD WALL (SECTION)

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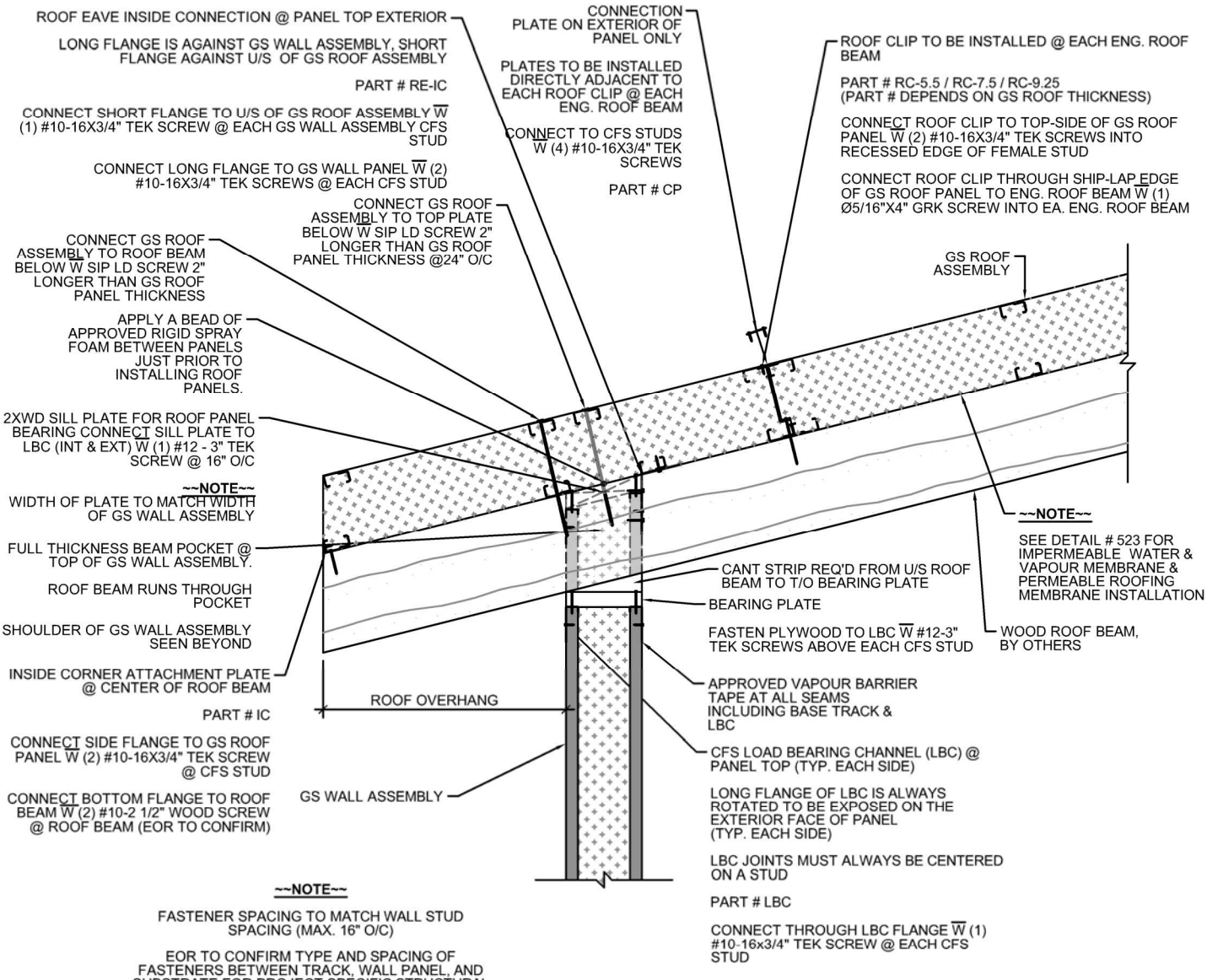


GS ROOF ON ENG. ROOF TRUSS @ GABLE WALL (NO OVERHANG) [SECTION] 513

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~~NOTE~~

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UNDER HEAVIER LOADS A STEEL PLATE OR PIECE OF LVL SHIM MAY BE RECOMMENDED BY THE ENGINEER OF RECORD IN LIEU OF 2 PLY 3/4" PWF PLYWOOD FOR BEAM BEARING

SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

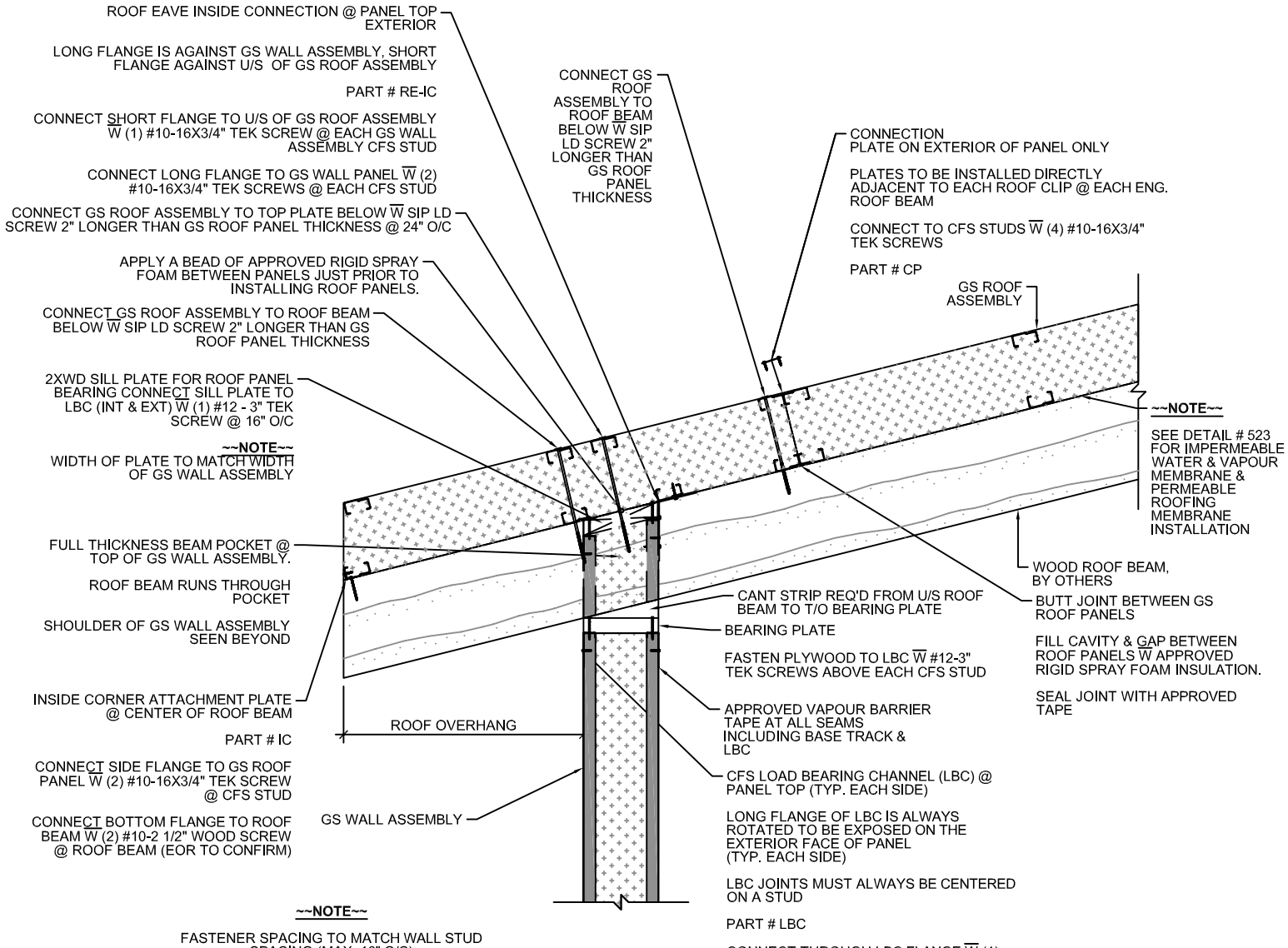
2XWD PLATE CAN BE SUBSTITUTED FOR PLYWOOD WHERE ROOF SLOPED 7:12 OR GREATER

GS ROOF @ EAVES ON BEAM (SHIP-LAP JOINT)[SECTION]

N.T.S. 514

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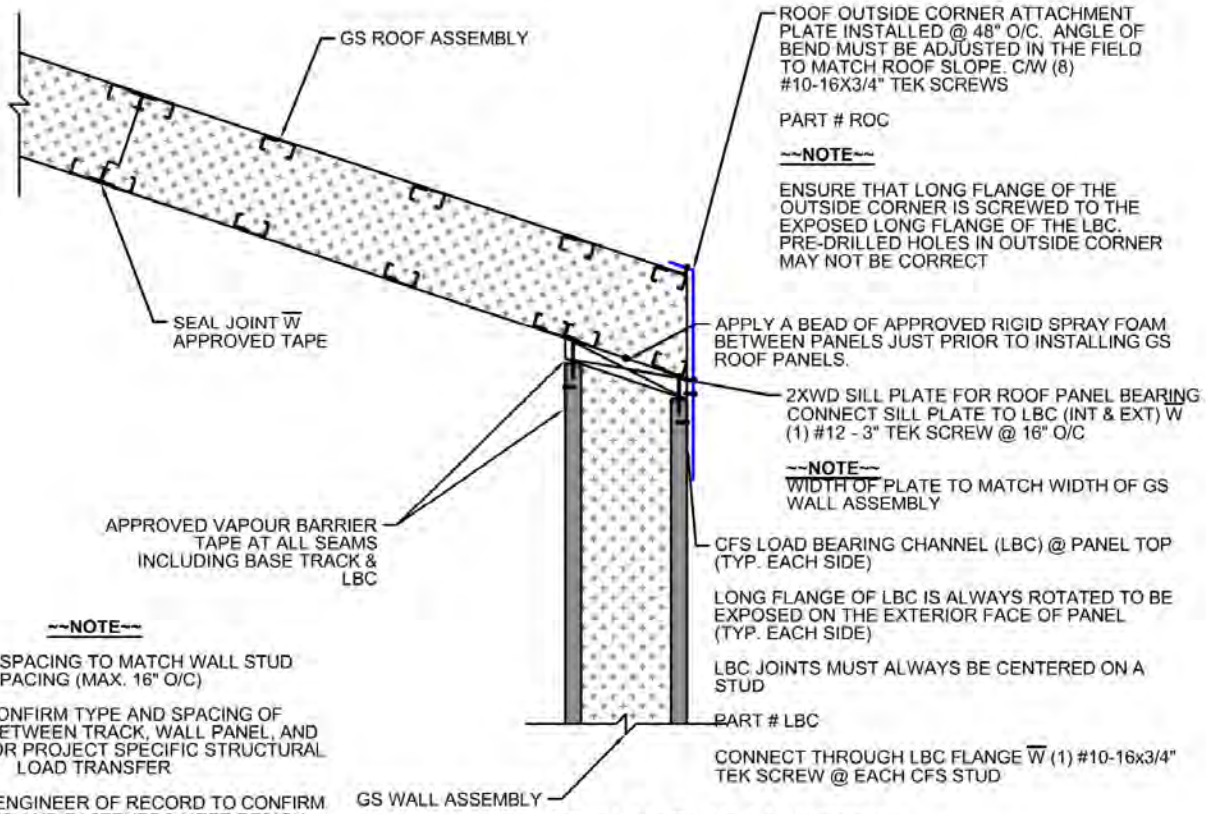
2XWD PLATE CAN BE SUBSTITUTED FOR PLYWOOD WHERE ROOF SLOPED 7:12 OR GREATER

GS ROOF @ EAVES ON BEAM (BUTT JOINT) [SECTION]

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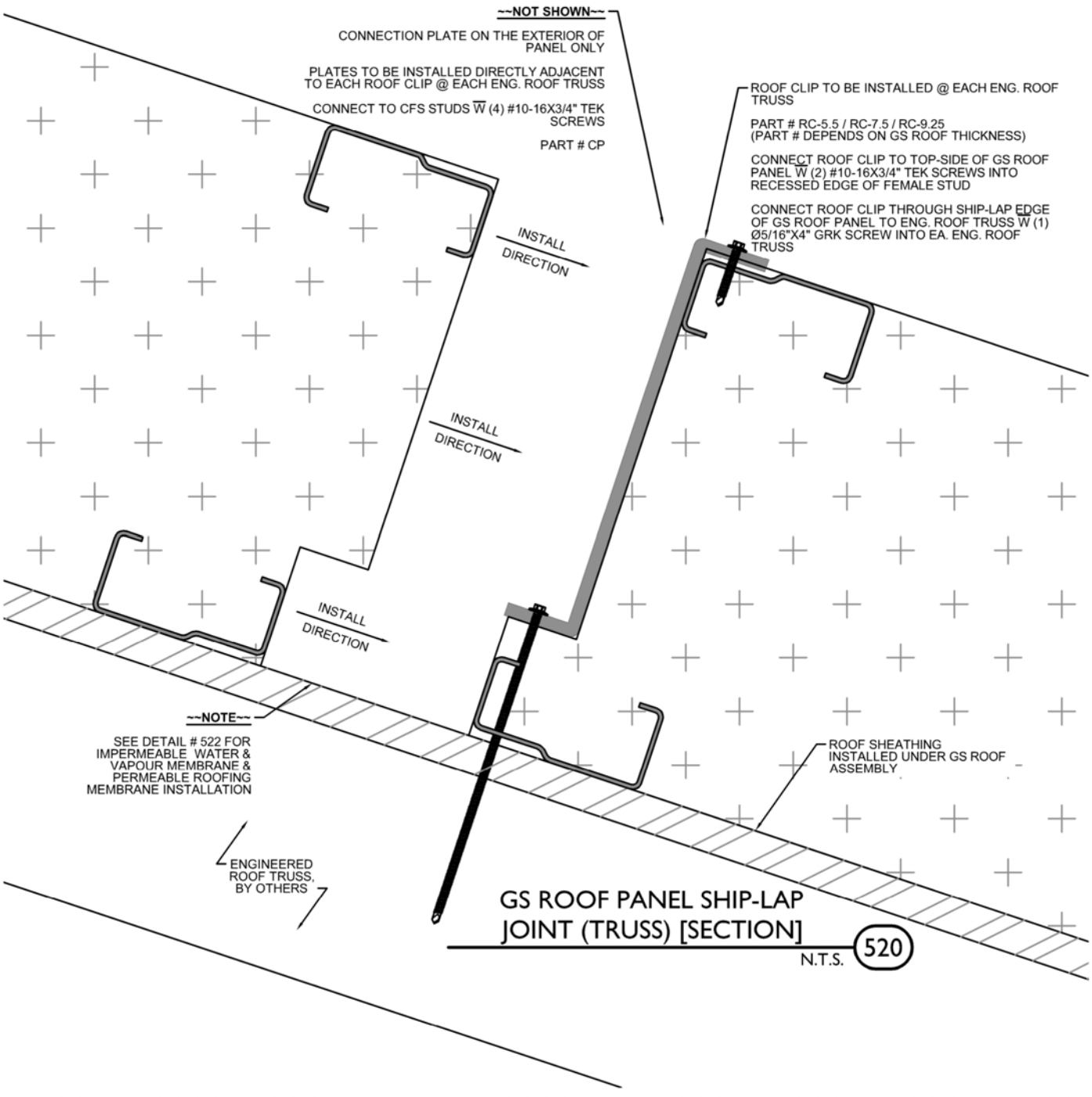


GS STRUCTURAL ROOF BETWEEN BEAMS @ EAVES (NO OVERHANG) [SECTION]

N.T.S. 516

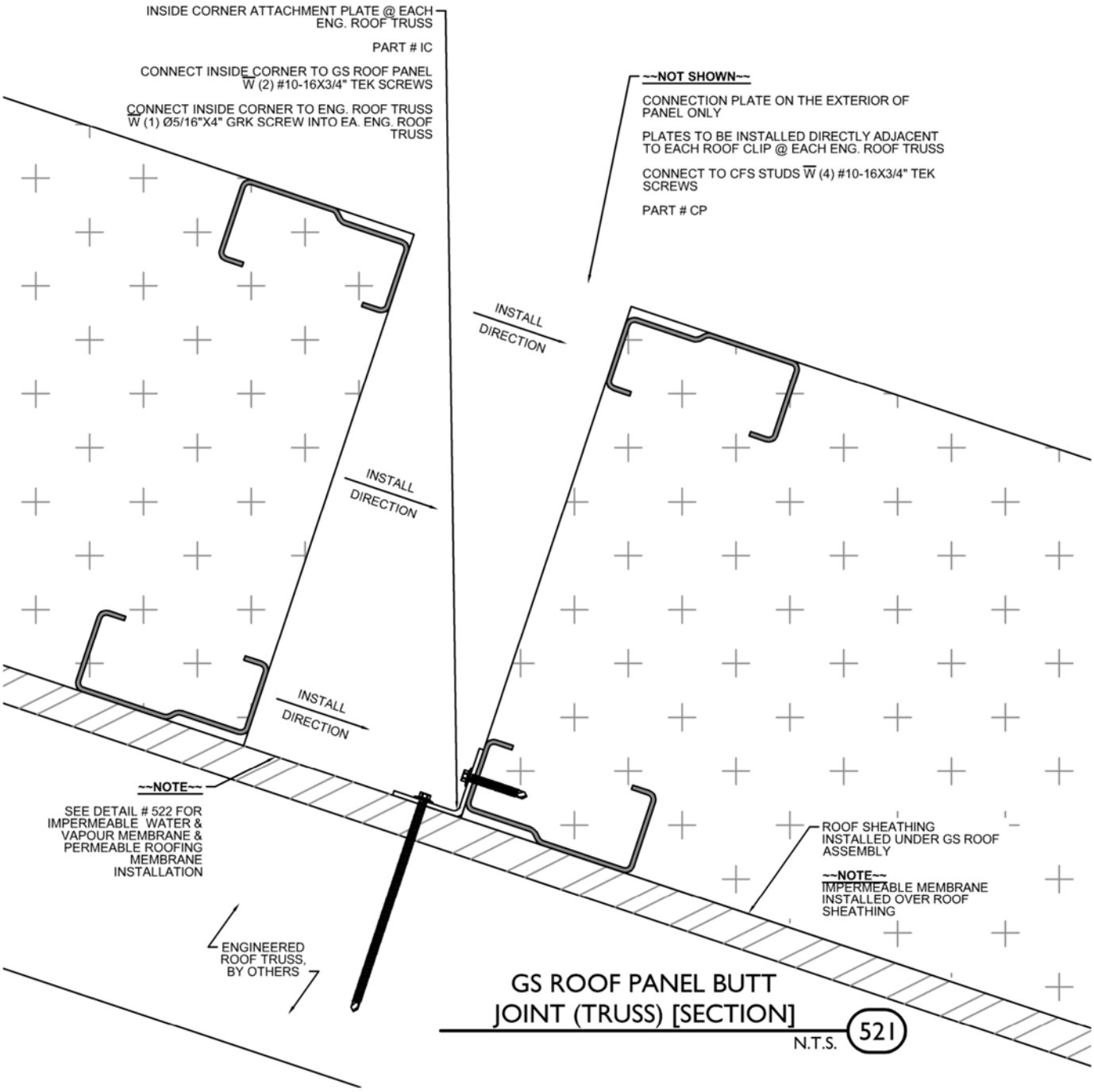
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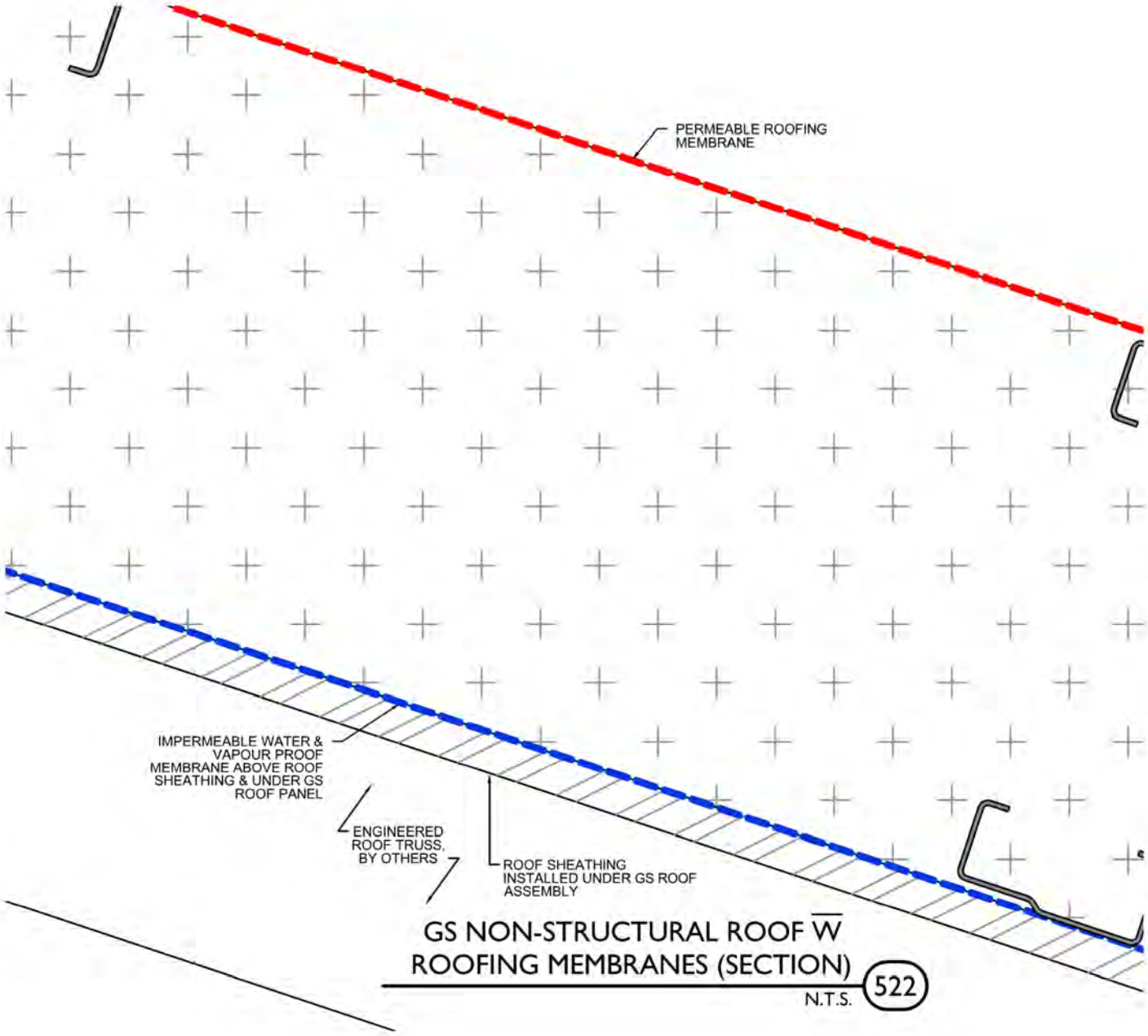
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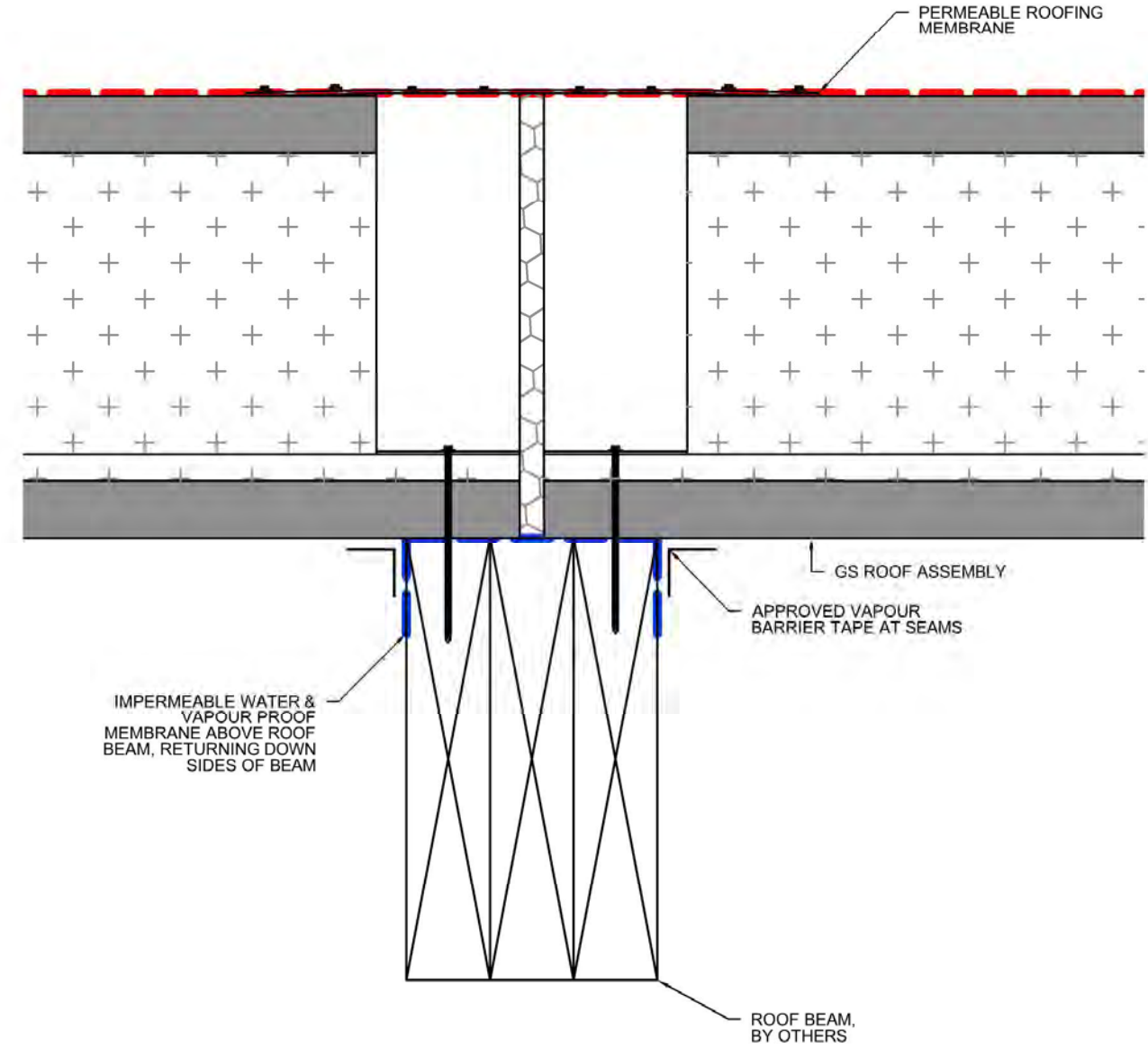
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GS NON-STRUCTURAL ROOF W ROOFING MEMBRANES (SECTION) 522
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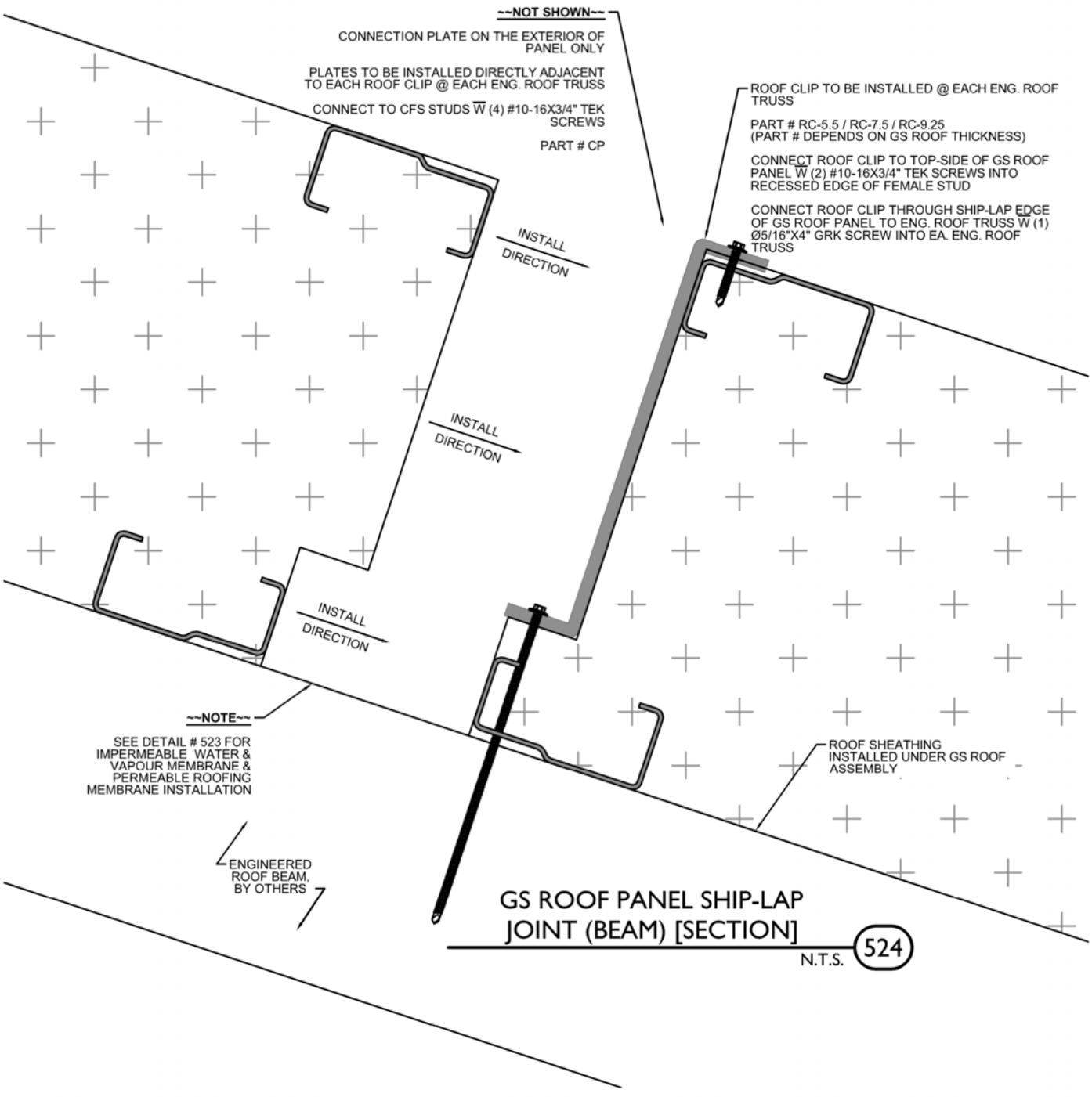
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GS STRUCTURAL ROOF W
ROOFING MEMBRANES (SECTION) 523
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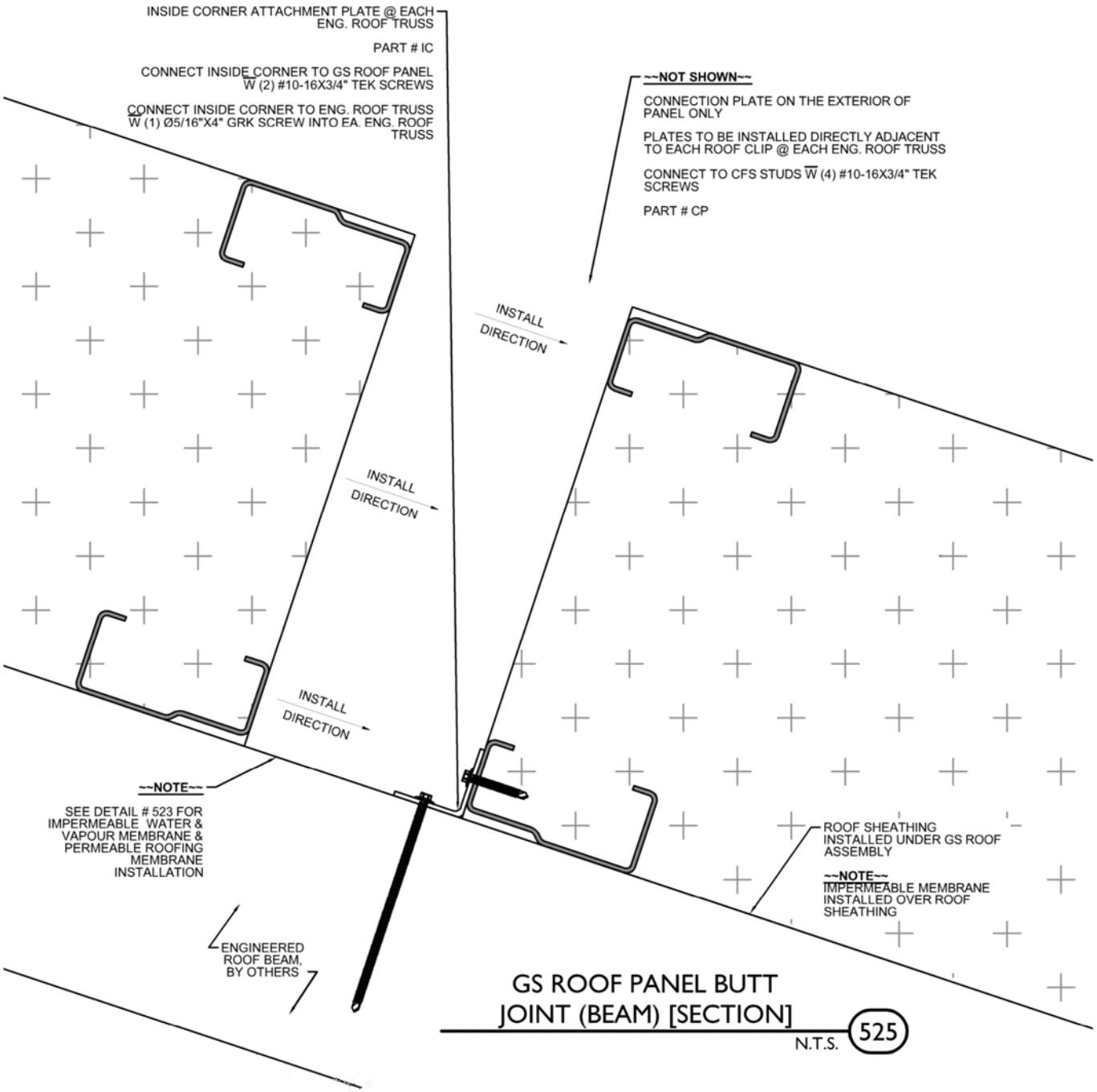
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GS ROOF PANEL SHIP-LAP JOINT (BEAM) [SECTION] 524
N.T.S.

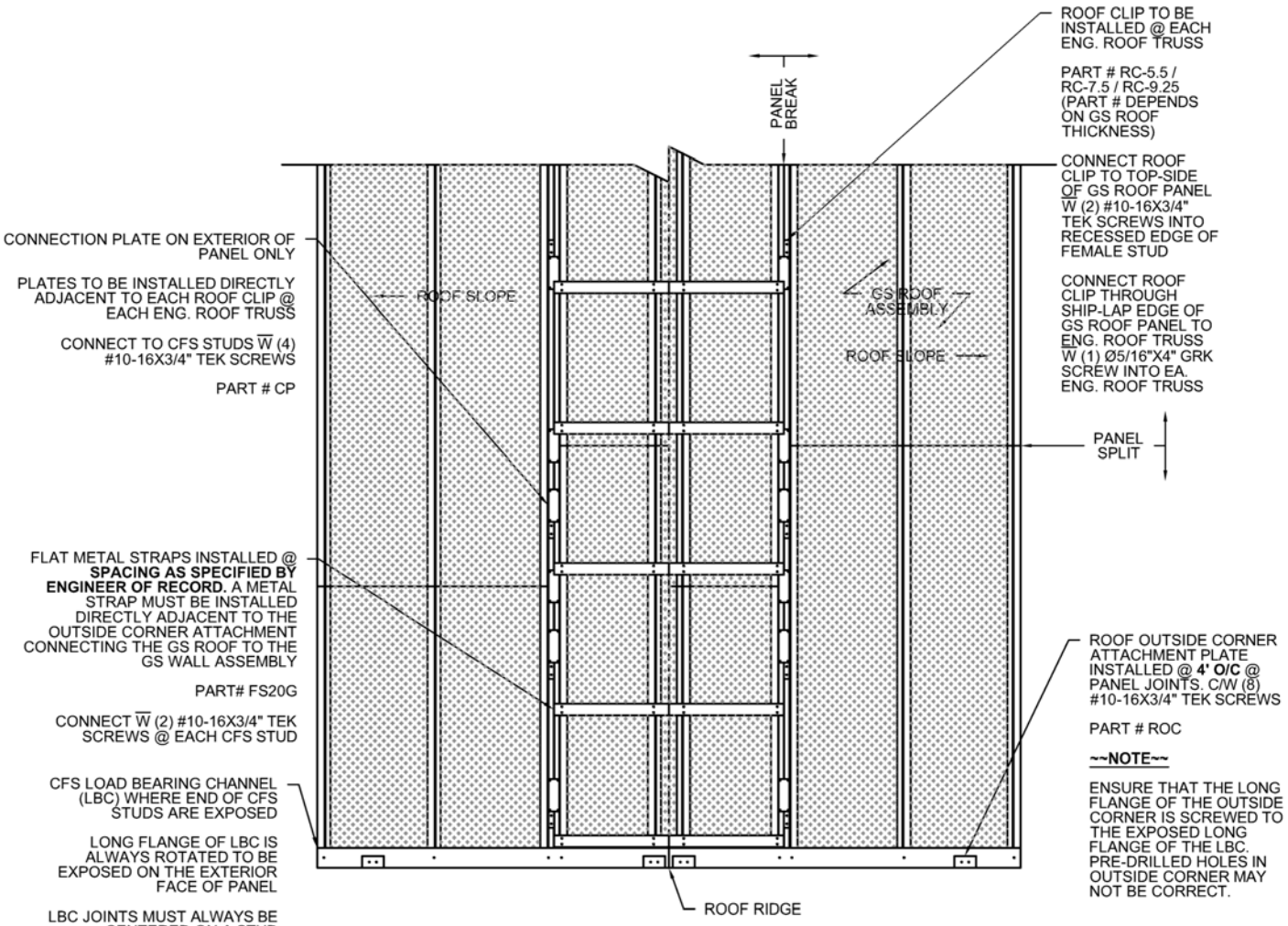
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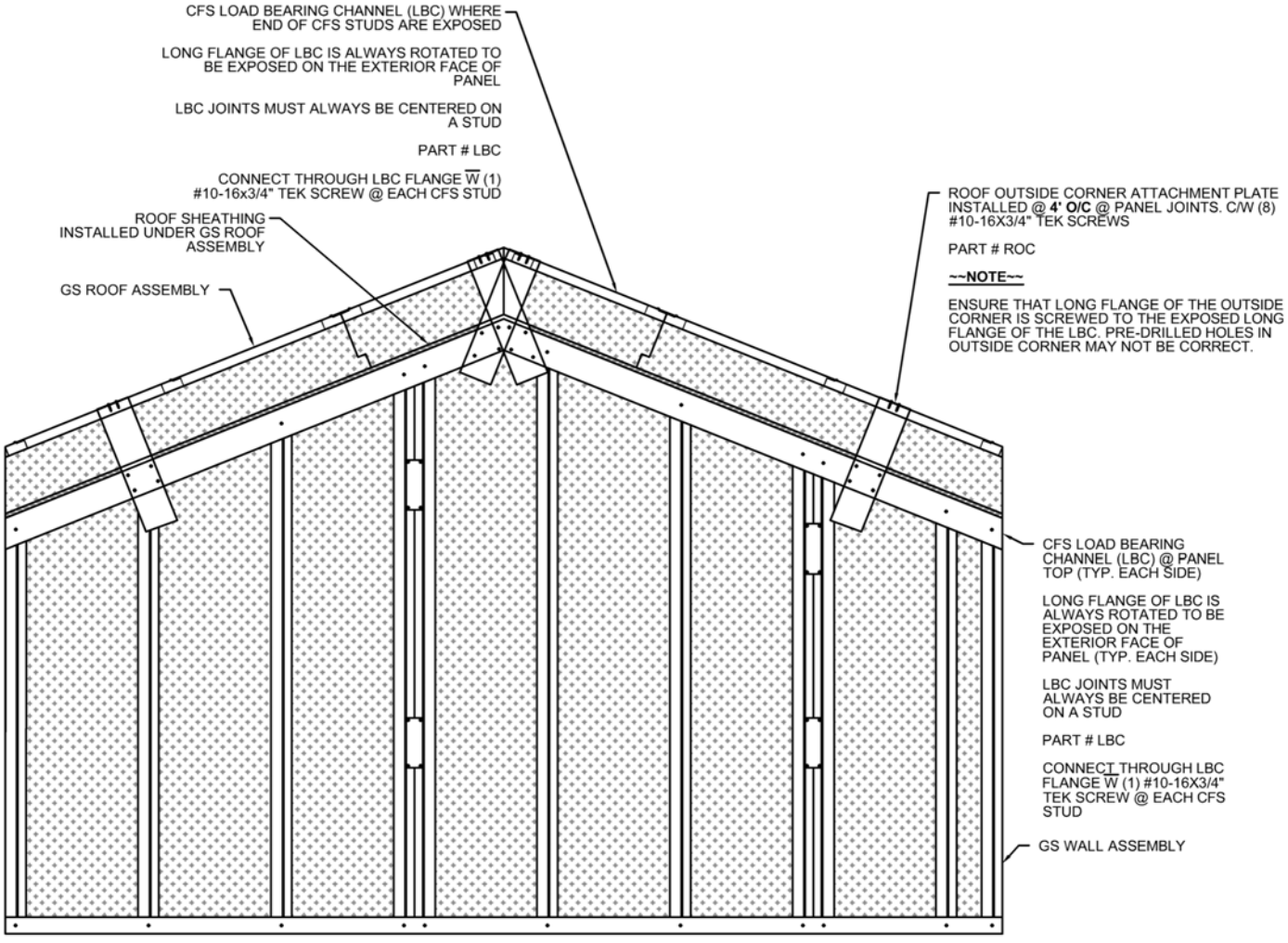


GS ROOF PEAK STRAPPING (OVER TRUSSES) [PLAN]

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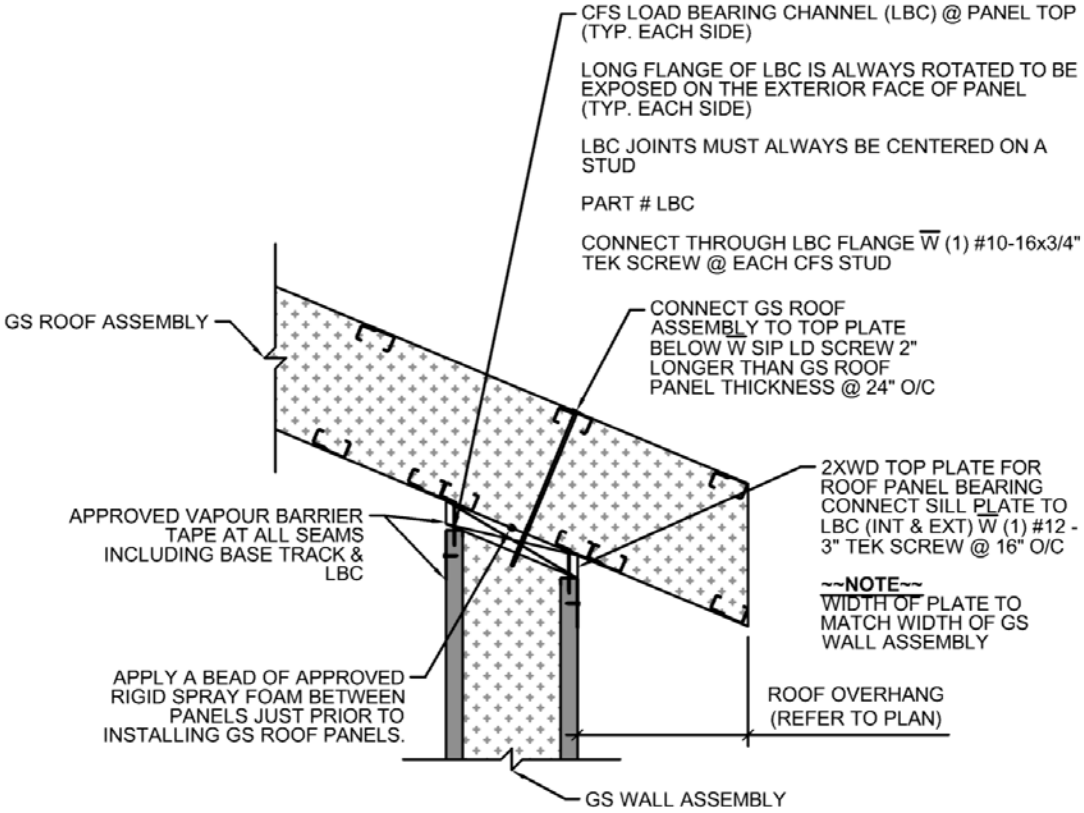
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GS ROOF ON ENG. ROOF TRUSS @ GABLE WALL (NO OVERHANG) [ELEVATION] 531
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GS ROOF @ LOW EAVES (GS O/H) [SECTION]

N.T.S. 538A

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

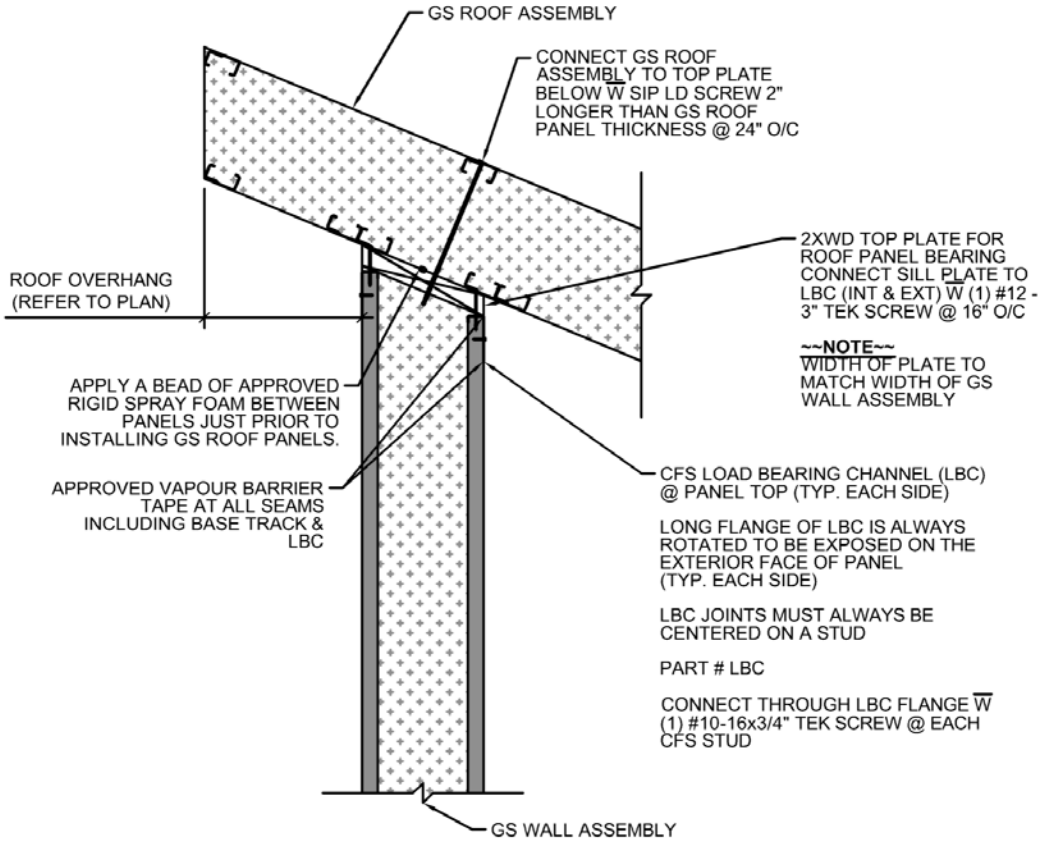
STRUCTURAL ENGINEER OF RECORD TO CONFIRM CONNECTORS AND FASTENERS MEET DESIGN INTENT AND CAN TRANSFER APPLIED LOADS AS REQUIRED.

SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

2XWD PLATE CAN BE SUBSTITUTED FOR PLYWOOD WHERE ROOF SLOPED 7:12 OR GREATER

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GS ROOF @ HIGH EAVES (GS O/H) [SECTION]

N.T.S. 538B

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

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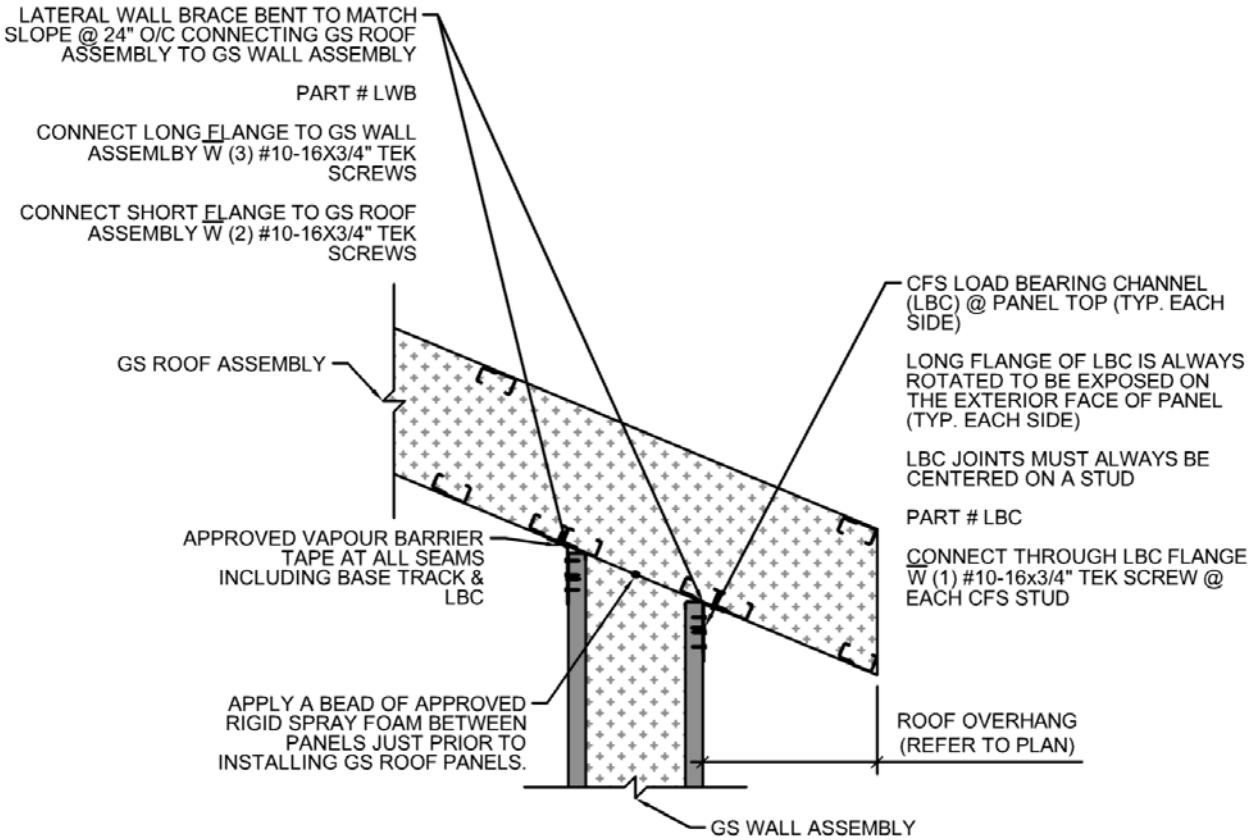
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"NET-ZERO" GS ROOF @ LOW EAVES (GS O/H) [SECTION]

N.T.S. 538C

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

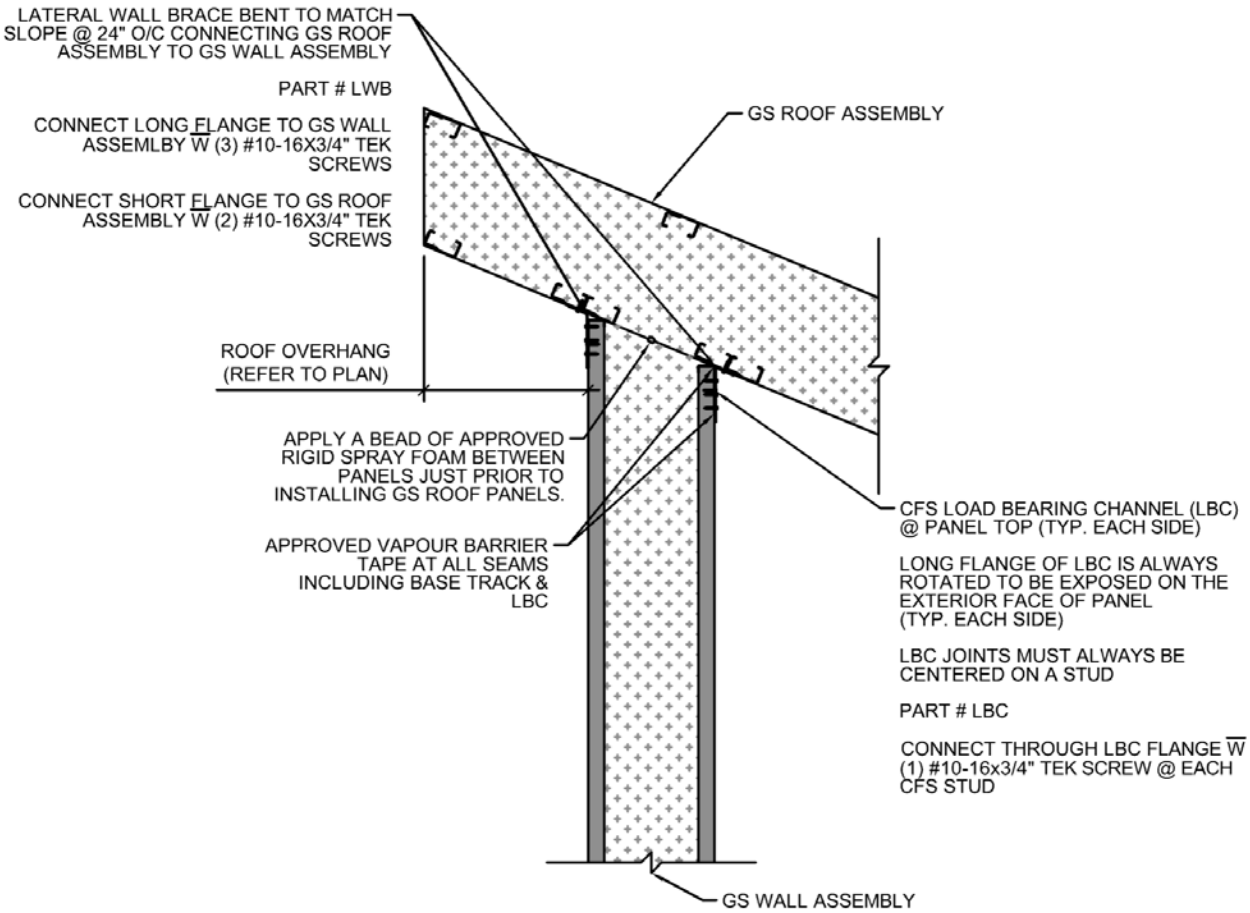
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"NET-ZERO" GS ROOF @ HIGH EAVES (GS O/H) [SECTION]

N.T.S. 538D

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

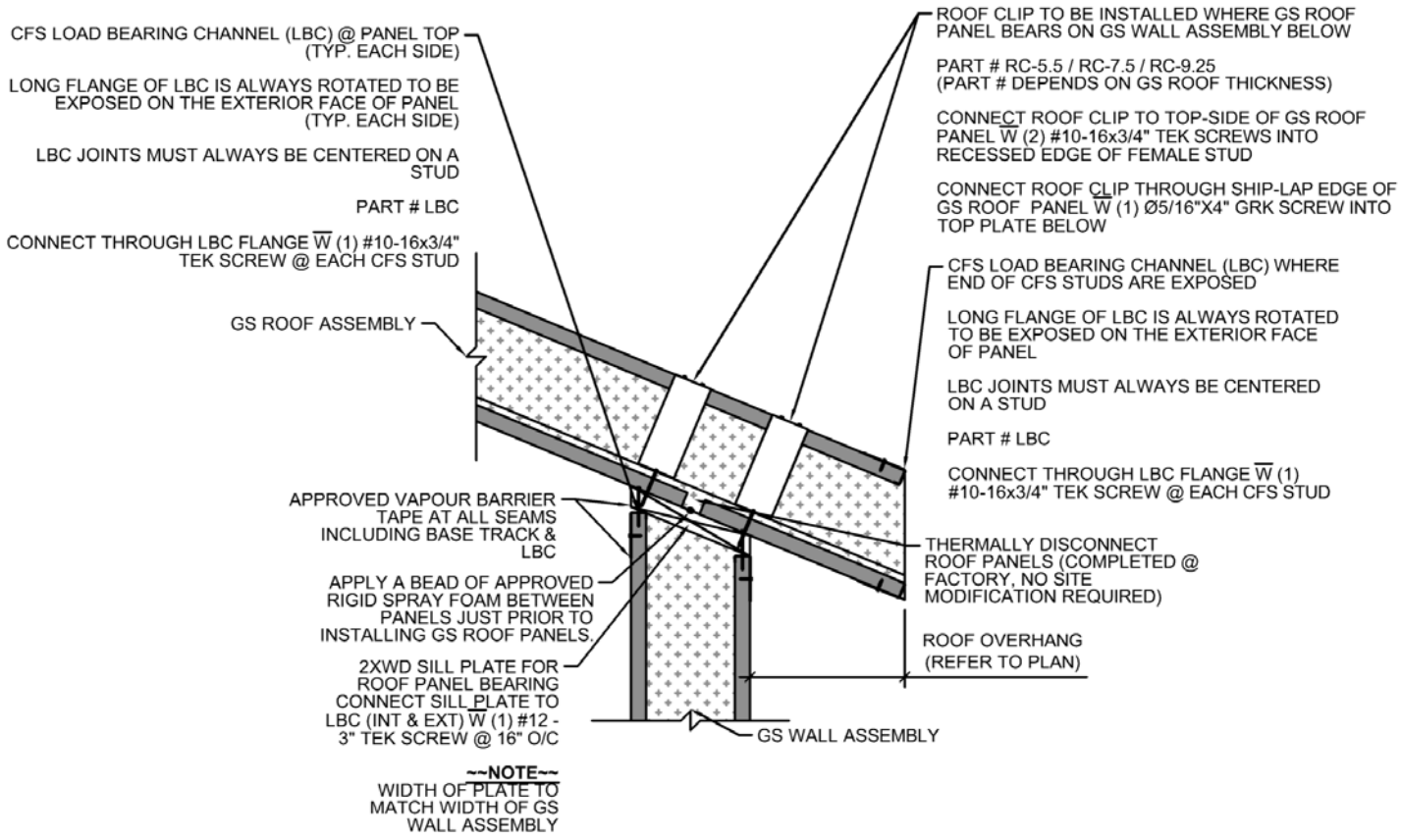
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GS ROOF SHIP-LAP @ LOW EAVES (GS O/H) [SECTION]

N.T.S. 539A

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

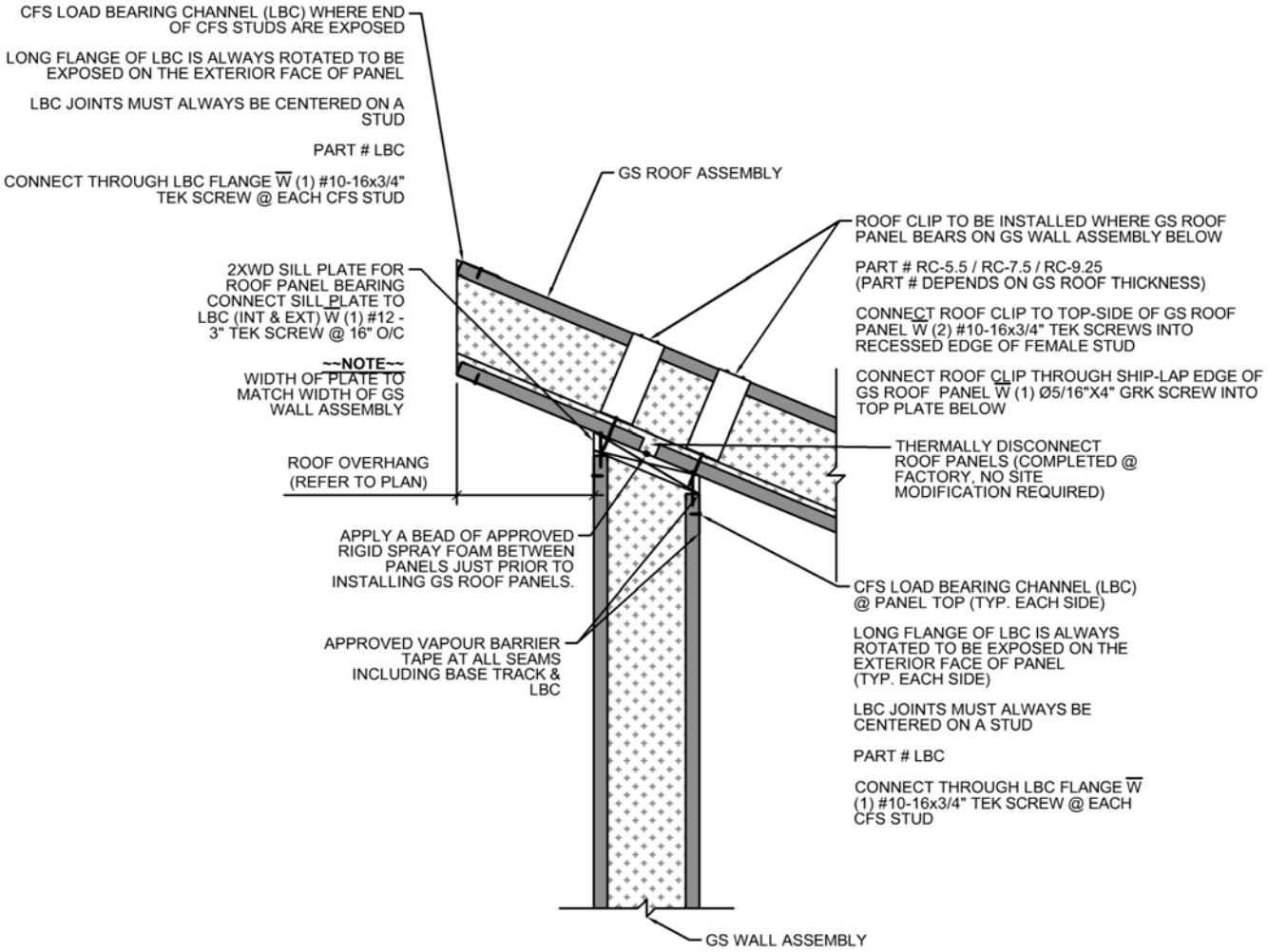
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SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

2XWD PLATE CAN BE SUBSTITUTED FOR PLYWOOD WHERE ROOF SLOPED 7:12 OR GREATER

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GS ROOF SHIP-LAP @ HIGH EAVES (GS O/H) [SECTION]

N.T.S. 539B

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

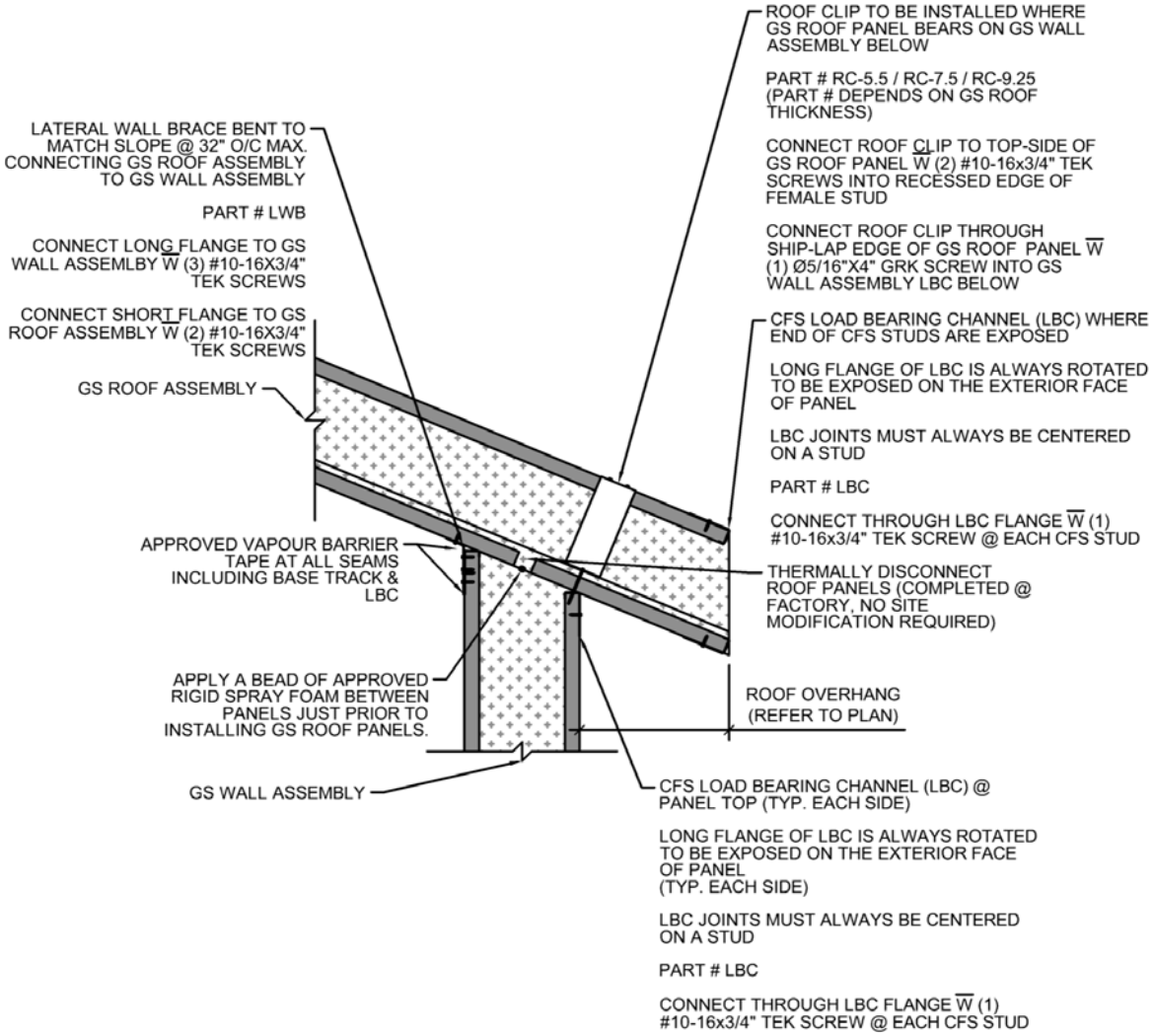
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"NET-ZERO" GS ROOF SHIP-LAP @ LOW EAVES (GS O/H) [SECTION]

N.T.S. 539C

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

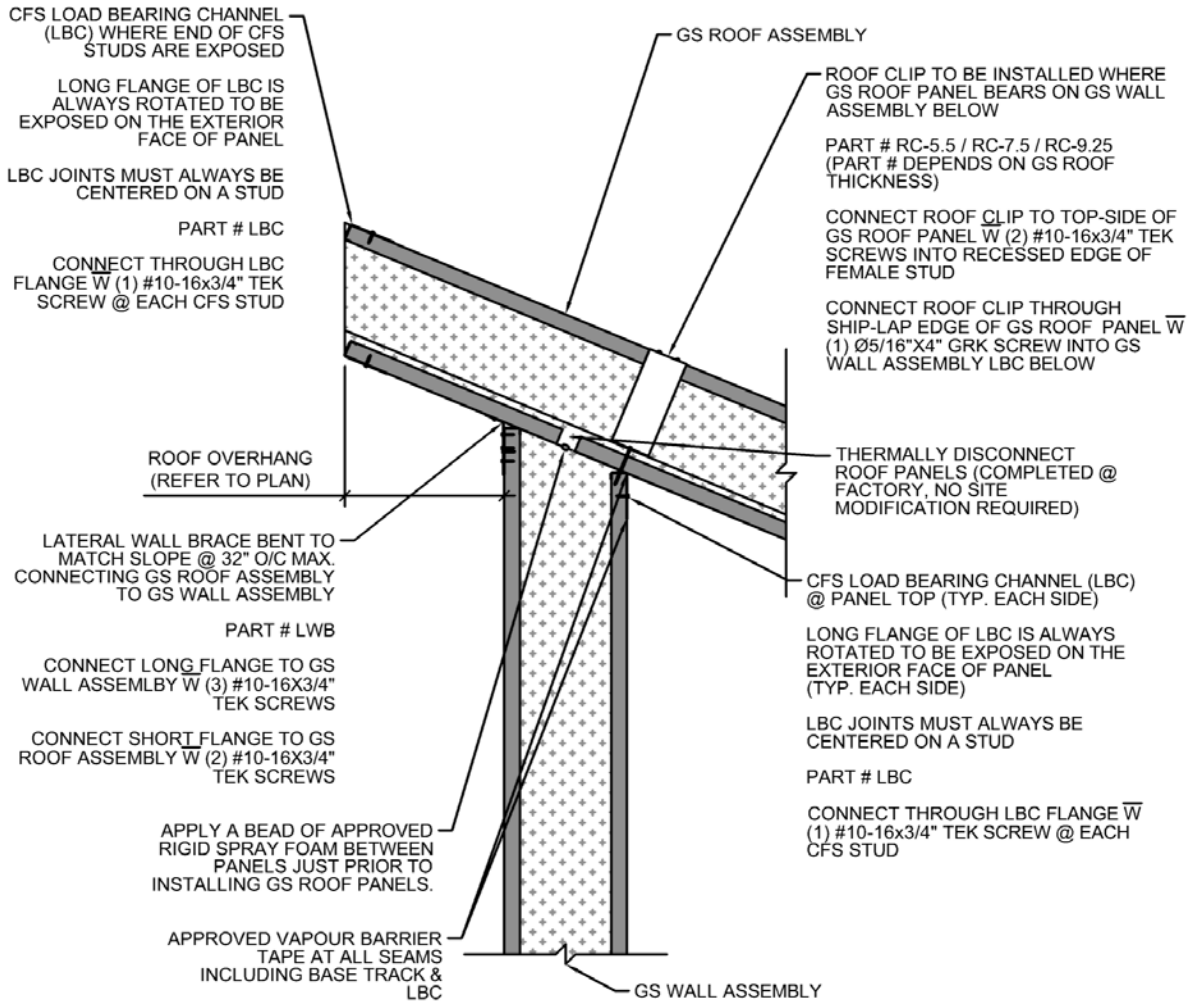
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"NET-ZERO" GS ROOF SHIP-LAP @ HIGH EAVES (GS O/H) [SECTION]

N.T.S. 539D

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

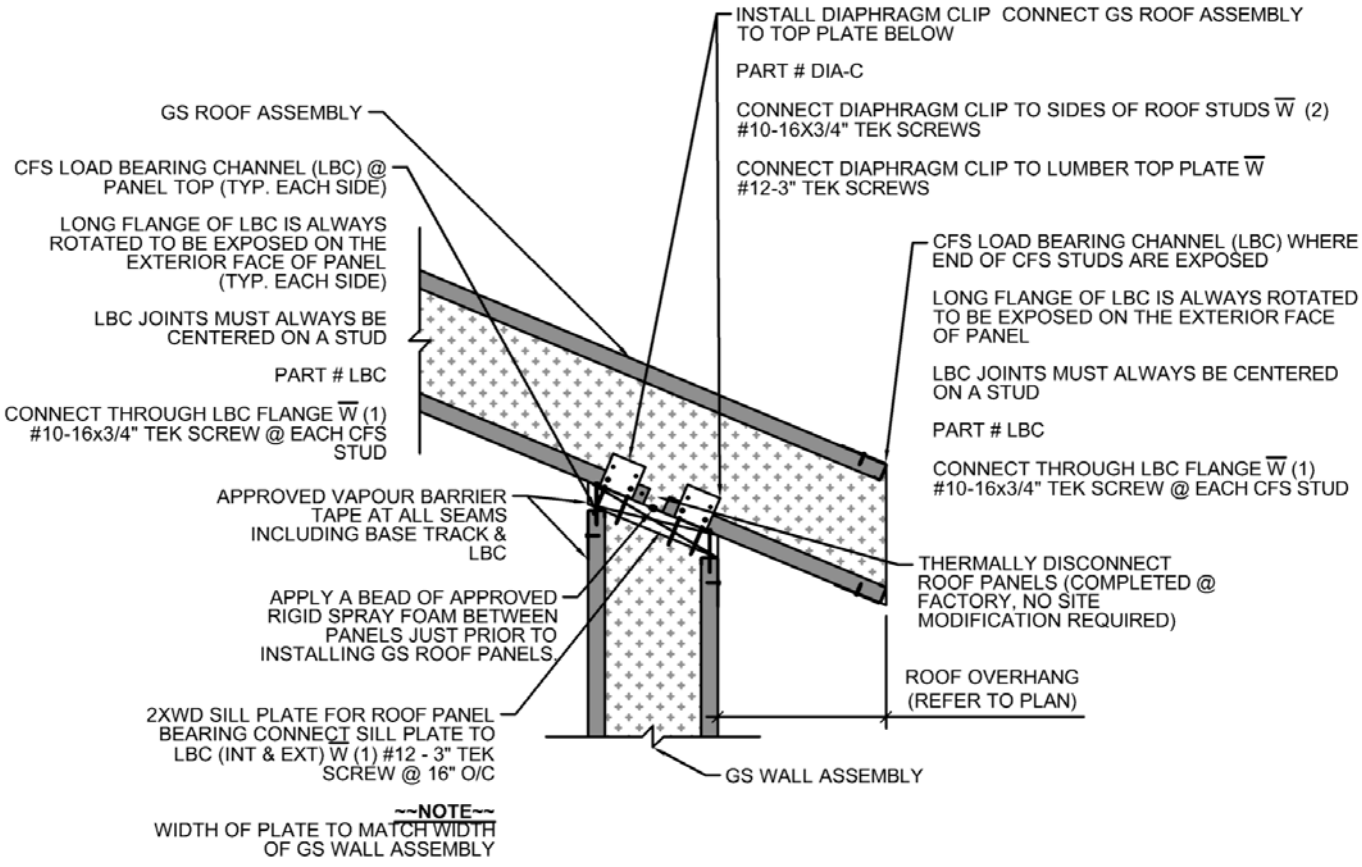
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GS ROOF BUTT JOINT @ LOW EAVES (GS O/H) [SECTION]

N.T.S. 540A

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

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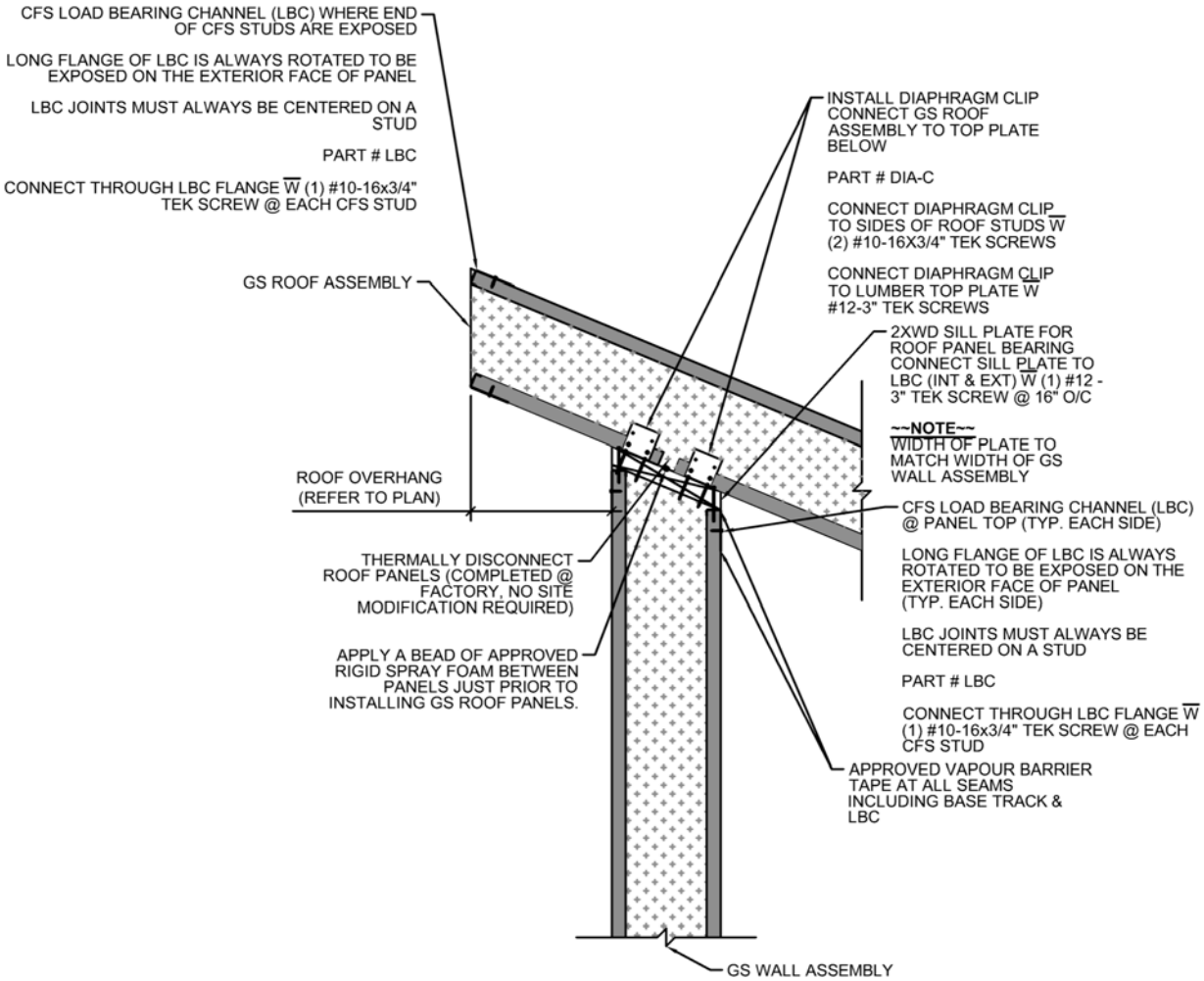
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2XWD PLATE CAN BE SUBSTITUTED FOR PLYWOOD WHERE ROOF SLOPED 7:12 OR GREATER

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GS ROOF BUTT JOINT @ HIGH EAVES (GS O/H) [SECTION]

N.T.S. 540B

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

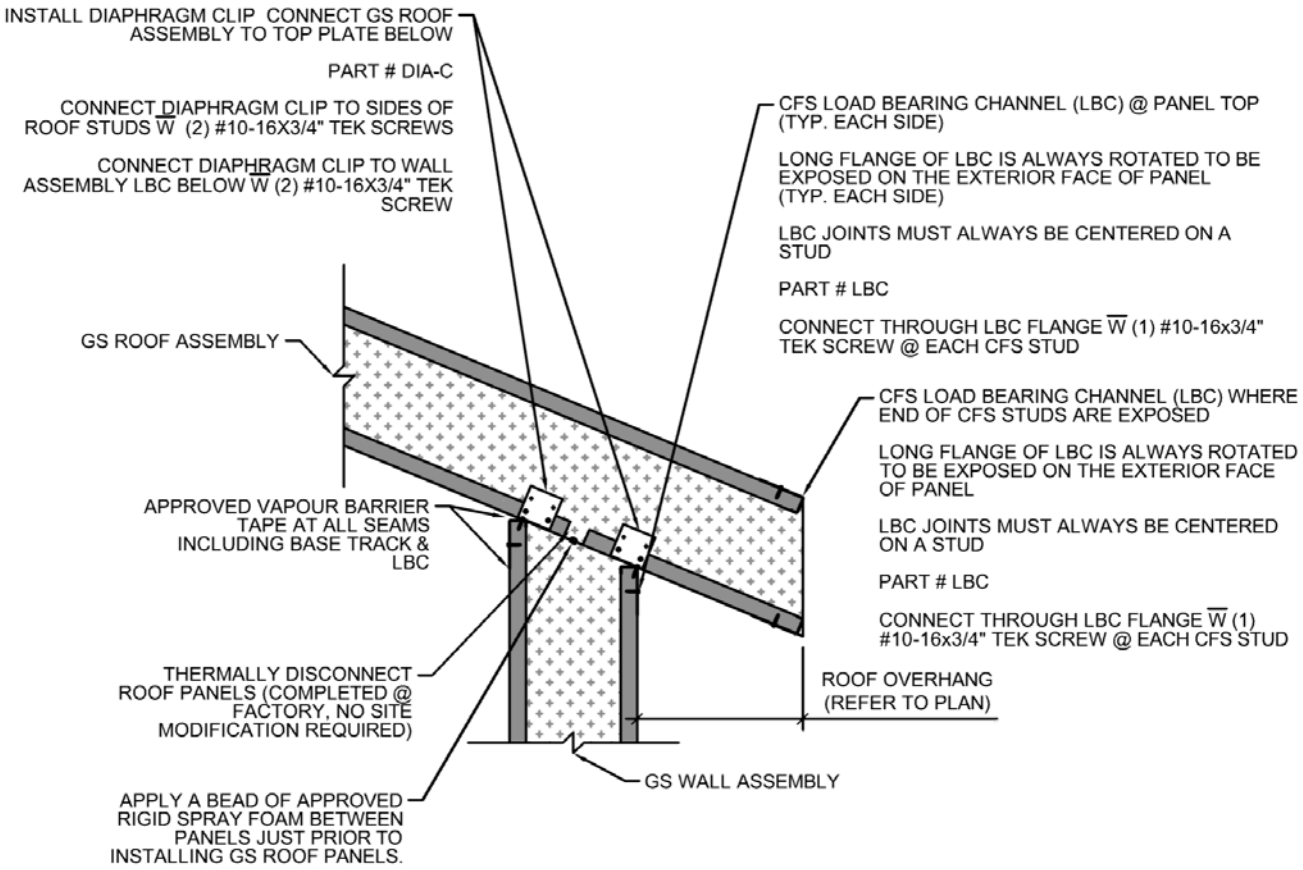
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"NET-ZERO" GS ROOF BUTT JOINT @ LOW EAVES (GS O/H) [SECTION]

N.T.S. 540C

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

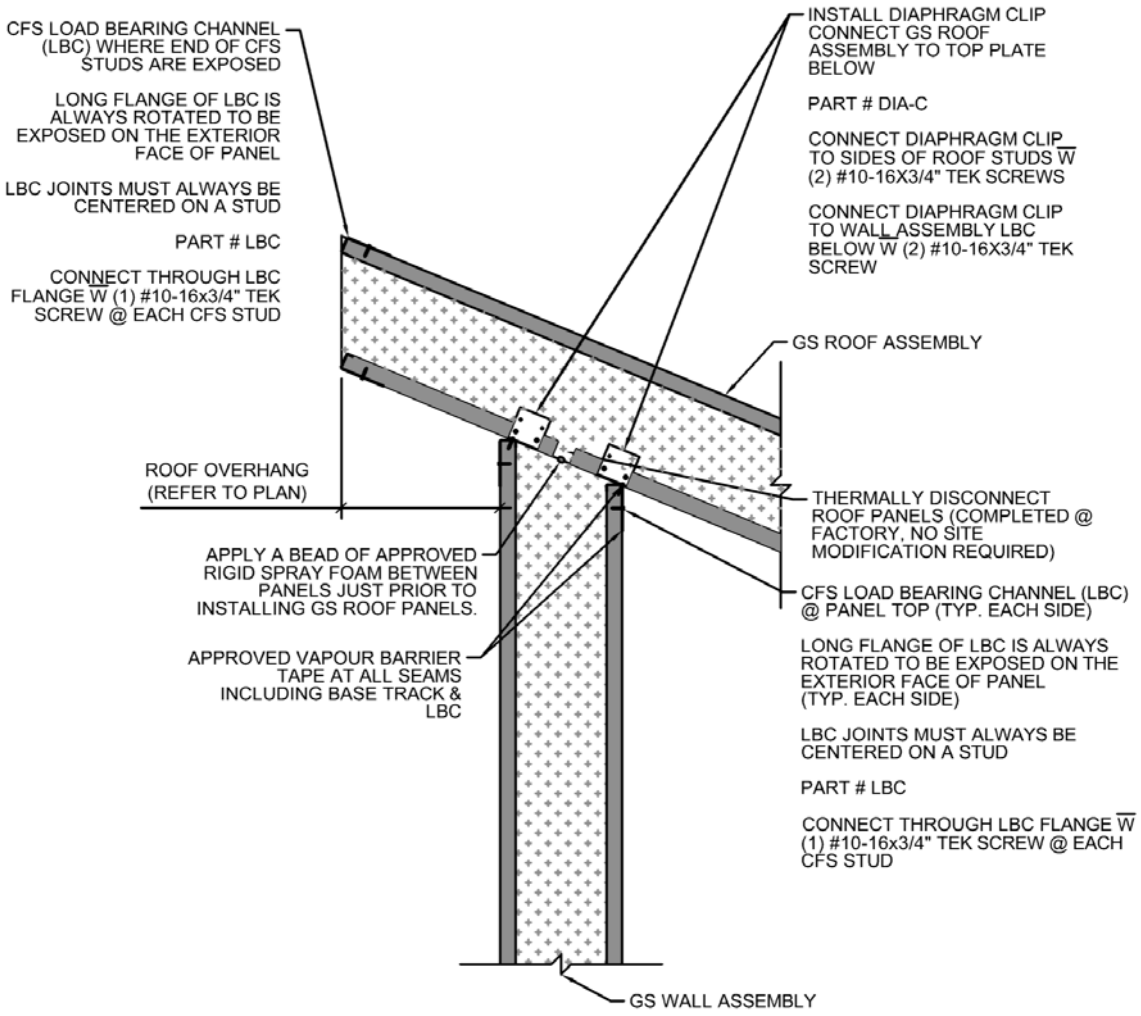
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"NET-ZERO" GS ROOF BUTT JOINT @ HIGH EAVES (GS O/H) [SECTION]

N.T.S. 540D

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

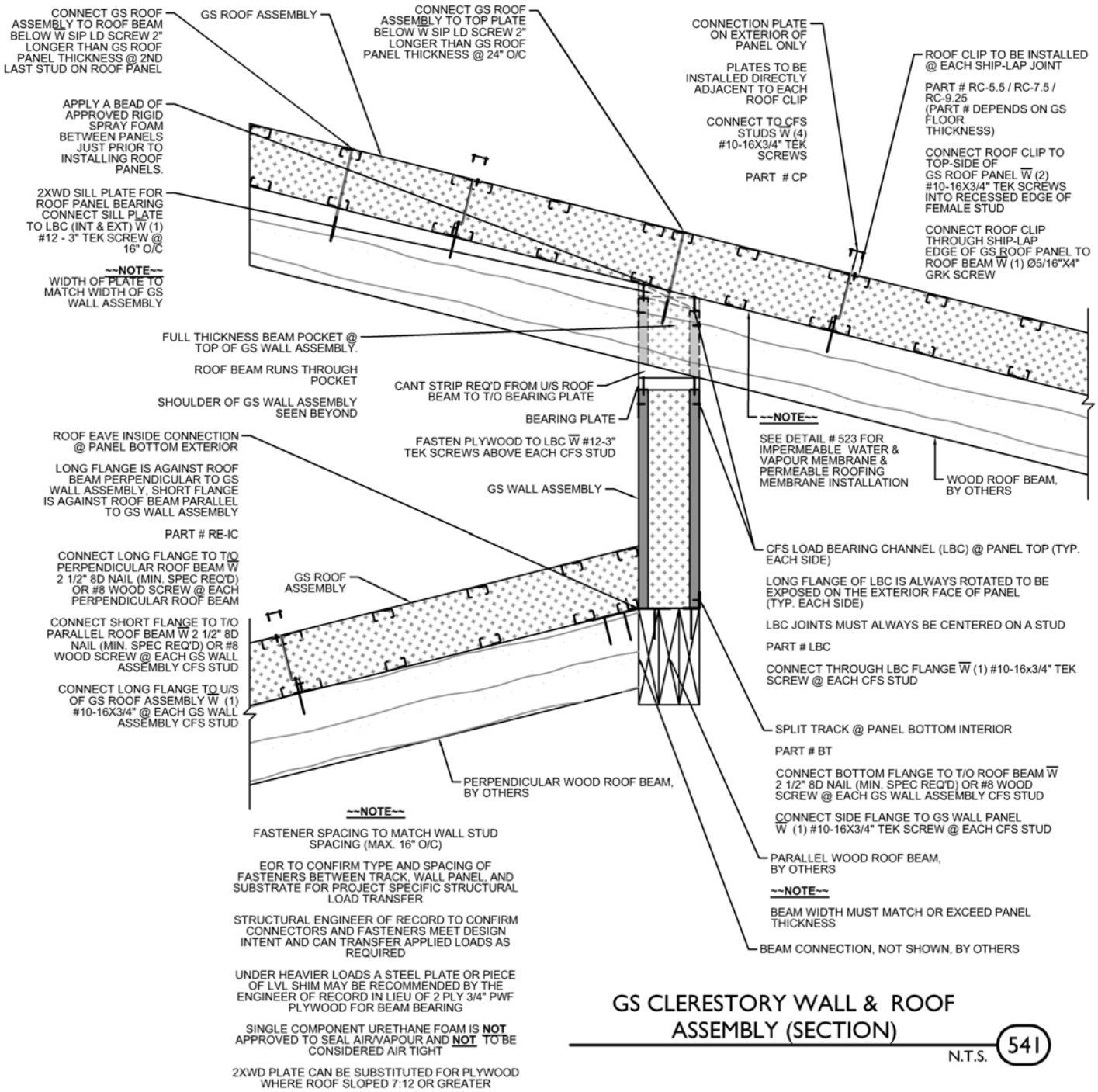
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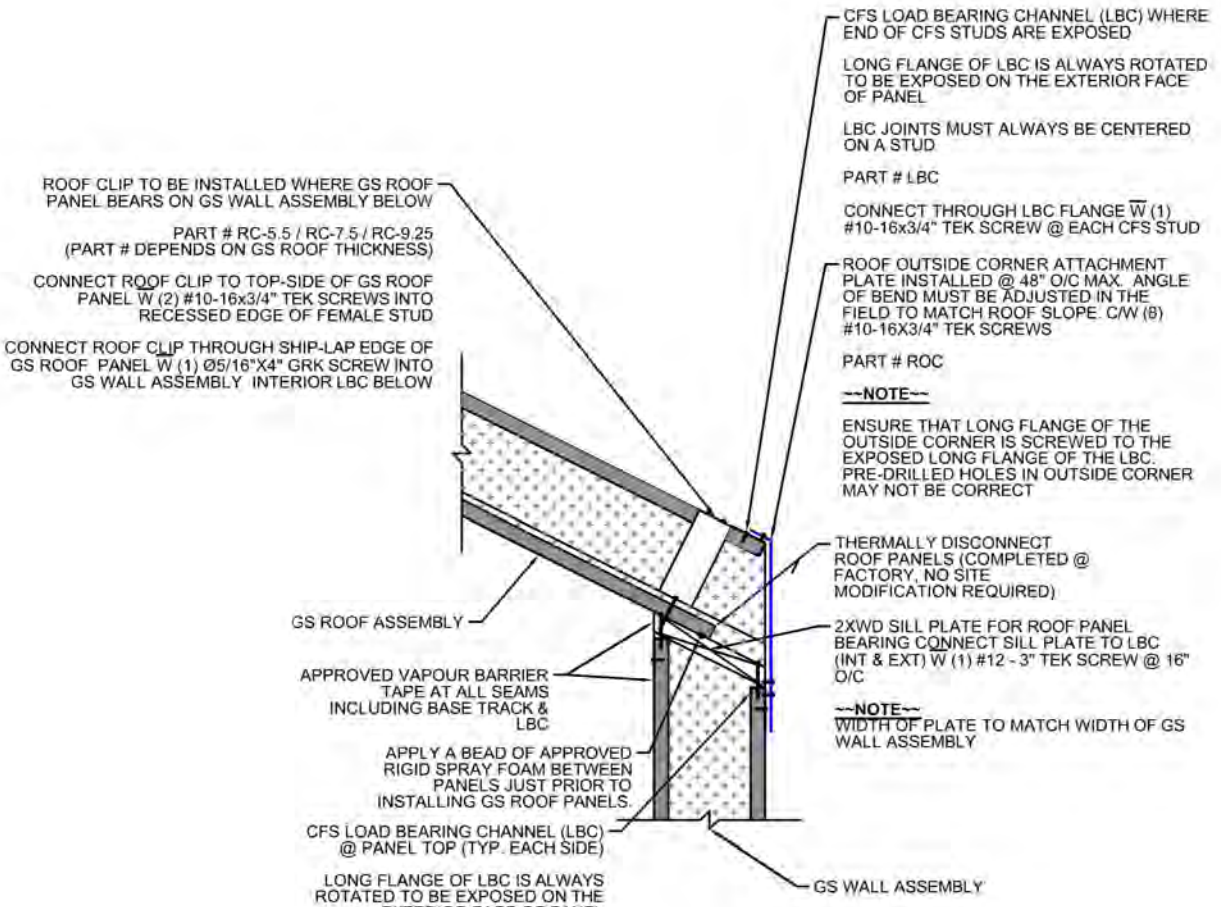


GS CLERESTORY WALL & ROOF ASSEMBLY (SECTION)

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GS ROOF @ EAVES (NO OVERHANG) [SECTION]

N.T.S. 542

~~NOTE~~

FASTENER SPACING TO MATCH WALL STUD SPACING (MAX. 16" O/C)

EOR TO CONFIRM TYPE AND SPACING OF FASTENERS BETWEEN TRACK, WALL PANEL, AND SUBSTRATE FOR PROJECT SPECIFIC STRUCTURAL LOAD TRANSFER

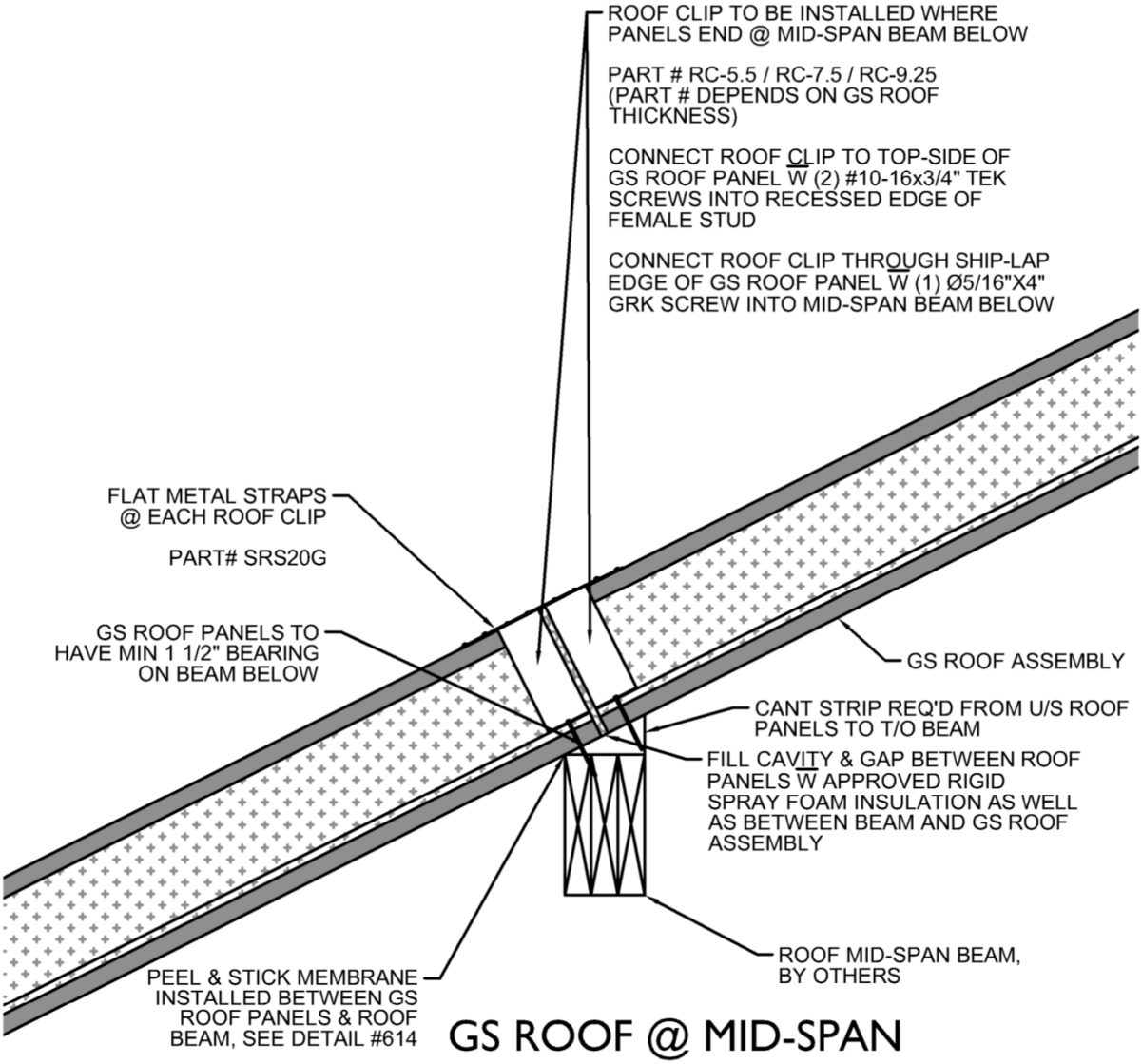
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SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

2XWD PLATE CAN BE SUBSTITUTED FOR PLYWOOD WHERE ROOF SLOPED 7:12 OR GREATER

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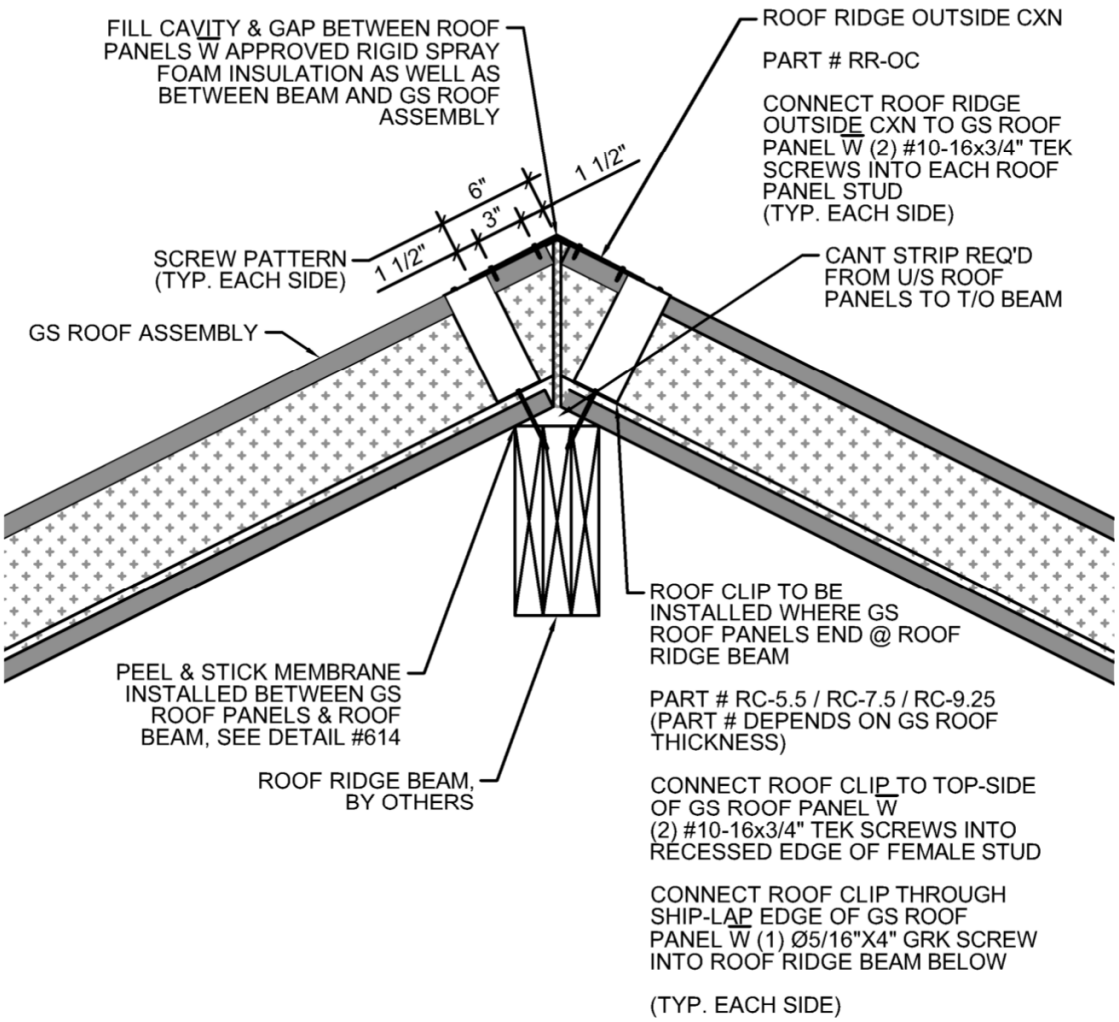
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GS ROOF @ MID-SPAN BEAM (SECTION) 543
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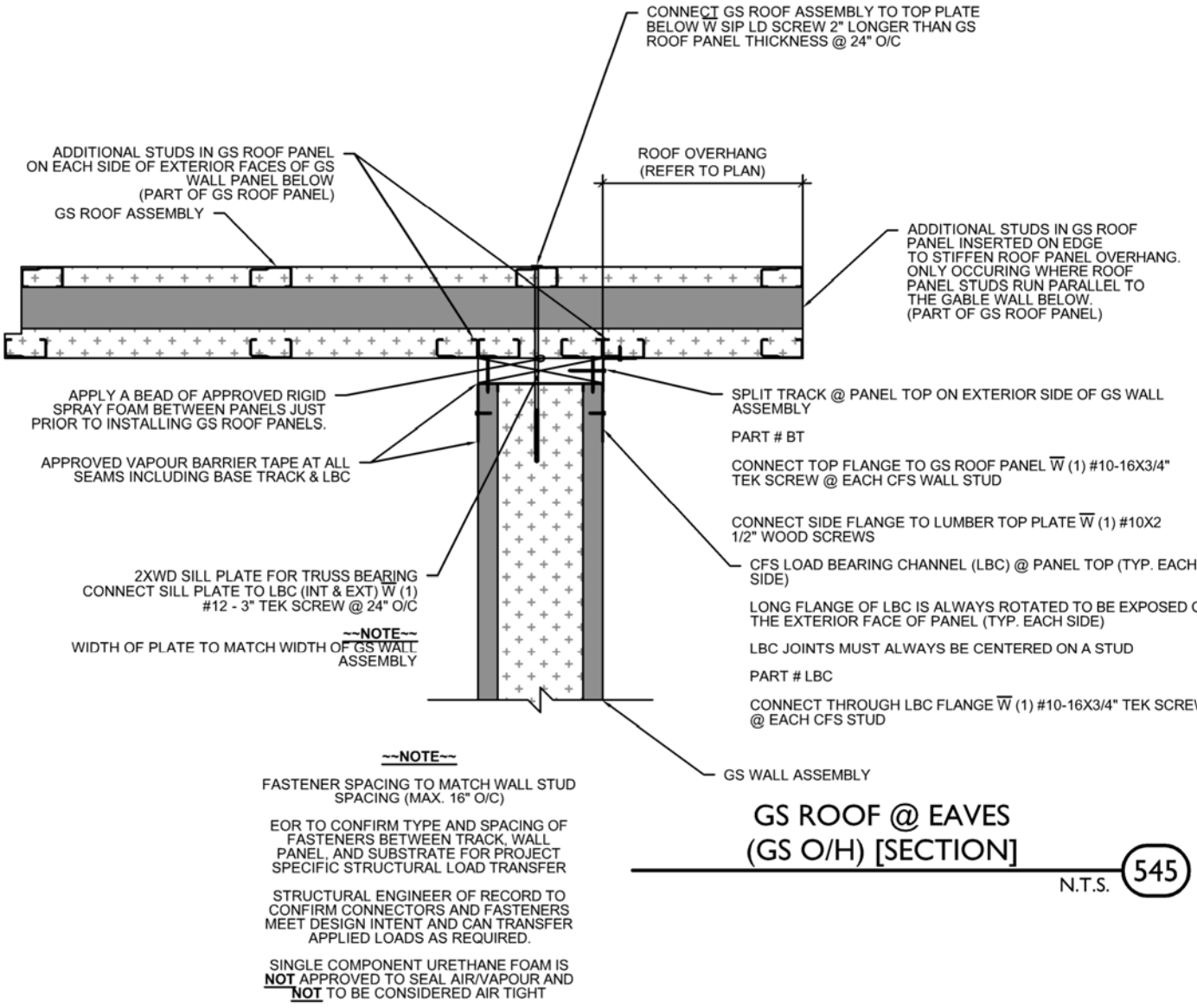


GS ROOF @ RIDGE (SECTION) 544

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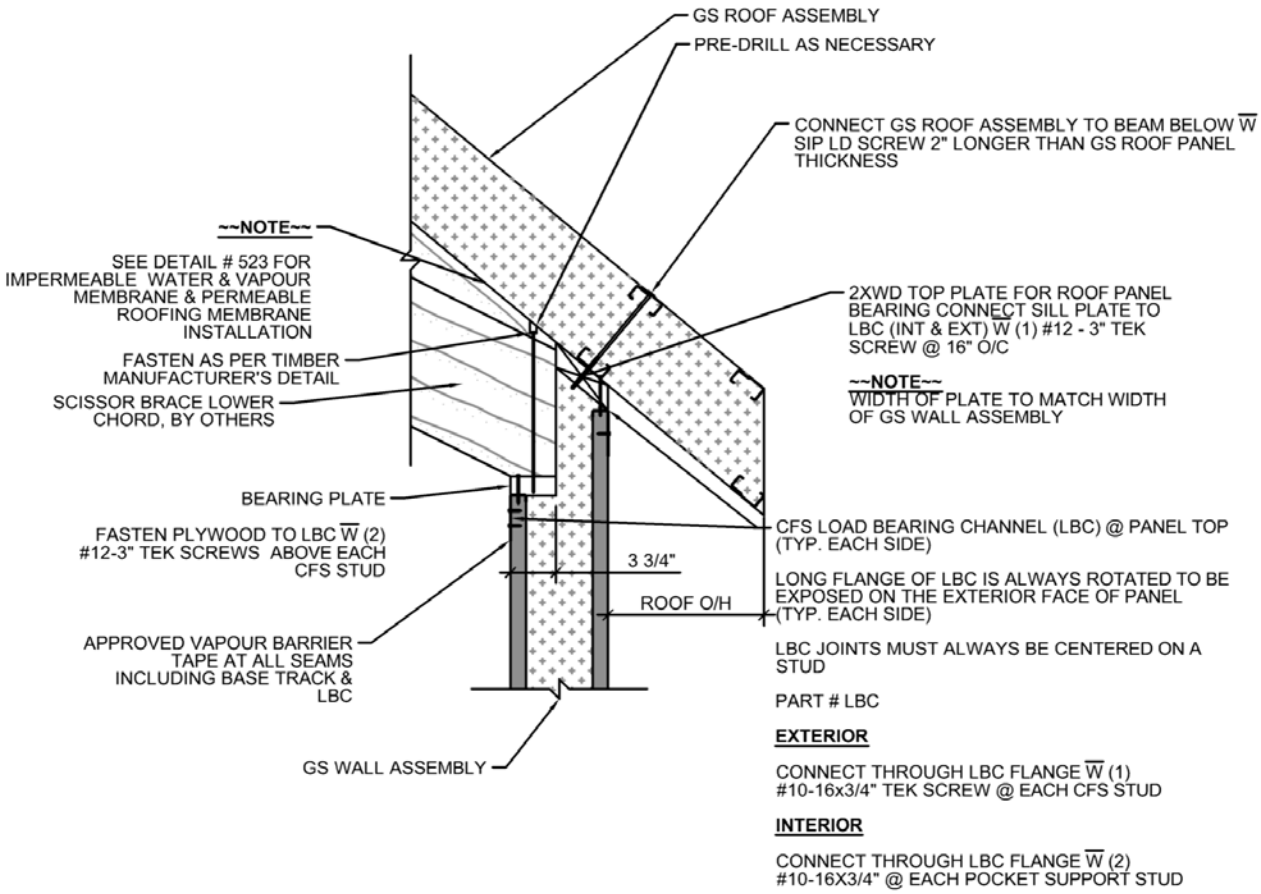
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GS ROOF @ EAVES (GS O/H) [SECTION]

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GS ROOF ON TIMBER BEAM @ EAVES TIE-DOWN (SECTION)

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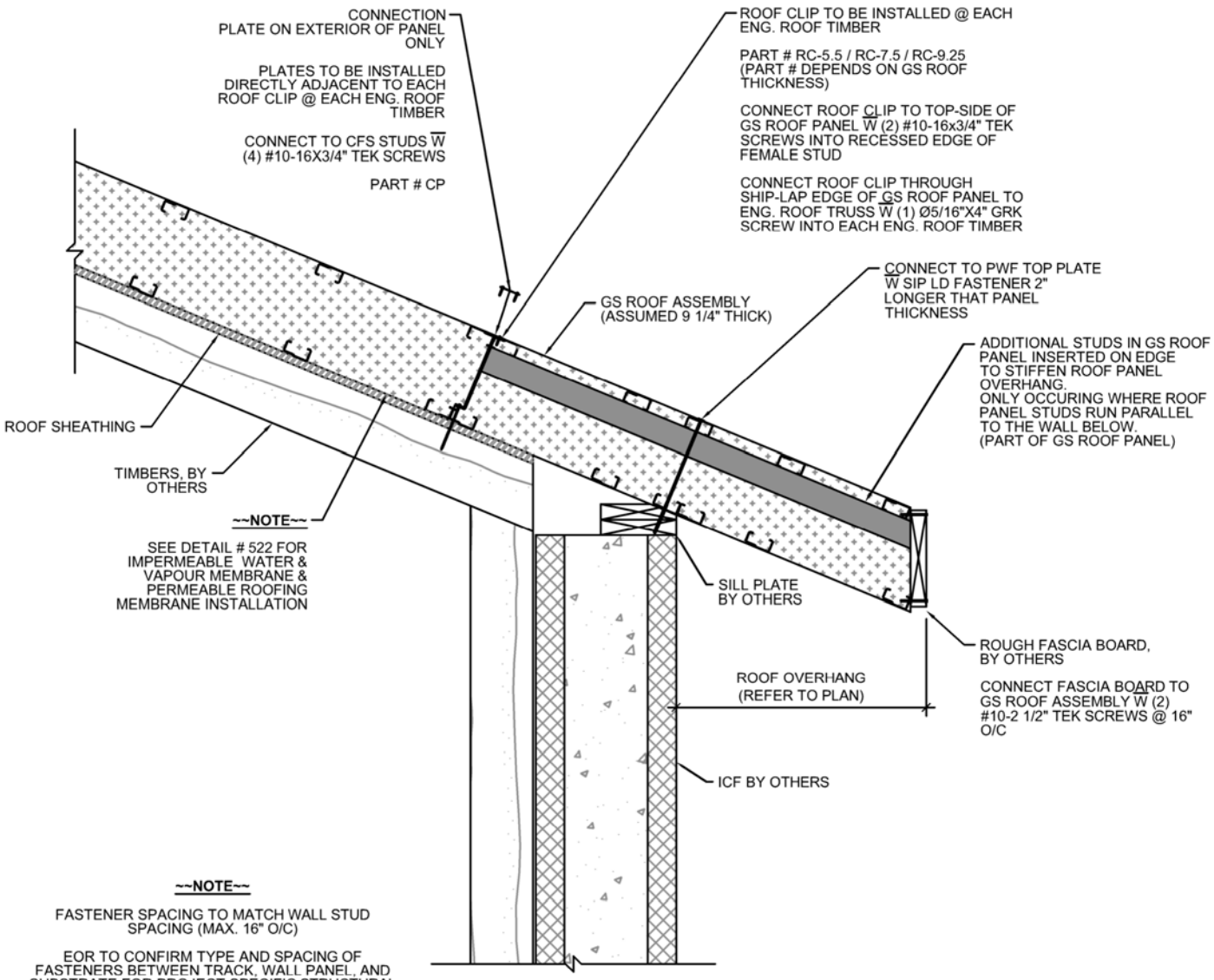
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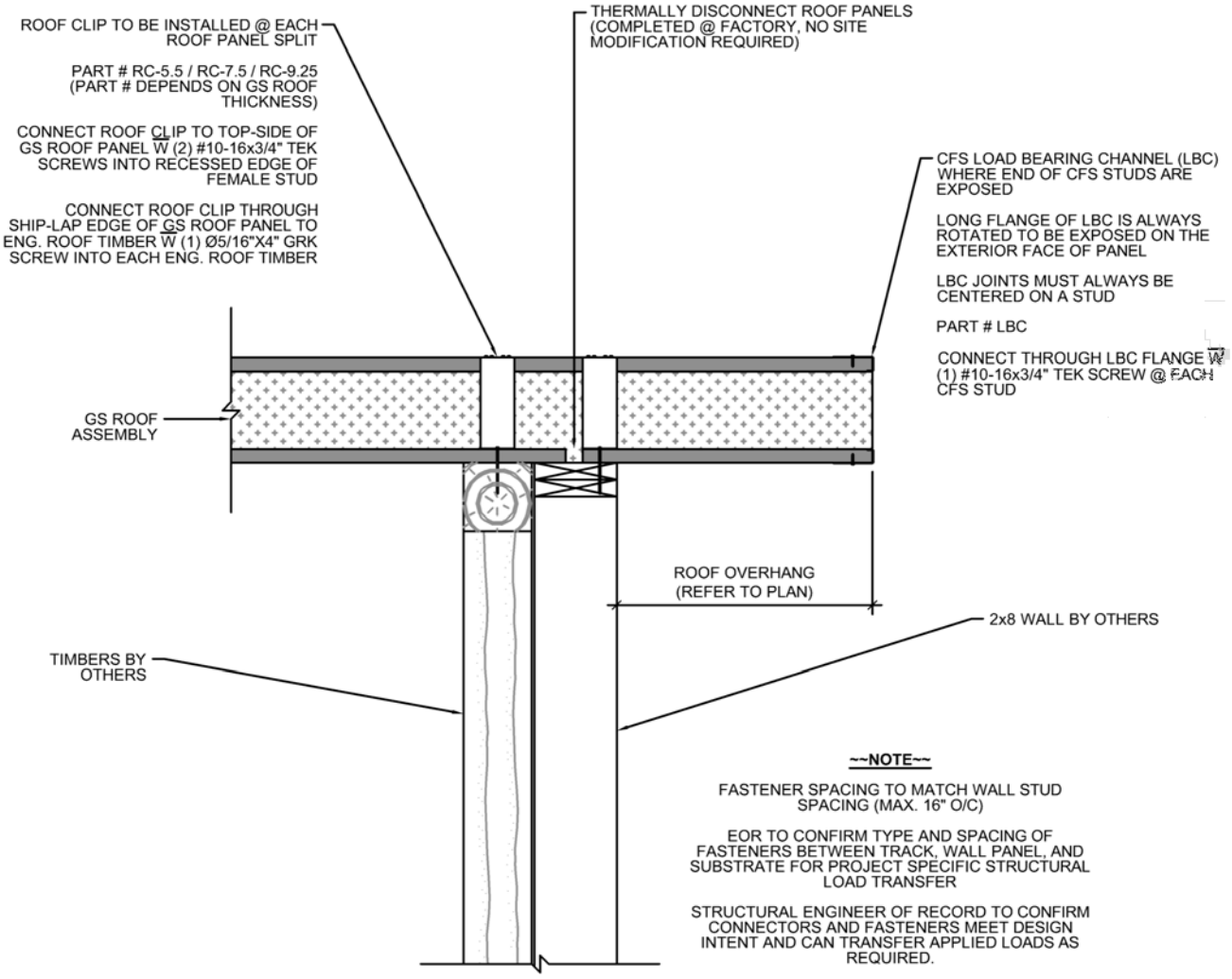
STRUCTURAL ENGINEER OF RECORD TO CONFIRM CONNECTORS AND FASTENERS MEET DESIGN INTENT AND CAN TRANSFER APPLIED LOADS AS REQUIRED.

GS ROOF ATTACHMENT ONTO TIMBER STRUCTURE (SECTION)

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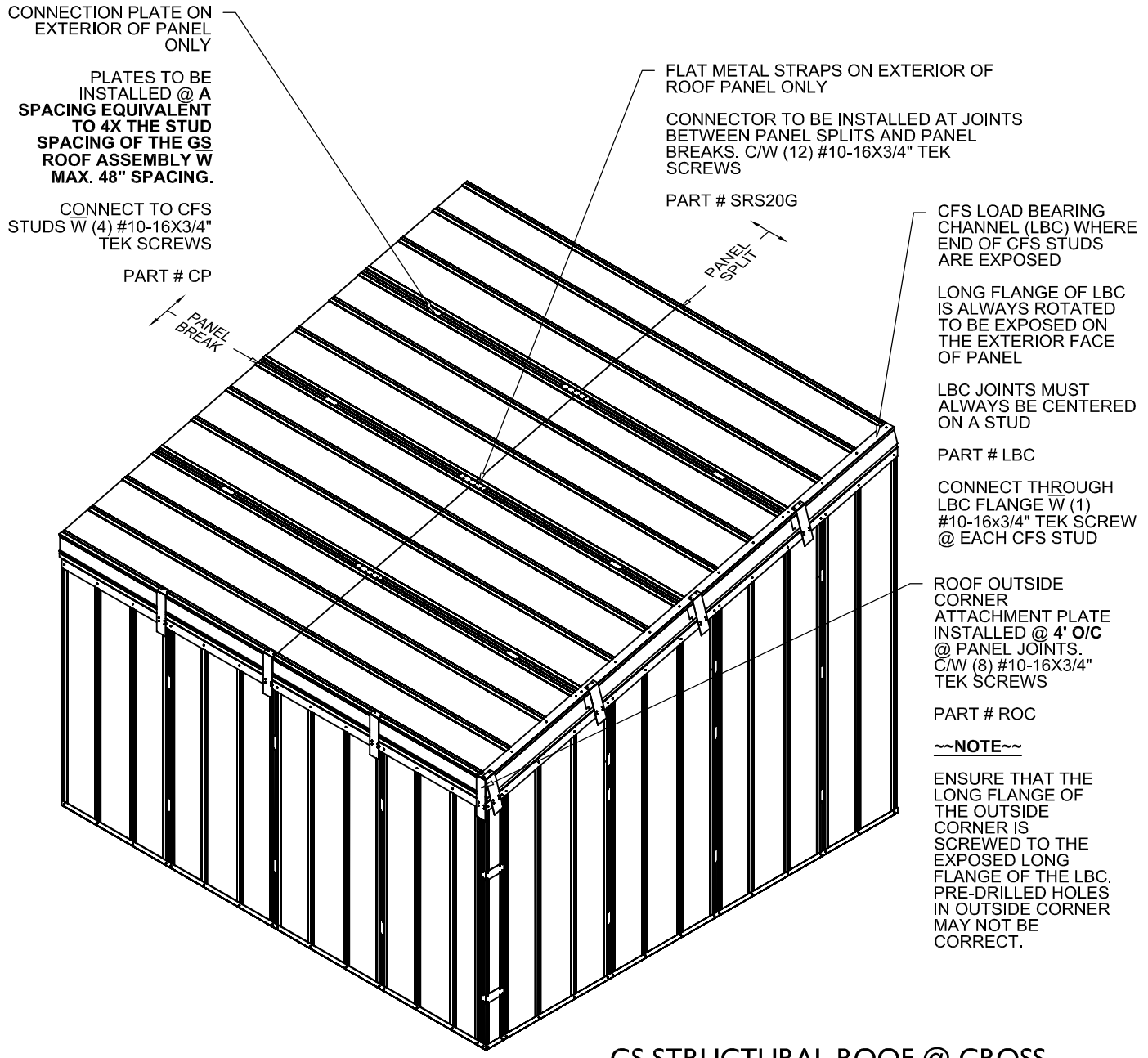


GS ROOF ATTACHMENT ONTO TIMBER STRUCTURE @ GABLE WALL (SECTION)

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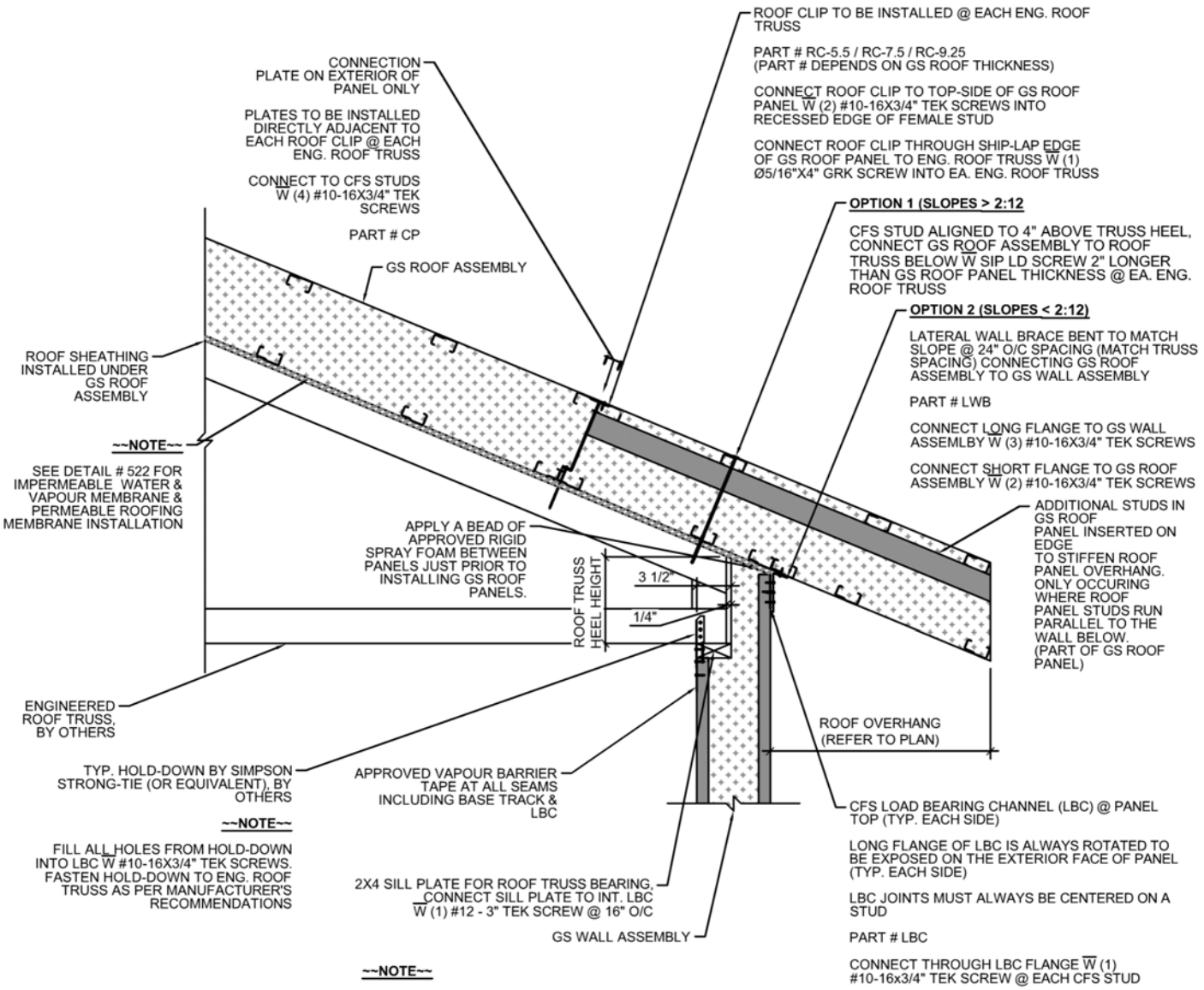
GS STRUCTURAL ROOF @ CROSS SLOPE (PERSPECTIVE)

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551

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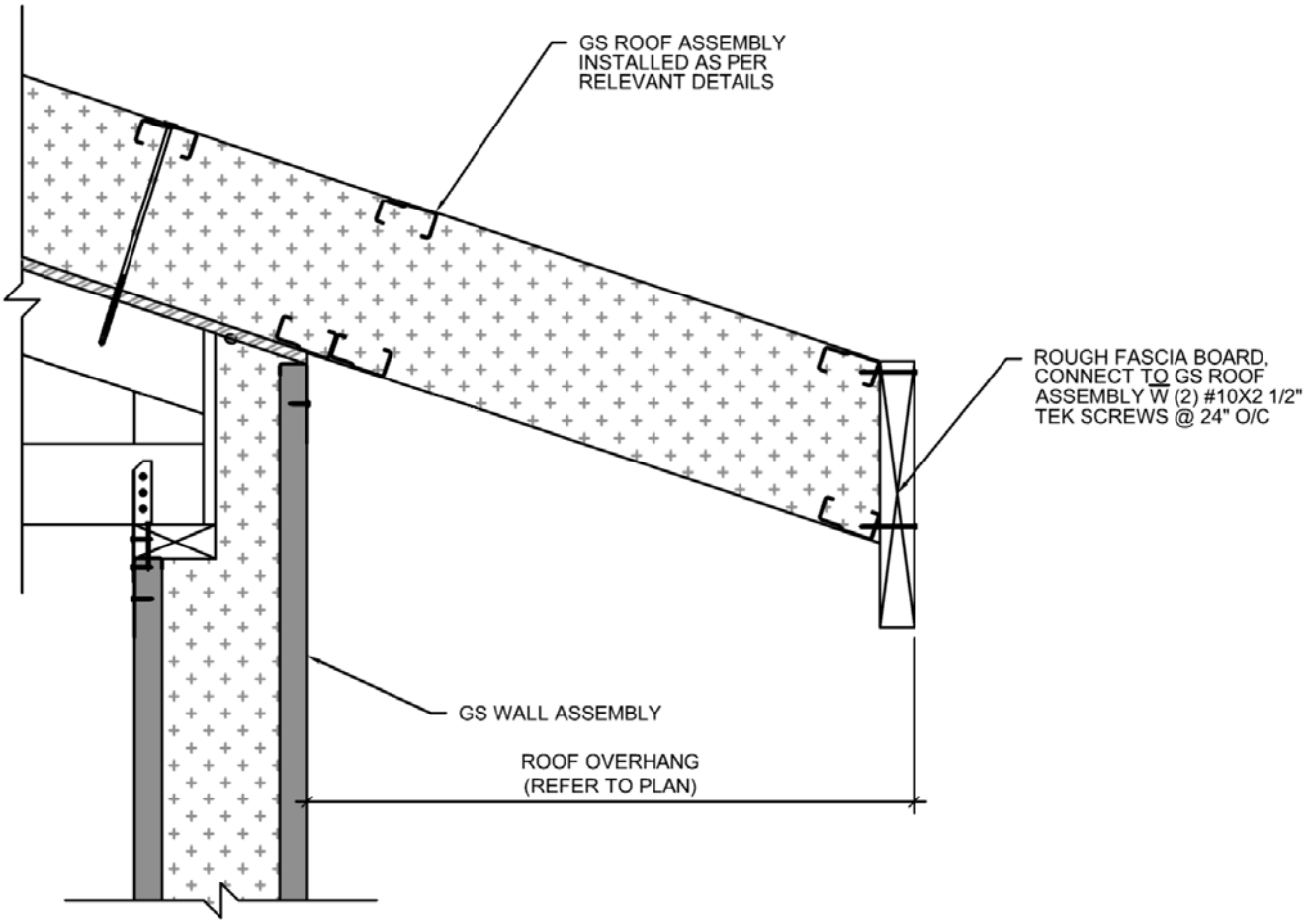
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GS ROOF ON RECESSED ENG. ROOF TRUSS @ EAVES (W OVERHANG) [SECTION]

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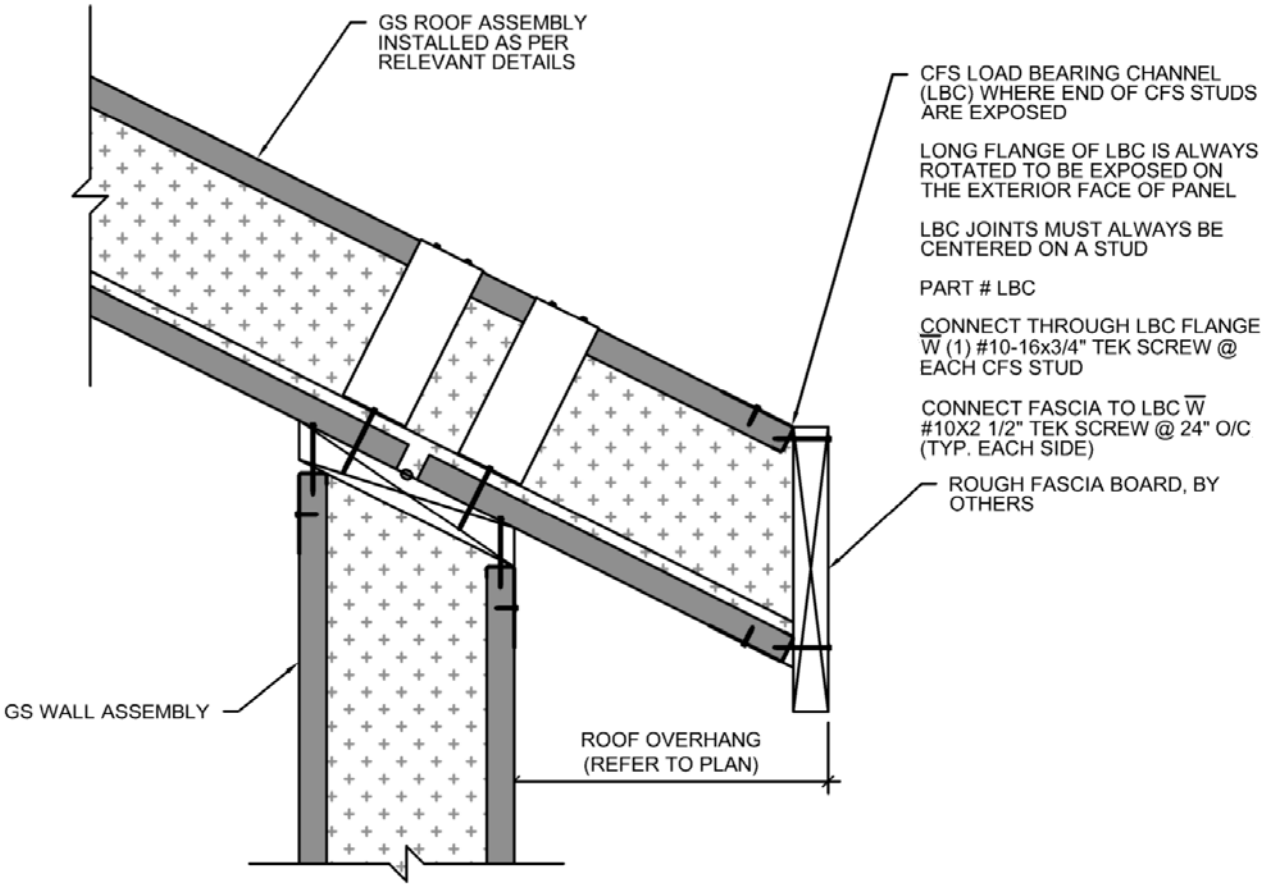


ROUGH FASCIA ATTACHMENT ONTO GS ROOF [SECTION]

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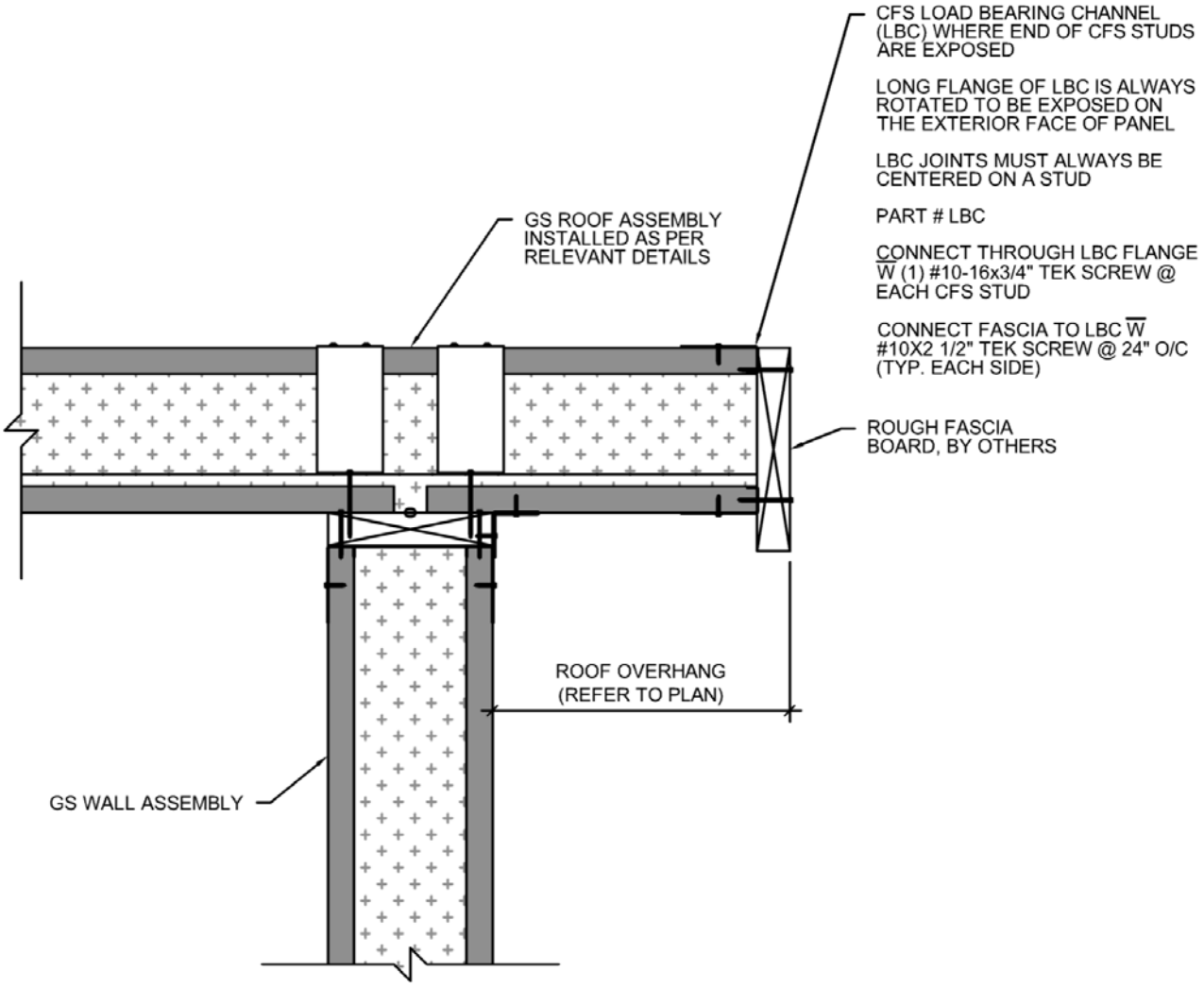


ROUGH FASCIA ATTACHMENT ONTO GS ROOF [SECTION]

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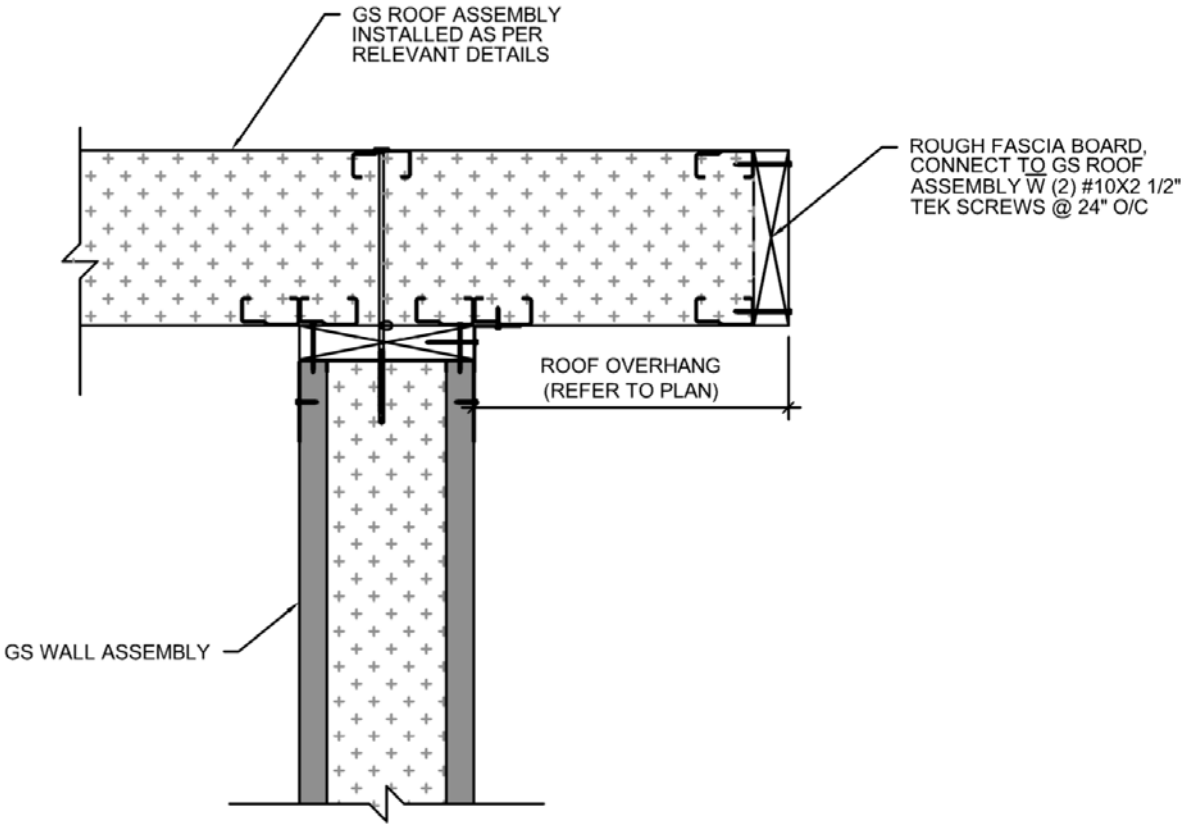


ROUGH FASCIA ATTACHMENT ONTO GS ROOF [SECTION]

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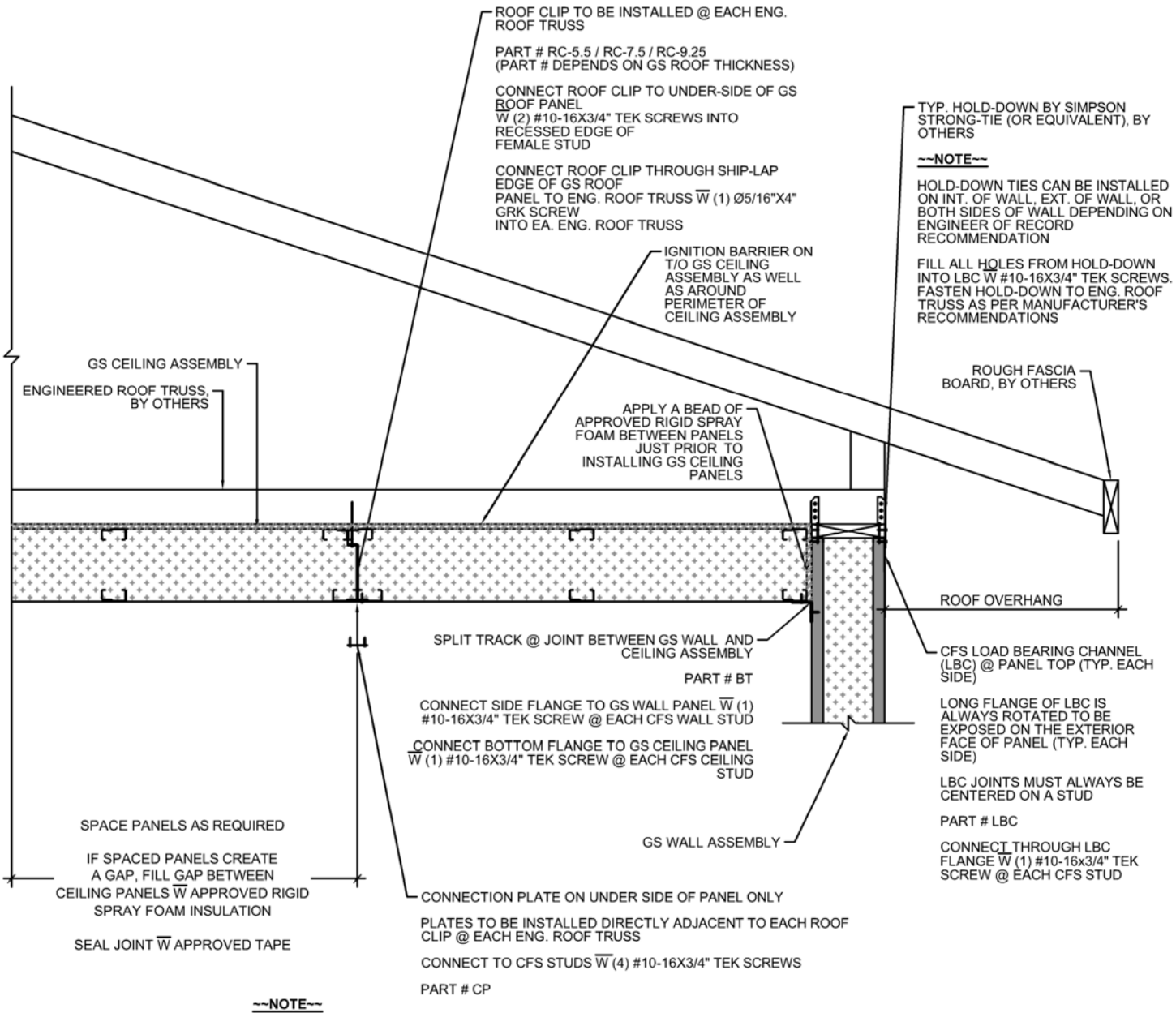


ROUGH FASCIA ATTACHMENT ONTO GS ROOF [SECTION]

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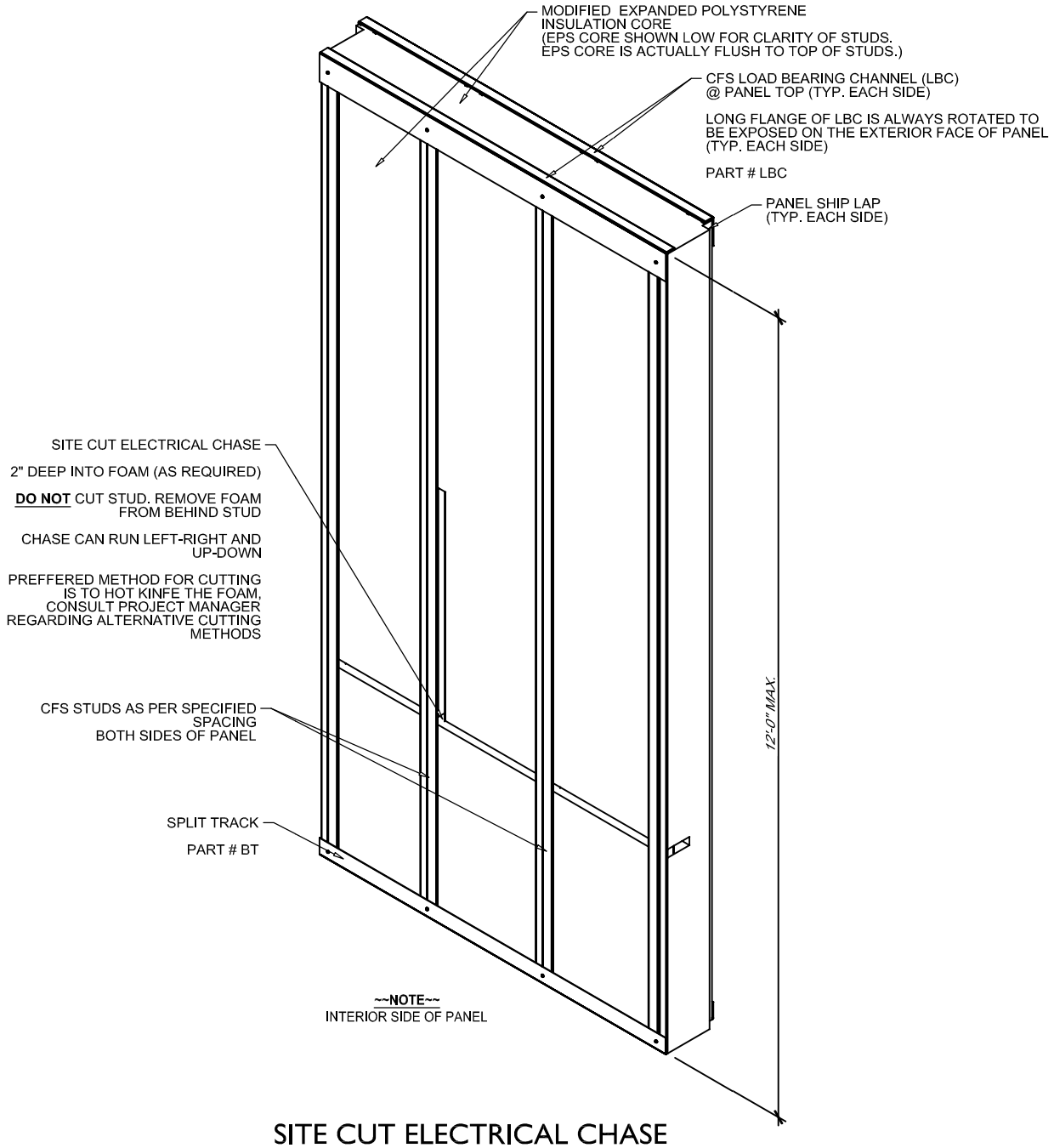
GS CEILING PANELS (SECTION)

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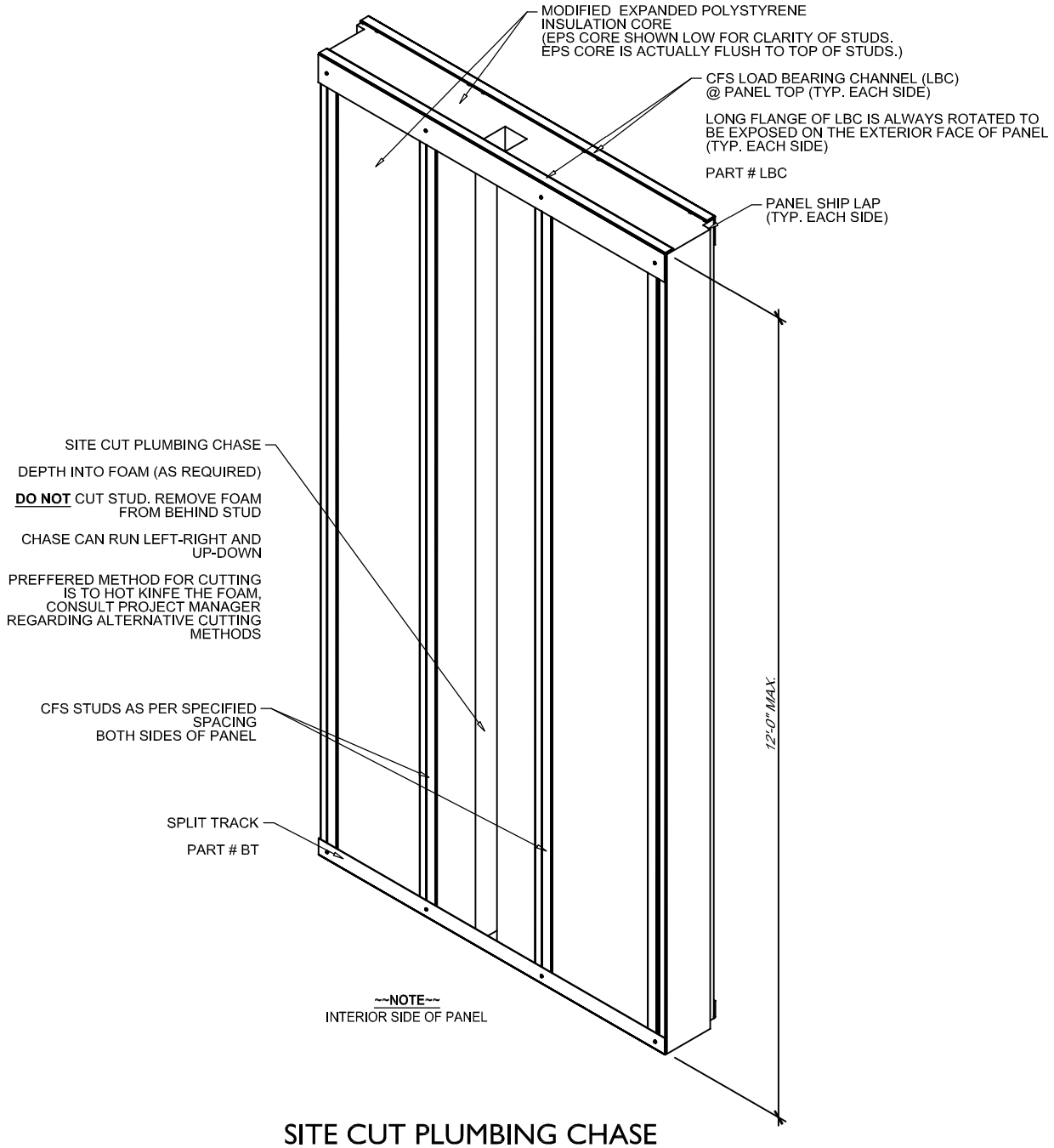


SITE CUT ELECTRICAL CHASE (PERSPECTIVE)

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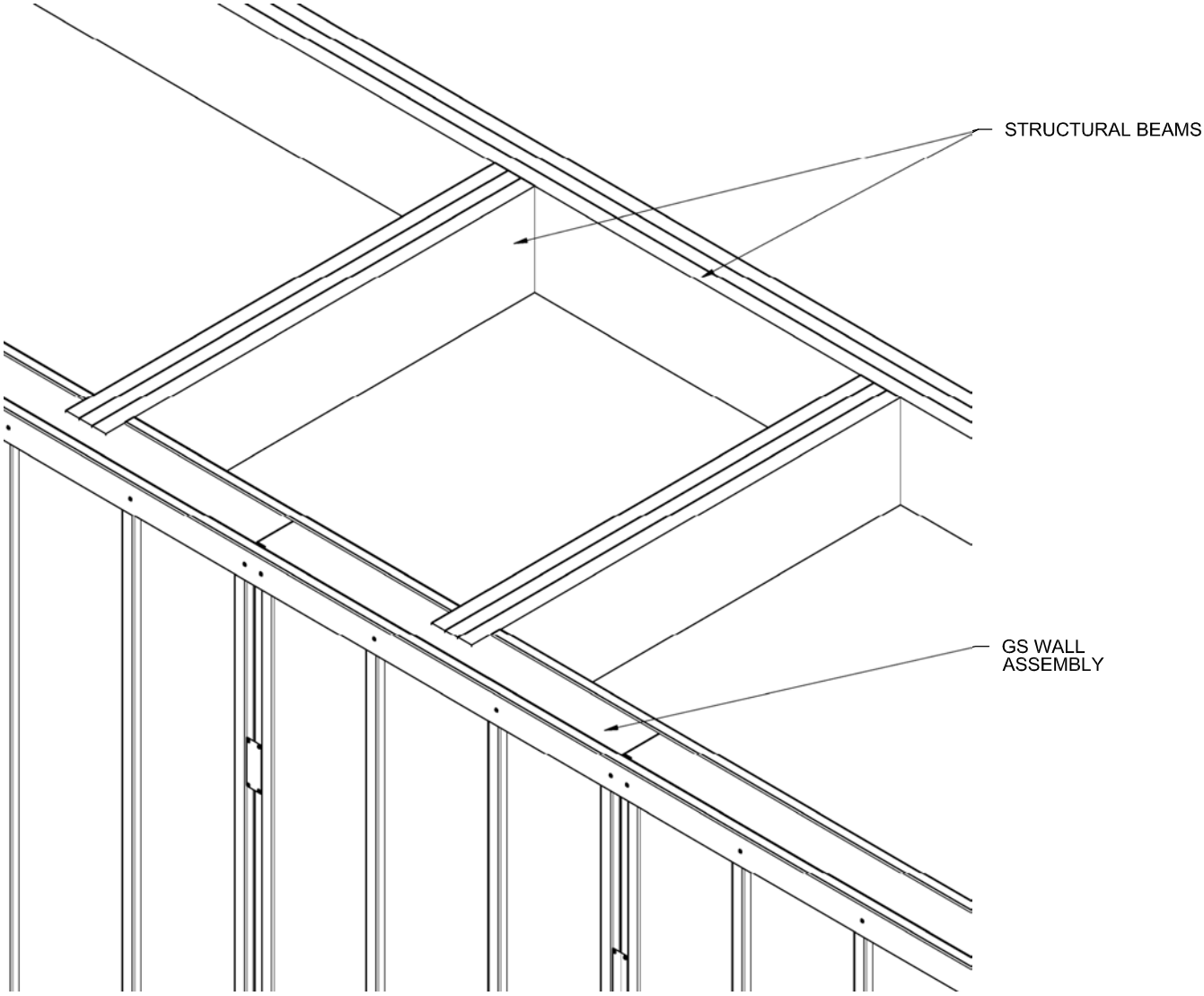


SITE CUT PLUMBING CHASE (PERSPECTIVE)

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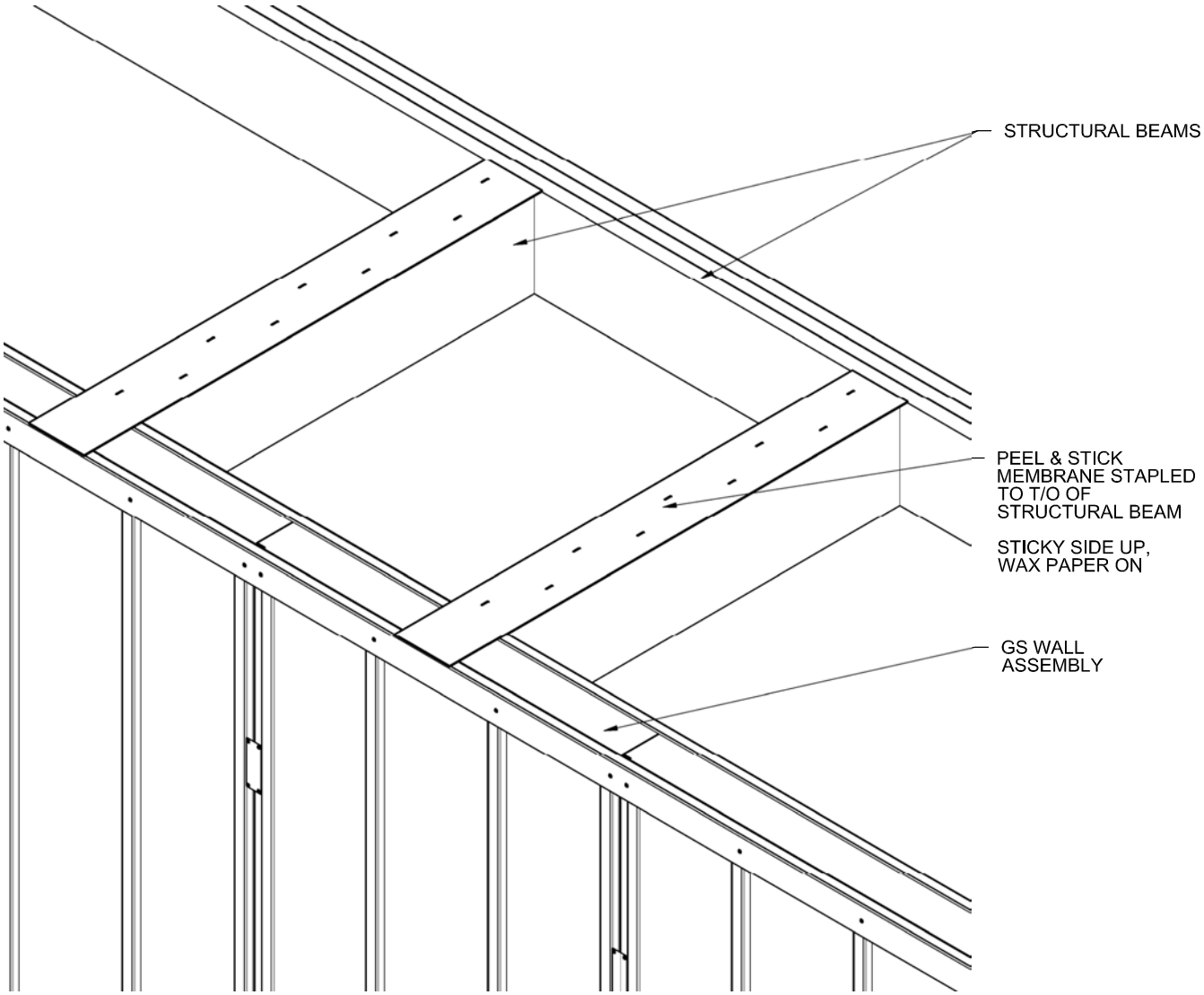
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PEEL & STICK INSTALLATION
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614A

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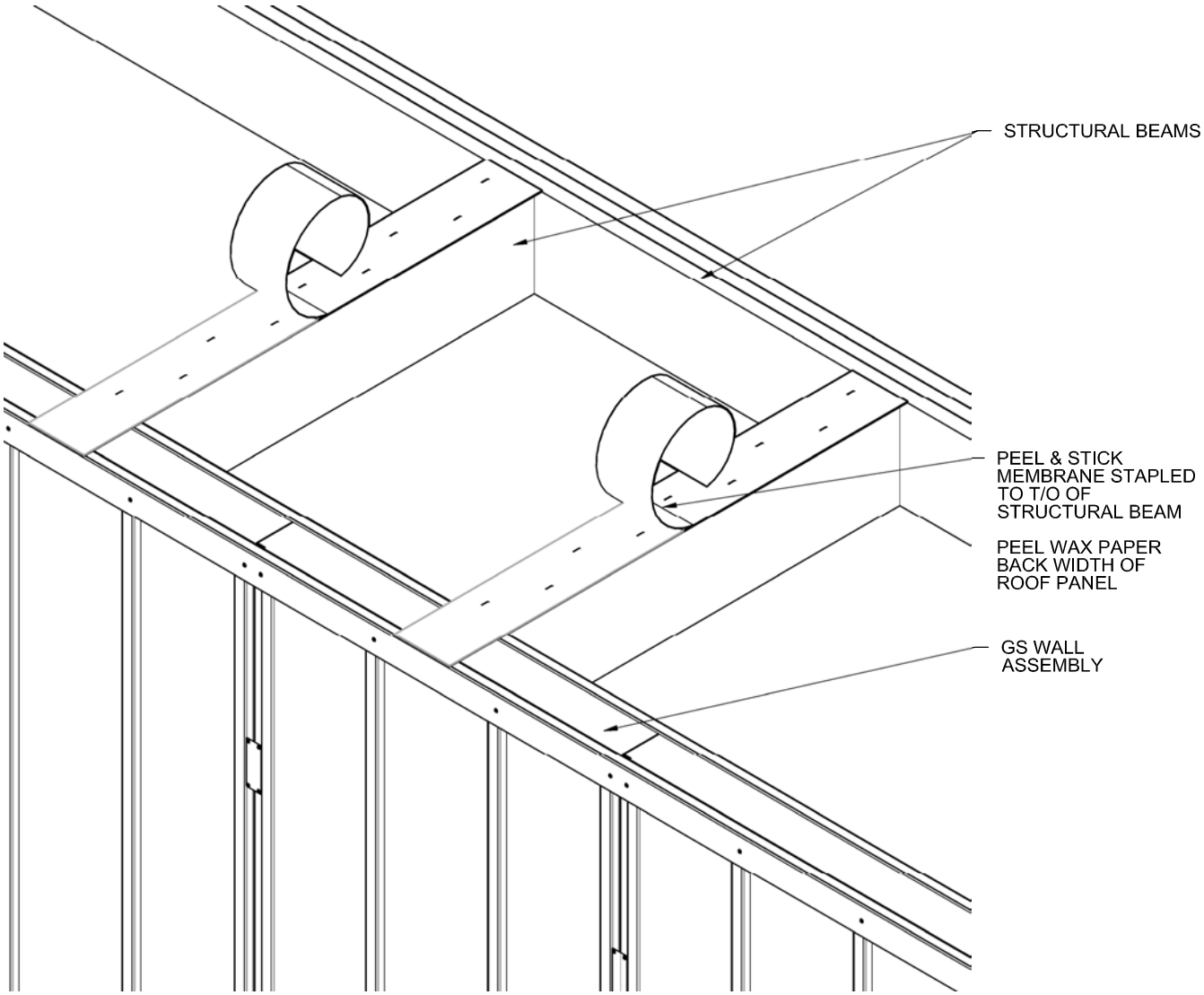


PEEL & STICK INSTALLATION
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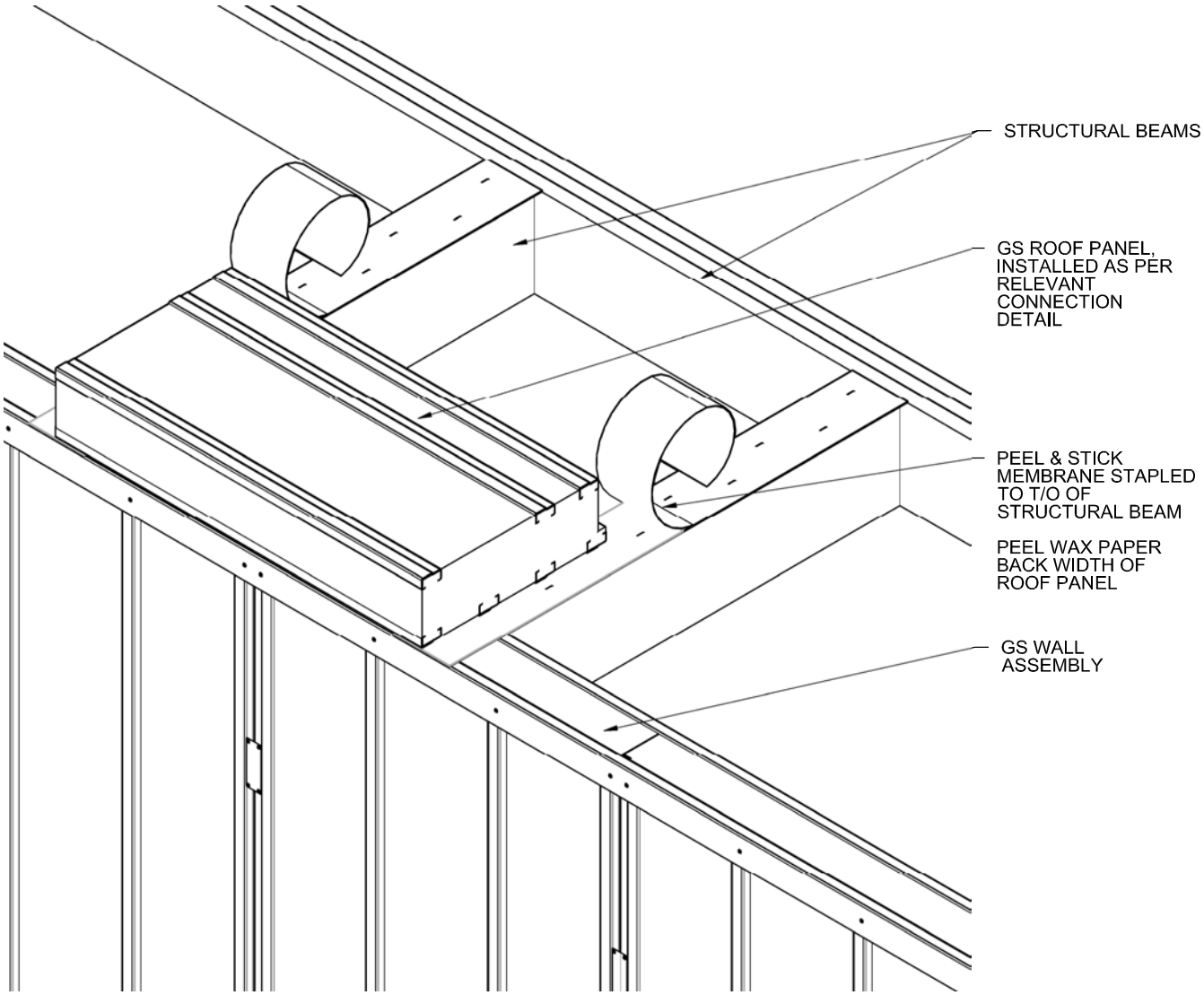


PEEL & STICK INSTALLATION
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TABLE OF CONTENTS

COMMERCIAL ALTERNATE DETAILS

GENERAL DETAILS

122. GS WALL ASSEMBLY W X-BRACING (PERSPECTIVE)
123. GS WALL ASSEMBLY W SHEATHING (PERSPECTIVE)

GS WALL BASE & GS FLOOR ATTACHMENT DETAILS

215. TIE DOWN STRAP ONTO GS WALL [SECTION & ELEVATION]
250. GS ASSEMBLY ONTO FOUNDATION BEAM (@ EXT. WALL W CONTINUOUS SUBFLOOR) [SECTION]
251. GS ASSEMBLY ONTO FOUNDATION BEAM (@ FLOOR PANEL BREAK) [SECTION]
252. GS ASSEMBLY ONTO FOUNDATION BEAM (@ FLOOR PANEL SPLIT) [SECTION]
253. GS ASSEMBLY ONTO FOUNDATION BEAM (@ FLOOR PANEL BUTT JOINT) [SECTION]
260. GS WALL & FLOOR ASSEMBLIES ON TOP CHORD BEARING FLOOR JOISTS & FOUNDATION [SECTION]

GS WALL PANEL DETAILS

301. TYP. EXT. FACE OF GS WALL PANEL @ CORNER (PERSPECTIVE)
302. TYP. INT. FACE OF GS WALL PANEL @ CORNER (PERSPECTIVE)
340. WINDOW ROUGH OPENING (EXT.) [PERSPECTIVE]
342. DOOR ROUGH OPENING (EXT.) [PERSPEVTIVE]
349. GS PANELIZING CLIP FLAT MODIFICATION (PERSPECTIVE)
383A. HOLD-DOWNS @ CORNERS (ELEVATION)
383B. EXAMPLE SCREW PATTERN (MIN. SPACING) [ELEVATION]

GS WALL TOP ATTACHMENT DETAILS

401. FULL BEAM POCKET [SECTION]
402. FULL BEAM POCKET (PLAN)
423. FULL BEARING FLOOR WITH SILL PLATE [SECTION]
424. LEDGER BEARING FLOOR [SECTION]
433. STAIRWELL WALL BREAK (HIGH) [SECTION]
435. REMOVABLE GS WALL INSTALLATION [SECTION]
460. LEDGER BOARD INSTALLATION [SECTION]

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COMMERCIAL ALTERNATE DETAILS *(continued from previous page)*

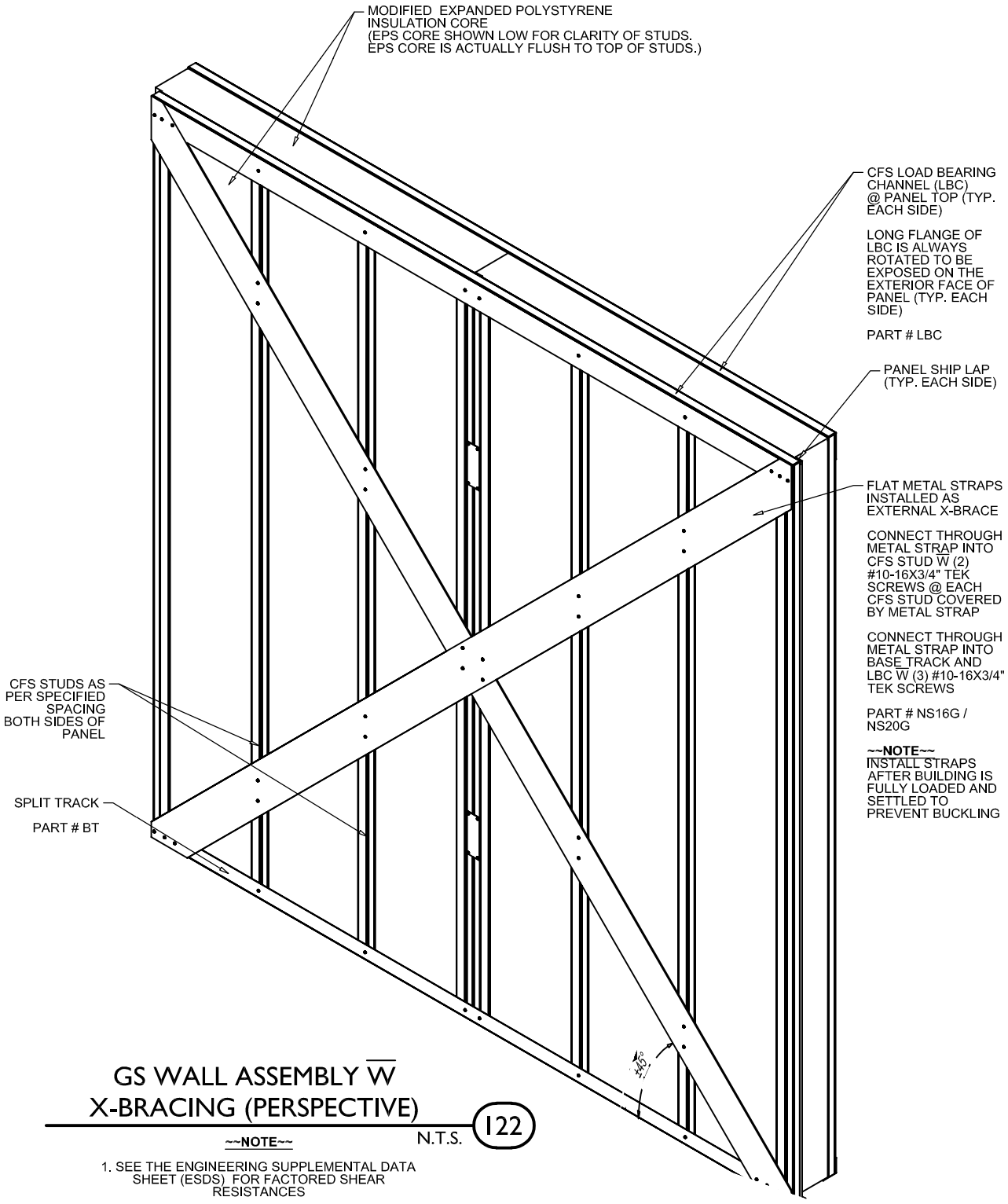
462. RECESSED LEDGER IN GS WALL SYSTEM (SECTION)

GS ROOF & CEILING ATTACHMENT DETAILS

503. GS ROOF ON ENG. ROOF TRUSS @ EAVES (NO O/H) [SECTION]
506. GS ROOF ON RECESSED ENG. ROOF TRUSS @ EAVES (NO O/H) [SECTION]
509. GS ROOF ON ENG. PARALLEL CHORD ROOF JOIST @ EAVES (NO OVERHANG) [SECTION]
513. GS ROOF ON ENG. ROOF TRUSS @ GS GABLE WALL (NO O/H) [SECTION]
514. GS ROOF @ EAVES ON BEAM [SECTION]
515. GS ROOF @ EAVES ON BEAM (SHIP-LAP JOINT) [SECTION]
516. GS STRUCTURAL ROOF BETWEEN BEAMS @ EAVES (NO OVERHANG) [SECTION]
530. GS ROOF PEAK STRAPPING (OVER TRUSSES) [PLAN]
531. GS ROOF ON ENG. ROOF TRUSS @ GS GABLE WALL (NO O/H) [ELEVATION]
538A. GS ROOF @ EAVES (GS O/H) [SECTION]
538B. GS ROOF @ EAVES (GS O/H) [SECTION]
538C. "NET-ZERO" GS ROOF @ EAVES (GS O/H) [SECTION]
538D. "NET-ZERO" GS ROOF @ EAVES (GS O/H) [SECTION]
539A. GS ROOF SHIP-LAP @ EAVES (GS O/H) [SECTION]
539B. GS ROOF SHIP-LAP @ EAVES (GS O/H) [SECTION]
539C. "NET-ZERO" GS ROOF SHIP-LAP @ EAVES (GS O/H) [SECTION]
539D. "NET-ZERO" GS ROOF SHIP-LAP @ EAVES (GS O/H) [SECTION]
540A. GS ROOF BUTT JOINT @ EAVES (GS O/H) [SECTION]
540B. GS ROOF BUTT JOINT @ EAVES (GS O/H) [SECTION]
540C. "NET-ZERO" GS ROOF BUTT JOINT @ EAVES (GS O/H) [SECTION]
540D. "NET-ZERO" GS ROOF BUTT JOINT @ EAVES (GS O/H) [SECTION]
541. GS CLERESTORY WALL & ROOF ASSEMBLY (SECTION)
542. GS ROOF @ EAVES (NO O/H) [SECTION]
543. GS ROOF @ MID-SPAN BEAM [SECTION]
551. GS STRUCTURAL ROOF @ CROSS SLOPE (PERSPECTIVE)

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GS WALL ASSEMBLY W
X-BRACING (PERSPECTIVE)

122

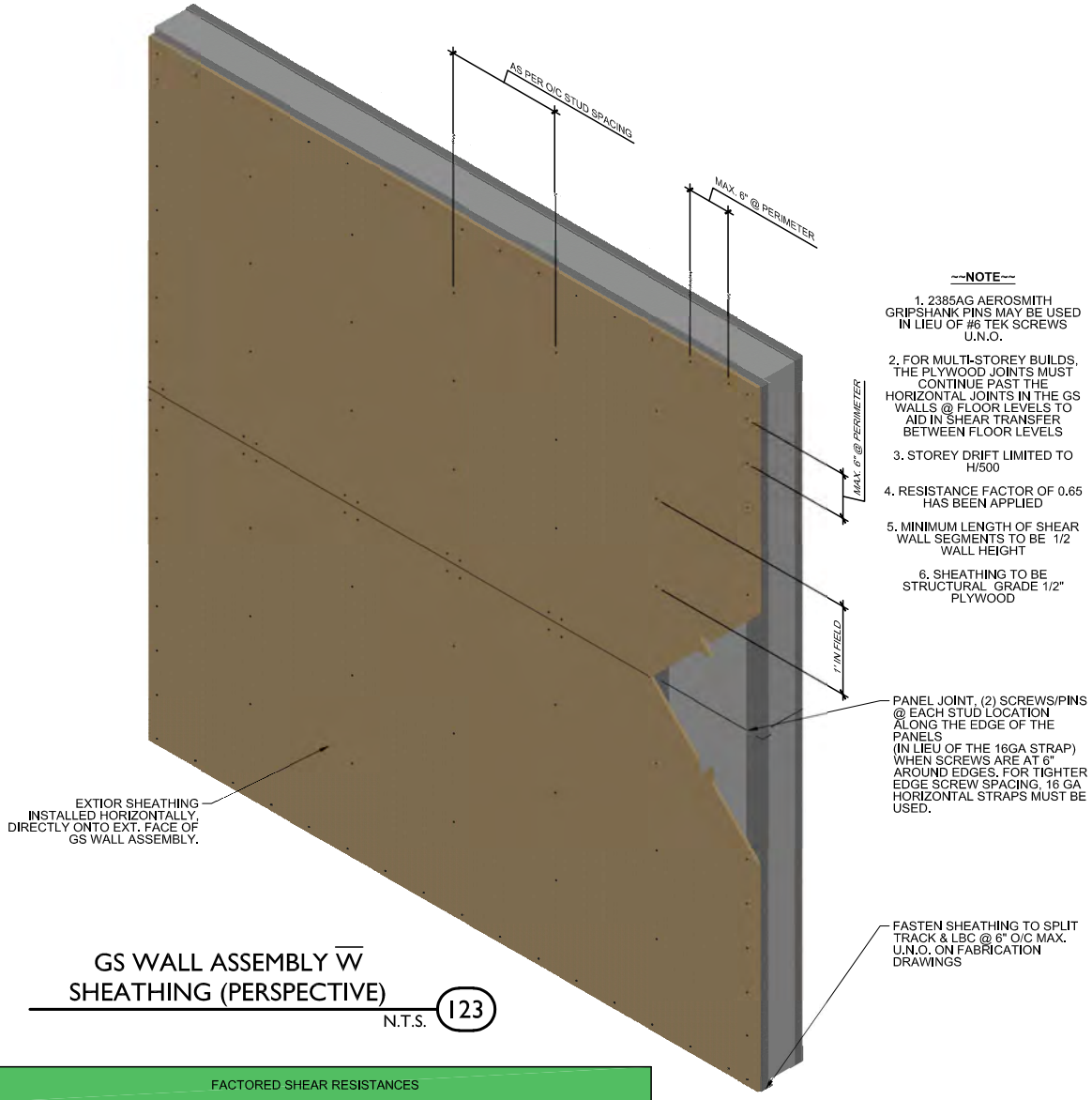
N.T.S.

~~NOTE~~

1. SEE THE ENGINEERING SUPPLEMENTAL DATA SHEET (ESDS) FOR FACTORED SHEAR RESISTANCES

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~~NOTE~~

1. 2385AG AEROSMITH GRIPSHANK PINS MAY BE USED IN LIEU OF #6 TEK SCREWS U.N.O.
2. FOR MULTI-STOREY BUILDS, THE PLYWOOD JOINTS MUST CONTINUE PAST THE HORIZONTAL JOINTS IN THE GS WALLS @ FLOOR LEVELS TO AID IN SHEAR TRANSFER BETWEEN FLOOR LEVELS
3. STOREY DRIFT LIMITED TO H/500
4. RESISTANCE FACTOR OF 0.65 HAS BEEN APPLIED
5. MINIMUM LENGTH OF SHEAR WALL SEGMENTS TO BE 1/2 WALL HEIGHT
6. SHEATHING TO BE STRUCTURAL GRADE 1/2" PLYWOOD

GS WALL ASSEMBLY W SHEATHING (PERSPECTIVE)

N.T.S. 123

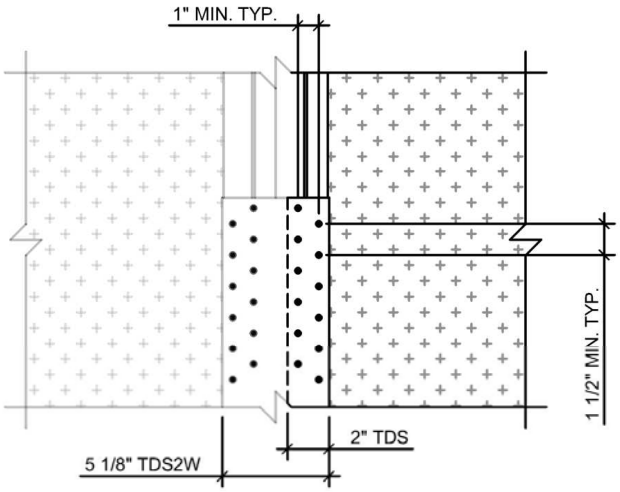
FACTORED SHEAR RESISTANCES						
SHEAR WALL TYPE	FASTENING REQUIREMENTS					MAX. SHEAR CAP. kN/m
	STUD GA	SHEATHING REQUIRED	FASTENERS	AROUND EDGES	IN FIELD	
SW1 *	20	NO	N/A	N/A	N/A	2.90
SW2	20	YES	AEROSMITH 2385AG PINS	6"	12"	4.52
SW3	18	YES	#6 TEK SCREWS	6"	12"	11.26
SW4	18	YES	AEROSMITH 2385AG PINS	4"	12"	12.51
SW5	16	YES	AEROSMITH 2385AG PINS	6"	12"	10.61
SW6	16	YES	AEROSMITH 2385AG PINS	4"	12"	14.4
SW7	16	YES	AEROSMITH 2385AG PINS	2"	12"	18.19

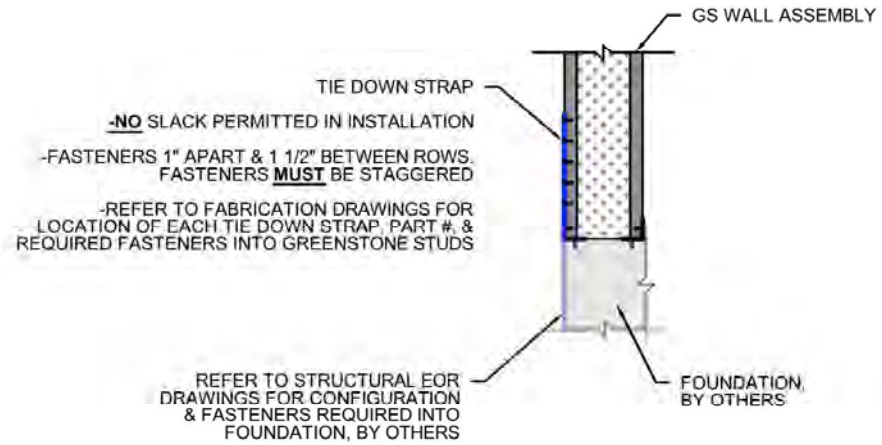
~~NOTE~~

- REFER TO FABRICATION DRAWINGS FOR LOCATION & TYPE OF SHEAR WALL
- * REFER TO ARCHITECTURAL DRAWINGS FOR WALL TYPES THAT REQUIRE EXTERIOR SHEATHING

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TIE DOWN STRAP ONTO GS WALL [SECTION & ELEVATION]

215

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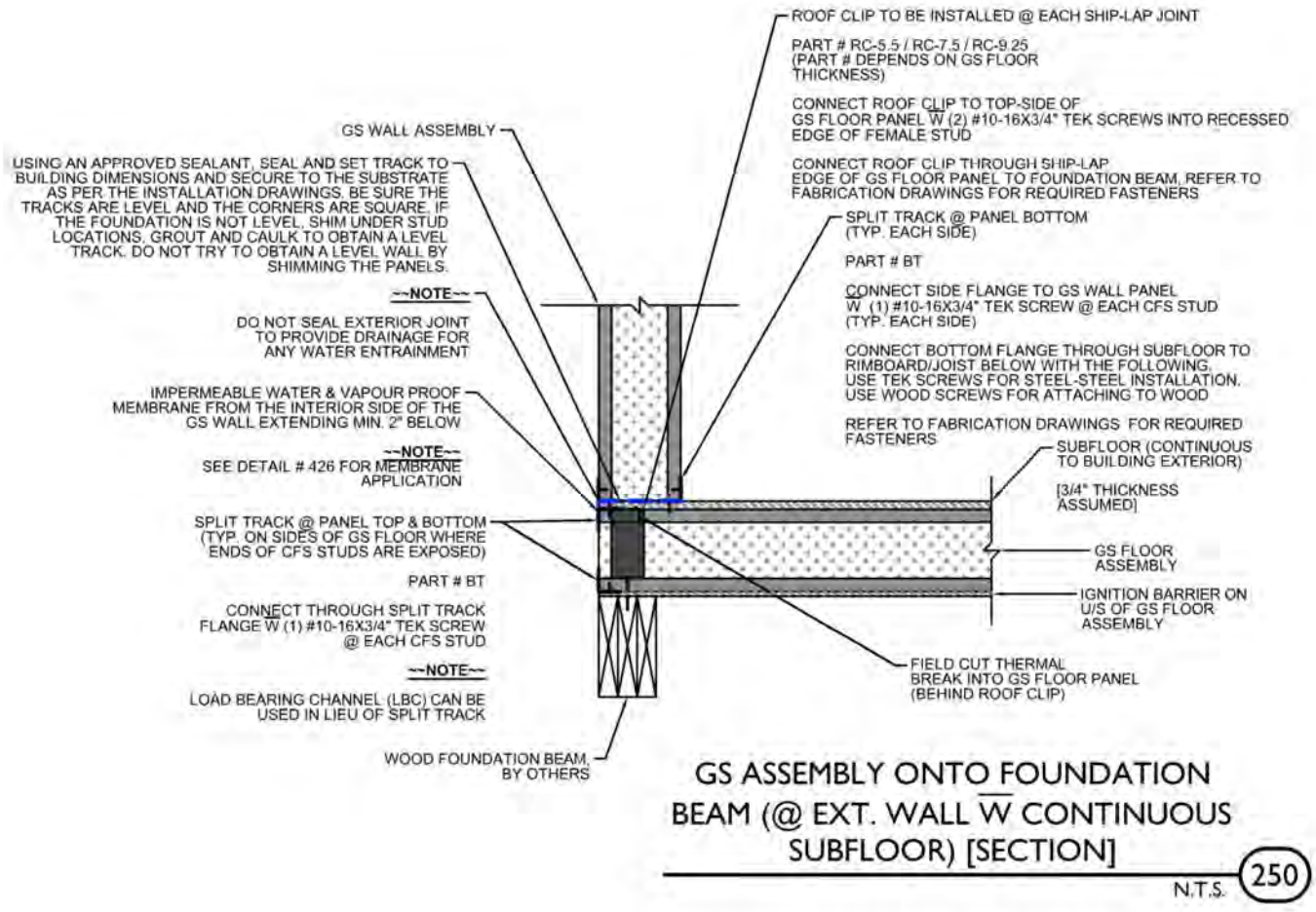
~~NOTE~~

TIE DOWN STRAP ILLUSTRATES INSTALLATION METHOD TO BE USED @ WINDOWS, DOORS, & BUILDING CORNERS TO THE FOUNDATION

@ CORNERS BETWEEN 2 SHEAR WALLS, BOTH SIDES OF THE CORNER REQUIRE A TIE DOWN STRAP

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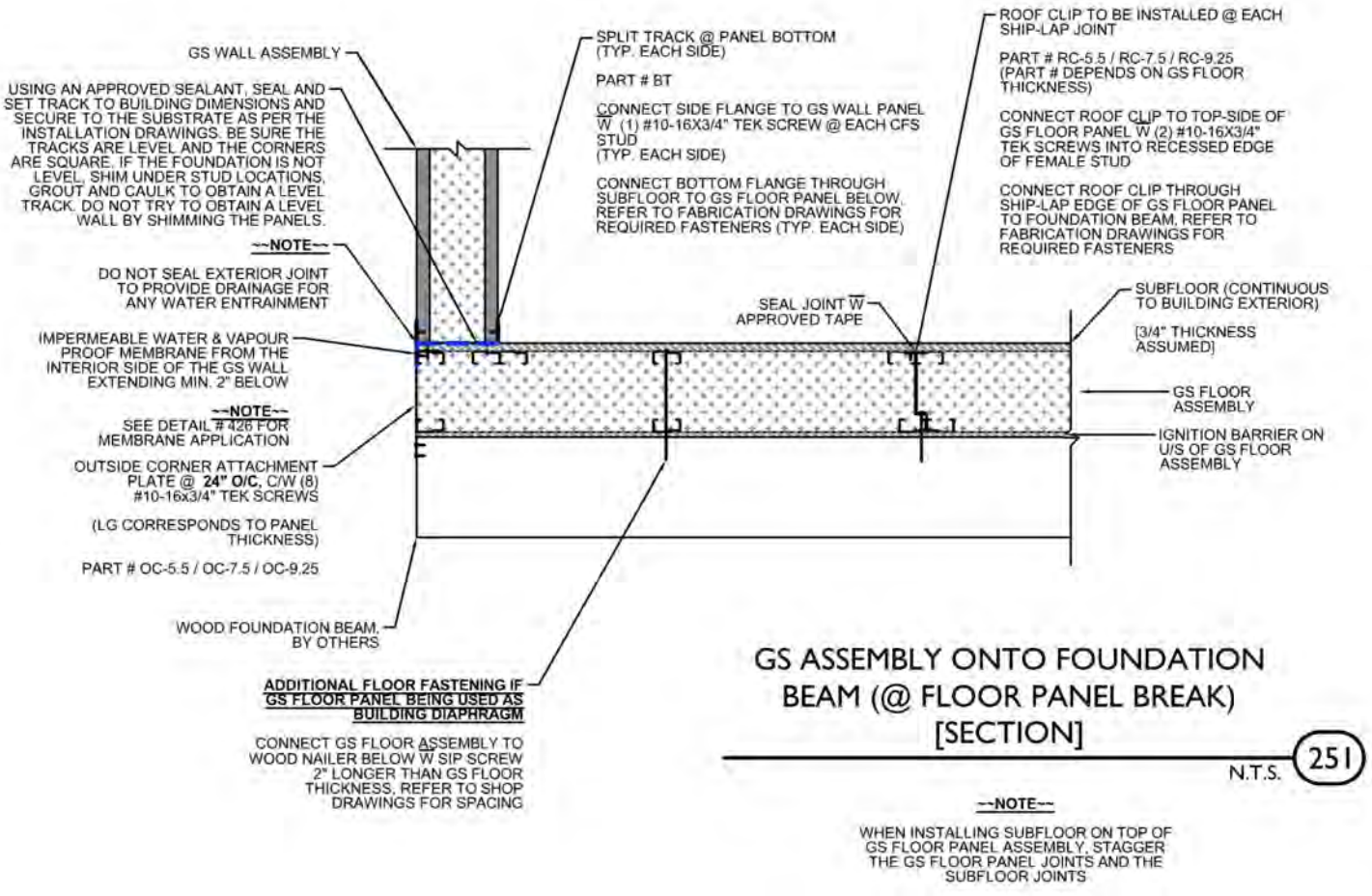


GS ASSEMBLY ONTO FOUNDATION BEAM (@ EXT. WALL W CONTINUOUS SUBFLOOR) [SECTION]

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GS ASSEMBLY ONTO FOUNDATION BEAM (@ FLOOR PANEL BREAK) [SECTION]

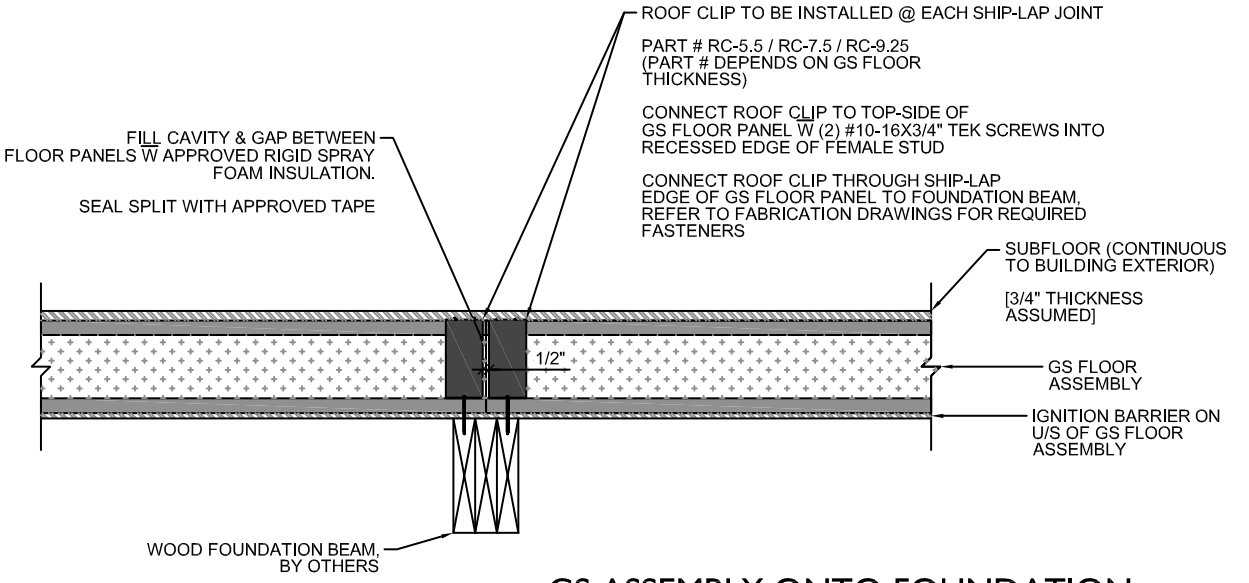
N.T.S. 251

~~NOTE~~

WHEN INSTALLING SUBFLOOR ON TOP OF GS FLOOR PANEL ASSEMBLY, STAGGER THE GS FLOOR PANEL JOINTS AND THE SUBFLOOR JOINTS

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GS ASSEMBLY ONTO FOUNDATION BEAM (@ FLOOR PANEL SPLIT) [SECTION]

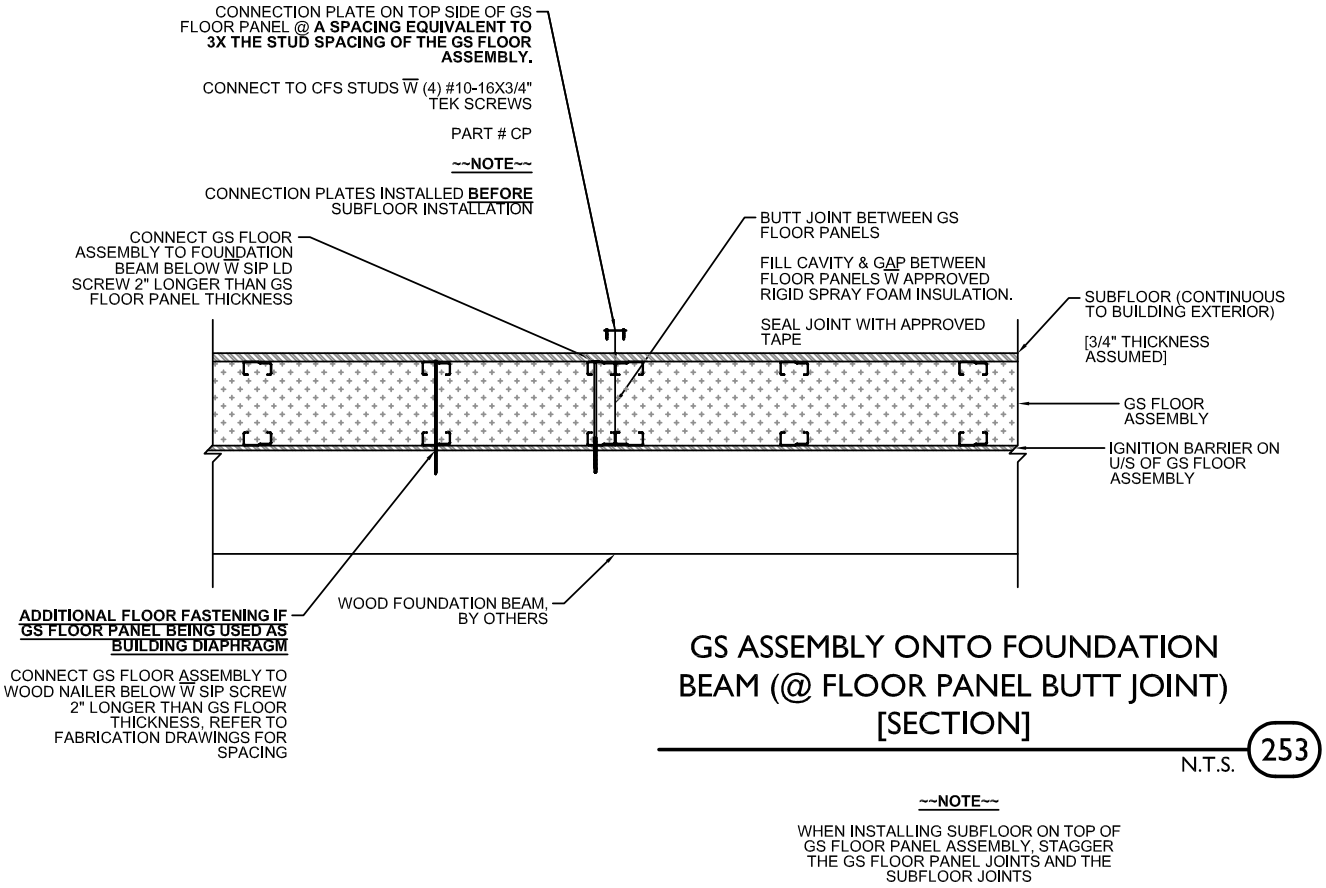
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~~NOTE~~

WHEN INSTALLING SUBFLOOR ON TOP OF GS FLOOR PANEL ASSEMBLY, STAGGER THE GS FLOOR PANEL JOINTS AND THE SUBFLOOR JOINTS

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GS ASSEMBLY ONTO FOUNDATION BEAM (@ FLOOR PANEL BUTT JOINT) [SECTION]

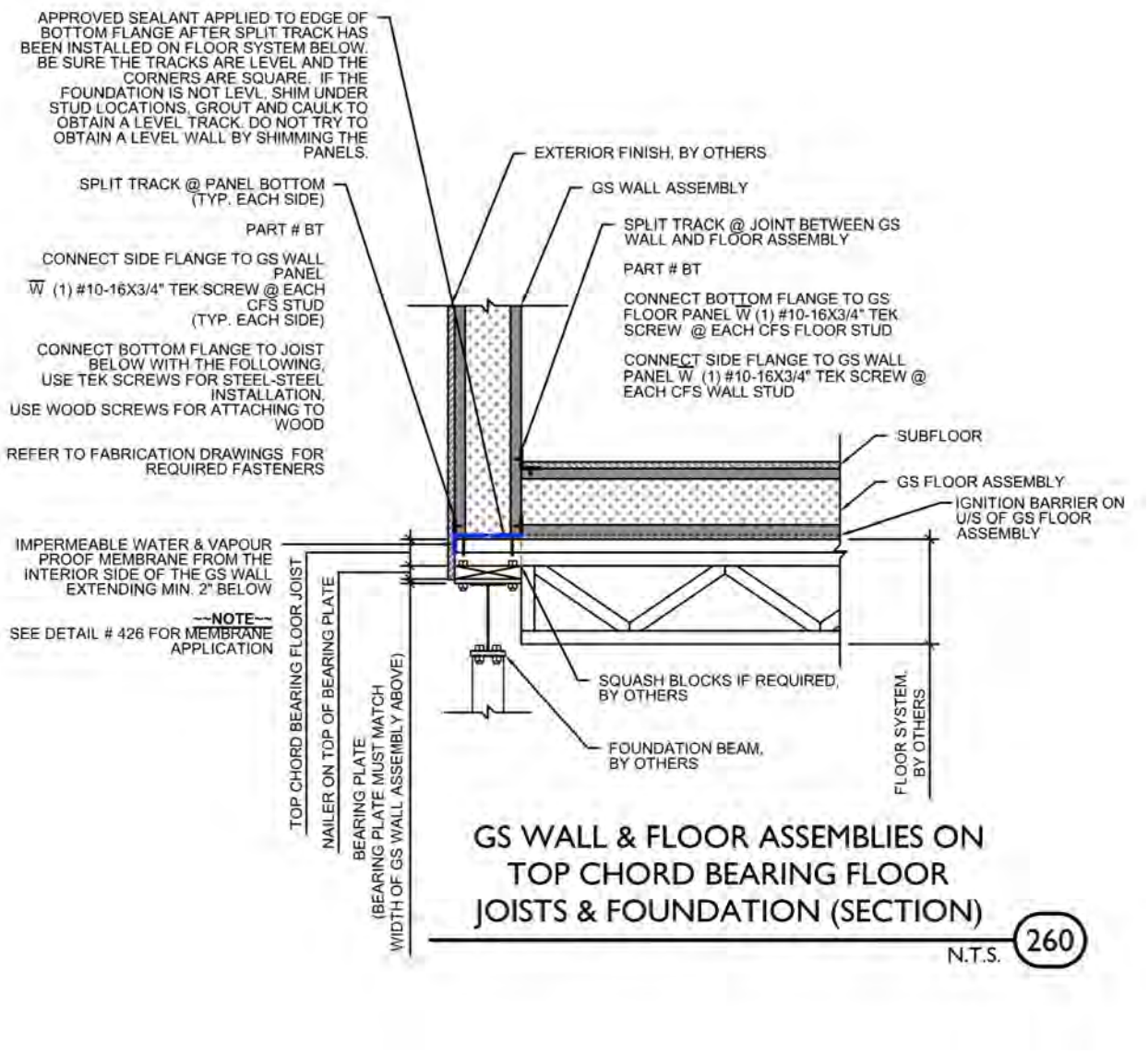
N.T.S. 253

~~NOTE~~

WHEN INSTALLING SUBFLOOR ON TOP OF GS FLOOR PANEL ASSEMBLY, STAGGER THE GS FLOOR PANEL JOINTS AND THE SUBFLOOR JOINTS

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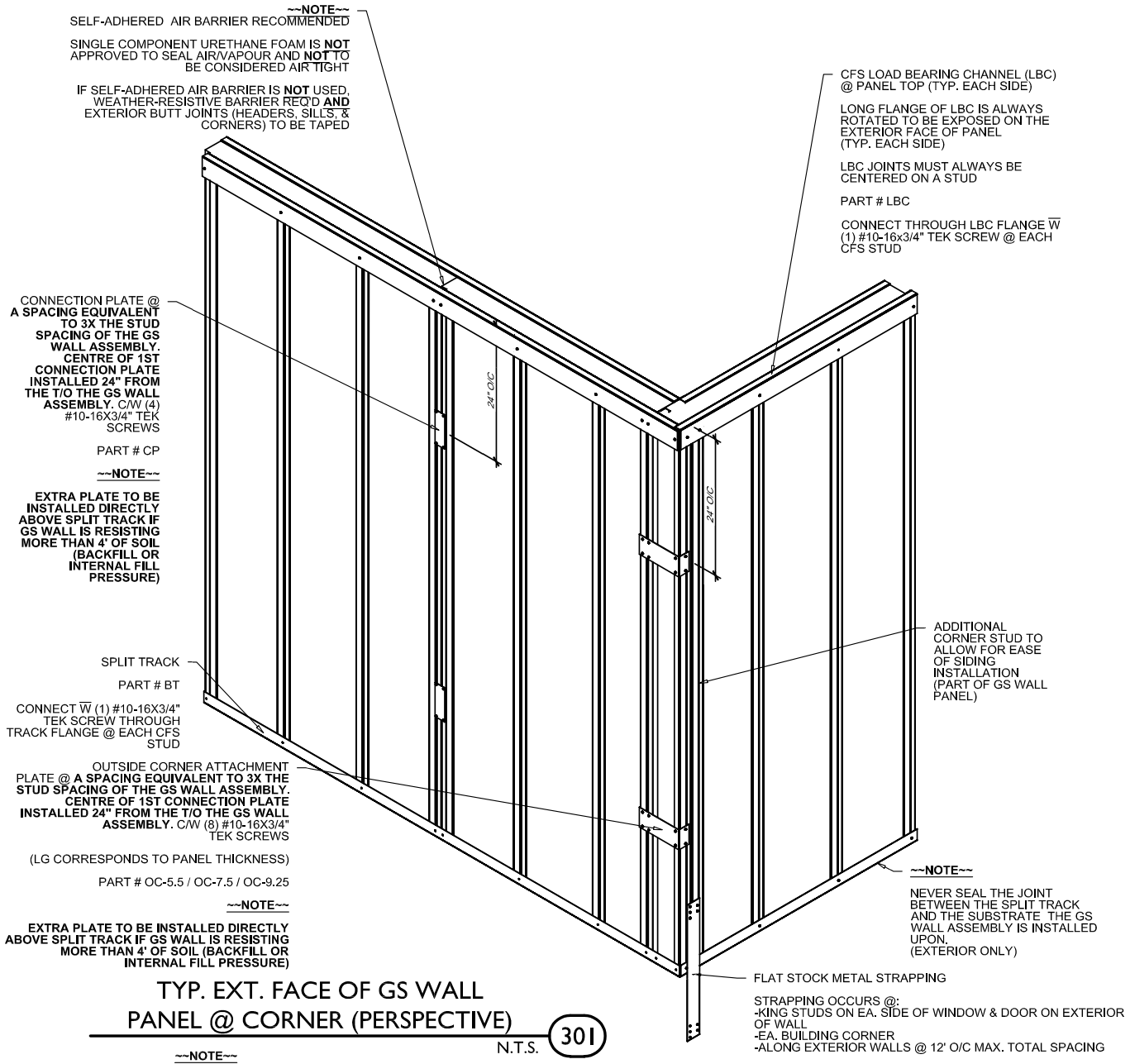


GS WALL & FLOOR ASSEMBLIES ON TOP CHORD BEARING FLOOR JOISTS & FOUNDATION (SECTION)

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TYP. EXT. FACE OF GS WALL PANEL @ CORNER (PERSPECTIVE)

N.T.S. 301

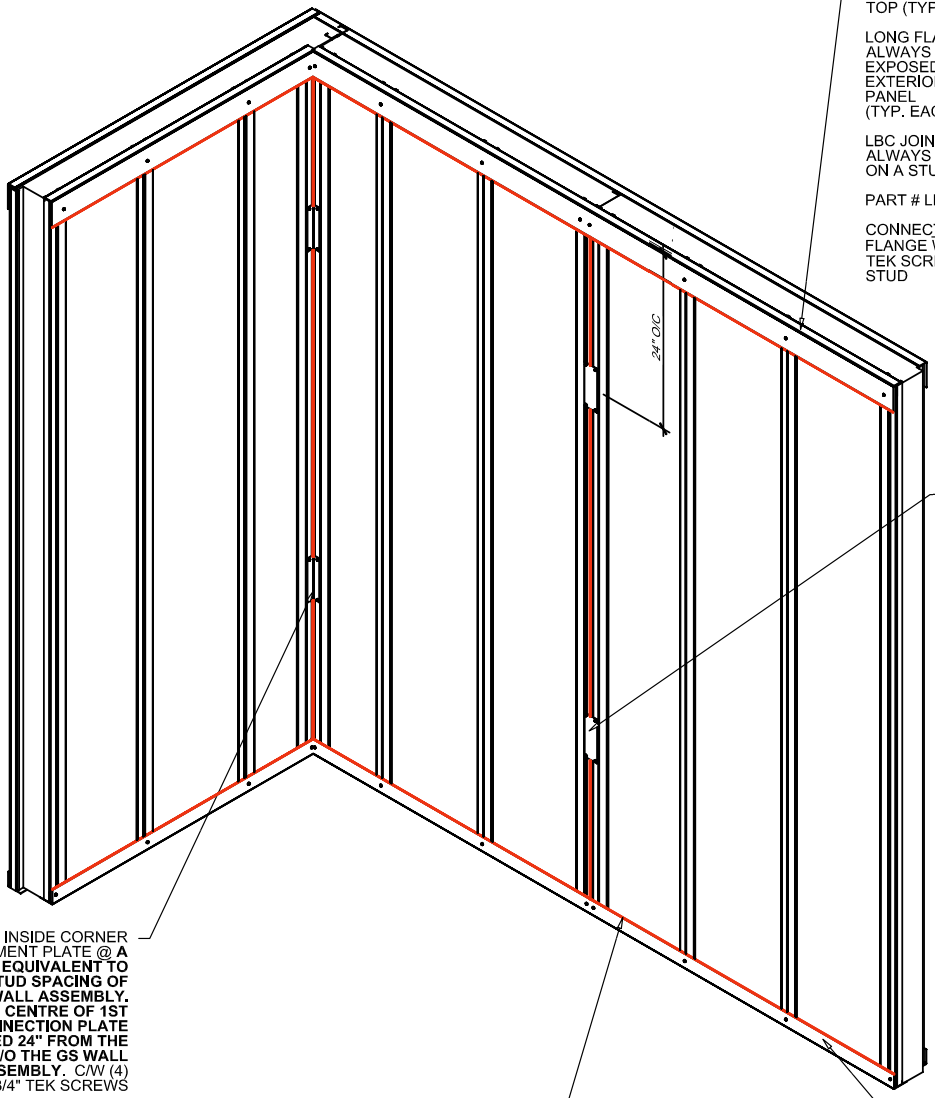
~~NOTE~~

1. GREENSTONE WALL PANELS ARE INSTALLED WITH THE "FRONT OF PANEL" FACING THE OUTSIDE OF THE STRUCTURE.

2. **IF GS WALLS ARE RESISTING MORE THAN 4' OF SOIL (BACKFILL OR INTERNAL FILL PRESSURE), ALL CONNECTION PLATES MUST BE INSTALLED @ 24" O/C**

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CFS LOAD BEARING CHANNEL (LBC) @ PANEL TOP (TYP. EACH SIDE)

LONG FLANGE OF LBC IS ALWAYS ROTATED TO BE EXPOSED ON THE EXTERIOR FACE OF PANEL (TYP. EACH SIDE)

LBC JOINTS MUST ALWAYS BE CENTERED ON A STUD

PART # LBC

CONNECT THROUGH LBC FLANGE W (1) #10-16x3/4" TEK SCREW @ EACH CFS STUD

CONNECTION PLATE @ **A SPACING EQUIVALENT TO 3X THE STUD SPACING OF THE GS WALL ASSEMBLY. CENTRE OF 1ST CONNECTION PLATE INSTALLED 24" FROM THE T/O THE GS WALL ASSEMBLY.** C/W (4) #10-16X3/4" TEK SCREWS

PART # CP

~~NOTE~~

EXTRA PLATE TO BE INSTALLED DIRECTLY ABOVE SPLIT TRACK IF GS WALL IS RESISTING MORE THAN 4' OF SOIL (BACKFILL OR INTERNAL FILL PRESSURE)

INSIDE CORNER ATTACHMENT PLATE @ **A SPACING EQUIVALENT TO 3X THE STUD SPACING OF THE GS WALL ASSEMBLY. CENTRE OF 1ST CONNECTION PLATE INSTALLED 24" FROM THE T/O THE GS WALL ASSEMBLY.** C/W (4) #10-16X3/4" TEK SCREWS

PART # IC

~~NOTE~~

EXTRA PLATE TO BE INSTALLED DIRECTLY ABOVE SPLIT TRACK IF GS WALL IS RESISTING MORE THAN 4' OF SOIL (BACKFILL OR INTERNAL FILL PRESSURE)

APPROVED VAPOUR BARRIER TAPE AT ALL SEAMS INCLUDING BASE TRACK & LBC

SPLIT TRACK

PART # BT

CONNECT W (1) #10-16X3/4" TEK SCREW THROUGH TRACK FLANGE @ EACH CFS STUD

~~NOTE~~

1. GREENSTONE WALL PANELS ARE INSTALLED WITH THE "FRONT OF PANEL" FACING THE OUTSIDE OF THE STRUCTURE.

2. **IF GS WALLS ARE RESISTING MORE THAN 4' OF SOIL (BACKFILL OR INTERNAL FILL PRESSURE), ALL CONNECTION PLATES MUST BE INSTALLED @ 24" O/C**

3. SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

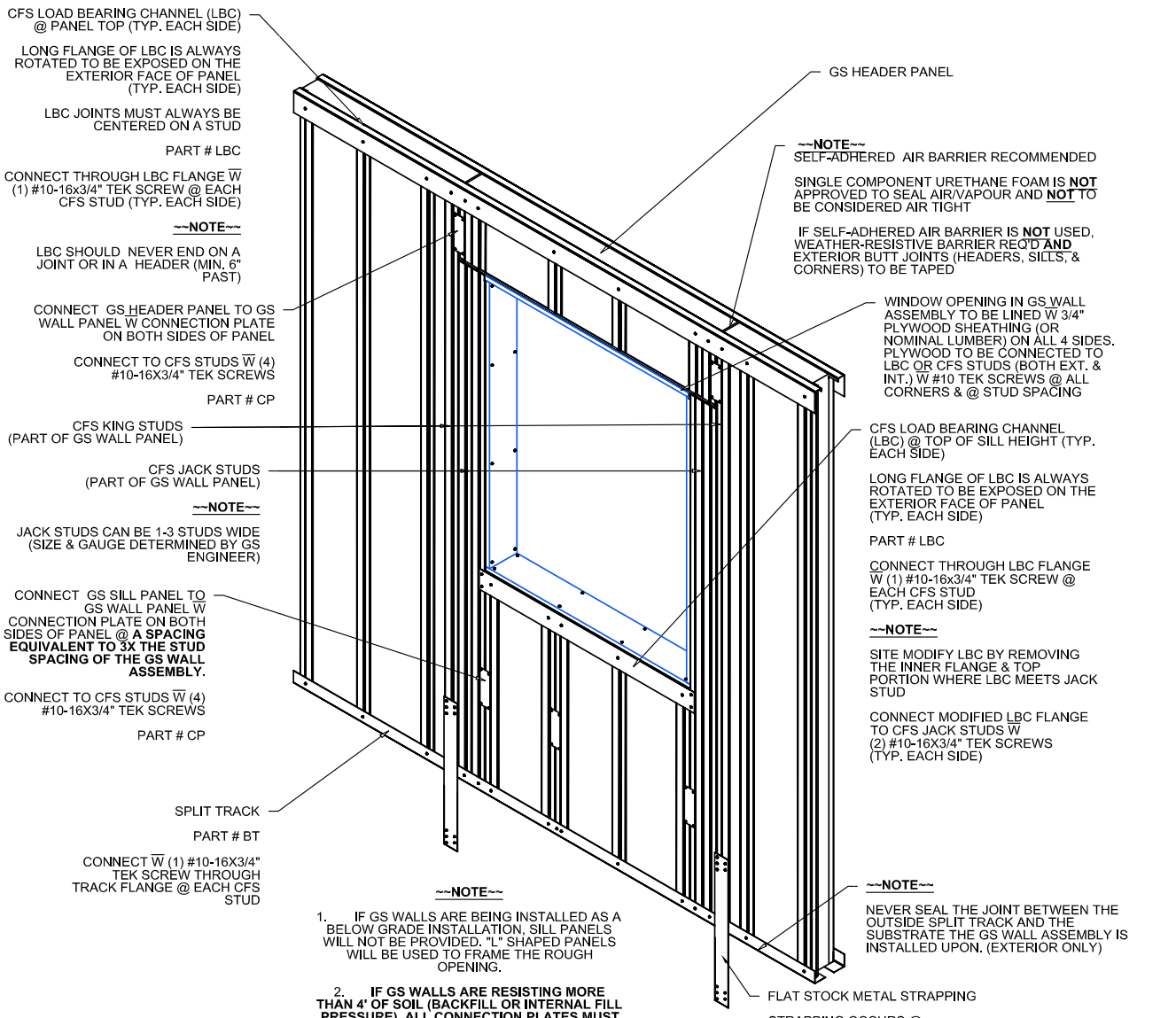
TYP. INT. FACE OF GS WALL PANEL @ CORNER (PERSPECTIVE)

N.T.S.

302

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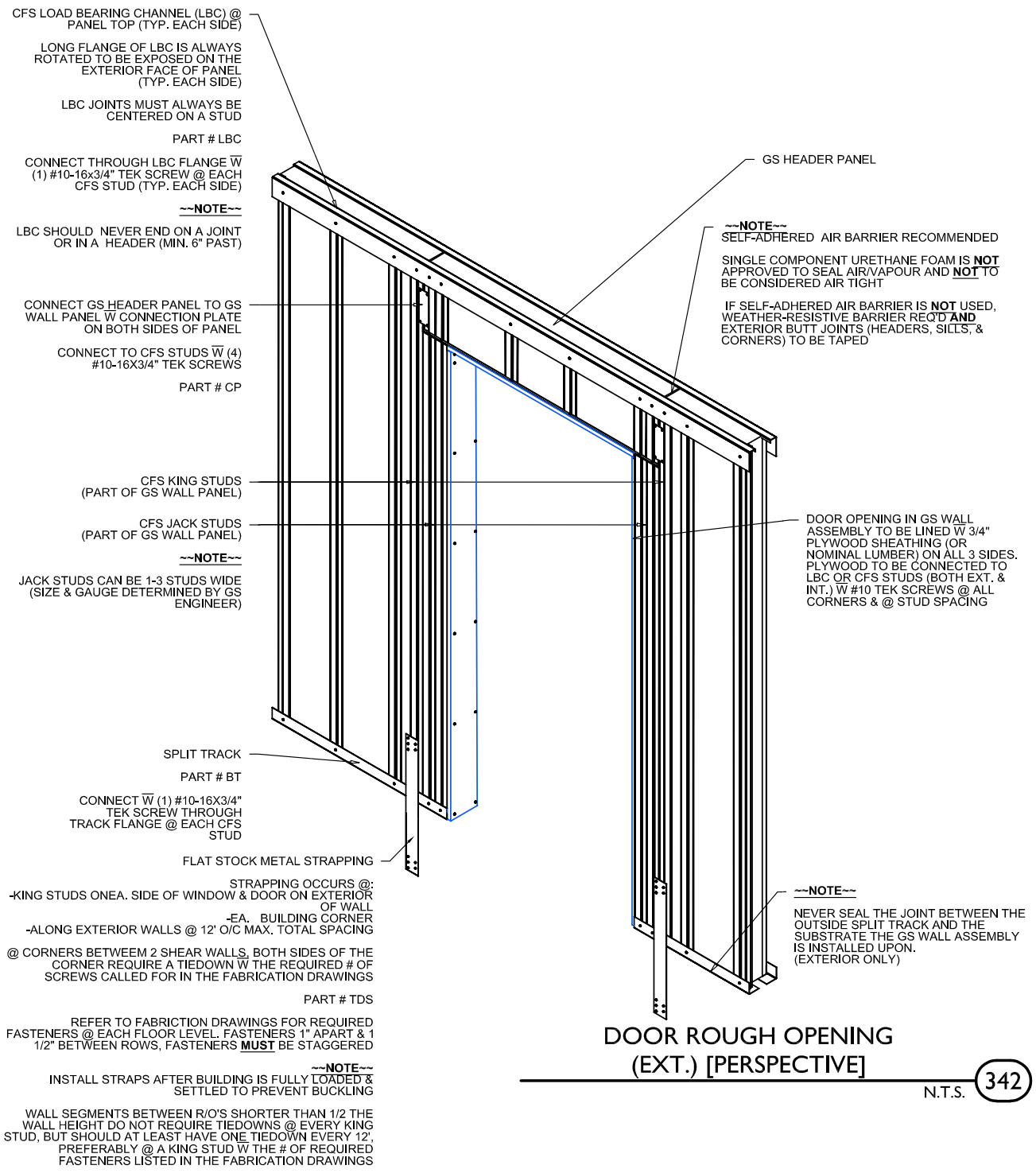


WINDOW ROUGH OPENING (EXT.) [PERSPECTIVE]

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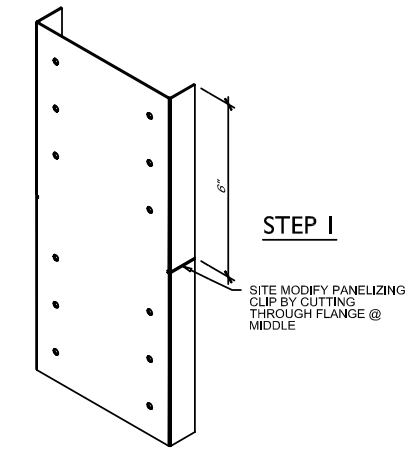


DOOR ROUGH OPENING (EXT.) [PERSPECTIVE]

N.T.S. 342

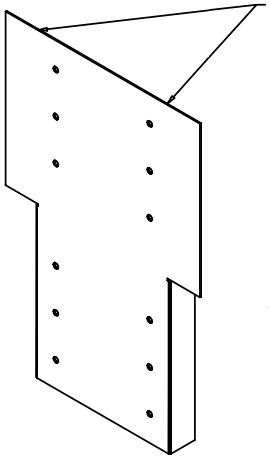
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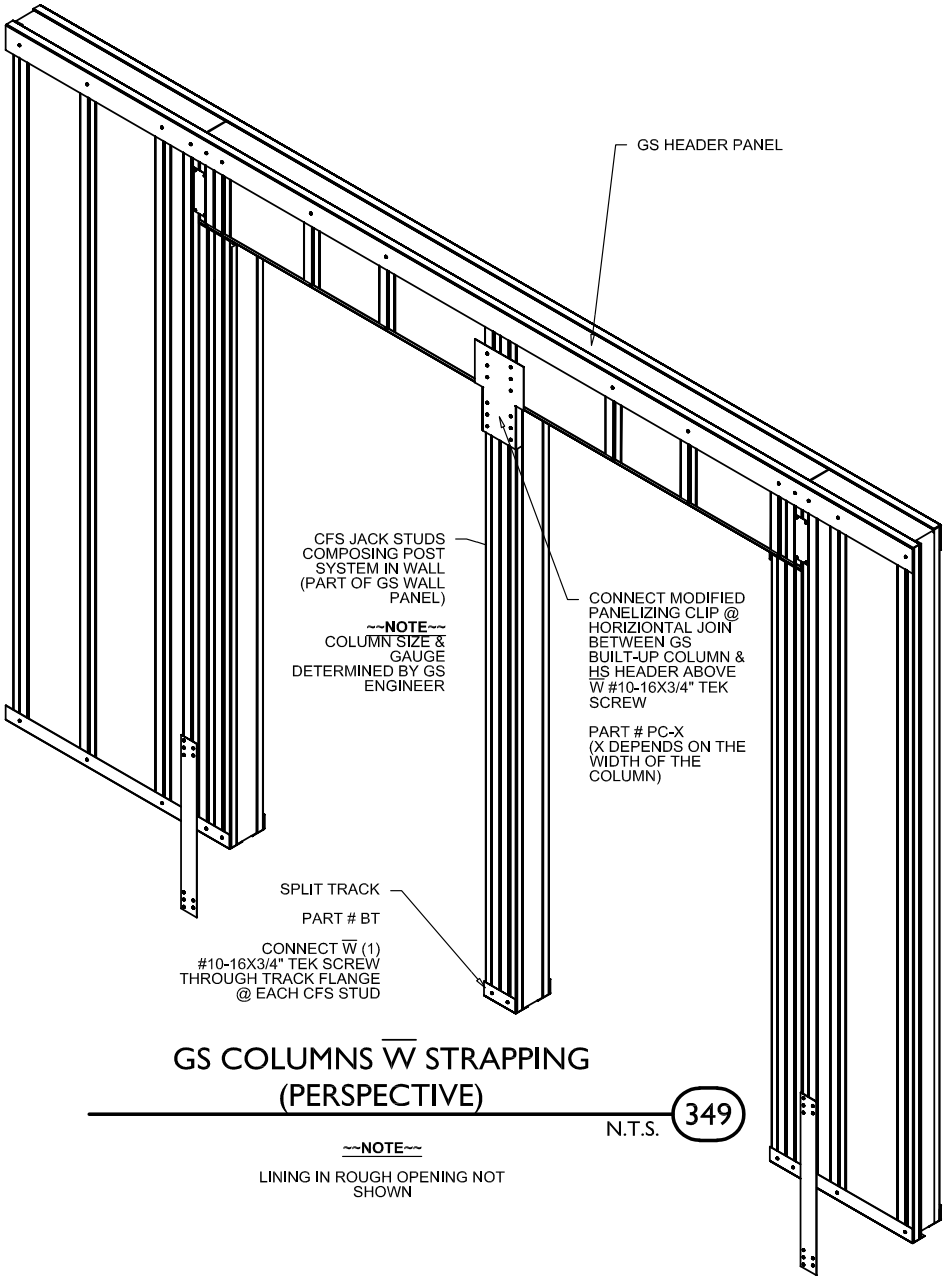
STEP 1

SITE MODIFY PANELIZING CLIP BY CUTTING THROUGH FLANGE @ MIDDLE



BEND FLANGE BACK TO FLAT ON THE TOP HALF OF THE PANELIZING CLIP

STEP 2



GS COLUMNS W STRAPPING (PERSPECTIVE)

N.T.S.

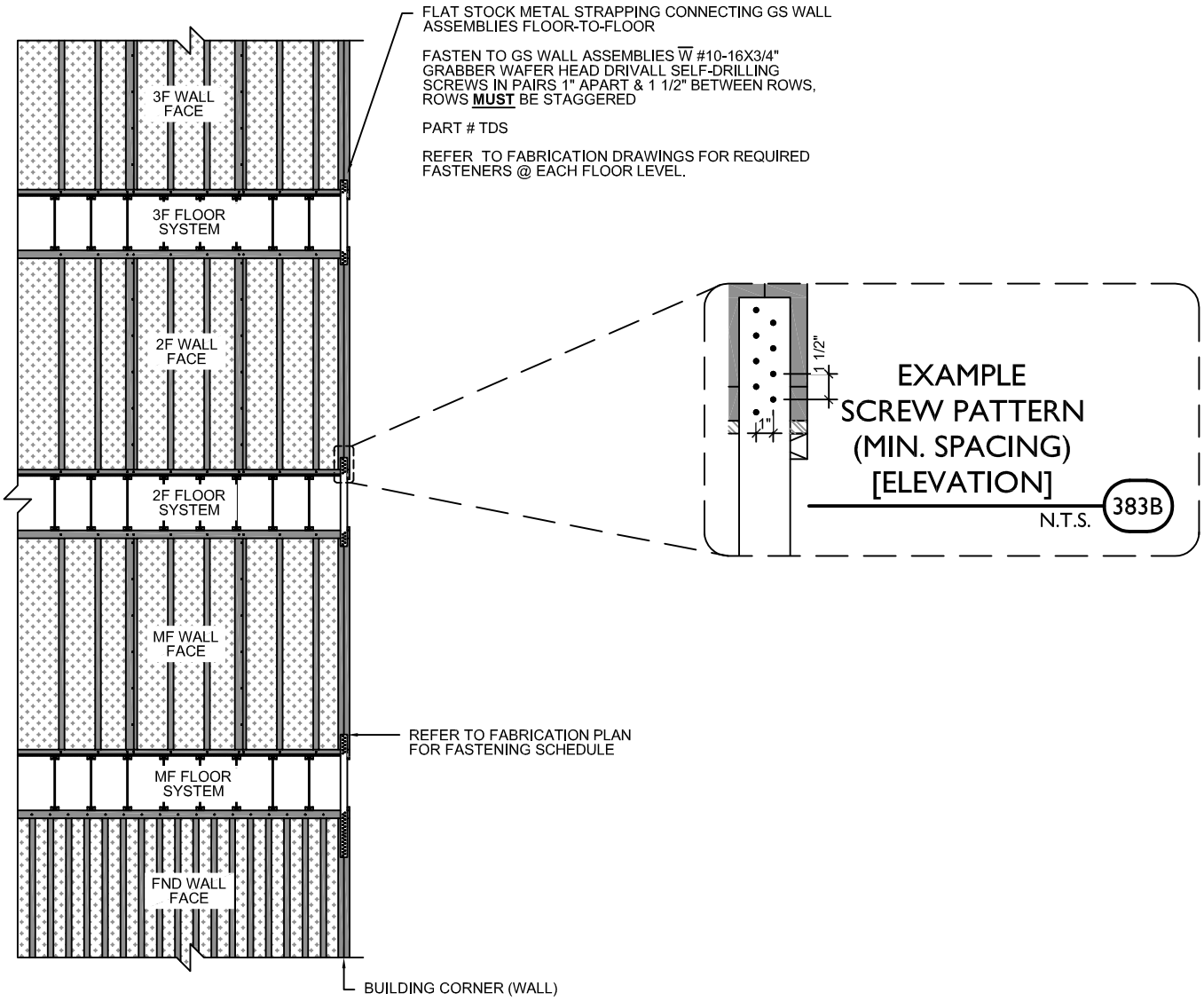
349

~~NOTE~~

LINING IN ROUGH OPENING NOT SHOWN

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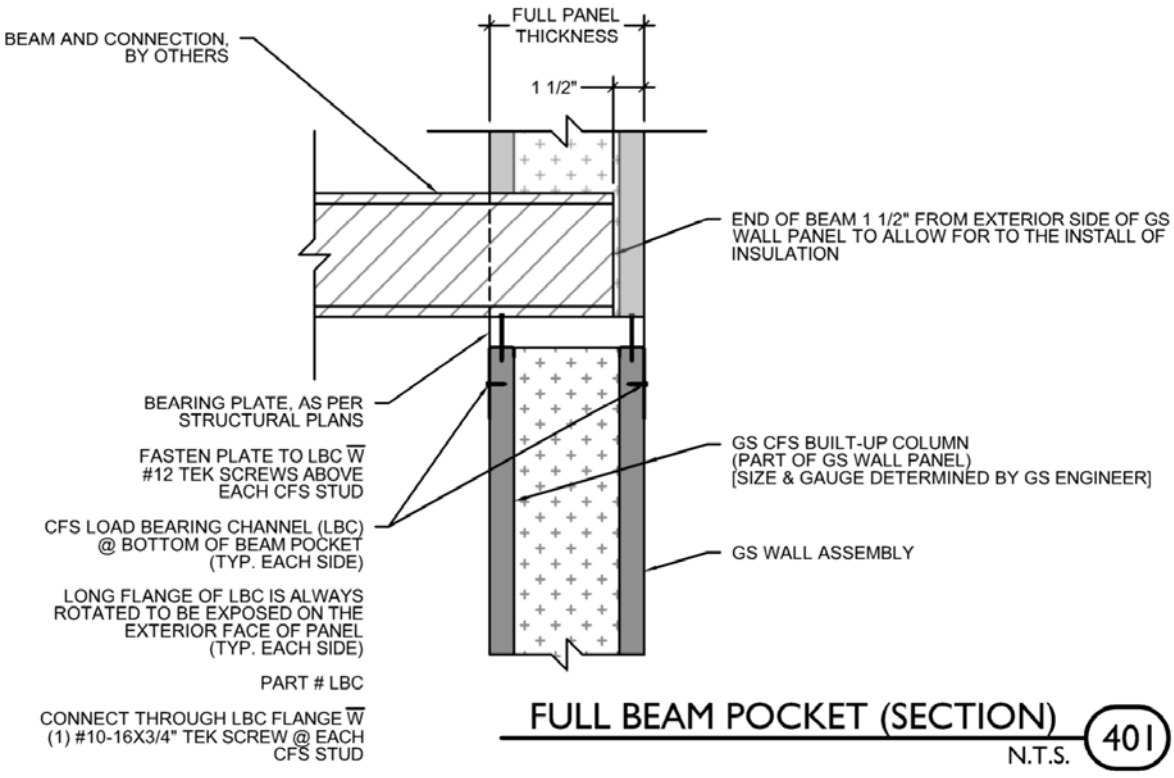


HOLD-DOWNS @ CORNERS (ELEVATION)

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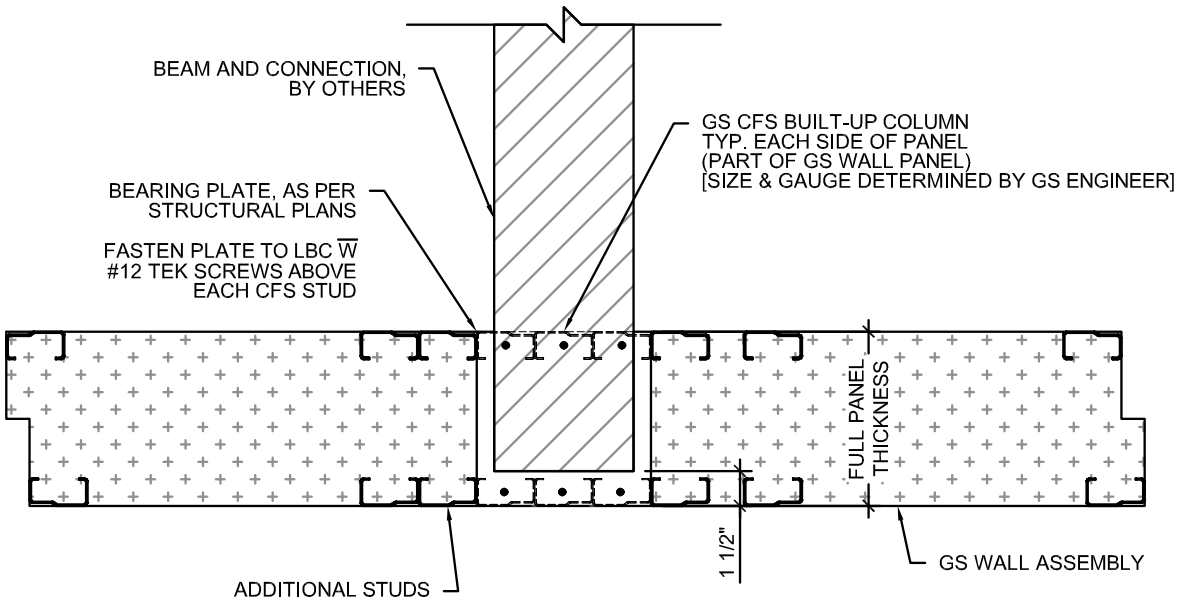
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FULL BEAM POCKET (SECTION) 401
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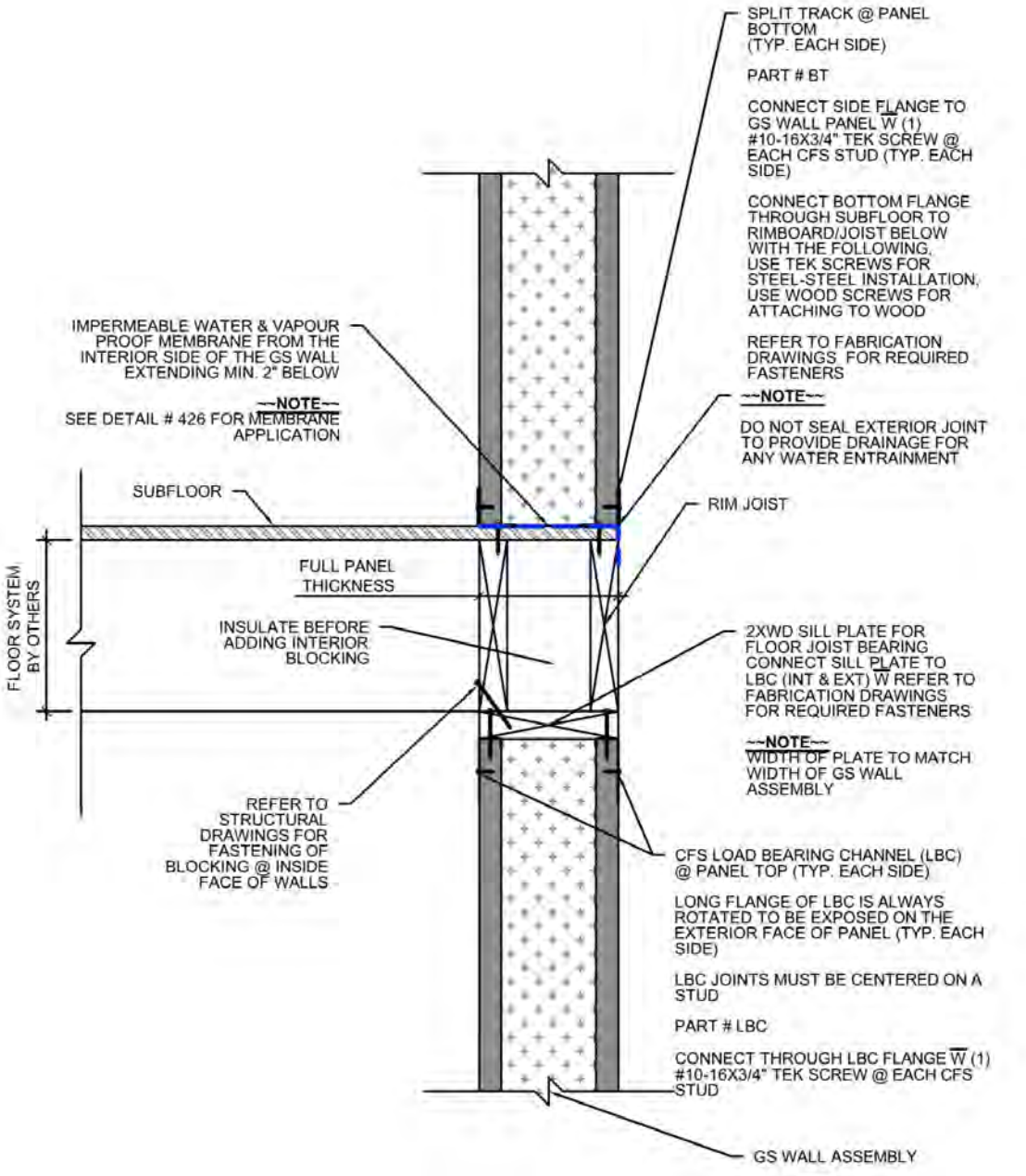
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FULL BEAM POCKET (PLAN) 402
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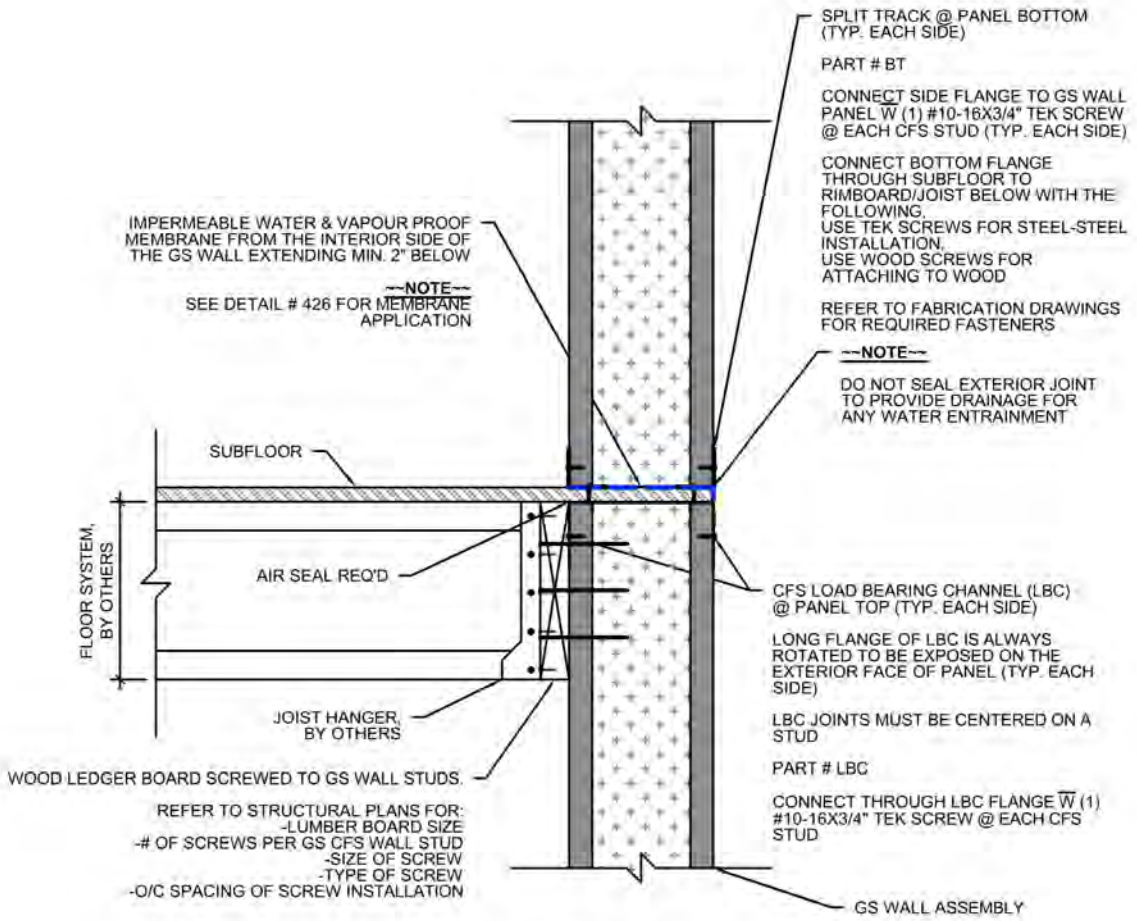


FULL BEARING FLOOR W SILL PLATE (SECTION)

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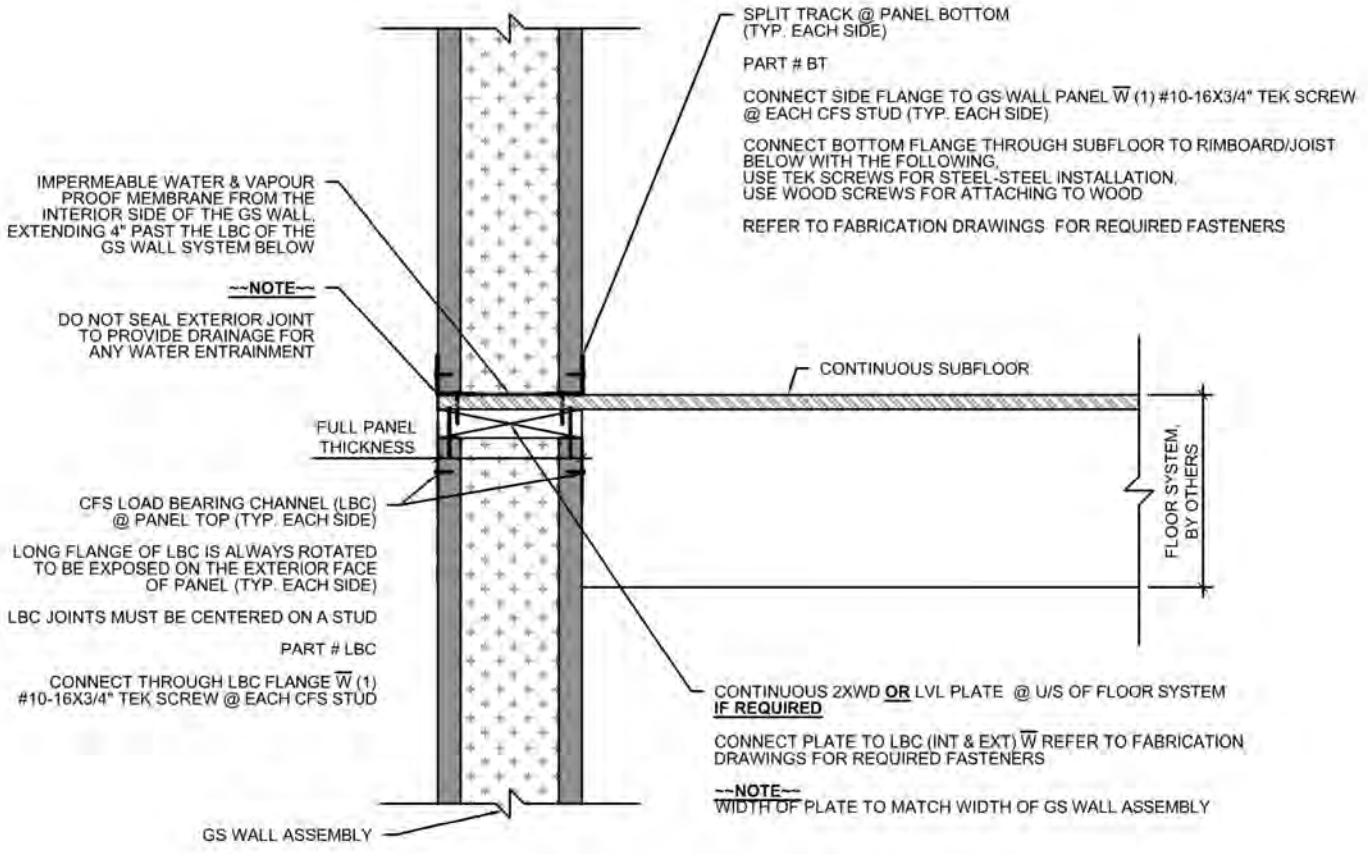


LEDGER BEARING FLOOR (SECTION)

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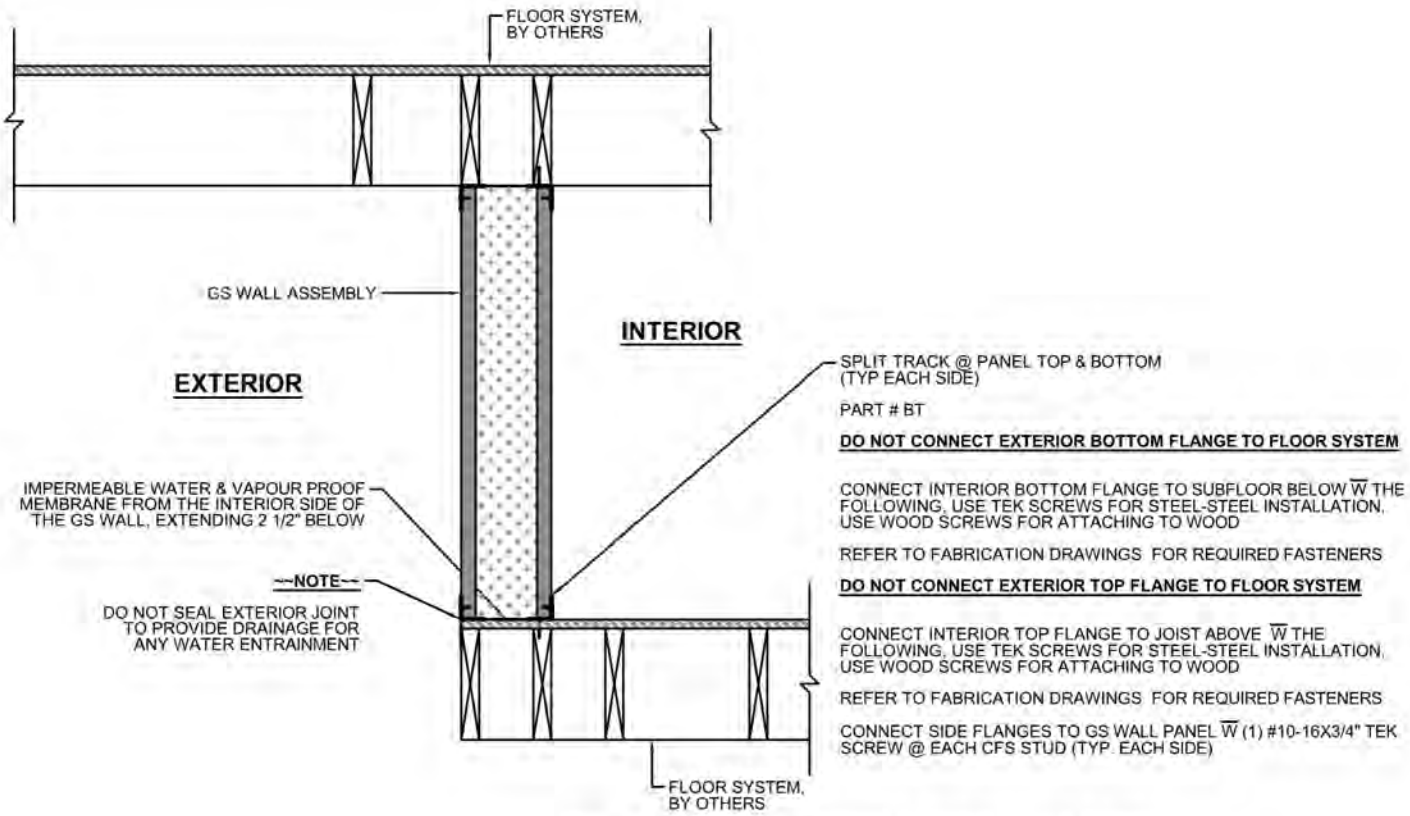


STAIRWELL WALL BREAK (HIGH) [SECTION]

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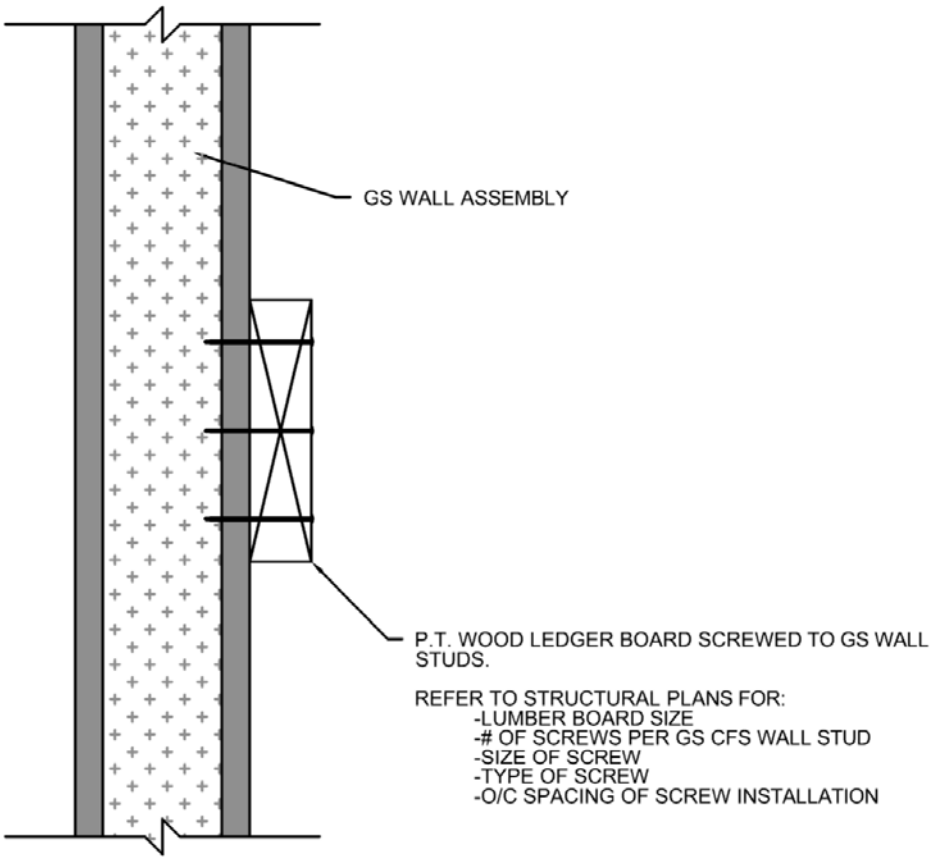


REMOVABLE GS WALL INSTALLATION [SECTION]

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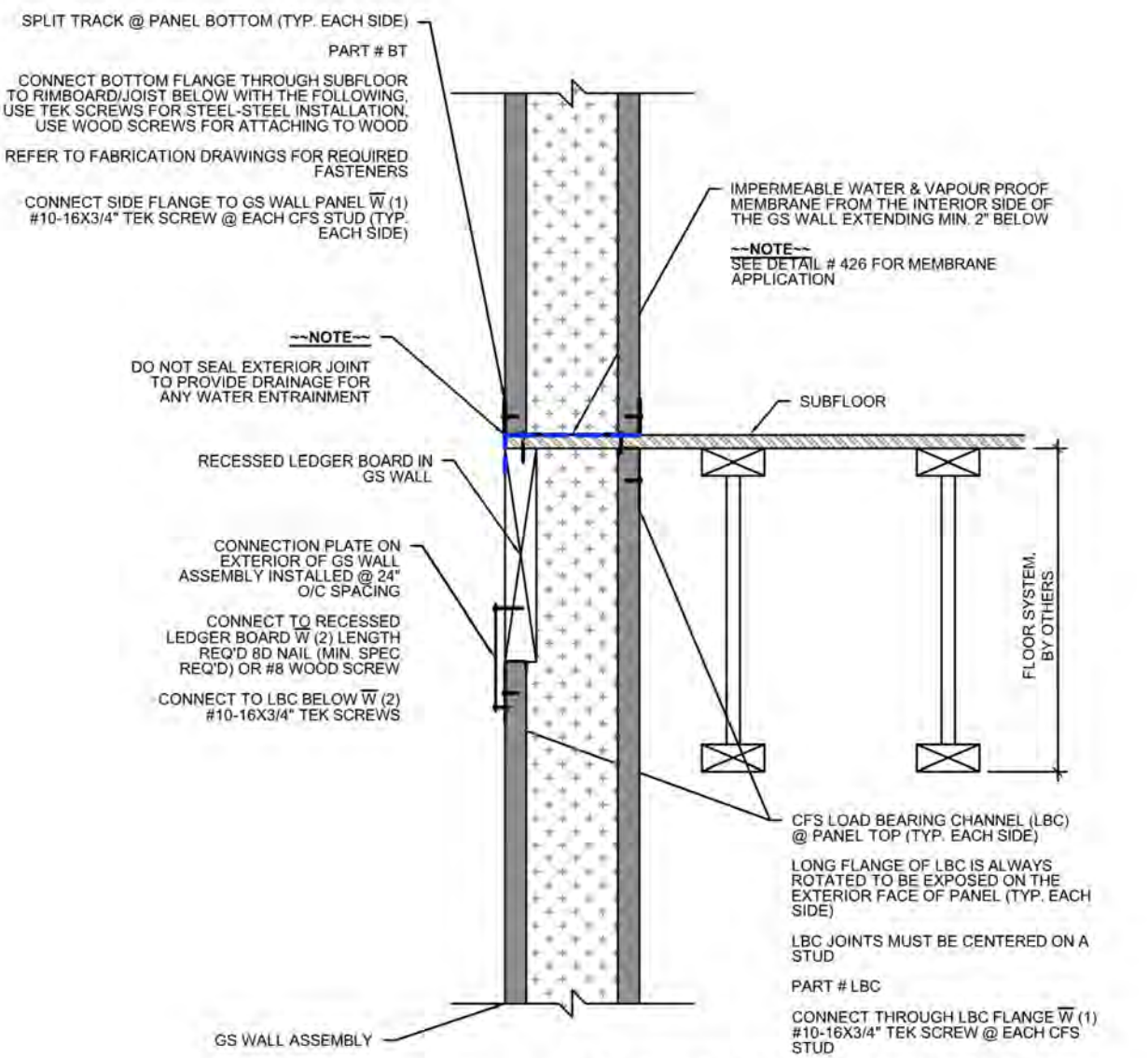


LEDGER BOARD INSTALLATION (SECTION) 460

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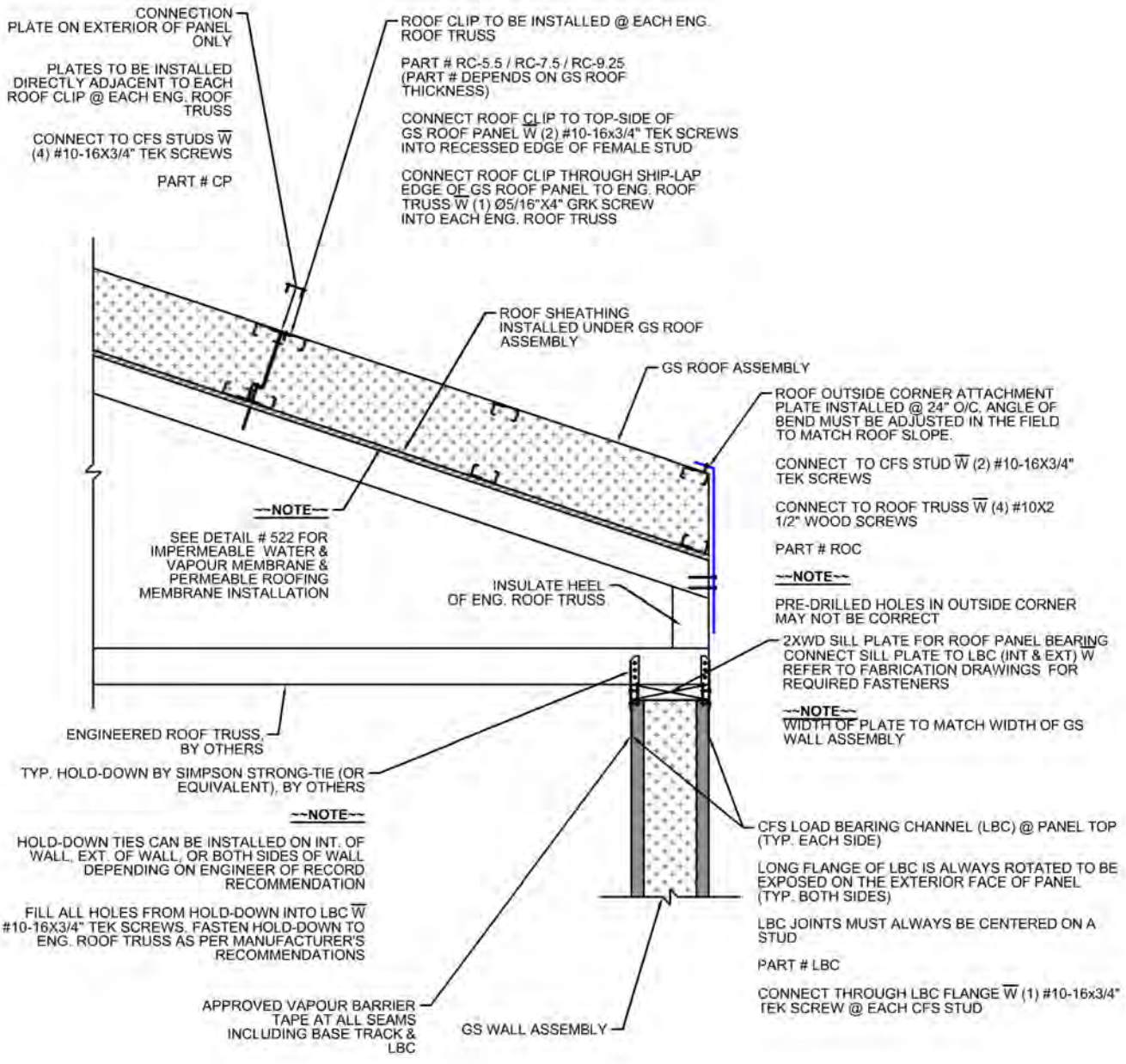


RECESSED LEDGER IN GS WALL SYSTEM (SECTION)

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GS ROOF ON ENG. ROOF TRUSS @ EAVES (NO OVERHANG) [SECTION]

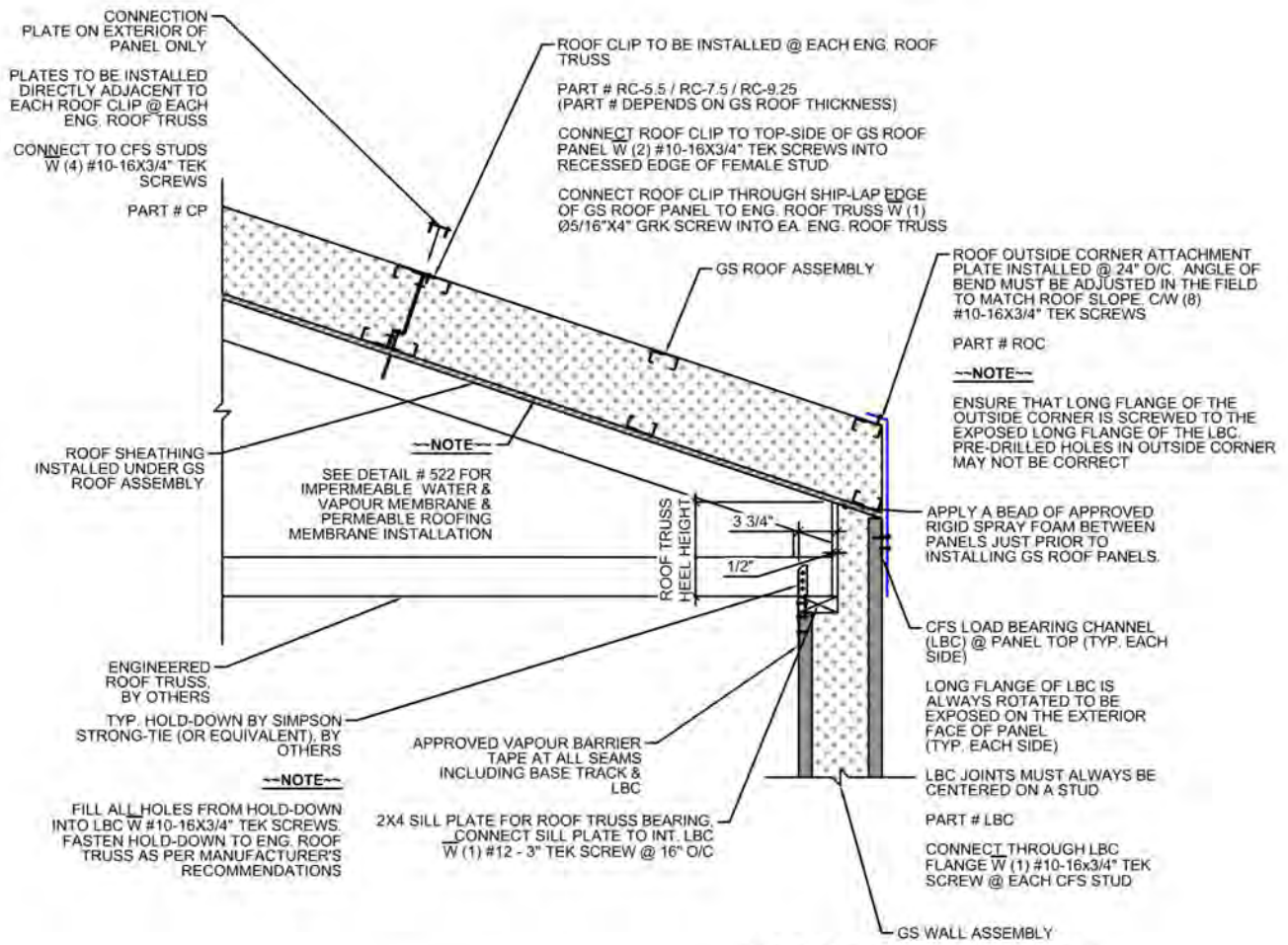
N.T.S. 503

~~NOTE~~

SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

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~~NOTE~~

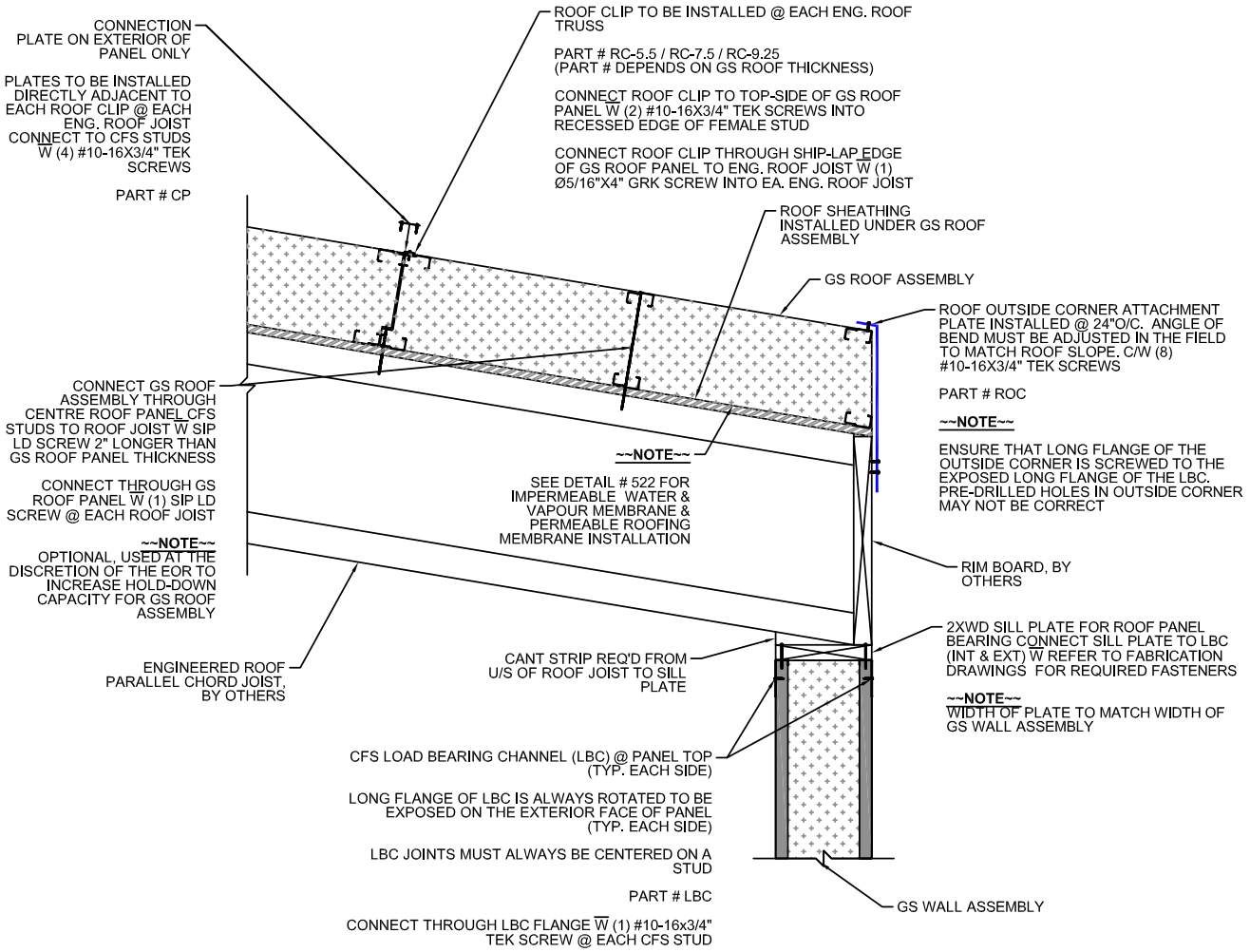
SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

GS ROOF ON RECESSED ENG. ROOF TRUSS @ EAVES (NO OVERHANG) [SECTION]

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~~NOTE~~

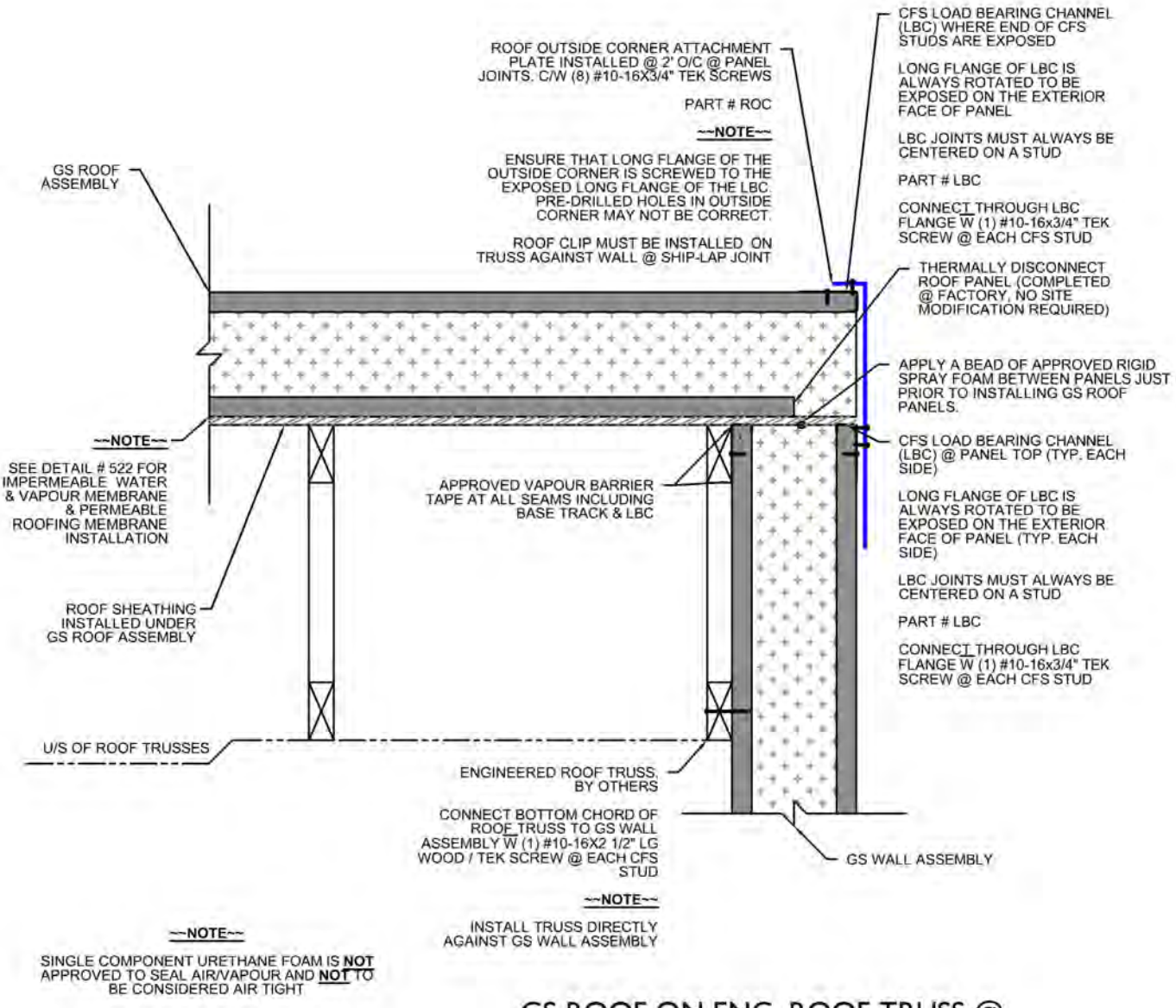
SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

GS ROOF ON ENG. PARALLELL CHORD ROOF JOIST @ EAVES (NO OVERHANG) [SECTION]

N.T.S. 509

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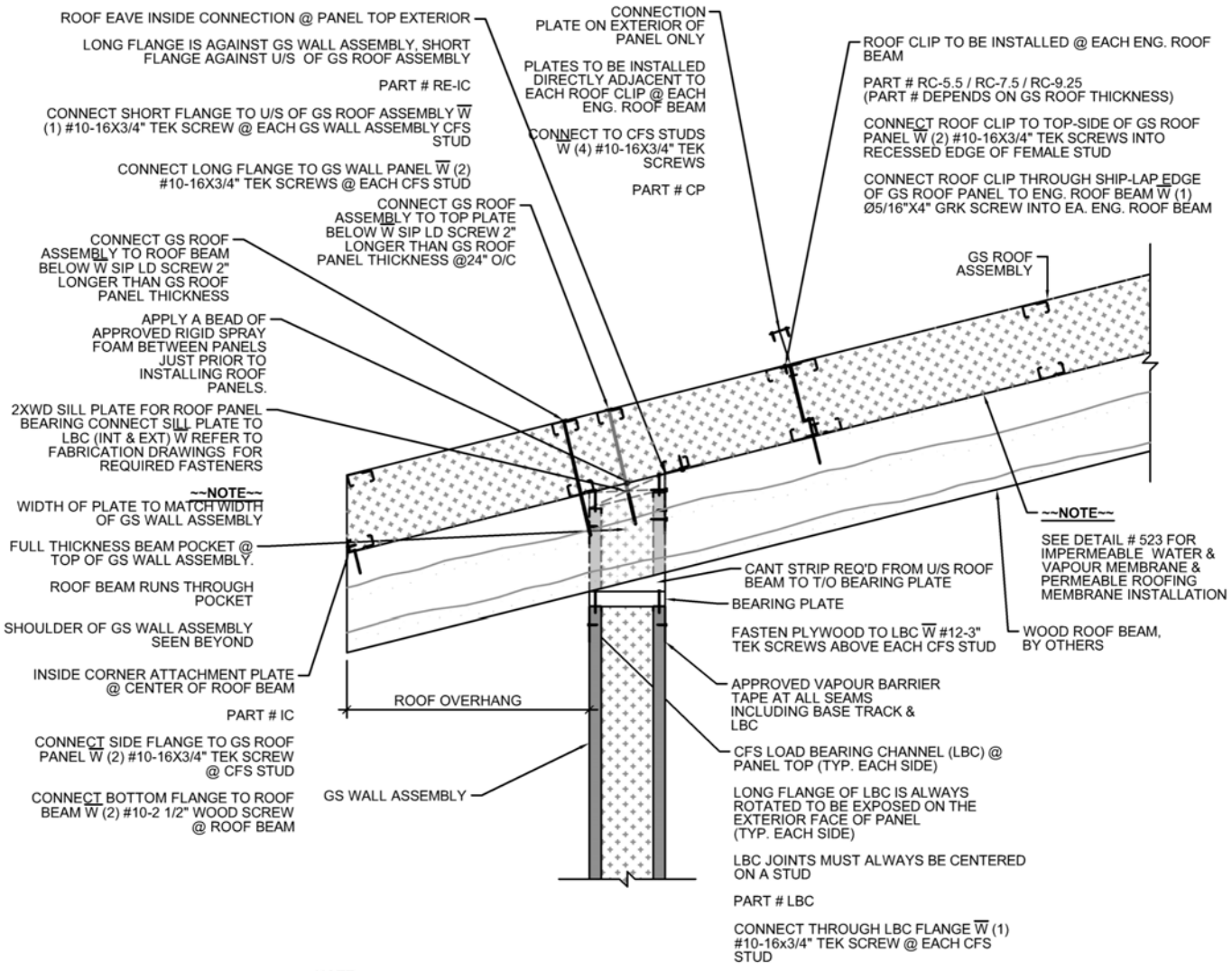


GS ROOF ON ENG. ROOF TRUSS @ GABLE WALL (NO OVERHANG) [SECTION] 513

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~~NOTE~~

UNDER HEAVIER LOADS A STEEL PLATE OR PIECE OF LVL SHIM MAY BE RECOMMENDED BY THE ENGINEER OF RECORD IN LIEU OF 2 PLY 3/4" PWF PLYWOOD FOR BEAM BEARING

SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

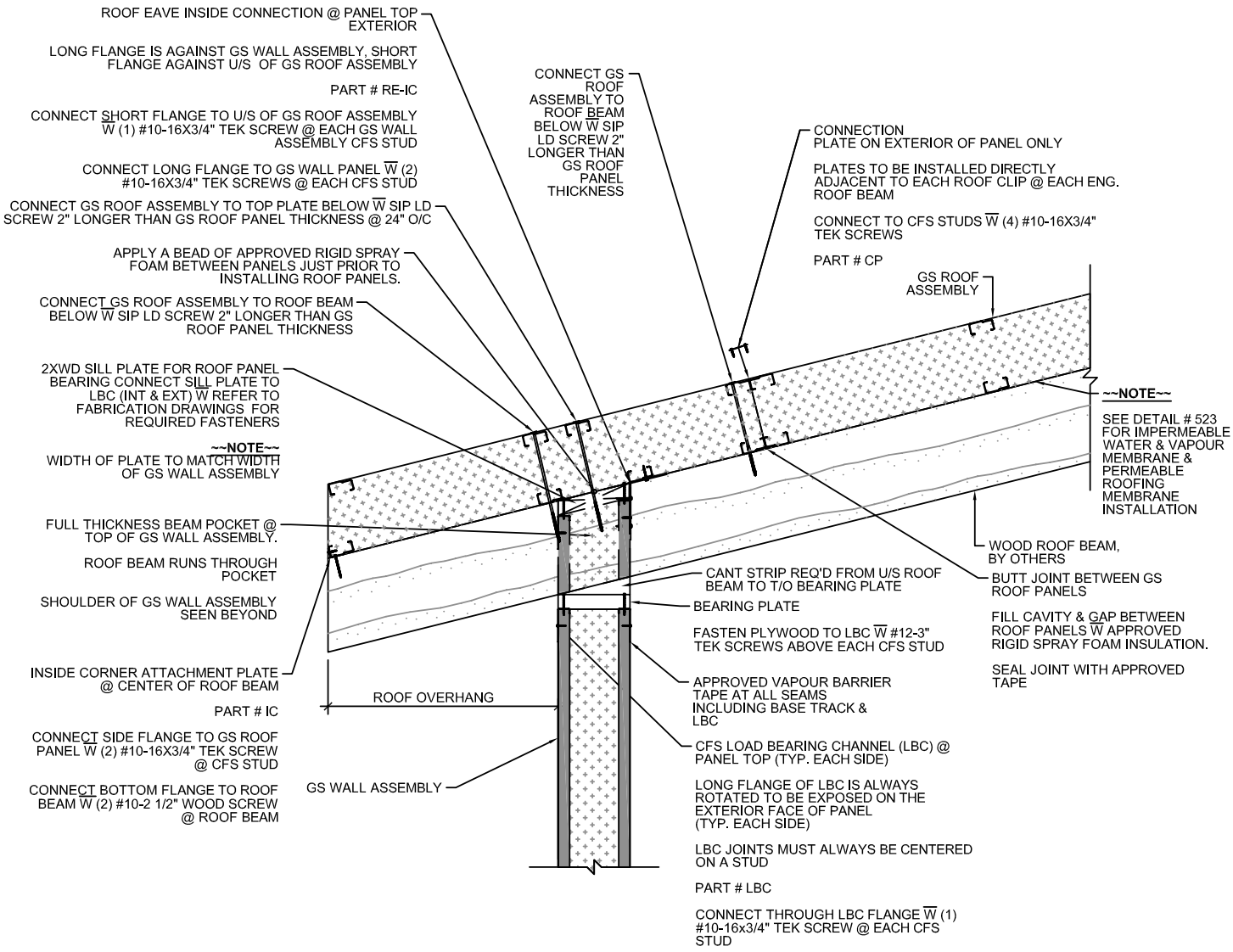
2XWD PLATE CAN BE SUBSTITUTED FOR PLYWOOD WHERE ROOF SLOPED 7:12 OR GREATER

GS ROOF @ EAVES ON BEAM (SHIP-LAP JOINT)[SECTION]

N.T.S. 514

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~~NOTE~~

UNDER HEAVIER LOADS A STEEL PLATE OR PIECE OF LVL SHIM MAY BE RECOMMENDED BY THE ENGINEER OF RECORD IN LIEU OF 2 PLY 3/4" PWF PLYWOOD FOR BEAM BEARING

SINGLE COMPONENT URETHANE FOAM IS **NOT** APPROVED TO SEAL AIR/VAPOUR AND **NOT** TO BE CONSIDERED AIR TIGHT

2XWD PLATE CAN BE SUBSTITUTED FOR PLYWOOD WHERE ROOF SLOPED 7:12 OR GREATER

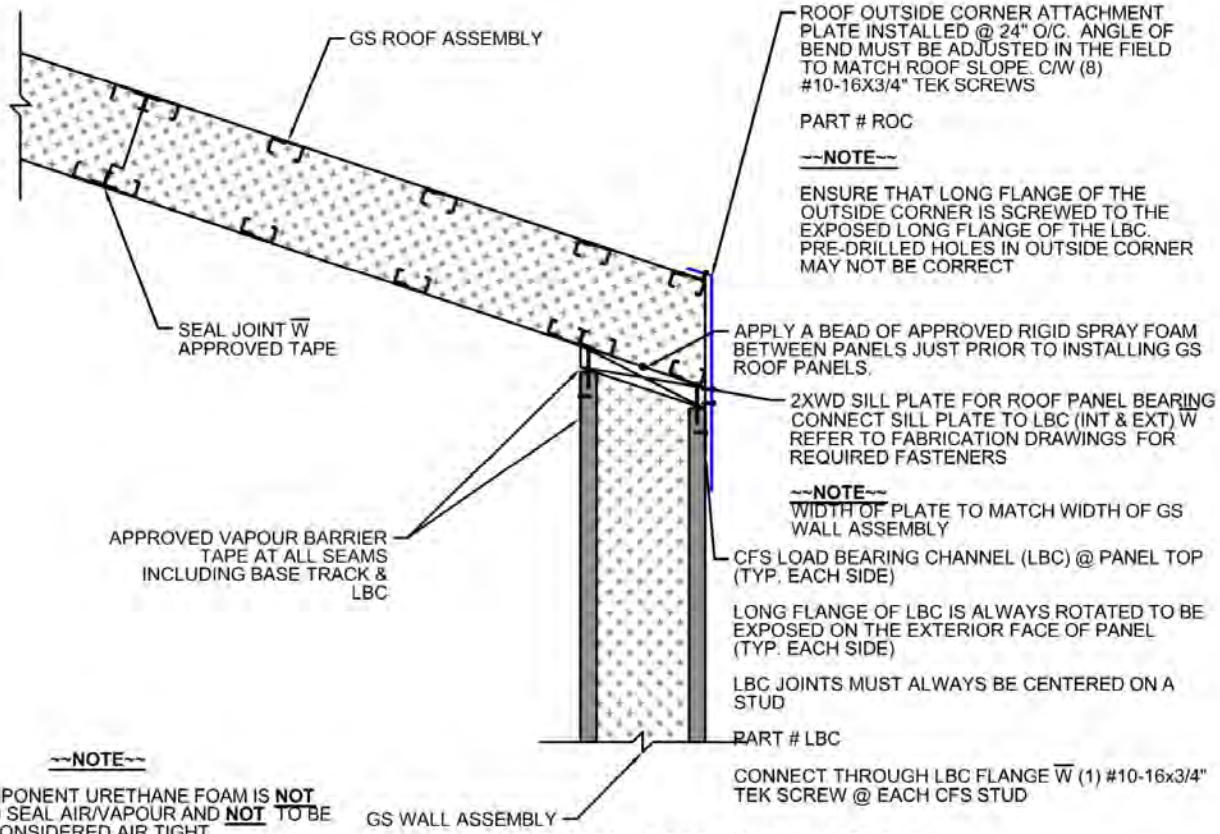
GS ROOF @ EAVES ON BEAM (BUTT JOINT) [SECTION]

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515

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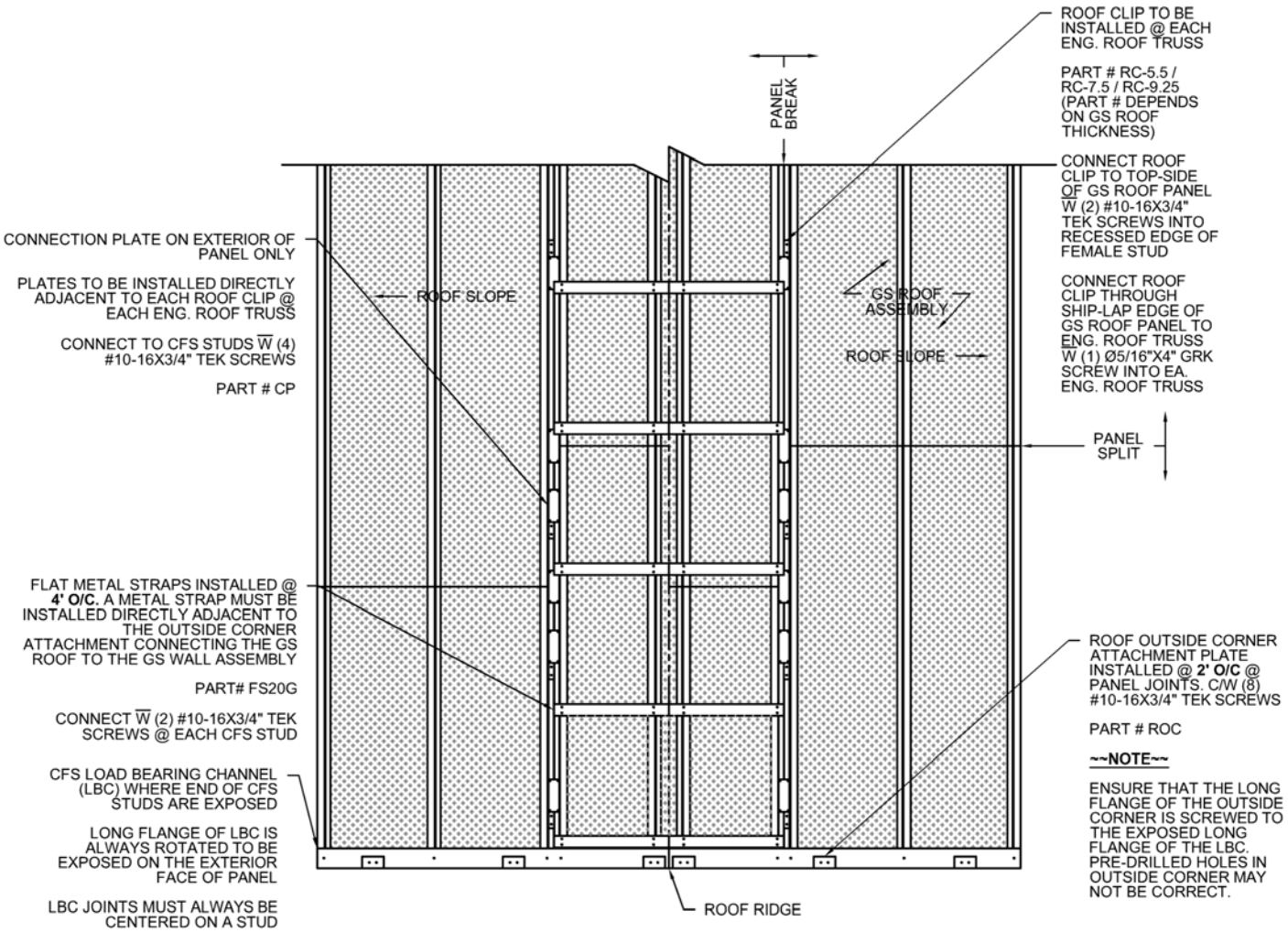


GS STRUCTURAL ROOF BETWEEN BEAMS @ EAVES (NO OVERHANG) [SECTION]

N.T.S. 516

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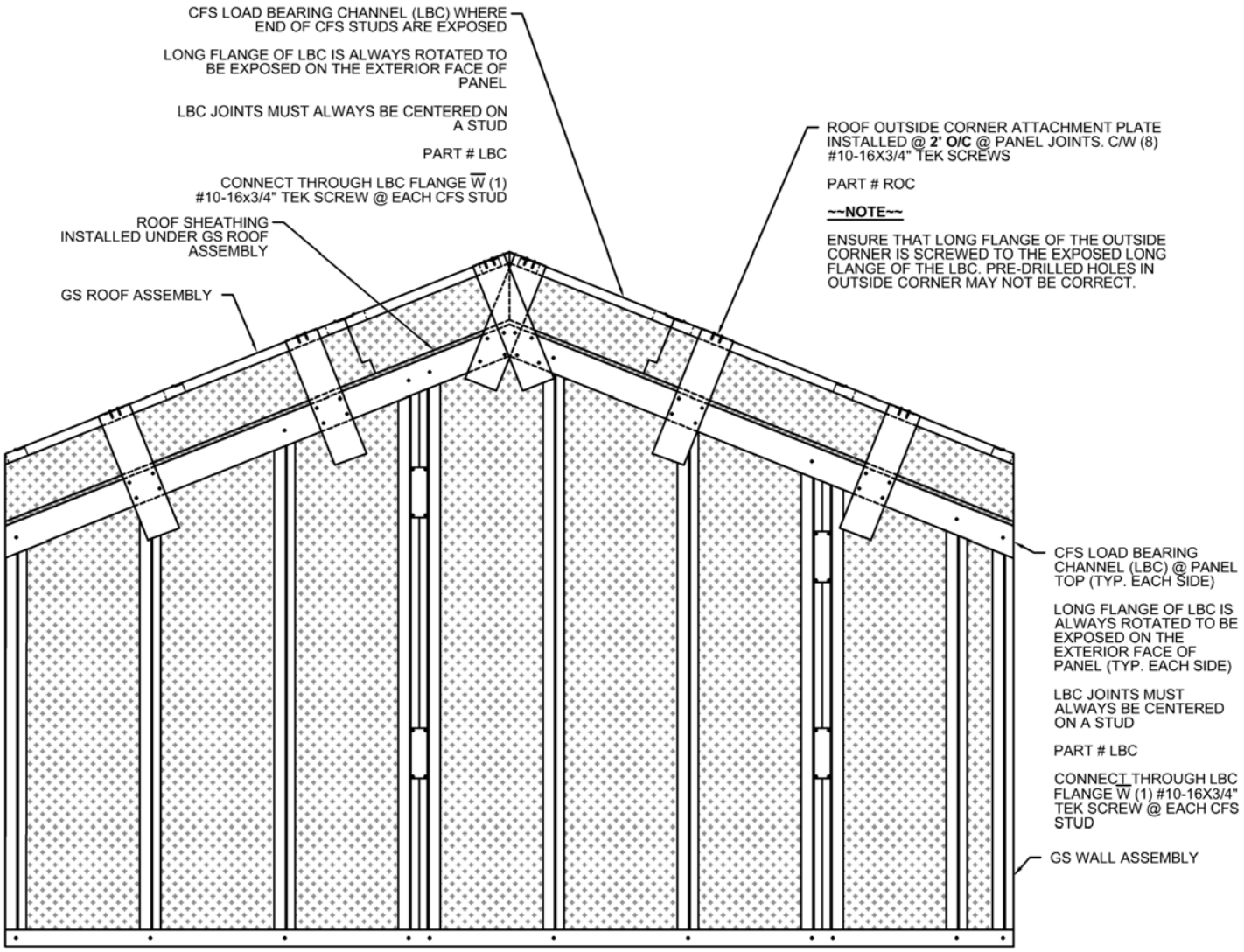


GS ROOF PEAK STRAPPING (OVER TRUSSES) [PLAN]

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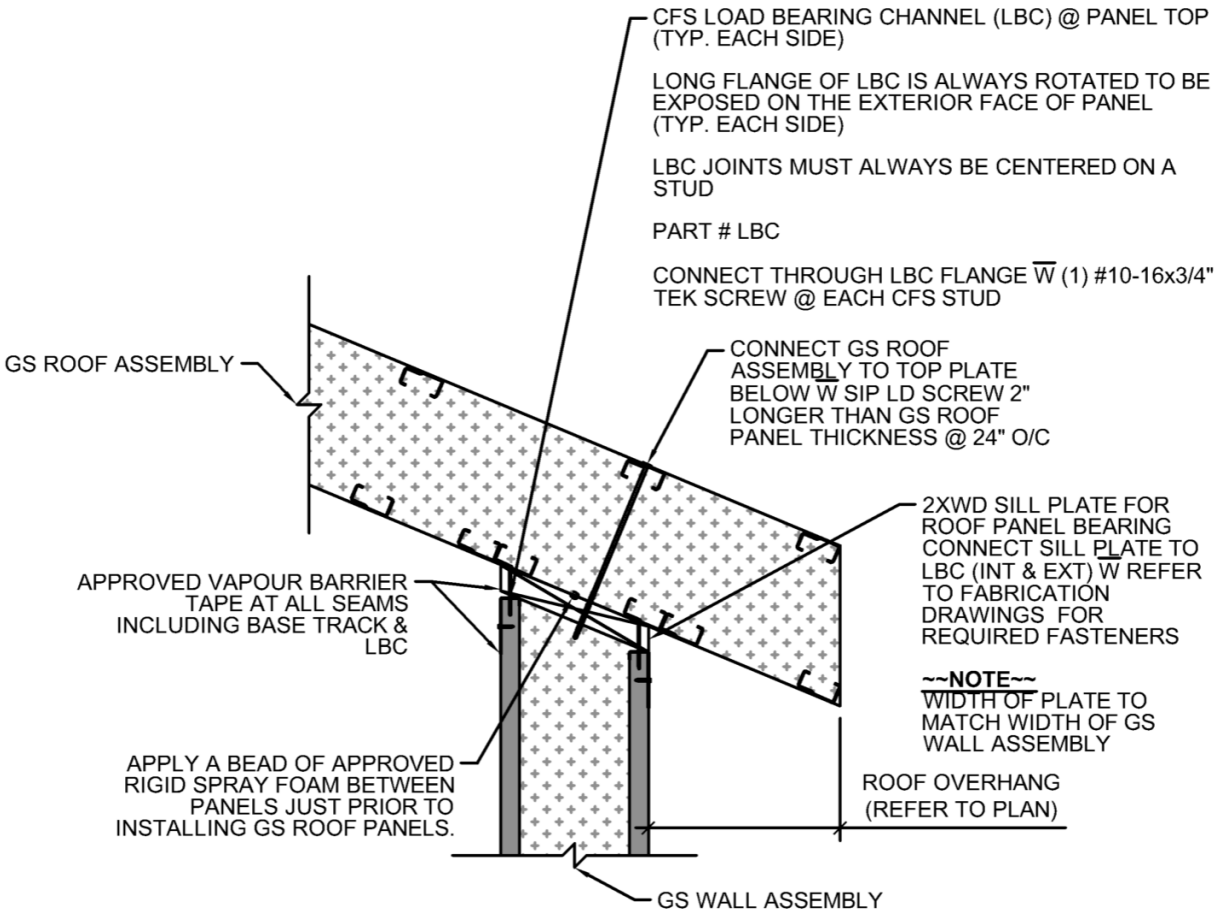
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GS ROOF ON ENG. ROOF TRUSS @ GABLE WALL (NO OVERHANG) [ELEVATION] 531
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GS ROOF @ LOW EAVES (GS O/H) [SECTION]

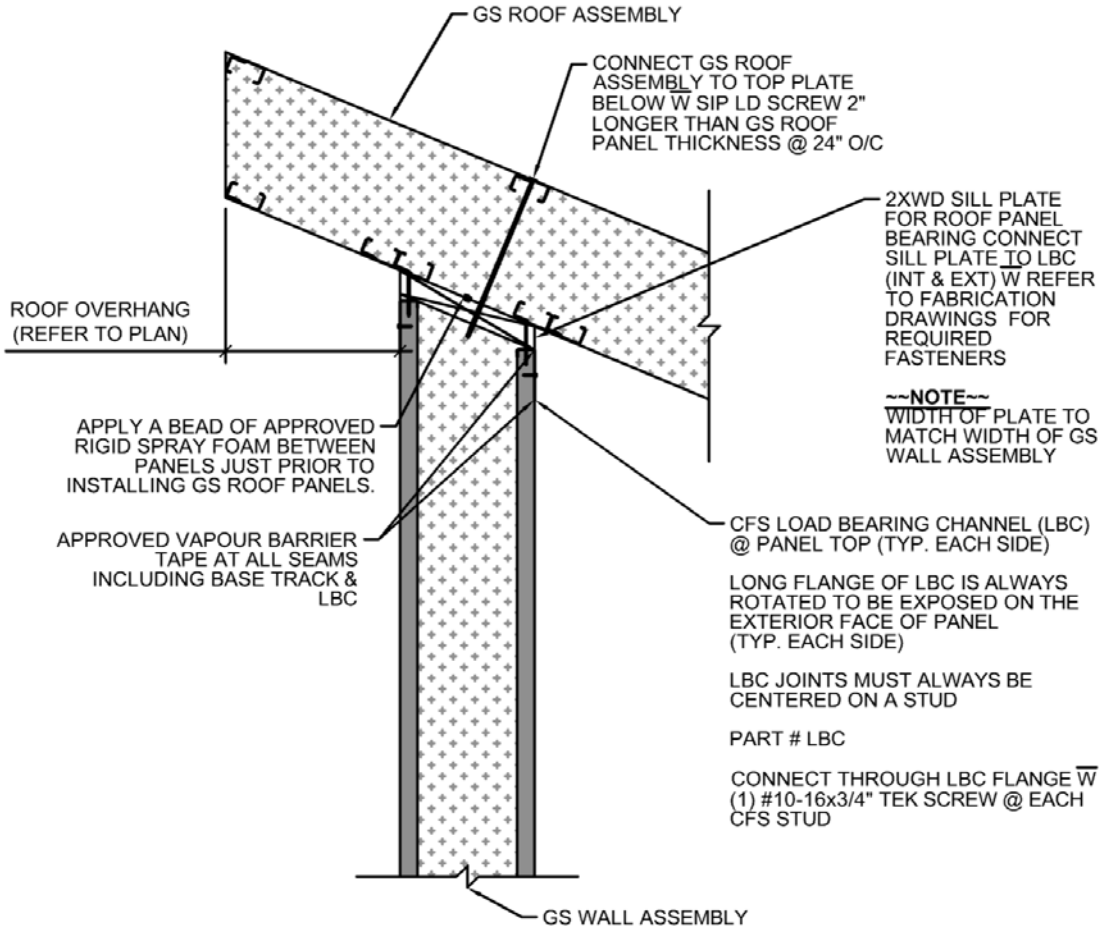
N.T.S. 538A

~~NOTE~~

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GS ROOF @ HIGH EAVES (GS O/H) [SECTION]

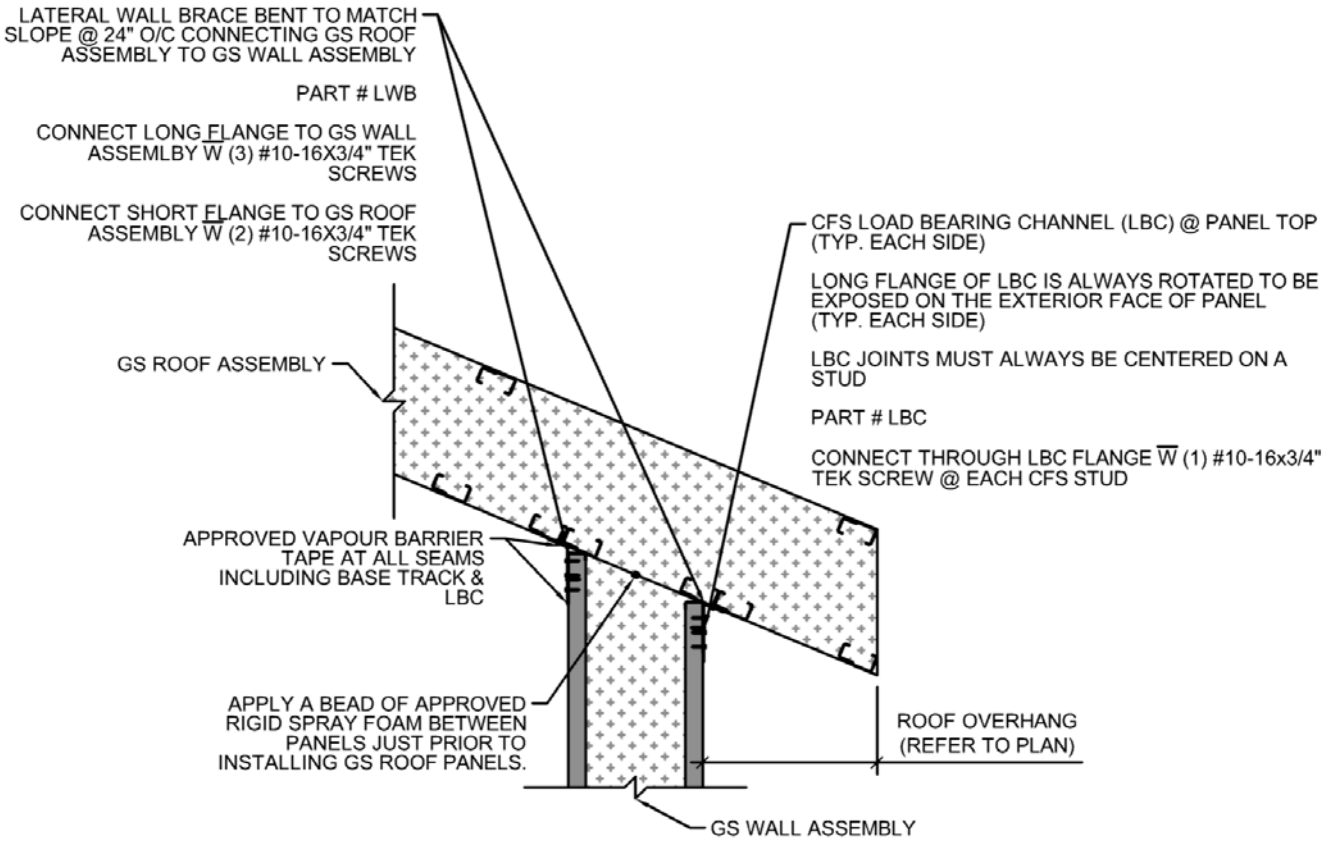
N.T.S. 538B

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"NET-ZERO" GS ROOF @ LOW EAVES (GS O/H) [SECTION]

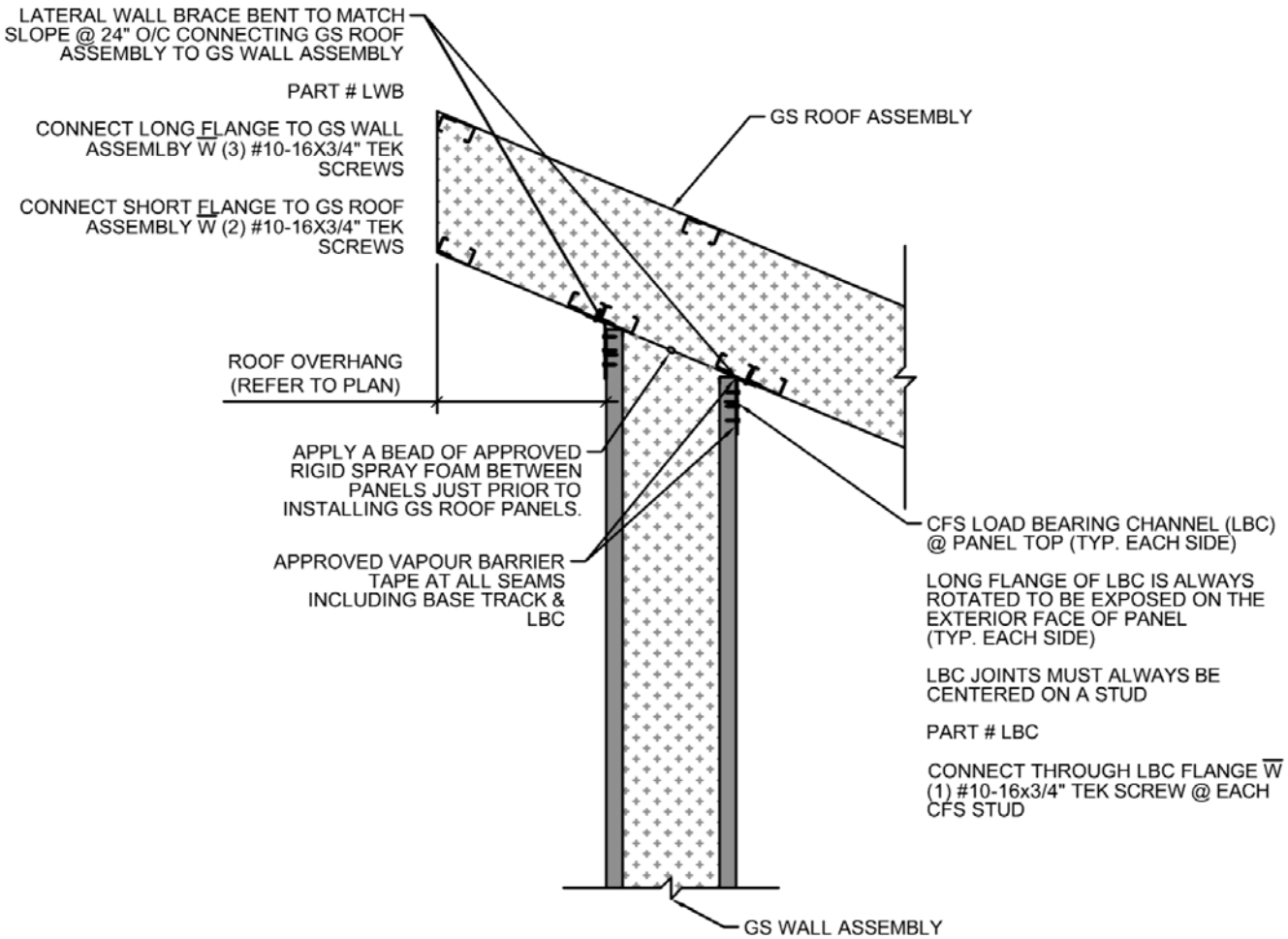
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"NET-ZERO" GS ROOF @ HIGH EAVES (GS O/H) [SECTION]

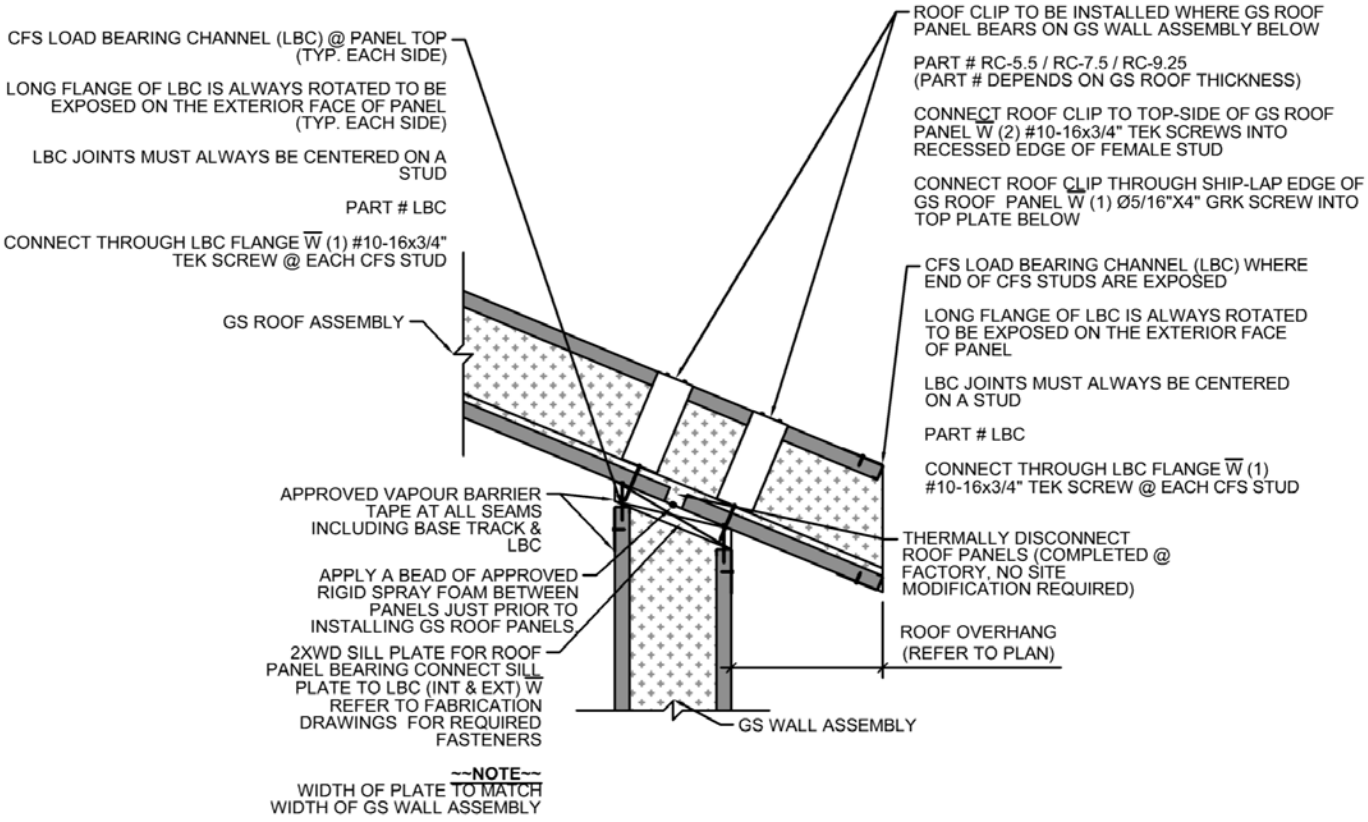
N.T.S. 538D

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GS ROOF SHIP-LAP @ LOW EAVES (GS O/H) [SECTION]

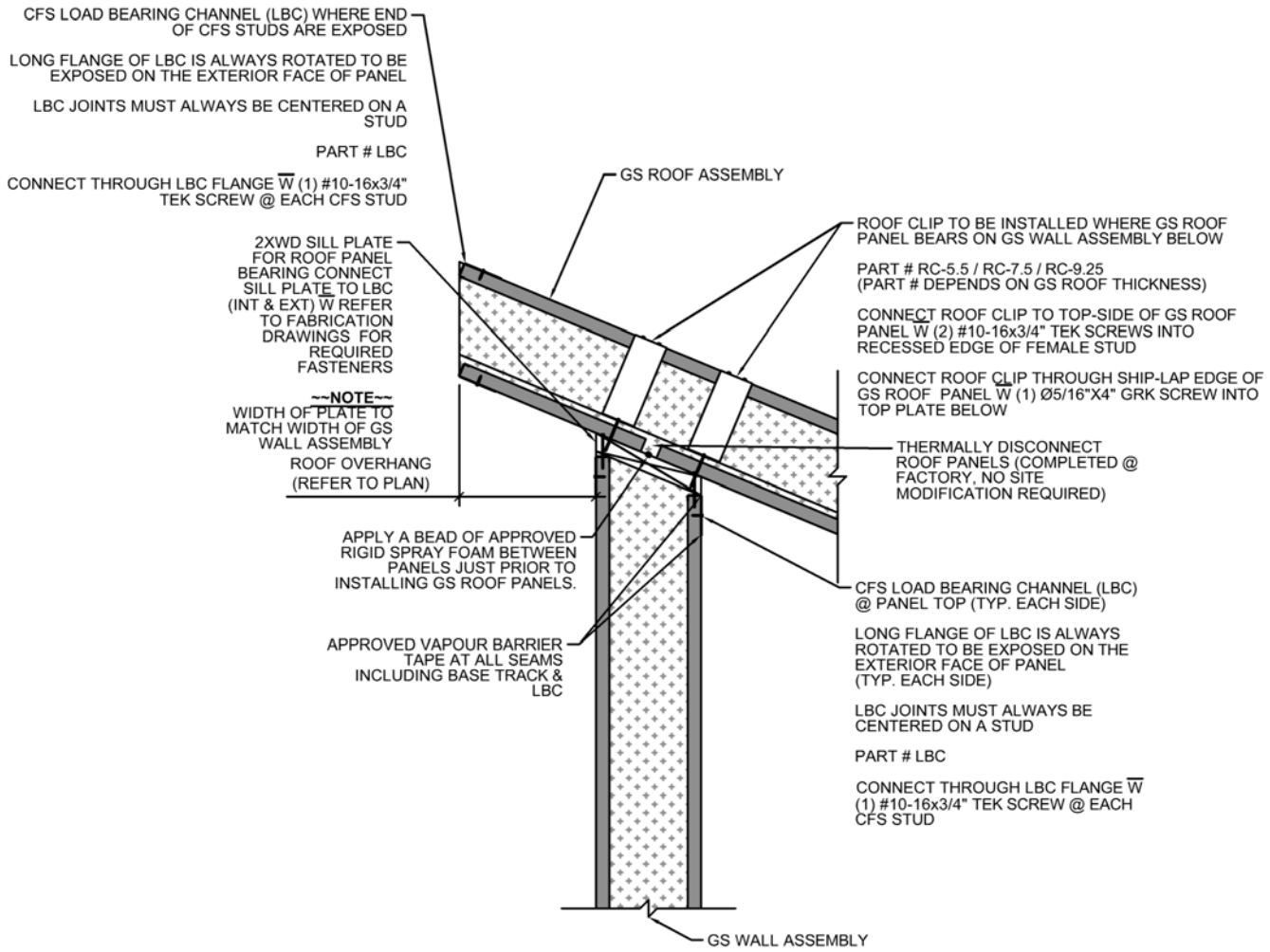
N.T.S. 539A

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GS ROOF SHIP-LAP @ HIGH EAVES (GS O/H) [SECTION]

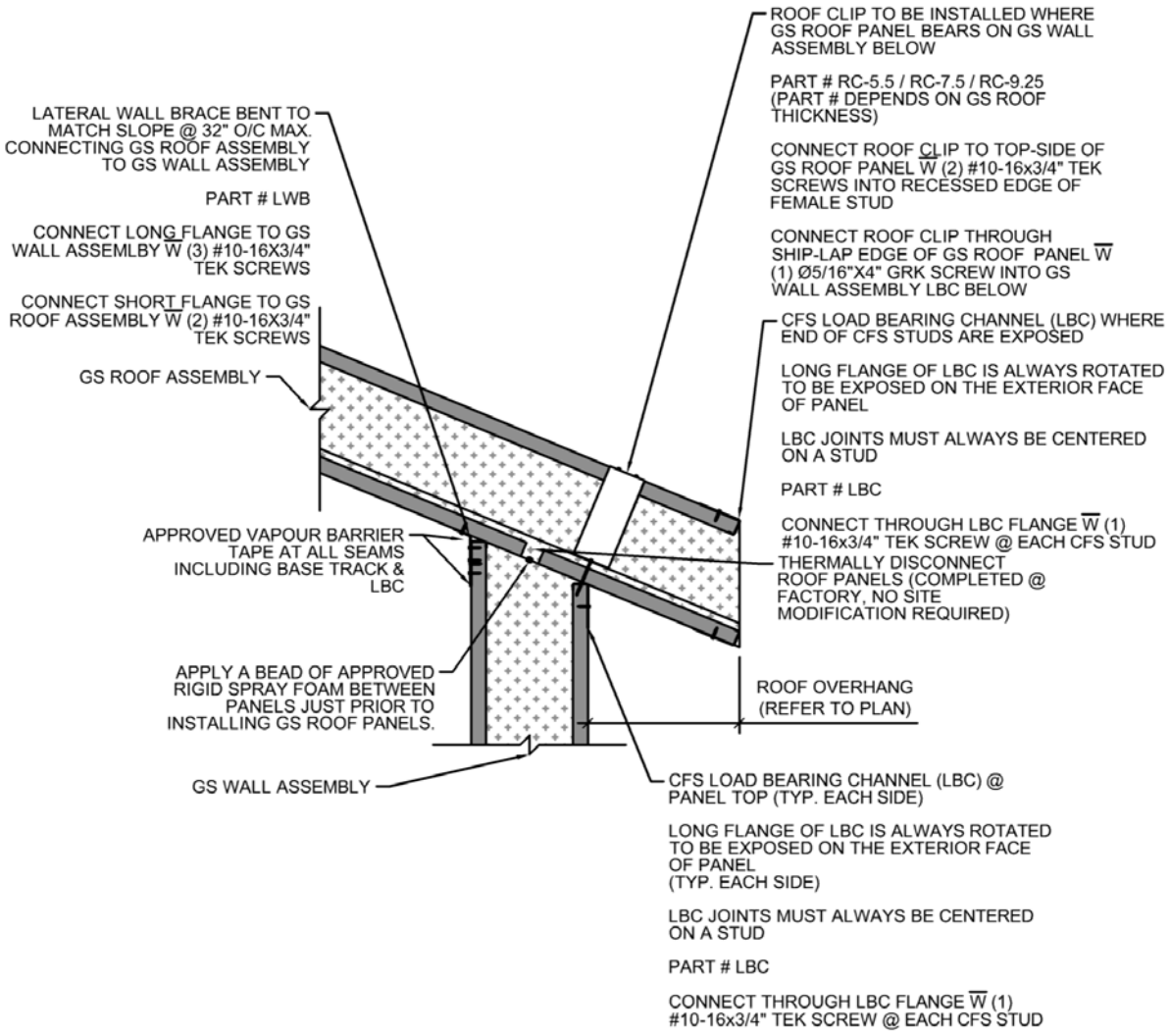
N.T.S. 539B

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"NET-ZERO" GS ROOF SHIP-LAP @ LOW EAVES (GS O/H) [SECTION]

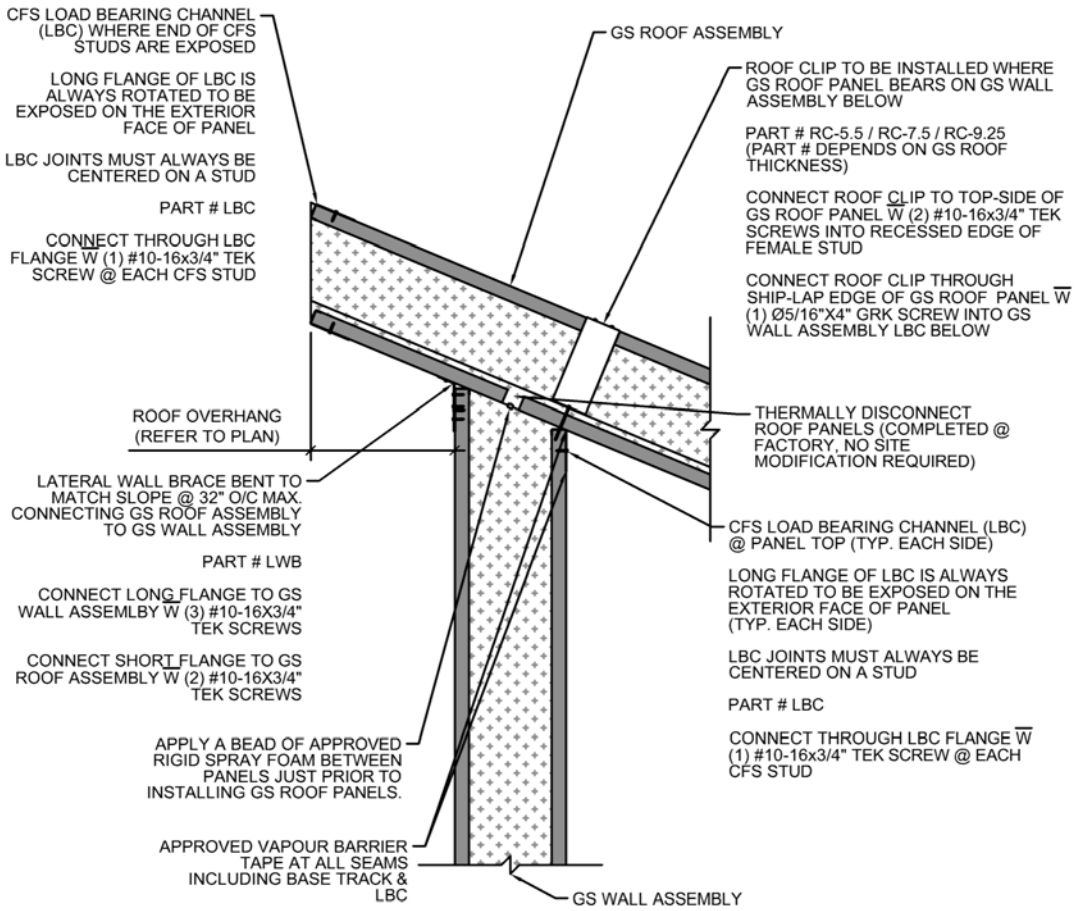
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"NET-ZERO" GS ROOF SHIP-LAP @ HIGH EAVES (GS O/H) [SECTION]

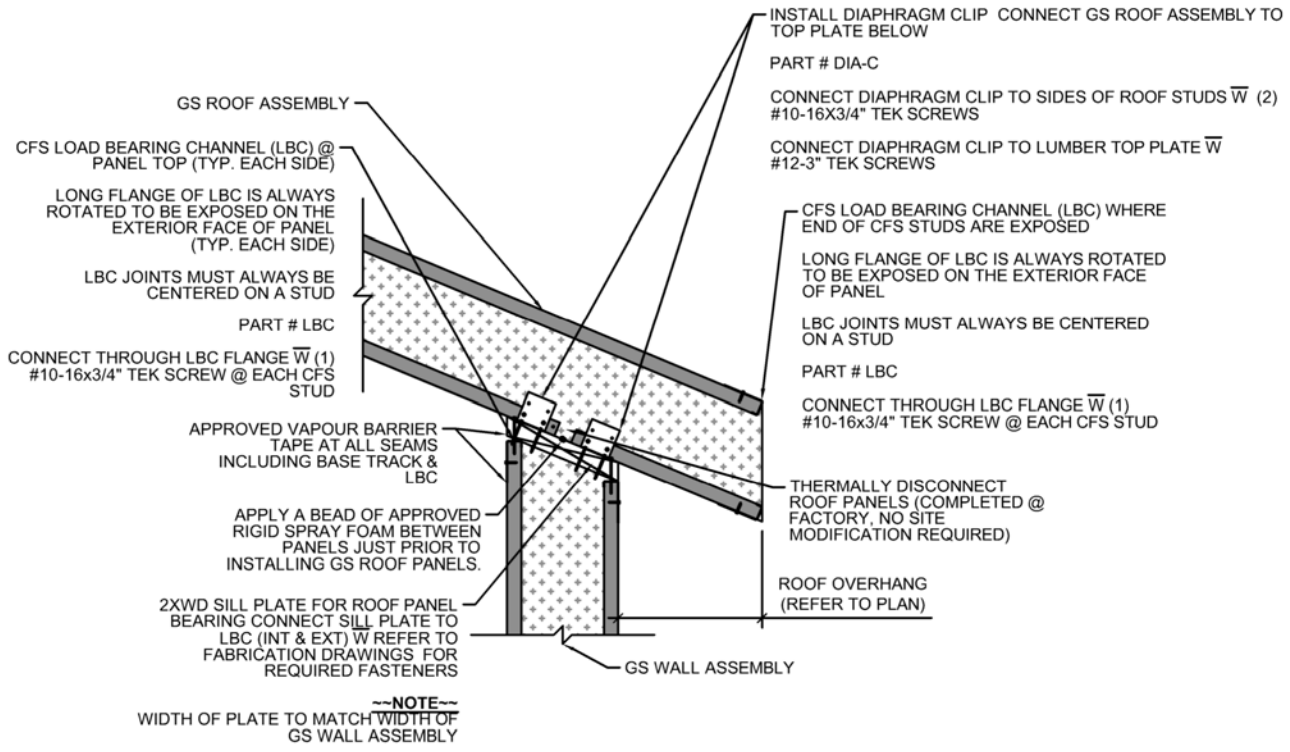
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GS ROOF BUTT JOINT @ LOW EAVES (GS O/H) [SECTION]

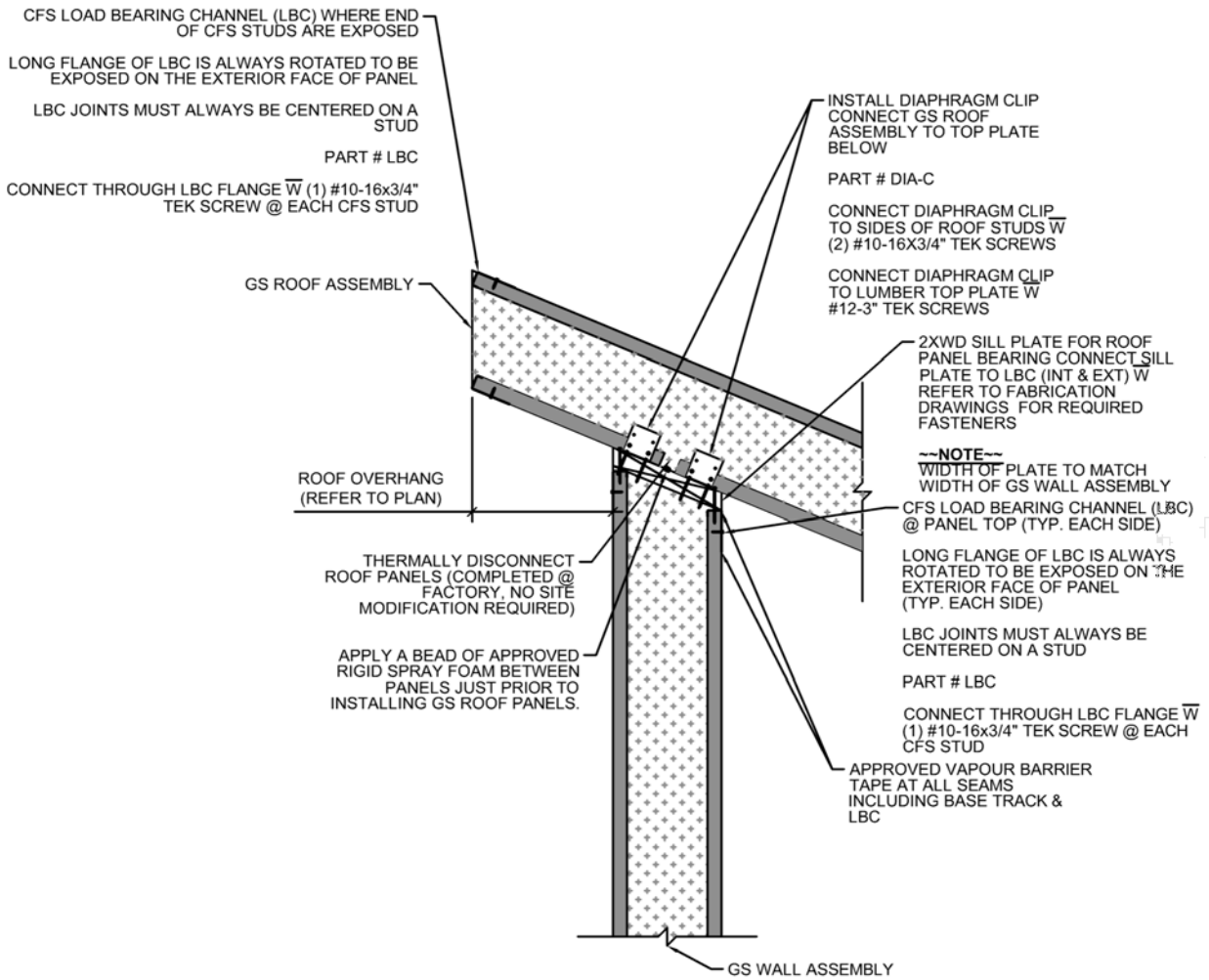
N.T.S. 540A

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GS ROOF BUTT JOINT @ HIGH EAVES (GS O/H) [SECTION]

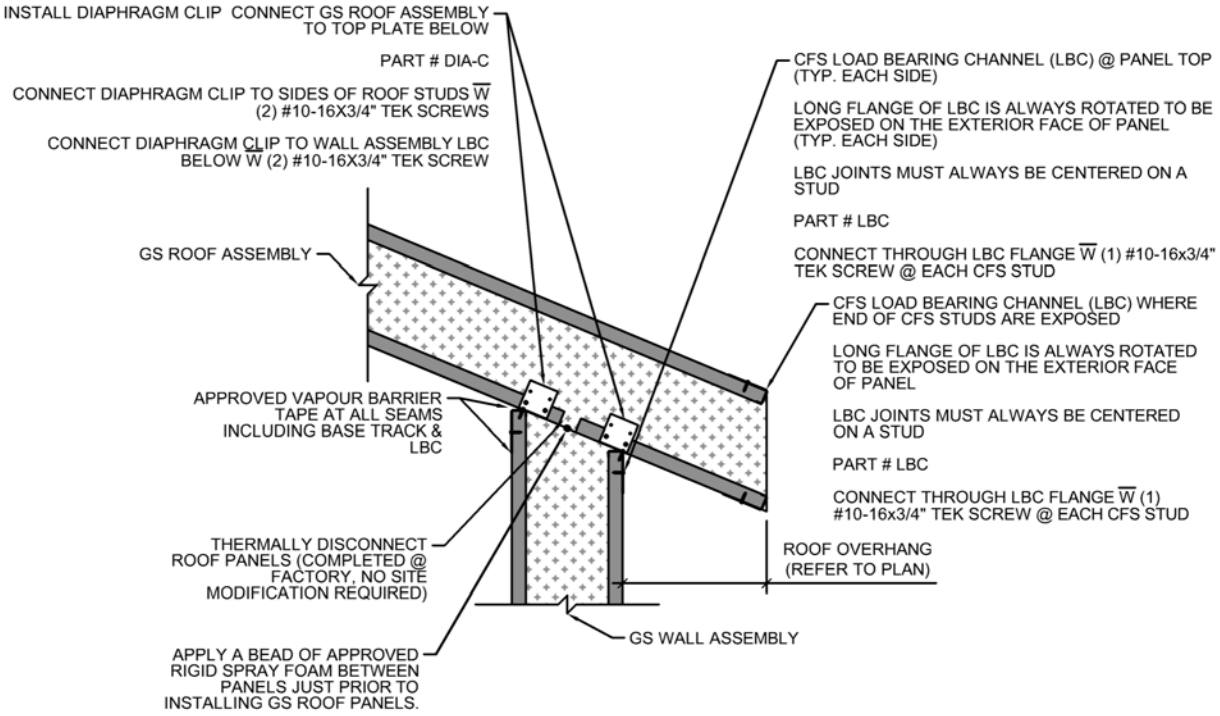
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"NET-ZERO" GS ROOF BUTT JOINT @ LOW EAVES (GS O/H) [SECTION]

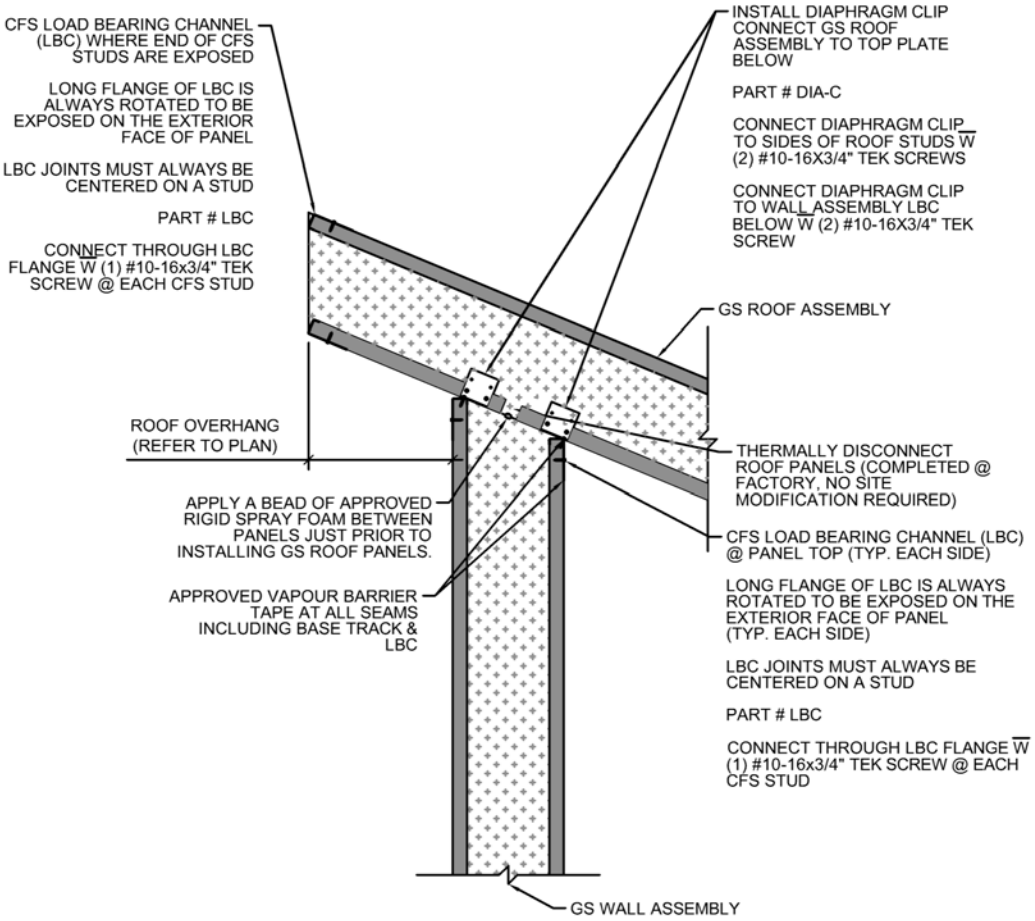
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~~NOTE~~

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"NET-ZERO" GS ROOF BUTT JOINT @ HIGH EAVES (GS O/H) [SECTION]

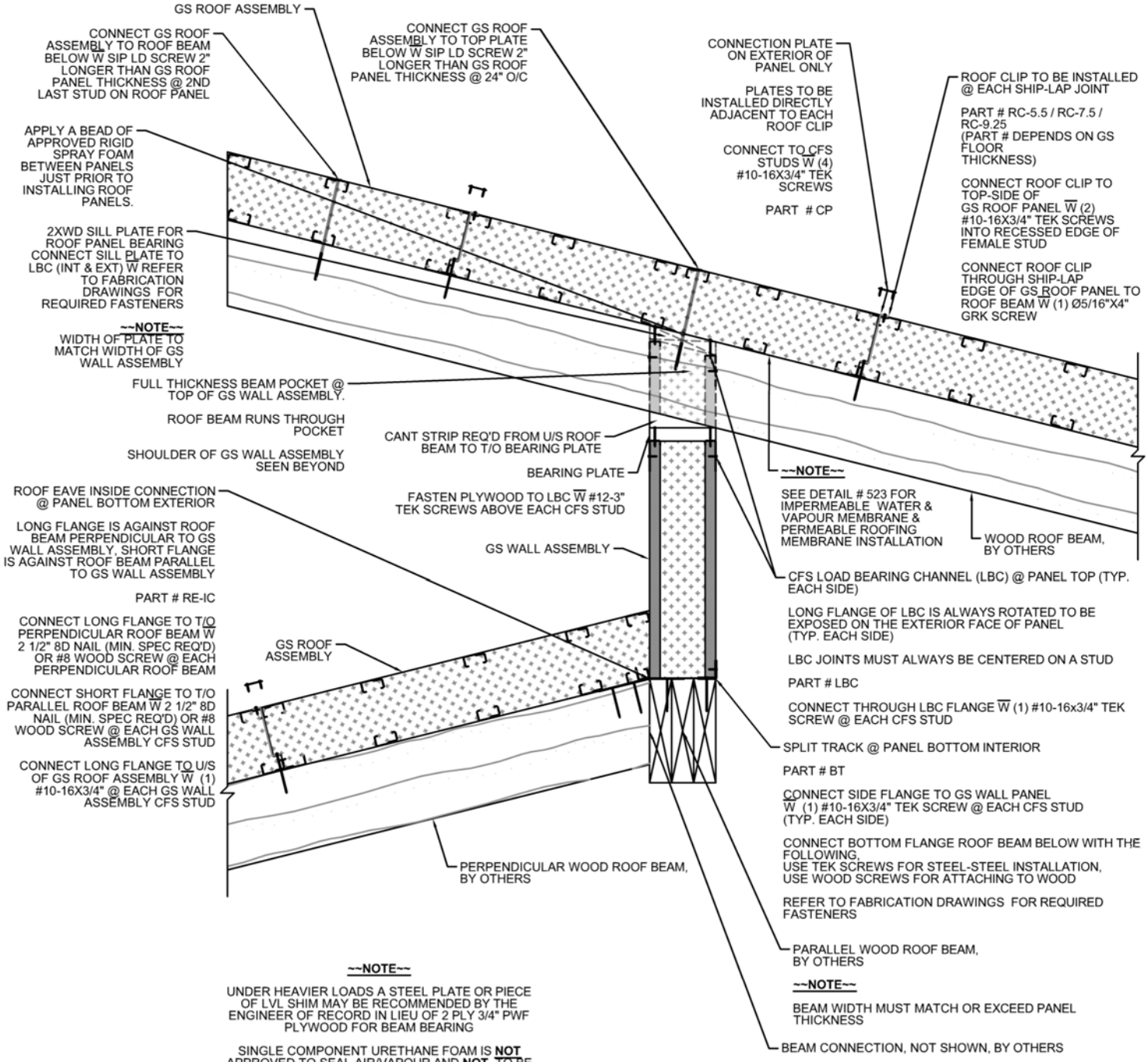
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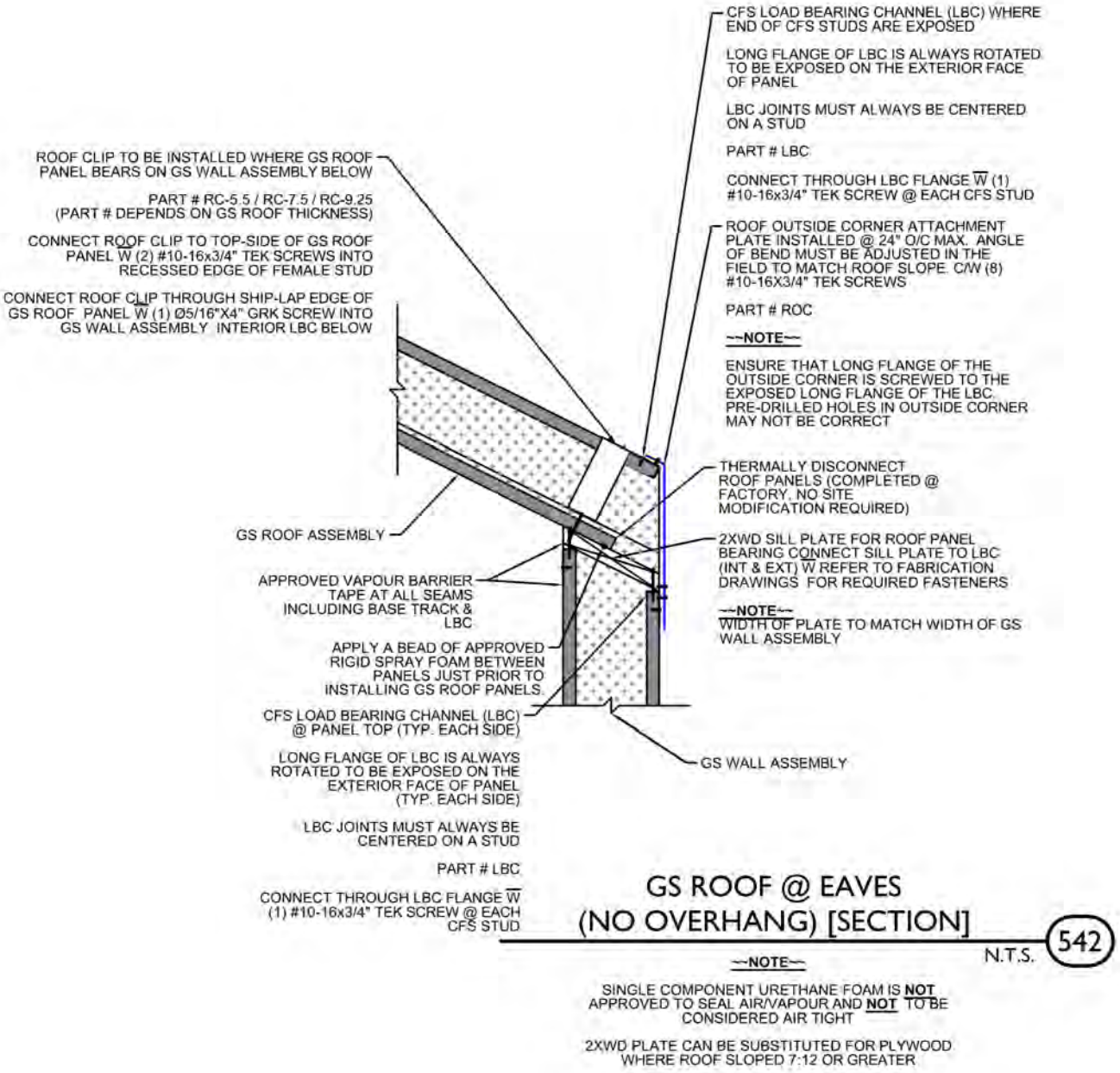


GS CLERESTORY WALL & ROOF ASSEMBLY (SECTION)

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GS ROOF @ EAVES (NO OVERHANG) [SECTION]

N.T.S.

542

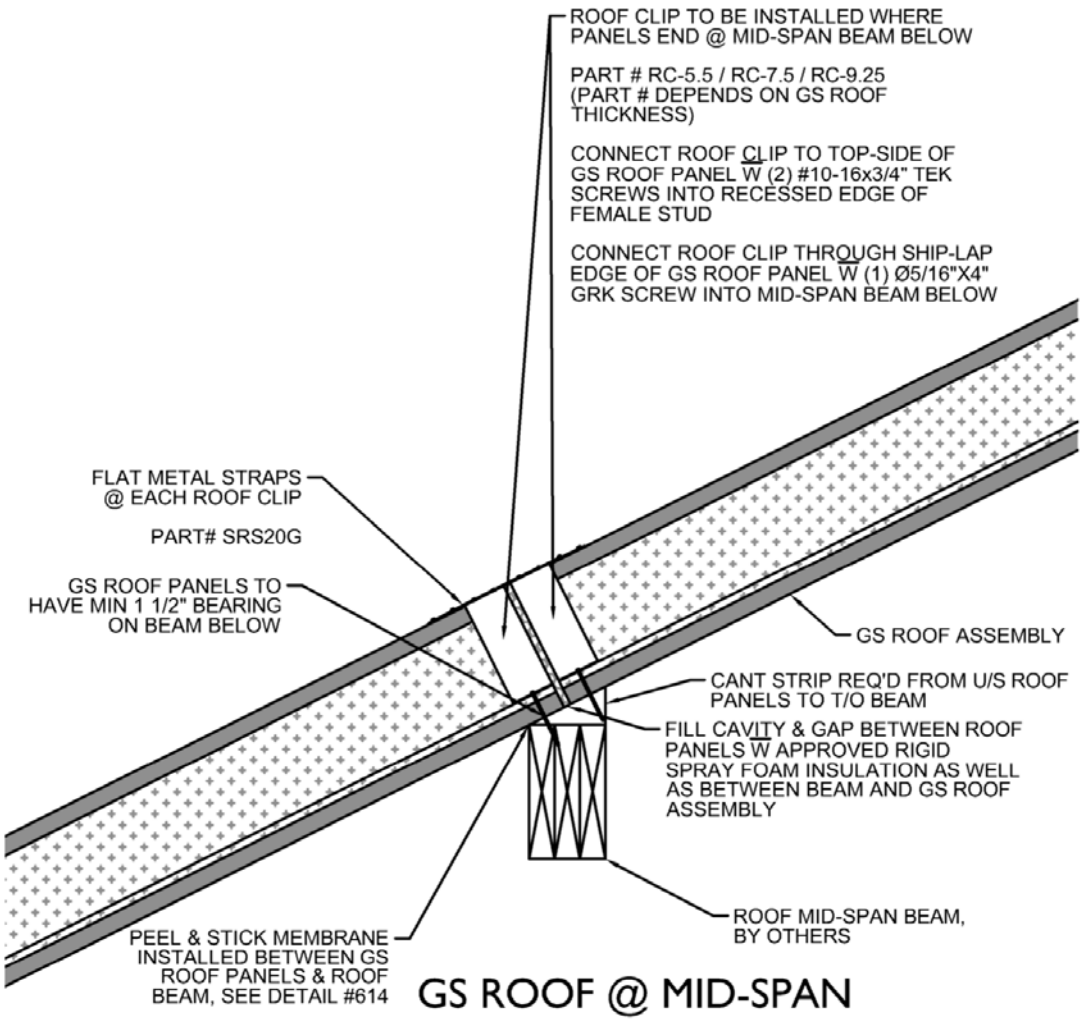
~~NOTE~~

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2XWD PLATE CAN BE SUBSTITUTED FOR PLYWOOD WHERE ROOF SLOPED 7:12 OR GREATER

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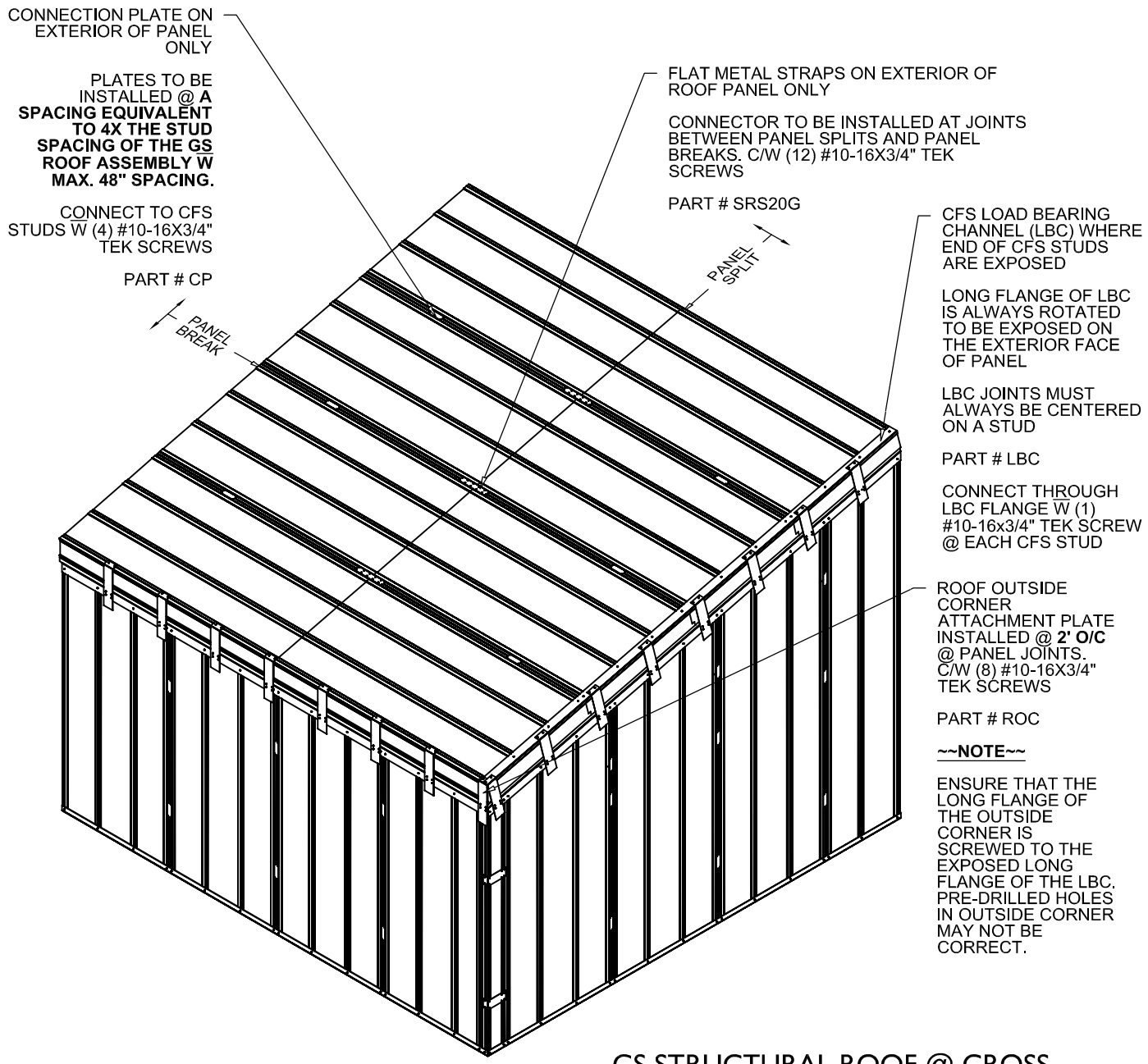
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GS ROOF @ MID-SPAN BEAM (SECTION) 543
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GS STRUCTURAL ROOF @ CROSS SLOPE (PERSPECTIVE)

N.T.S.

551

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APPENDIX C
ACCESSORY CATALOGUE

GREENSTONE
BUILDING PRODUCTS



ICE PANEL

ACCESSORY CATALOGUE

UPDATED AS OF 2025.08.12

TABLE OF CONTENTS

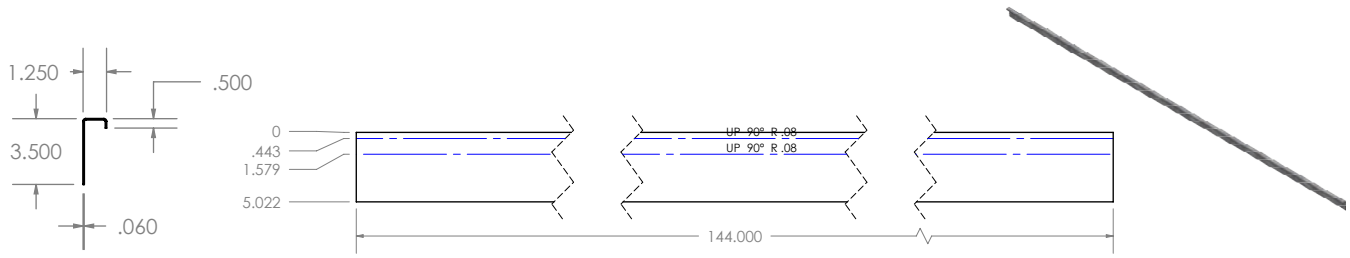
LOAD BEARING CHANNEL	5
CONNECTION PLATE	5
INSIDE CORNER	5
OUTSIDE CORNER 5.5	6
OUTSIDE CORNER 7.5	6
OUTSIDE CORNER 9.25	6
OUTSIDE CORNER 11.5	7
OUTSIDE CORNER 45	7
BOTTOM SPLIT TRACK	7
ROOF CLIP 5.5	8
ROOF CLIP 7.5	8
ROOF CLIP 9.25	8
HEADER BASE PLATE SINGLE-JOIST	9
HEADER BASE PLATE DOUBLE-JOIST	9
HEADER BASE PLATE TRIPLE-JOIST	9
ROOF OUTSIDE CORNER	10
ROOF RIDGE INSIDE CONNECTION	10
ROOF RIDGE OUTSIDE CONNECTION	10
LATERAL WALL BRACE	11
PANELIZING CLIP SINGLE	11
PANELIZING CLIP-2	11
PANELIZING CLIP-3	12
PANELIZING CLIP-4	12
PANELIZING CLIP-5	12
PANELIZING CLIP-6	13
PANELIZING CLIP-7	13
DIAPHRAGM CLIP	13

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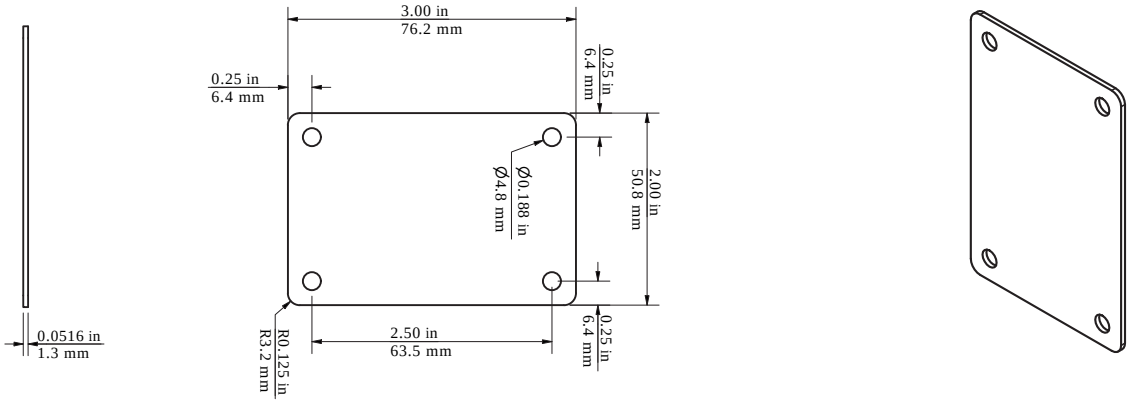
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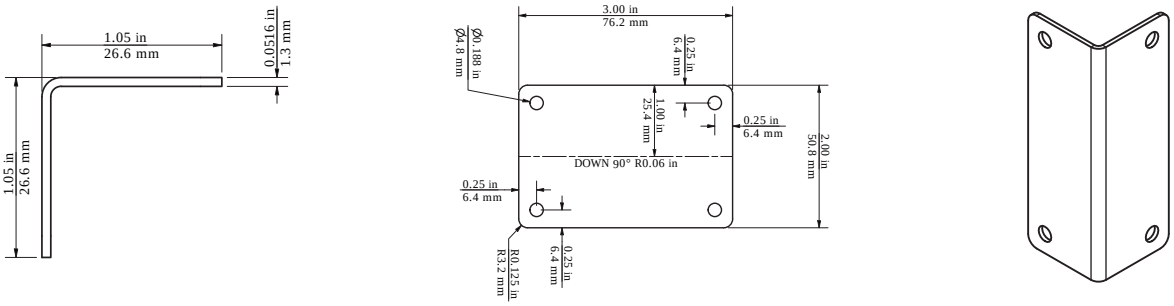
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GALVANIZED STEEL - 18GA



INSIDE CORNER

PART NO. **IC2**
GALVANIZED STEEL - 18GA

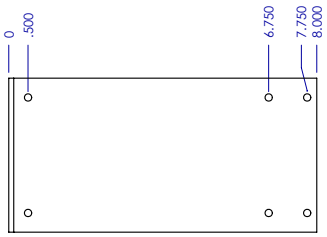


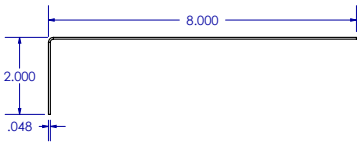
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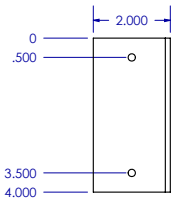
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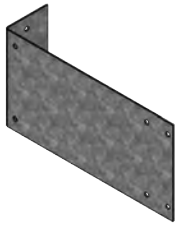
OUTSIDE CORNER 5.5

PART NO. OC-5.5
GALVANIZED STEEL - 18GA



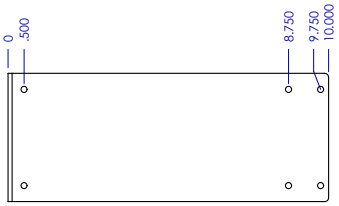


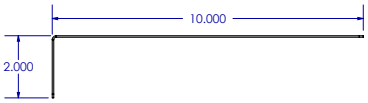


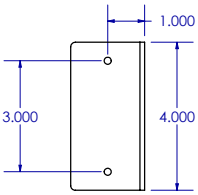


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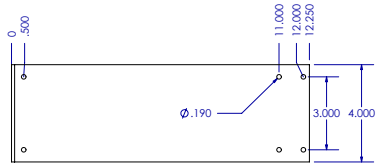


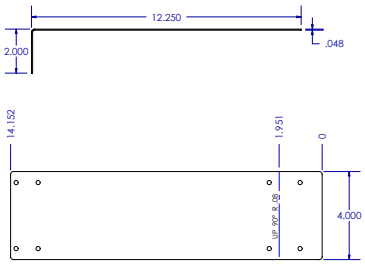


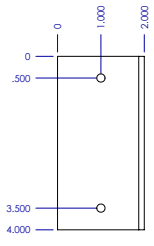


OUTSIDE CORNER 9.25

PART NO. OC-9.5
GALVANIZED STEEL - 18GA







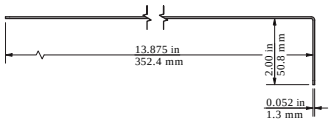


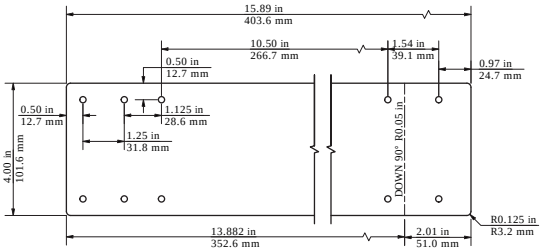
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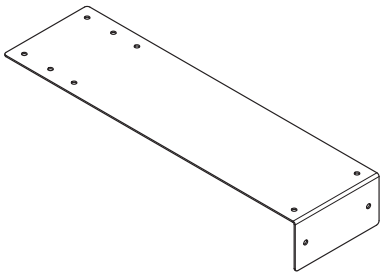
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OUTSIDE CORNER 11.5

PART NO. **OC-11.5**
GALVANIZED STEEL - 18GA

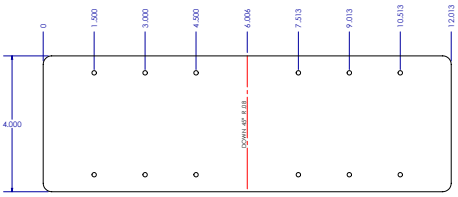


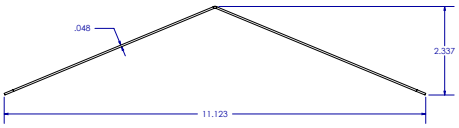


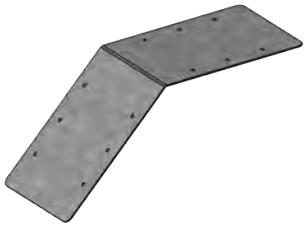


OUTSIDE CORNER 45

PART NO. **C-45**
GALVANIZED STEEL - 18GA

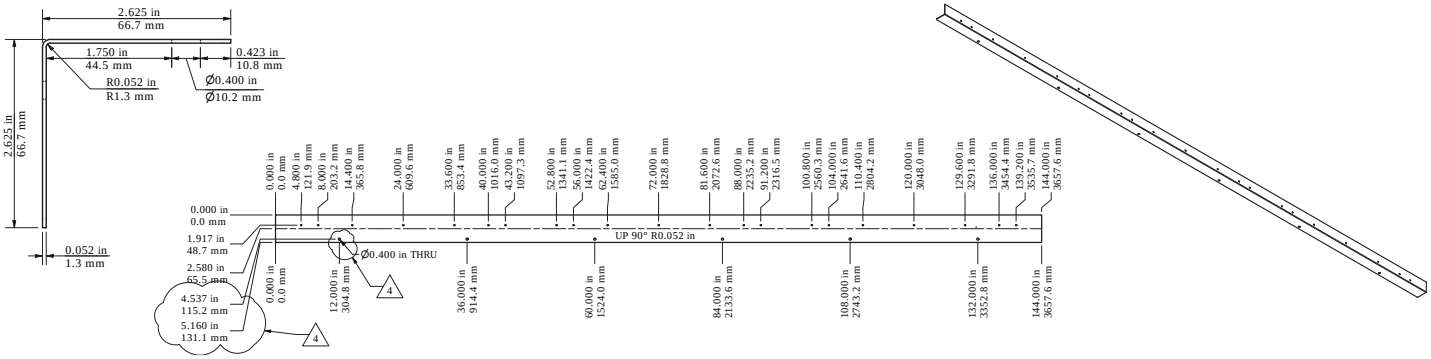






BOTTOM SPLIT TRACK

PART NO. **BT**
GALVANIZED STEEL - 18GA

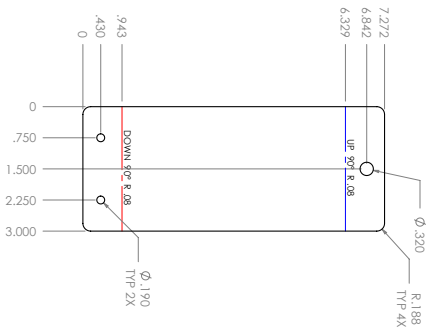


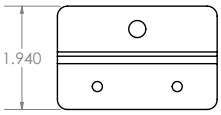
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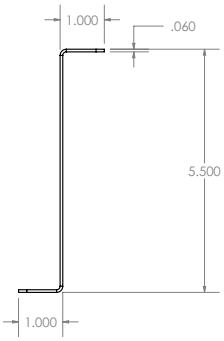
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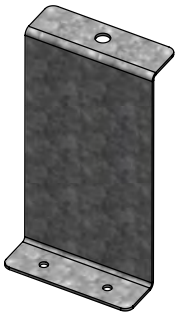
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PART NO. **RC-5.5**
GALVANIZED STEEL - 16GA



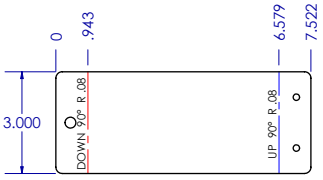


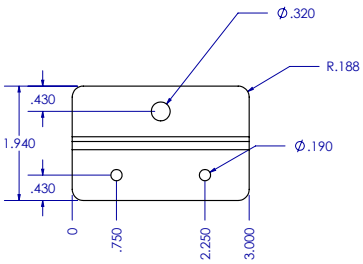


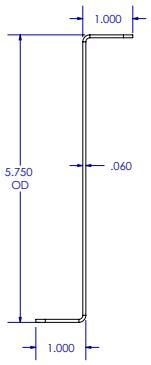


ROOF CLIP 7.5

PART NO. **RC-7.5**
GALVANIZED STEEL - 16GA



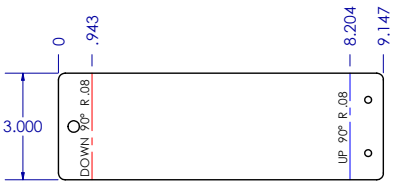


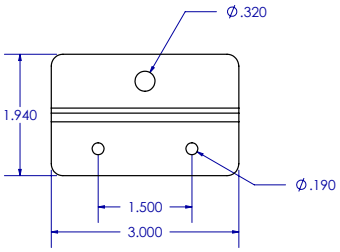


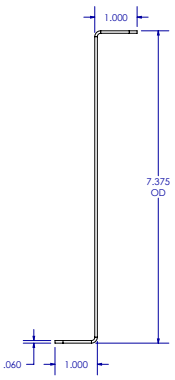


ROOF CLIP 9.25

PART NO. **RC-9.25**
GALVANIZED STEEL - 16GA







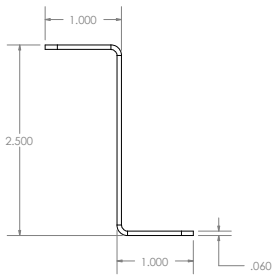


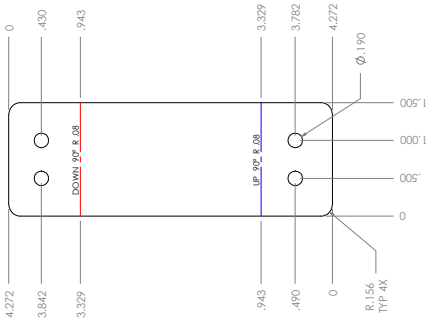
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HEADER BASE PLATE SINGLE JOIST

PART NO. **HBP-SJ**
GALVANIZED STEEL - 16GA

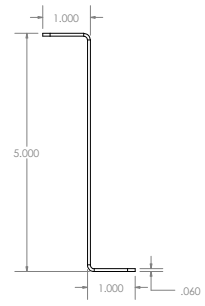


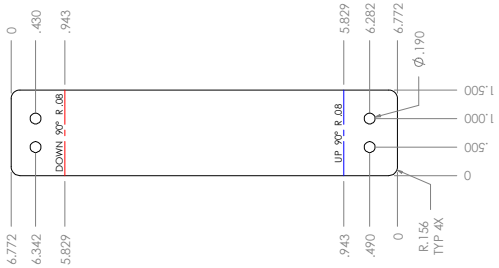




HEADER BASE PLATE DOUBLE JOIST

PART NO. **HBP-DJ**
GALVANIZED STEEL - 16GA

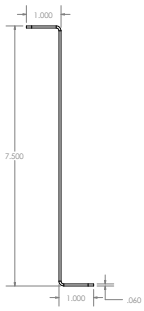


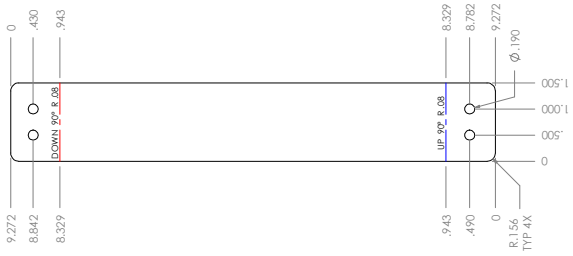




HEADER BASE PLATE TRIPLE JOIST

PART NO. **HBP-TJ**
GALVANIZED STEEL - 16GA





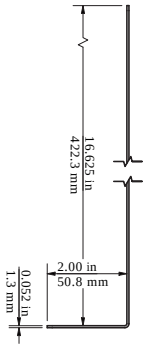


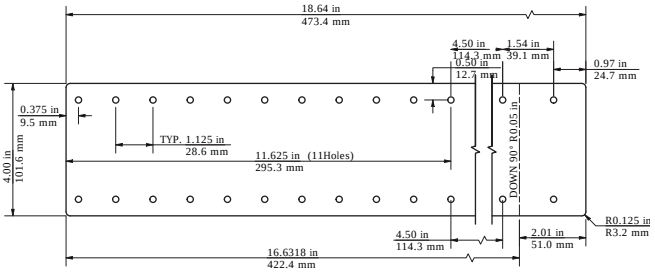
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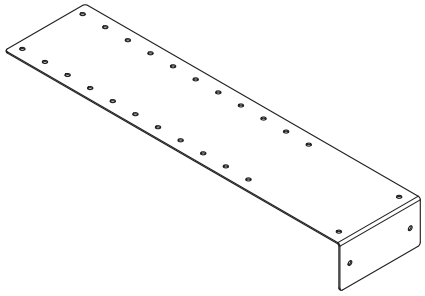
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ROOF OUTSIDE CORNER

PART NO. **ROC**
GALVANIZED STEEL - 18GA

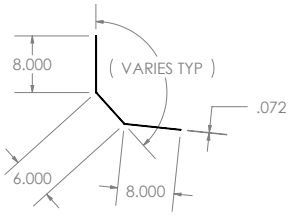


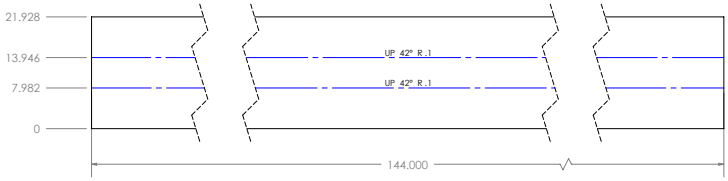


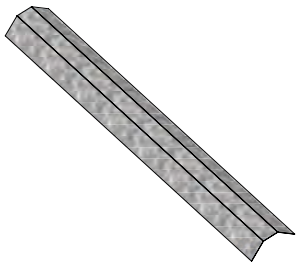


ROOF RIDGE INSIDE CONNECTION

PART NO. **RR-IC**
GALVANIZED STEEL - 14GA

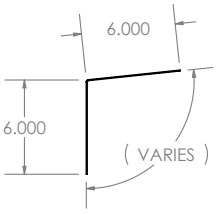


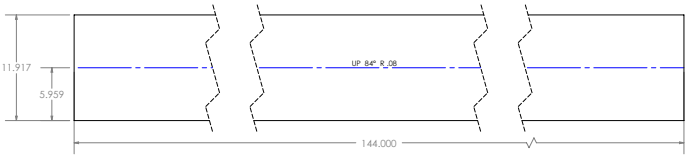


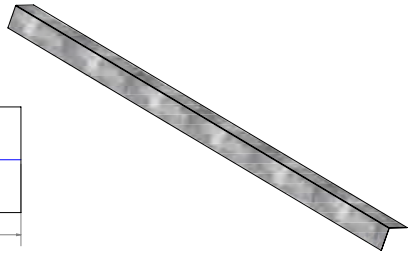


ROOF RIDGE OUTSIDE CONNECTION

PART NO. **RR-OC**
GALVANIZED STEEL - 18GA





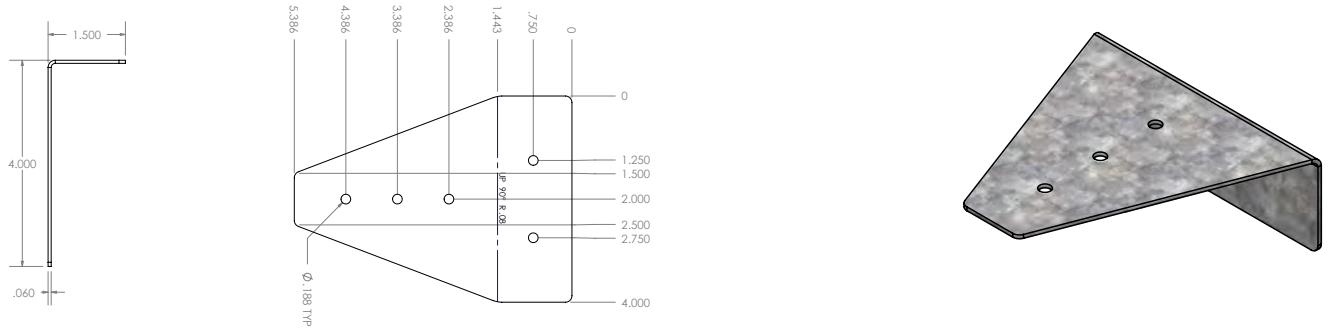


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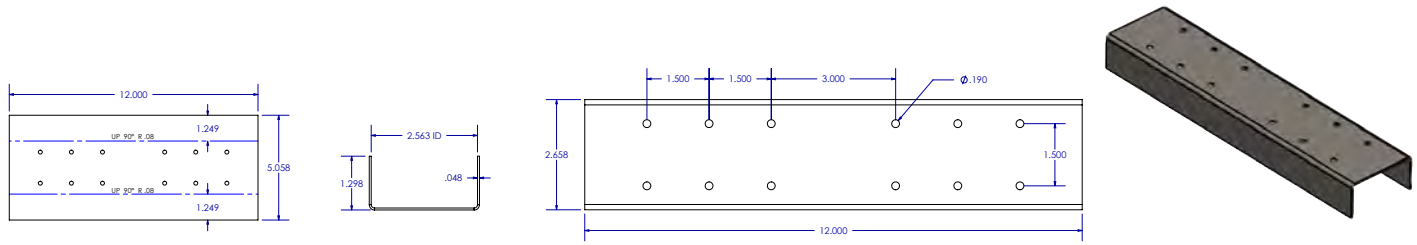
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PART NO. LWB
GALVANIZED STEEL - 16GA



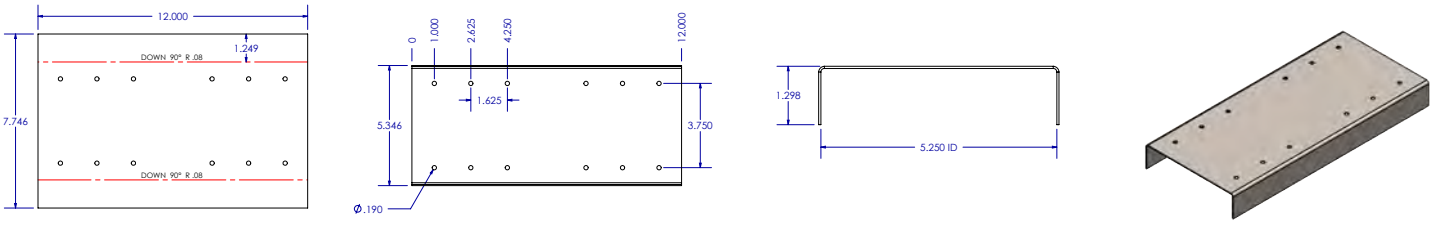
PANELIZING CLIP SINGLE

PART NO. PCS
GALVANIZED STEEL - 18GA



PANELIZING CLIP 2

PART NO. PC-2
GALVANIZED STEEL - 18GA

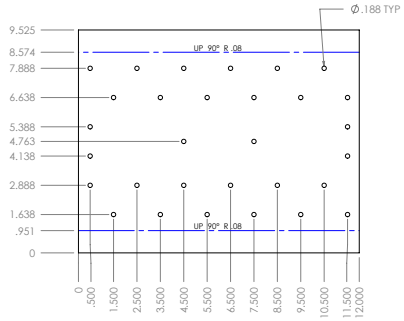


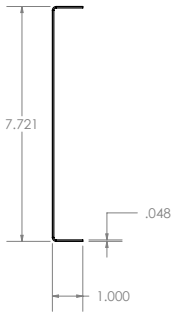
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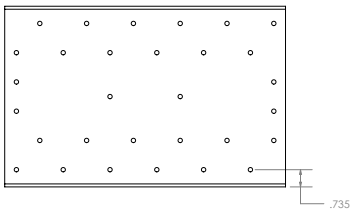
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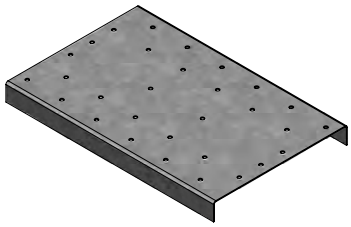
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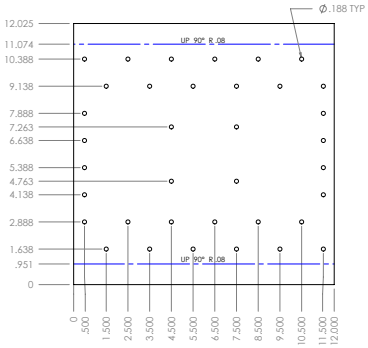


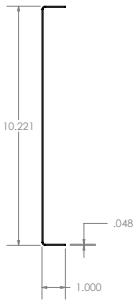


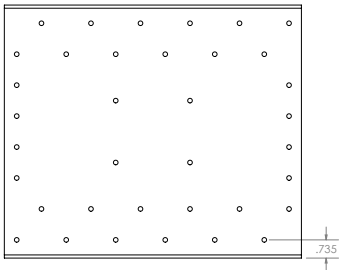


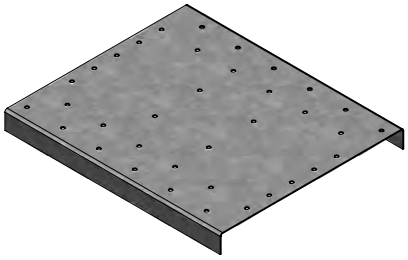
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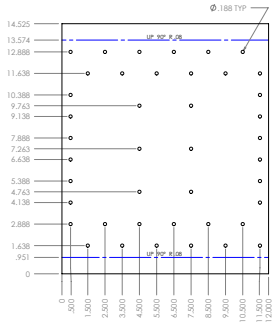




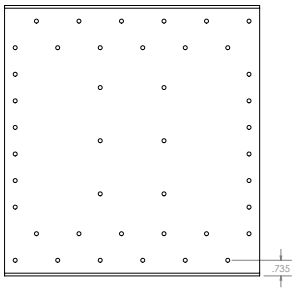


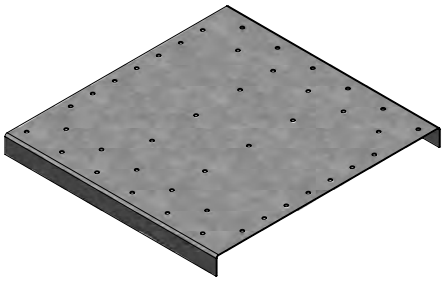
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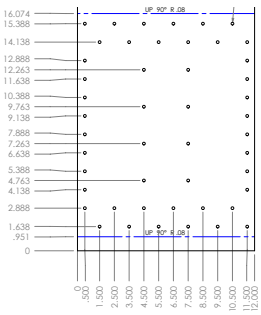


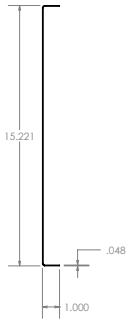
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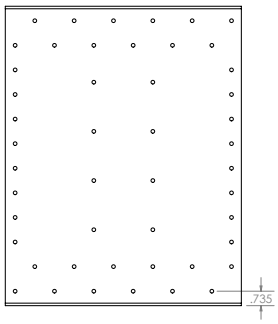
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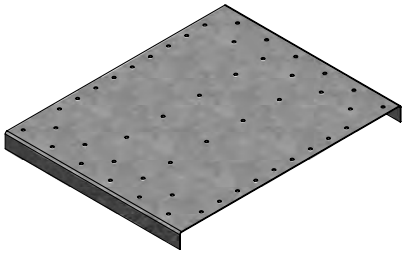
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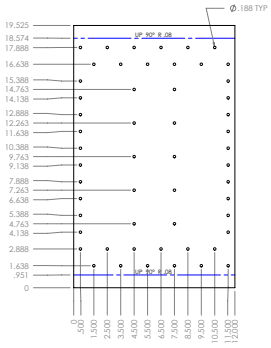




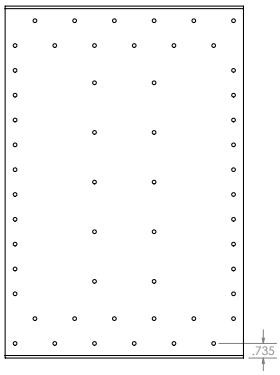


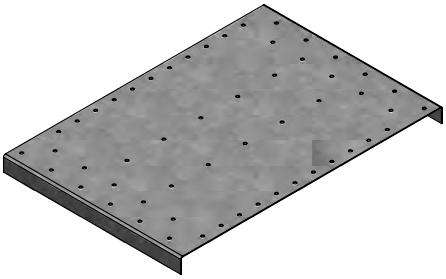
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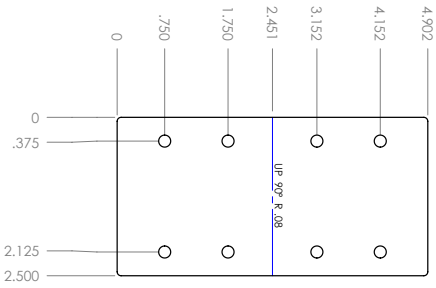


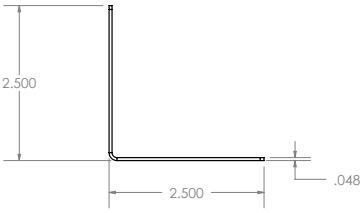


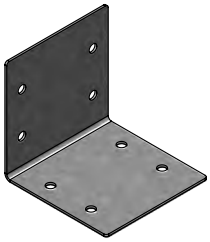


DIAPHRAGM CLIP

PART NO. DIA-C
GALVANIZED STEEL - 18GA







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APPENDIX D
SAMPLE PROJECTS

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ICE PANEL

SAMPLE PROJECTS

UPDATED AS OF 2024.05.01

TABLE OF CONTENTS

DAVIS WAY COMMERCIAL MULTI-UNIT | WINNIPEG, MANITOBA 5

OBANYE RESIDENCE | QUESNEL, BRITISH COLUMBIA 7

4 STOREY MULTI-UNIT BUILDING | IQALUIT, NUNAVUT 9

BEST WESTERN PLUS HOTEL | NEEPAWA, MANITOBA 11

ADMINISTRATIVE OFFICE BUILDING | SIOUX VALLEY DAKOTA NATION, MANITOBA 13

18TH STREET MULTI-UNIT BUILDING | BRANDON, MANITOBA 15

AGRICULTURAL SHOP | RIVERS, MANITOBA 17

RAE RESIDENCE | FAIRMONT HOT SPRINGS, BRITISH COLUMBIA 19

WHEATLAND BAY CUSTOM HOME | BRANDON, MANITOBA 21

HOME HARDWARE | ARVIAT, NUNAVUT 23

THE VILLAGE AT PINERIDGE HOLLOW | OAKBANK, MANITOBA 25

3 STOREY MULTI-UNIT BUILDING | BRANDON, MANITOBA 27

18-PLEX MULTI-UNIT BUILDING | IQALUIT, NUNAVUT 29

CEVADA RESIDENCE | BRAMPTON, ONTARIO 31

STRAUSE RESIDENCE | MERIDIAN BEACH, ALBERTA 33

HUNTER RESIDENCE | FRANCOIS LAKE, BRITISH COLUMBIA 35

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DAVIS WAY COMMERCIAL MULTI-UNIT

WINNIPEG, MB







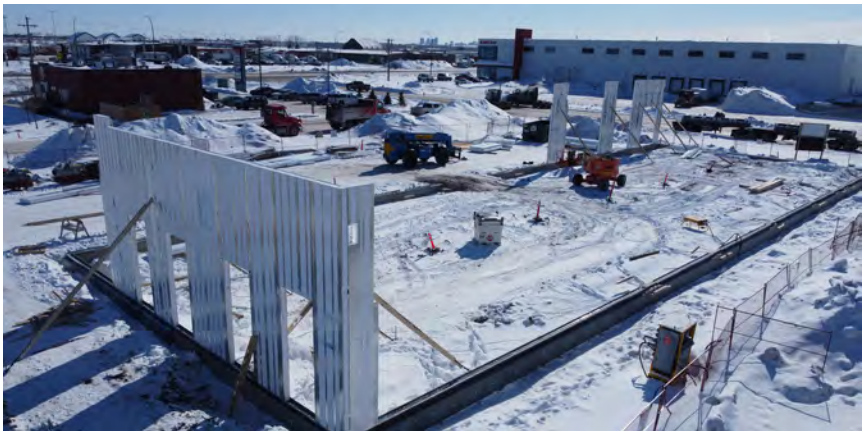


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OBANYE RESIDENCE

QUESNEL, BC











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4 STOREY MULTI-UNIT BUILDING

IQALUIT, NU







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BEST WESTERN PLUS HOTEL

NEEPAWA, MB







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ADMINISTRATIVE OFFICE SPACE

SIOUX VALLEY DAKOTA NATION, MB













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18TH STREET MULTI-UNIT BUILDING

BRANDON, MB







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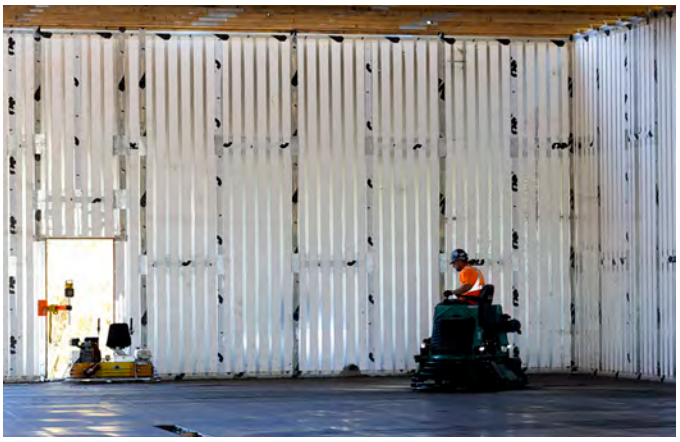
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AGRICULTURAL SHOP

RIVERS, MB











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RAE RESIDENCE

FAIRMONT BANFF SPRINGS, BC









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WHEATLAND BAY CUSTOM HOME

BRANDON, MB







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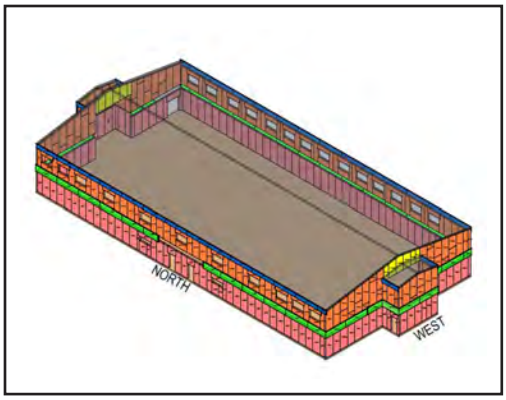
HOME HARDWARE

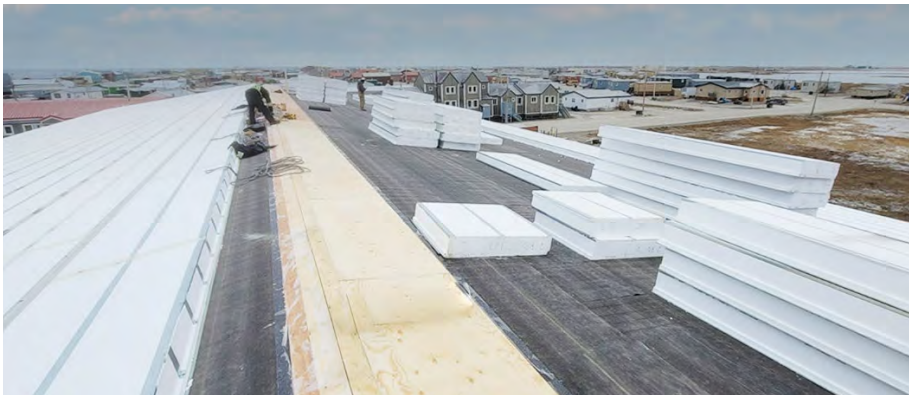
ARVIAT, NU











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THE VILLAGE AT PINERIDGE HOLLOW

OAKBANK, MB









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3 STOREY MULTI-UNIT BUILDING

BRANDON, MB







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18-PLEX COMMERCIAL BUILDING

IQALUIT, NU

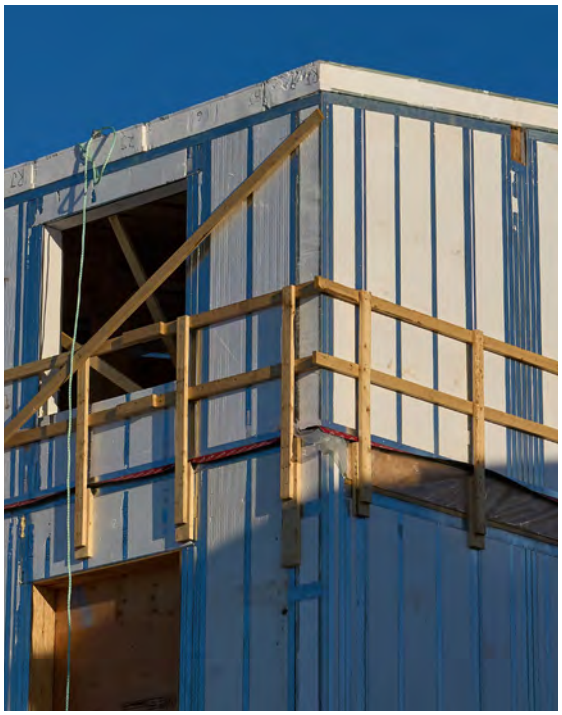






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CEVADA RESIDENCE

BRAMPTON, ON



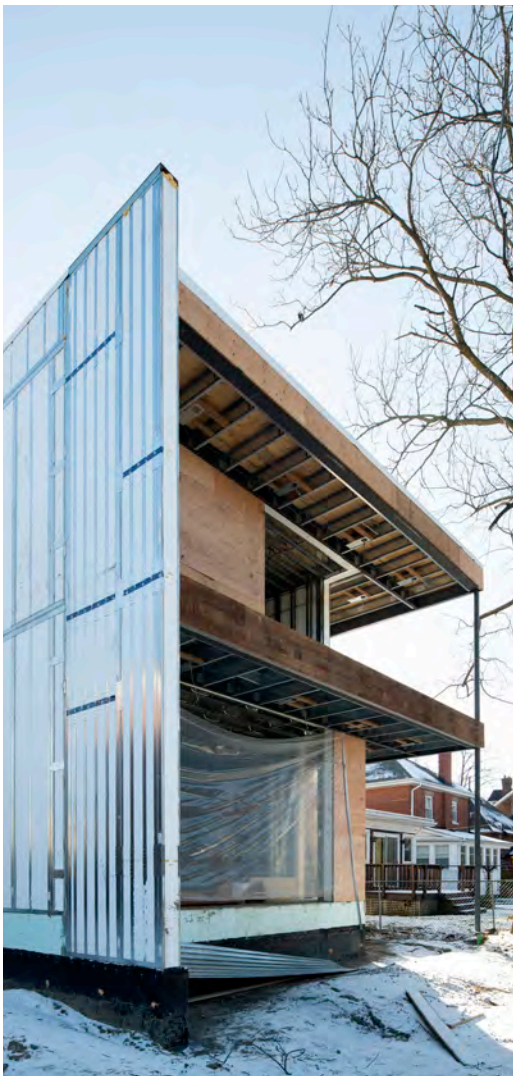






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STRAUSE RESIDENCE

MERIDIAN BEACH, AB











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HUNTER RESIDENCE

FRANCOIS LAKE, BC









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APPENDIX E
ASSEMBLY MANUAL

GREENSTONE
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ICE PANEL

ASSEMBLY MANUAL

UPDATED AS OF 2023.04.04

Table of Contents

DISCLAIMERS/RECOMMENDATIONS

STRUCTURAL INSPECTION CHECKLIST

1.0 INTRODUCTION

1.1 GREENSTONE ICE PANEL
1.2 BEFORE YOU GET STARTED
1.3 DRAWING AND ELEMENT NUMBERS

2.0 ASSEMBLY

2.1 ICE PANEL ASSEMBLY

STEP 1: UNLOADING & STAGING YOUR SITE
STEP 2: TRACK LAYOUT, INSTALLATION, AND PANEL LAYOUT
STEP 3: CORNER INSTALLATION
STEP 4: WALL PANEL ASSEMBLY
STEP 5: BRACING
STEP 6: INSTALLING THE LOAD BEARING CHANNEL (LBC)
STEP 7: STRAIGHTENING & FINAL FASTENING
STEP 8: SEALING WALLS: INTERIOR VAPOUR BARRIER/EXTERIOR WEATHER BARRIER

2.2 ALTERNATIVE ASSEMBLY OF INTERCHANGEABLE PANELS

2.3 WALL ASSEMBLY BELOW GRADE

2.4 ROOF AND FLOOR ASSEMBLY

2.5 INSTALLATION COMPLIANCE

3.0 QUALITY CONTROL

3.1 INSPECTION OF PANELS

3.2 ON-SITE CHANGES

3.3 DIMENSIONAL TOLERANCES

4.0 SAFETY

5.0 DRAWINGS & REFERENCE DOCUMENTS

APPENDIX A

HOW TO GET YOUR INSTALLATION APPROVAL

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DISCLAIMERS/ RECOMMENDATIONS

Greenstone ICE Panels are manufactured with galvanized cold-formed steel studs and Type 2 EPS insulation. Thermal barrier or ignition barriers are generally required to cover the inside face of the panels to meet local building codes. Check with your local authority for areas in question.

Greenstone ICE Panels are compliant as a Class II vapour barrier when installed in accordance with the installation instructions and proper measures have been taken to seal all transitions and joints tightly. Proper sealing and quality control during this process falls solely on the installer. Measures to ensure a good seal like blower door testing, or alternative sealing methods like installing AeroBarrier® are good building practices and avoid quality control concerns regarding the sealing process.

Greenstone recommends all panel joints be sealed on the interior face. All accessible voids in the assembly should be filled with low expansion foam insulation prior to interior sealing of the joints and transitions. Expanding foam should not be relied on for air or vapour sealing.

The Greenstone assembly is not detailed to repel water and requires a weather resistive barrier on the exterior (such as building wrap or equal, and ice and water shield for roofs) as a minimum covering before installing exterior finishes.

Once installed, ICE Panels should be protected from large temperature swings whenever possible. For residential and commercial building applications, Greenstone recommends maintaining an interior temperature above -10°C once the envelope is installed to manage contraction and expansion of the envelope. Excessive temperature swings may compromise the vapour barrier characteristics of an exposed panel.

An ICE Panel assembly should not be left exposed to the elements for more than 3 months after erection without any covering. UV light may damage the surface of the EPS causing it to develop a yellow chalking powder on the surface. Any self adhering membranes will no longer adhere to this surface. ICE Panels produced with graphite EPS are more susceptible to sun damage due to the darker color. Ensure these panels are covered as soon as possible during summer installations, especially on roof applications.

The installer must provide Greenstone with photos of the complete ICE Panel installation after structural assembly is complete ***before covering***. Approval from Greenstone is required before making any portion of the assembly inaccessible to inspection. See Appendix A for more information.

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STRUCTURAL INSPECTION CHECKLIST

GREENSTONE BUILDING PRODUCTS

INSPECTION ITEMS:	EXTERIOR ✓	INTERIOR ✓	WAS THIS 📷?
REQUIRED REFERENCE DOCUMENTATION: Installation Documents binder provided in the Project Installation Package. *Please note that not all details referenced below will apply to this project. The standard connection details that directly apply to this project are listed in the project installation documents binder.*			*REMINDER: To complete your Installation Review, you must photograph the panels before covering them. **See the Installation Review Process in Appendix A of the Assembly Manual.***
Is the split track anchored correctly (if anchors are visible)? Mushroom head spikes are used for concrete applications. • Standard Connection Details to reference: 201, 202, 203, 204, 205, 208, 220 2.5" Deck screws are used for wood applications. • Standard Connection Details for reference: 207, 222, 223, 241, 420, 421, 422, 423, 424, 425, 426, 430, 431, 432, 433, 434			
Are screws at stud locations? 1 screw for every stud through the Split Track and the Load Bearing Channel (LBC). • Standard Connection Details to reference: 301, 302, 320, 321, 322, 340, 341, 346, 347, 349, 352, 360, 361, 362, 380, 381, 382			
Are the clip spacings and placement correct? • Standard Connection Details to reference: 301, 302, 303, 304, 306, 345, 346, 347, 351, 352			
Are the LBC's joined at the stud with stagger joints inside to outside? • Standard Connection Details to reference: 320, 321, 322, 323			
Are LBC's correctly installed on sills? LBC's cover corner-to-corner and are notched into the jack studs on either side by 1". • Standard Connection Details to reference: 340, 341, 351, 362			
Are Panelizing Clips installed in the right locations? • Standard Connection Details to reference: 347, 349, 360, 361, 362			
Are all joist notch ledges fastened correctly? • All joist notch ledges are to have 2x nominal lumber fastened to top track below the joists. • The joists are to be fastened to the lumber as well.			

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INSPECTION ITEMS:	EXTERIOR ✓	INTERIOR ✓	WAS THIS 📷?
REQUIRED REFERENCE DOCUMENTATION: Installation Documents binder provided in the Project Installation Package. *Please note that not all details referenced below will apply to this project. The standard connection details that directly apply to this project are listed in the project installation documents binder.*			*REMINDER: To complete your Installation Review, you must photograph the panels before covering them.* ***See the Installation Review Process in Appendix A of the Assembly Manual.***
Are beam pockets and bearing points for non-Greenstone headers installed correctly? • Beam pockets and bearing points for non-Greenstone headers are to have a minimum of two layers of plywood as specified in the Greenstone assembly drawings.			
Are all the pre-drilled screw holes filled with screws? • At minimum, 4 pre-drilled holes in Greenstone connection hardware are to be filled with screws. • In the event that the pre-drilled holes do not line up with the steel stud of the wall panel, the installer must drill new screw holes. • Number of new holes must match number of existing pre-drilled holes.			

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1.0 INTRODUCTION

1.1 Greenstone ICE Panel

The ICE Panel is an engineered combination of expanded polystyrene and galvanized steel studs. The panel has load bearing, sound transmission, thermal insulation, and vapour barrier characteristics. This manual outlines the proper method for erecting buildings using the ICE Panel. The directions found in this manual must be observed to achieve the full effectiveness of the characteristics of the system and for Greenstone's Engineer approval.

IMPORTANT | DO NOT cover the Greenstone ICE Panel installation without written installation approval from Greenstone Building Products. (see section 2.5).

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1.2 | Before You Get Started..



Review and complete the Greenstone Pre-Build Checklist.



Read all installation and connection details provided in the Install Package.



Confirm a square and level foundation. The maximum tolerance is 1/8" for an efficient Greenstone installation. If foundation is not level, grind high spots and/or shim Greenstone base track.

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IMPORTANT | Always use foams, adhesives, membranes, and sealants approved for use with EPS and Steel.





Tape is used on interior connections. Foam is for use to fill gaps and voids.



Be sure not to strip your screws as this will VOID Greenstone's warranty.

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1.3 | Drawing & Element Numbers



Builders should study the appropriate drawings before beginning construction and assembly.



The provided Installation Drawings show an element number for each panel in the floor plan, which appears on the top and bottom end of each panel.



The leading edge of a ship lap panel always points the intended direction of assembly.

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2.0 ASSEMBLY

2.1 ICE Panel Assembly

STEP 1: Unloading & Staging your Site



Verify that the dimensions of your slab or subfloor match the contract drawings and coordinate with the Greenstone Installation Drawings.



Identify opening starts and stops and mark for reference. You will adjust the panels to these during installation by leaving slight gaps between panels on the interior wall.



When unloading, stack the panel bundles where they can easily be accessed for distribution once the base track is installed.



Protect panels from high winds and sharp impact.

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STEP 2: Track Layout, Installation and Panel Layout

ICE Panels are attached to the foundation using specified steel base track with wedge anchors (concrete) or specified screw fasteners (wood sub base). Size and spacing of anchors shall be installed as per installation drawings.



BELOW GRADE



ABOVE GRADE



Set interior split track to building dimensions & secure to slab or subfloor using specified anchors. Self adhered membrane must be installed overlapping the bottom flange of the inside split track and run out to overlap the rim board or face of wall below and extend past the transition by a minimum of 4.



Using a small panel (header) or foam block sized to match wall thickness (typically within the panel stacks), set exterior track relative to interior track.

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Be sure the track is level and corners are square. If the foundation is not level, shim and fill below track to obtain level.

IMPORTANT | Do NOT shim individual panels.



Mark start and stop of rough openings on exterior track per layout.

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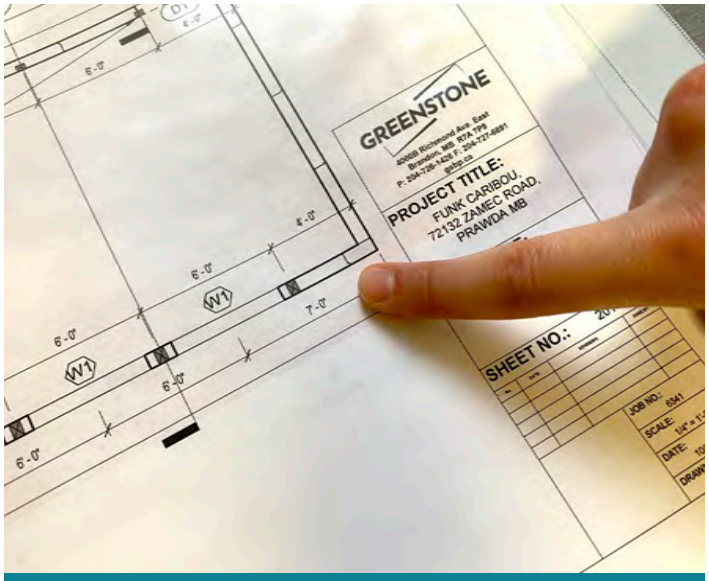
Determine sequence of panel assembly. It can initiate in any building corner, with the direction of assembly as shown on your installation drawings.



Unbundle and lay the panels near their install location for easy access during erection.

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STEP 3: Corner Installation



Reference the installation drawings to determine which panel runs to the outer edge of the corner.



Install **outside corner connector plate** (OC) at approximately 6', or 2' down from top of first panel.



Place first corner panel into the corner.



Straighten, square and secure panel to bottom track with one screw.

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Place other corner panel approximately 1" from the first panel.



Apply foam (in a corner butt joint application) between the panels from top to bottom, and push panels together.



Plumb both ways and secure with the outside corner connector. Screw to the bottom track so the panels cannot move.



You should have a straight and plumb starting point.

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STEP 4: Wall Panel Assembly

Once the corner is installed, follow the install direction on the installation drawings.



IMPORTANT | Do not winch panels tight.
Any gaps will be foamed shut later.



Place the next panel into track and tilt
up against previous panel.





Plumb panel and install connector plate with 4 screws into the leading edge of the previous panel.

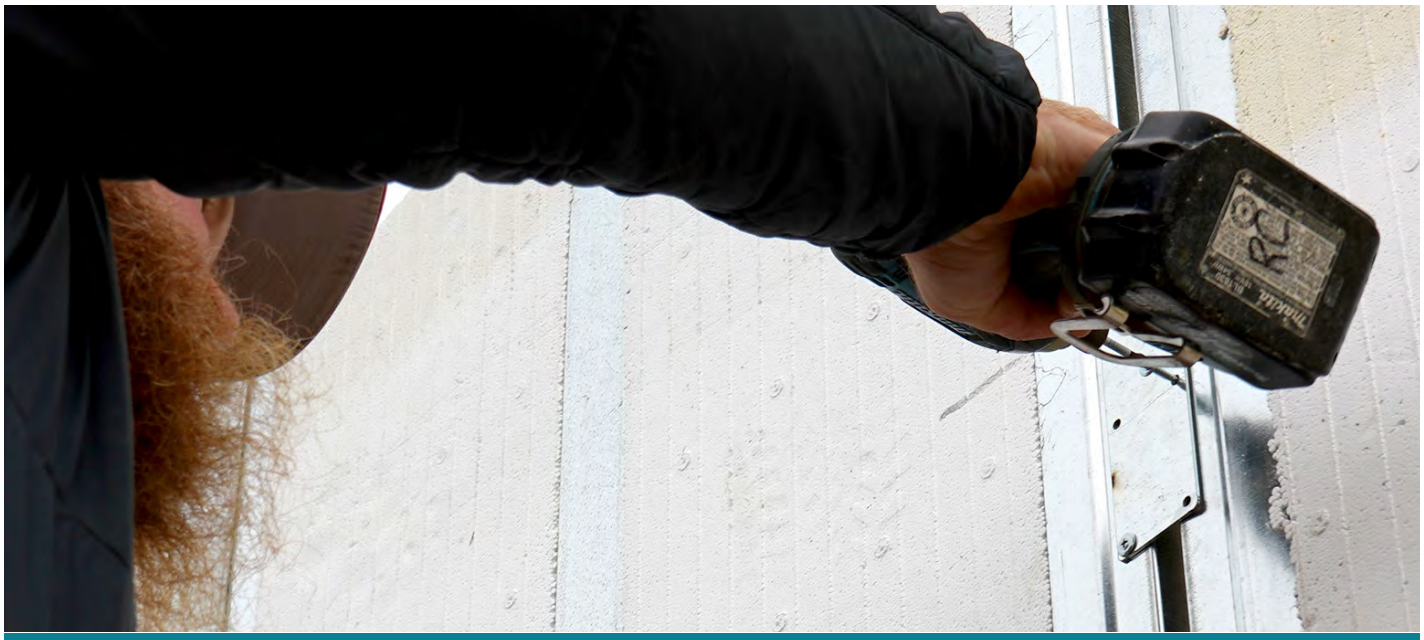
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IMPORTANT | When there is no shiplap, the panels may not touch when correctly placed.





Gaps will be foamed and the interior joints will be sealed with approved tape. Install 1 screw in second stud from edge on either side (exterior typically) of the panel on one side of the base track only.



Only install fasteners on one side of the envelope during erection at this time.
Final fastening per connection details is completed as the final step in the installation process.

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Opening size & placement must be as per installation drawings. Adjust panel placement at openings accordingly as per layout.



Insulated Header panels are built 3/8” shorter than the opening to allow for placement and foaming.

IMPORTANT | Do NOT strip screws during installation.
If you strip a screw, be sure to add another right beside to ensure Greenstone Warranty remains valid.

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STEP 5: Bracing



Install temporary wall bracing at MAX 10' intervals during wall panel erection.



Bracing can be installed to the inside or outside of the building.



Use the side of rough openings to secure bracing when available.



Field Bent Connector Plate can be used as temporary brace connectors.

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Use appropriate screws to fasten bracing.



Ensure walls are straight as you brace to minimize adjustments.

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STEP 6: Installing the Load Bearing Channel (LBC)





Load Bearing Channels (LBC) are longer sections which tie the building together.
They must end on a stud. They should never end on a joint (6" past) and always join at a stud.



IMPORTANT | Begin LBC installation once more than 12' of straight wall length is erected.

Stagger LBC's termination from inside to outside a minimum of 24" to further straighten and stiffen the wall.

Gap between adjacent LBC's (ie. due to cutting error) shall not exceed ¼".

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On-site modification will be required to install exterior LBC's in the corner per connection details.



Interior LBC's stop at interior face of intersecting panel; **DO NOT** run to exterior of wall.



Install a continuous piece of LBC on the bottom of window openings on the interior & exterior panel faces of the opening.

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STEP 7: Straightening & Final Fastening





Once the panels are in place for one level, the overall dimensions and squareness of the building should be checked before proceeding with the assembly of any upper level floor or roof system.



String line the wall before final foaming any gaps.



Do a visual inspection of all joints after erection is complete. Spray foam any gaps on the inside & outside of the assembly.

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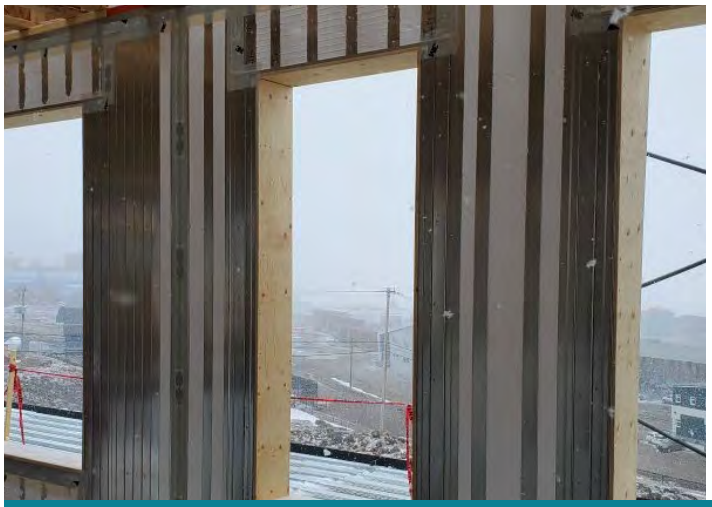
IMPORTANT | Do NOT strip screws during installation.

If you strip a screw, be sure to add another right beside to ensure Greenstone Warranty remains valid.

Install all connection plates and screws per connection details.

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STEP 8: SEALING WALLS: INTERIOR VAPOUR BARRIER/ EXTERIOR WEATHER BARRIER





Gaps and voids must be filled with low expansion foam. After final foaming and fastening, seal all interior joints with approved vapour tape. Tape must be approved for EPS and galvanized steel for air and vapour tightness.



Panel joints, floor to wall, and roof to wall joints require spray foam and approved tape on the inside of the assembly.

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STOP! BEFORE YOU COVER IT, PHOTOGRAPH IT!

DO NOT Cover Your ICE Panel Installation Without Receiving Your **INSTALLATION REVIEW** From Greenstone.

Before proceeding with the installation of the weather barrier, Greenstone requires photos of ALL installed panels (interior and exterior views) including all panel joints and connections in order to issue your **Installation Confirmation**.

See Appendix A for more information.



Always install a high vapour permeance weather barrier membrane on the exterior to act as a drainage plane to drain water away from the panel joints.

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2.2 Alternative Assembly of Interchangeable Panels

In assembly, some panels are identical and marked so by a Designation number before the individual panel identifying tag (ie. FA2). These panels are interchangeable and can be swapped out for other panels with the same Interchangeability Code.

Panel Labeling Chart

INTERCHANGEABILITY CODE			
Prefix	Prefix	Level	Number
1, 2, 3, etc..	F = Floor	A = First	1, 2, 3, etc..
1, 2, 3, etc..	R = Roof	B = Second	1, 2, 3, etc..
1, 2, 3, etc..	W = Wall	C = Third	1, 2, 3, etc..
1, 2, 3, etc..	H = Header	D = Fourth	1, 2, 3, etc..
1, 2, 3, etc..	C = Ceiling	E = Fifth	1, 2, 3, etc..

Example

Panel 1-FA27, as it would be labeled on the supplied shop drawing and the panel itself, could fit in place of any other panel starting with “1FA”. A panel labeled as 3-WA106 could fit where 3-WA1 is called for on the drawings, or 9-RB27 could fit where 9-RB43 is called for on the shop drawings.

The preceding number, along with the letters indicating the type of panel and what level it is at, dictate where the panel can go in the assembly. The letters along with the numbers track the individual panel for inventory, shipping and quality control purposes.

Panels without a number before the letter are unique and must be installed in the location designated by the shop drawings. Differences may not be apparent, and no assumptions may be made about their interchangeability.

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Important Note

If panels are substituted for identical panels other than the ones designated in the supplied shop drawings, the panel used as alternate needs to be recorded on a copy of the shop drawing, as an as built, and returned to the supplier after the project is assembled. This is for our product tracking, and is a necessary component of our quality control, and is therefor required for validity of Greenstone's warranty and engineer sign-off. As-built drawings are not required for interchangeable panels used in non-structural elements such as floors and roofs supported by trusses.

2.3 Wall Assembly Below Grade

Reference GSS Typ. Foundation Detail for either deep burial or shallow burial below grade installation. Follow wall assembly instructions above. Add PWF Plywood / dimple board and waterproofing membrane as shown.

2.4 Roof and Floor Assembly

Reference Connection Details provided for assembly requirements for Roof and Floor Assembly.

Leading edge for floor and roof assembly is on the bottom side, placed against support and attached with a roof/floor clip through the ship lap and leading edge.

When sealing roof and floor connections, refer to Connection Details:

- **Ship Lap Connection** – Apply continuous bead of foam to ship lap joint before installing next roof panel. Foam any remaining gap with foam after installation. Fill any gap between panels with foam. Address all connections on the interior with vapour tape and use peel and stick membrane as per connection detail.
- **Butt Joint Connection** – Space panel approximately 1" apart from installed panel. Apply continuous bead of foam to fill void between panels. Press panels together and tape interior side of butt joint after installation is complete.

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2.5 Installation Compliance

To certify the ICE Panel installation and provide written installation approval, Installation Photos (panel connections, both interior and exterior sides, as well as connections to foundation, roof and other structural elements) must be provided to Greenstone for approval. An on-site inspection by an authorized Greenstone representative may also be required.

PLEASE NOTE | Do not cover the Greenstone ICE Panel installation without written installation approval from Greenstone.

The completed installation photos will be reviewed by Greenstone and a letter will be provided to you for the Structural Engineer of Record for the project. An engineering letter cannot be provided without installation review by Greenstone.

See Appendix A for a guide to achieving your Greenstone Installation Confirmation.

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3.0 QUALITY CONTROL

3.1 Inspection of Panels

Panels have been checked for density and fusion quality and for dimensions before shipment, but should be checked for damage and spot-checked for dimensions as they are unloaded and stacked. For dimensional tolerances refer to section 3.3 below.

As a general rule, any defect in the polystyrene core of the panel such as small cuts or nicks will not affect the integrity of the panel. Damage to the metal will affect the panel's strength and integrity and can result in a rejected panel; refer to 3.2 below.

3.2 On-site Changes

In general, any changes deemed necessary on-site must be cleared with the manufacturer before the changes are made.

The following site changes may be made:

- Reject any panel with vertical steel members that are buckled.
- Electrical Boxes: Use a hot knife or other acceptable cutting tool. Do not exceed the box dimensions and, where possible, locate the box beside a vertical steel channel for screw attachment. Boxes should have recessed "ears" or brackets behind the wall cladding.
- Wiring or Conduit Chases. Vertical chases may be cut in to the polystyrene with a hot knife or other acceptable cutting tool. Vertical chases shall be cut a minimum of 2" from any vertical steel channel. Do not exceed half the panel thickness in depth or 1" in width when making these cuts. Do not cut or drill any steel without approval from an engineer.
- After installing wire, conduit or boxes, refill cut areas with low-expansion foam to seal and secure wires and boxes.

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3.3 Dimensional Tolerances

PANELS:

- Thickness ± 1/8"
- Panel Bow ± 1/8”
- Width ± 0", - 1/4"
- Additional Width Deviation at mid height + 0", - 1/4"
- Length ± 1/4”
- Length difference between panels of same nominal length ± 1/8"
- Diagonal out of square ± 1/4"

DOOR, WINDOW, AND OTHER ROUGH OPENINGS:

- Width ± 1/4"
- Length ± 1/4"
- Diagonal out of square ± 3/8"

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4.0 SAFETY

The panels may be handled by one or two people. The following rules should be followed:

- Gloves should be worn at all times when moving panels. The metal edges can cut and must be handled carefully.
- Do not remove panels in high wind conditions. The surface of the panel will catch the wind and can create a potentially hazardous condition.
- If high winds are possible, panels must be sheltered, weighted, or otherwise protected from moving.

5.0 DRAWINGS AND REFERENCE DOCUMENTS

The following documents are required for installation and will be provided as part of the GREENSTONE Installation Documents sent by your Greenstone Supplier:

- Greenstone Ice Panel Assembly Manual
- Greenstone Project Specific Installation Drawing Package
- Greenstone Project Specific Connection Details
- Greenstone Structural Inspection Checklist

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Appendix A

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STOP..

Before you cover it, photograph it.

DO NOT Cover Your ICE Panel Installation Without Receiving Your INSTALLATION REVIEW From Greenstone.

> Greenstone requires photos of ALL installed panels (interior and exterior views) including all panel joints and connections in order to issue your **Installation Confirmation**.

Free PROMO
On our Social Media

We want to promote you on our social media! Send us some photos of your team at the job site and we will post about it on our Facebook, Instagram, and LinkedIn accounts. Love our product? Let's make a testimonial video! Contact your sales rep to make arrangements.

See back page for photo instructions.

GSBP.CA

Here's How to Complete Your Installation Review:

To review the ICE Panel installation and provide written installation confirmation, **INSTALLATION PHOTOS** (panel connections, both interior and exterior sides, as well as connections to foundation, roof and other structural elements) must be provided to Greenstone for review. An on-site inspection by an authorized Greenstone representative may also be required. The completed installation photos will be reviewed by Greenstone and a confirmation letter will be provided to you for the project's Structural Engineer of Record. An engineering letter cannot be provided without installation review by Greenstone.

- Please send photos of each completed stage of the project as they are done to expedite your review process. Timeline for installation photo review is a minimum of 5 business days.
- DO NOT send photos of incomplete work. Ensure all installation criteria has been met **before** submitting photos for review.



Take photos in a walk-around fashion starting with Panel #1 in a corner.



Take exterior photos showing 15-20 foot sections of wall per photo.



Make sure the photos overlap so the picture progression can be followed.

RULE OF THUMB | If you can see the screws when you zoom in, you are close enough. Extreme close-ups are not required; we can zoom in to see the connections.



Take a few shots from far away showing the whole building.



Take Interior photos from as far back from the wall as possible, and include 15-20 foot sections of wall per photo.

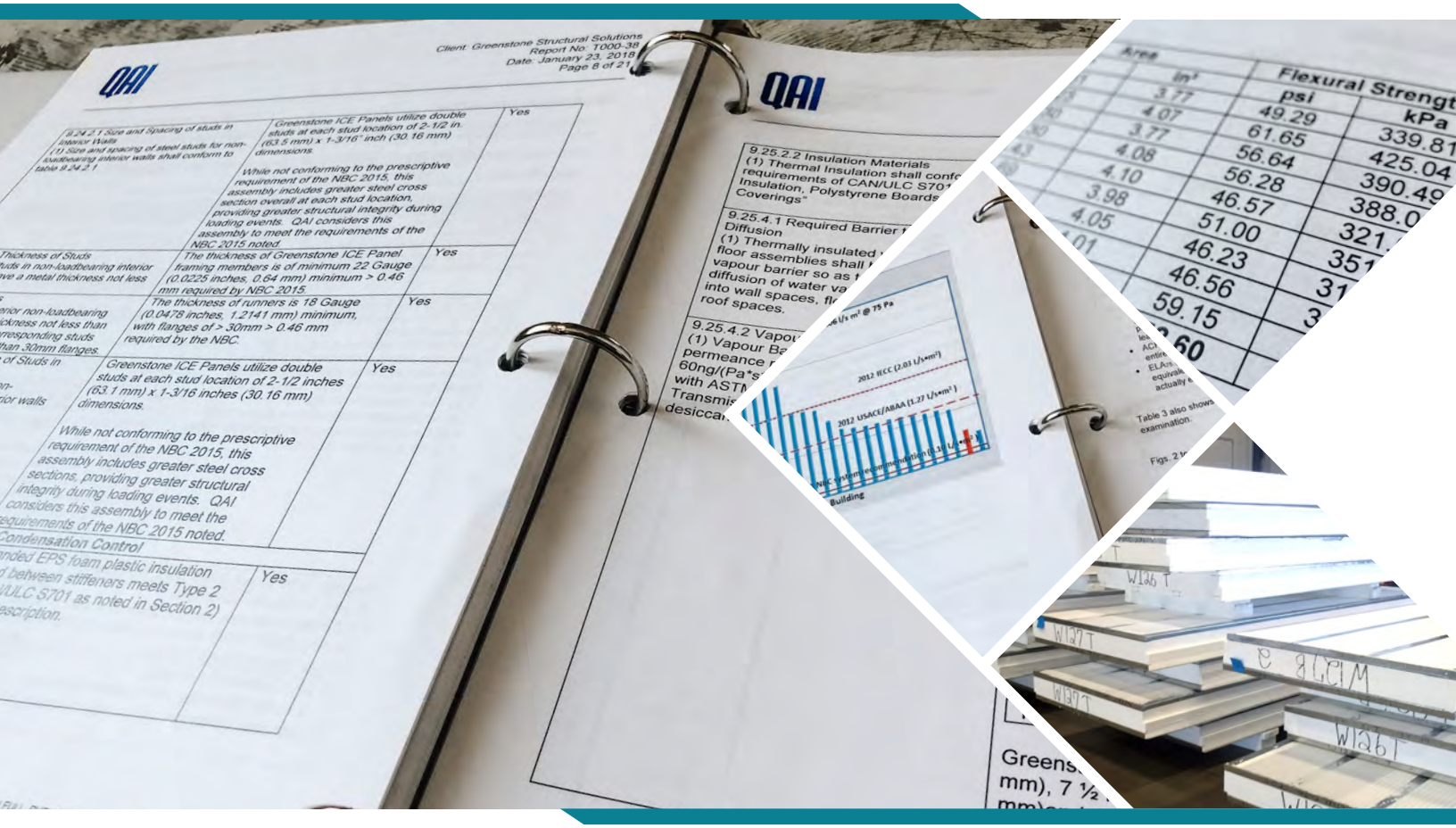


When a close-up photo is warranted (ie. a beam pocket) take a photo further back first, then close up.

REMEMBER! We need to see all installed panels, panel-to-panel connections, as well as connections to foundation, roof, and other structural elements.

APPENDIX F
TEST DATA

GREENSTONE
BUILDING PRODUCTS



ICE PANEL

TEST DATA

UPDATED AS OF 2025.04.14

TABLE OF CONTENTS

BUILDING PRODUCT LISTING | QAI LABORATORIES 5

ENGINEERING EVALUATION | QAI LABORATORIES *Updated to NBC 2020 19

ENERGUIDE RATING REPORT (PENNER RESIDENCE) | ENERGUIDE 51

ENERGUIDE RATING REPORT (99 DODDS RESIDENCE) | ENERGUIDE 55

EFFECTIVE RSI CALCULATION (THERM) | COEFFICIENT BUILDING SCIENCE 59

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WASHINGTON, DC: 540.636.9445 ph. | 540.636.9414 fx.
TULSA, OK: 918.437.8333 ph. | 918.437.8487 fx.
TORONTO, ON 905.605.5444
WEBSITE: WWW.QAI.ORG

BUILDING PRODUCTS LISTING PROGRAM

Customer: Greenstone Building Products Ltd.
Class: Insulated Structural Panels
Website: www.gsbp.ca

Locations: Brandon, Manitoba, Canada

Listing No. B1122-1
Project No. B1122-1 Edition 1

Effective Date: November 5, 2020
Last Revised Date: December 8, 2020
Expires: N/A

Standards:

ASTM C578	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
CAN/ULC-S701	Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
UL 723	Standard for Test for Surface Burning Characteristics of Building Materials.
CAN/ULC-S102.2	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
CAN/ULC-S101	Standard Methods of Fire Endurance Tests of Building Construction and Materials.
ASTM E119	Standard Test Methods for Fire Tests of Building Construction and Materials.
ASTM E72	Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
ASTM E564	Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings.

Product: Greenstone Insulated Composite Envelope (ICE) Prefabricated Wall Panels.

Markings: Each panel is marked with a permanent label containing the following information:

a) Manufacturers name or recognized trademark
b) Product name
c) Date of manufacture
d) QAI file number: B1122
e) UL 723 / CAN/ULC S102.2 Flame Spread Index and Smoke Developed Index (UL 723 FSI ≤ 25 / SDI ≤ 450) (S102.2 FSI ≤ 250 SDI ≥ 500).
f) QAI logo shown here:

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Models / Ratings:

The following outlines Greenstone Building Products ICE panel performance determined in accordance with the noted standards.

Greenstone Building Products ICE panel thermal insulation specifications per CAN/ULC-S701:

PROPERTY	Expanded Polystyrene Insulation TYPE 2
Thermal Resistance Minimum at 25 mm Thickness (m^2*^oC/W)	0.70
Water Vapour Permeance Maximum at 25 mm Thickness ($Ng/Pa*s*m^2$)	200
Dimensional Stability Maximum Linear Change (%)	1.5
Flexural Strength Minimum (kPa)	240
Water Absorption By Volume Maximum (%)	4.0
Compressive Strength Minimum at 10% Deformation (kPa)	110
Limiting Oxygen Index Minimum (%)	24

Greenstone Building Products ICE panel thermal insulation surface burning characteristics determined in accordance with CAN/ULC S102.2:

EXPANDED POLYSTYRENE (EPS) INSULATION	DENSITY	MAXIMUM THICKNESS	FLAME SPREAD INDEX (FSI)	SMOKE DEVELOPED INDEX (SDI)
Type 2 (Type II) EPS	Maximum 32 kg/m^3	100 mm Maximum	≤ 250	≥ 500

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Greenstone Building Products ICE panel thermal insulation specifications per ASTM C578:

PROPERTY	Expanded Polystyrene Insulation TYPE II
Compressive Strength Minimum @ 10% Deformation (psi)	15.0
Thermal Resistance Minimum @ 1 inch Thick (F*ft²*h/Btu)	4.0
Flexural Strength Minimum (psi)	35.0
Water Vapor Permeance @ 1 inch Thickness Maximum (Perms)	3.5
Water Absorption By Volume Maximum (%)	3.0
Dimensional Stability Linear Change Maximum (%)	2.0
Oxygen Index Minimum (%)	24.0
Density Minimum (lbs/ft³)	1.35

Greenstone Building Products ICE panel thermal insulation surface burning characteristics determined in accordance with UL 723:

EXPANDED POLYSTYRENE (EPS) INSULATION	DENSITY	MAXIMUM THICKNESS	FLAME SPREAD INDEX (FSI)	SMOKE DEVELOPED INDEX (SDI)
Type 2 (Type II) EPS	Maximum 2.0 lbs/ft³	6.0 Inches Maximum	≤ 25	≤ 450

Greenstone Building Products ICE panels fire-resistance ratings per CAN/ULC-S101 & ASTM E119 – Loadbearing† Walls and Partitions:

QAI Design #	Fire Resistance Rating	Sheathing
B1122-1a	**CAN/ULC-S101/ASTM E119 1 Hour Restricted – Load Bearing[1] Fire Resistance-Rated Wall Assembly**	**2 Layers Gypsum Board facing interior**
B1122-1b	**CAN/ULC-S101/ASTM E119 2 Hour Non-Load Bearing Fire Resistance-Rated Wall Assembly**	**2 Layers Gypsum Board over 25 mm (1 inch) mineral wool insulation on interior face. 1 layer gypsum board on unexposed face.**

[1] Restricted-Load Bearing - Load rating for this assembly is 50% of the design load determined in accordance with CSA S136 or AISI S100.

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Greenstone Building Products ICE panels Transverse Load Resistance determined in accordance with ASTM E72:

Transverse Load Resistance Imperial[1,2,3,4] Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels							
PANEL THICKNESS inches	STUD SPACING Inches	STEEL GAUGE	PANEL HEIGHT ft	DEFLECTION LIMIT lbs/ft²			MAX PRESSURE lbs/ft²
				L/360	L/240	L/180	
5.5	16	20	8	42.1	60.1	74.3	125.9
			10	26.4	39.7	48.6	94.5
			12	18.9	27.6	35.7	69.7
		18	8	39.7	59.0	77.9	130.6
			10	24.4	38.3	50.7	76.7
			12	21.5	32.0	40.2	76.7
		16	8	49.6	69.6	87.7	144.0
			10	30.7	45.2	57.5	79.4
			12	23.2	34.6	45.4	79.4
7.5	12	20	10	53.6	79.0	103.0	162.7
		16	8	81.8	120.8	157.0	240.7
			10	63.7	91.1	114.8	168.7
			12	45.1	69.4	88.4	158.8
7.5	16	20	8	55.8	78.5	99.6	174.5
			10	39.7	59.2	79.7	118.8
			12	32.8	47.4	60.2	94.0
		18	8	58.4	83.7	107.1	141.9
			10	38.2	57.0	76.4	106.1
			12	32.3	48.4	63.3	90.2
		16	8	59.9	85.9	107.9	159.5
			10	42.6	64.0	81.9	107.3
			12	37.8	54.5	70.5	95.9
9.25	12	20	8	85.5	121.6	153.9	267.2
			10	62.0	90.2	116.0	189.4
			12	50.7	74.0	93.9	151.5
11.5	12	20	12	62.5	91.0	113.5	173.3

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Transverse Load Resistance Imperial[1,2,3,4]
Greenstone ICE Type 2 / Type II (32.0 kg/m³, 2.0 lbs/ft³ Density) Panels

PANEL THICKNESS inches	STUD SPACING Inches	STEEL GAUGE	PANEL HEIGHT ft	DEFLECTION LIMIT lbs/ft²			MAX PRESSURE lbs/ft²
				L/360	L/240	L/180	
7.5	8	20	10	83.4	121.9	162.3	307.4
9.25	8	20	10	101.1	143.8	186.6	303.5

Transverse Load Resistance Imperial[1,2,3,4]
Greenstone ICE Type 2 / Type II (40.0 kg/m³, 2.5 lbs/ft³ Density) Panels

PANEL THICKNESS inches	STUD SPACING Inches	STEEL GAUGE	PANEL HEIGHT ft	DEFLECTION LIMIT lbs/ft²			MAX PRESSURE lbs/ft²
				L/360	L/240	L/180	
7.5	8	20	8	127.6	186.2	240.7	372.1
			10	94.7	139.9	181.7	352.7
7.5	12	20	10	76.1	107.6	138.0	230.4

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Transverse Load Resistance Metric[1,2,3,4] Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels							
PANEL THICKNESS mm	STUD SPACING mm	STEEL GAUGE	PANEL HEIGHT mm	DEFLECTION LIMIT kPa			MAX PRESSURE kPa
				L/360	L/240	L/180	
140	406	20	2438	2.0	2.9	3.6	6.0
			3048	1.3	1.9	2.3	4.5
			3658	0.9	1.3	1.7	3.3
		18	2438	1.9	2.8	3.7	6.3
			3048	1.2	1.8	2.4	3.7
			3658	1.0	1.5	1.9	3.7
		16	2438	2.4	3.3	4.2	6.9
			3048	1.5	2.2	2.8	3.8
			3658	1.1	1.7	2.2	3.8
191	305	20	3048	2.6	3.8	4.9	7.8
		16	2438	3.9	5.8	7.5	11.5
			3048	3.0	4.4	5.5	8.1
			3658	2.2	3.3	4.2	7.6
191	406	20	2438	2.7	3.8	4.8	8.4
			3048	1.9	2.8	3.8	5.7
			3658	1.6	2.3	2.9	4.5
		18	2438	2.8	4.0	5.1	6.8
			3048	1.8	2.7	3.7	5.1
			3658	1.5	2.3	3.0	4.3
		16	2438	2.9	4.1	5.2	7.6
			3048	2.0	3.1	3.9	5.1
			3658	1.8	2.6	3.4	4.6
235	305	20	2438	4.1	5.8	7.4	12.8
			3048	3.0	4.3	5.6	9.1
			3658	2.4	3.5	4.5	7.3
292	305	20	3658	3.0	4.4	5.4	8.3

Transverse Load Resistance Metric[1,2,3,4] Greenstone ICE Type 2 / Type II (32.0 kg/m³, 2.0 lbs/ft³ Density) Panels							
PANEL THICKNESS mm	STUD SPACING mm	STEEL GAUGE	PANEL HEIGHT mm	DEFLECTION LIMIT kPa			MAX PRESSURE kPa
				L/360	L/240	L/180	
191	203	20	3048	4.0	5.8	7.8	14.7
235	203	20	3048	4.8	6.9	8.9	14.5

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Transverse Load Resistance Metric[1,2,3,4] Greenstone ICE Type 2 / Type II (40.0 kg/m^3, 2.5 lbs/ft^3 Density) Panels							
PANEL THICKNESS Mm	STUD SPACING mm	STEEL GAUGE	PANEL HEIGHT mm	DEFLECTION LIMIT kPa			MAX PRESSURE kPa
				L/360	L/240	L/180	
191	203	20	2438	6.1	8.9	11.5	17.8
			3048	4.5	6.7	8.7	16.9
191	305	20	3048	3.6	5.2	6.6	11.0

1. Transverse load capacity is determined based on minimum bearing of 3 inches at panel ends. Alternate bearing conditions for connection of panels for transferring loads to the underlying structure are outside the scope of this listing and are to follow the approved Engineering Design and project specifications.
2. Transverse loads are determined for Greenstone ICE panels only and do not consider the contribution from sheathing materials.
3. Allowable pressure determined based on CSA S136 Limit State Design (LS) methodology with $\Phi = 0.67$ for use in Canada.
4. Load capacities for Greenstone ICE panels used in the USA are directed to follow QAI Code Evaluation Report CER_{US}-1002.

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Greenstone Building Products ICE panels Axial Load Resistance determined in accordance with ASTM E72:

Axial Load Capacity Imperial[5,6,7,8,9] Greenstone ICE ICE Type 2 / Type II (24.0 kg/m^3, 1.5 lbs/ft^3 Density) Panels					
PANEL THICKNESS inches	STUD SPACING Inches	GAUGE	MAXIMUM HEIGHT ft	LOAD @ COMPRESSION LIMIT Δ = 1/8 inch lbs/ft	MAXIMUM ALLOWABLE LOAD [10] lbs/ft
5.5	16	20	≤ 12	6,571	6,571
		18		8,639	8,639
		16		10,674	`10,674
7.5	12	20	≤ 12	8,214	8,214
		18		10,799	10,799
		16		13,343	13,343
7.5	16	20	≤ 12	6,571	6,571
		18		8,639	8,639
		16		10,674	10,674

Axial Load Capacity Metric[5,6,7,8,9] Greenstone ICE Type 2 / Type II (24.0 kg/m^3, 1.5 lbs/ft^3 Density) Panels					
PANEL THICKNESS mm	STUD SPACING mm	GAUGE	MAXIMUM HEIGHT mm	LOAD @ COMPRESSION LIMIT Δ = 1/8 inch kN/m	MAXIMUM ALLOWABLE LOAD [10] kN/m
140	406	20	3658	95.9	95.9
		18		126.1	126.1
		16		155.8	155.8
191	305	20	3658	119.9	119.9
		18		157.6	157.6
		16		194.7	194.7
191	406	20	3658	95.9	95.9
		18		126.1	126.1
		16		155.8	155.8

5. Allowable loads are determined for Greenstone ICE panels without sheathing, thermal barrier or ignition barrier.
6. Allowable loads are determined for uniformly distrubuted load over Greenstone ICE panels. For point loads, top track (LBC) or additional reinforcing may be added where supported by by Engineering Design and approved by the authority having jurisdiction.
7. Connection details including attachment of floor and roof panels, and connection of wall panels to the underlying structure is outside the scope of this report, and is to be in accordance with Engineering Design and project specifications
8. Allowable loads determined based on CSA S136 Limit State Design (LS) methodology with Φ = 0.67 for use in Canada.
9. Load capacities for Greenstone ICE panels used in the USA are directed to follow QAI Code Evaluation Report CER_{US}-1002.

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Greenstone Building Products ICE panels Racking Shear Load Resistance determined in accordance with ASTM E564:

Racking Shear Capacity Imperial Greenstone ICE Type 2 / Type II (24.0 kg/m^3, 1.5 lbs/ft^3 Density) Panels[10,11,12]							
PANEL THICKNESS inches	STUD SPACING Inches	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT lbs/ft			MAXIMUM ALLOWABLE LOAD [10] lbs/ft
				H/500	H/360	H/240	
7.5	16	20	1:1	153	180	226	414
Racking Shear Capacity Imperial Greenstone ICE Type 2 / Type II (24.0 kg/m^3, 1.5 lbs/ft^3 Density) Panels with 7/16 PS2 Rated Exterior Grade Oriented Strand Board on Exterior Face[10,11,12,13]							
PANEL THICKNESS inches	STUD SPACING Inches	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT lbs/ft			MAXIMUM ALLOWABLE LOAD [10] lbs/ft
				H/500	H/360	H/240	
7.5	16	20	1:1	594	594	594	594
Racking Shear Capacity Imperial Greenstone ICE Type 2 / Type II (24.0 kg/m^3, 1.5 lbs/ft^3 Density) Panels with 16 Gauge, 33 ksi G60 Steel Strapping Exterior Face[10,11,12,14]							
PANEL THICKNESS inches	STUD SPACING Inches	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT lbs/ft			MAXIMUM ALLOWABLE LOAD [10] lbs/ft
				H/500	H/360	H/240	
7.5	16	20	1:1	381	507	567	567

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Racking Shear Capacity Metric Greenstone ICE Type 2 / Type II (24.0 kg/m^3, 1.5 lbs/ft^3 Density) Panels[10,11,12]							
PANEL THICKNESS mm	STUD SPACING mm	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT kN/m			MAXIMUM ALLOWABLE LOAD [10] kN/m
				H/500	H/360	H/240	
191	406	20	1:1	2.2	2.6	3.3	6.0
Racking Shear Capacity Metric Greenstone ICE Type 2 / Type II (24.0 kg/m^3, 1.5 lbs/ft^3 Density) Panels with 7/16 PS2 Rated Exterior Grade Oriented Strand Board on Exterior Face[10,11,12,13]							
PANEL THICKNESS mm	STUD SPACING mm	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT kN/m			MAXIMUM ALLOWABLE LOAD [10] kN/m
				H/500	H/360	H/240	
191	406	20	1:1	8.7	8.7	8.7	8.7
Racking Shear Capacity Metric Greenstone ICE Type 2 / Type II (24.0 kg/m^3, 1.5 lbs/ft^3 Density) Panels with 16 Gauge, 33 ksi G60 Steel Strapping Exterior Face[10,11,12,13,14]							
PANEL THICKNESS mm	STUD SPACING mm	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT kN/m			MAXIMUM ALLOWABLE LOAD [10] kN/m
				H/500	H/360	H/240	
191	406	20	1:1	5.6	7.4	8.3	8.3

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10. Connection details including attachment of floor and roof panels, and connection of wall panels to the underlying structure is outside the scope of this report, and is to be in accordance with Engineering Design and project specifications.
11. Allowable loads determined based on CSA S136 Limit State Design (LS) methodology with $\Phi = 0.50$ for use in Canada.
12. Load capacities for Greenstone ICE panels used in the USA are directed to follow QAI Code Evaluation Report CER_{US}-1002.
13. OSB is to be installed with minimum #6- 1-1/2 in. (38 mm) self-tapping screws, spaced at 6 in. (153 mm) around the perimeter, and 12 in. (305 mm) in the field with minimum 1 in. (25 mm) distance from OSB panel edges at perimeter installation. OSB joints are to be blocked with 16 Ga. steel straps, with fasteners staggered along each panel joint at 6 in. (152 mm) where OSB joints are not over studs.
14. Steel straps are required to be minimum 5-1/4 in. (133 mm) width and extend from panel corner to panel corner at maximum 8 ft (2432 mm) lengths. Steel straps are required to be connected to Greenstone ICE panels with three minimum #10-3/4 in. (19 mm) self-tapping screws at each strap end, and two #10-3/4 in. (19 mm) self-tapping screws installed at each stud location

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Greenstone Building Products ICE panel header components have the following structural capacities:

Header Z-Channel Strength [15]														
Z-Channel Designation	Height (h)		Gauge Thickness (t)		S_{x+}		I_x		A_w	F_v	Moment Resistance		Shear Resistance	
Height-Shape-Gauge	inches	mm	inches	mm	in^3	mm^3	in^4	mm^4	mm^2	mPa	kN m	ft lbs	kN	lbs
4Z16	4	101.6	0.063	1.588	0.441	7.23E+03	0.954	4.0E+05	161.29	412.27	1.48	1089	59.85	13.4
4Z14	4	101.6	0.078	1.984	0.540	8.85E+03	1.169	4.9E+05	201.61	644.18	1.81	1333	116.89	26.2
4Z12	4	101.6	0.109	2.778	0.727	1.19E+04	1.574	6.6E+05	282.26	1262.59	2.44	1795	320.74	71.9
6Z16	6	152.4	0.063	1.588	0.808	1.32E+04	2.578	1.1E+06	241.94	183.23	2.71	1995	39.90	8.9
6Z14	6	152.4	0.078	1.984	0.994	1.63E+04	3.173	1.3E+06	302.42	286.30	3.34	2454	77.92	17.5
6Z12	6	152.4	0.109	2.778	1.349	2.21E+04	4.305	1.8E+06	423.39	561.15	4.53	3331	213.82	48.0
8Z16	8	203.2	0.063	1.588	1.261	2.07E+04	5.302	2.2E+06	322.58	103.07	4.23	3114	29.92	6.7
8Z14	8	203.2	0.078	1.984	1.555	2.55E+04	6.543	2.7E+06	403.23	161.04	5.22	3839	58.44	13.1
8Z12	8	203.2	0.109	2.778	2.120	3.47E+04	8.923	3.7E+06	564.52	315.65	7.11	5234	160.37	36.0
10Z16	10	254	0.063	1.588	1.797	2.94E+04	9.378	3.9E+06	403.23	65.96	6.03	4437	23.94	5.4
10Z14	10	254	0.078	1.984	2.221	3.64E+04	11.592	4.8E+06	504.03	103.07	7.45	5484	46.75	10.5
10Z12	10	254	0.109	2.778	3.039	4.98E+04	15.864	6.6E+06	705.64	202.01	10.20	7504	128.29	28.8
12Z16	12	304.8	0.063	1.588	2.418	3.96E+04	15.056	6.3E+06	483.87	45.81	8.11	5970	19.95	4.5
12Z14	12	304.8	0.078	1.984	2.992	4.90E+04	18.634	7.8E+06	604.84	71.58	10.04	7388	38.96	8.7
12Z12	12	304.8	0.109	2.778	4.105	6.73E+04	25.567	1.1E+07	846.77	140.29	13.77	10136	106.91	24.0
14Z16	14	355.6	0.063	1.588	3.122	5.12E+04	22.585	9.4E+06	564.52	33.65	10.48	7708	17.10	3.8
14Z14	14	355.6	0.078	1.984	3.868	6.34E+04	27.980	1.2E+07	705.64	52.59	12.98	9550	33.40	7.5
14Z12	14	355.6	0.109	2.778	5.317	8.71E+04	38.470	1.6E+07	987.90	103.07	17.84	13128	91.64	20.6

15. Allowable loads determined based on CSA S136 Limit State Design (LS) methodology.

Notes: Products must be installed with the manufacturer's published installation instructions and in accordance with the building codes recognized by the authority having jurisdiction.

Product is to be installed in accordance with the QAI Design Listing and manufacturer's published installation instructions by qualified installing personnel.

Listed manufacturers are subject to on-going inspections by QAI to ensure that the products outlined above remains as it is listed.

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CLIENT: **GREENSTONE BUILDING PRODUCTS**
4000B Richmond Avenue East
Brandon, Manitoba
Canada R7A 7P8

Evaluation Report No: QA-1286rev1	Revision Date: April 10, 2025

PRODUCT ID: Greenstone Insulated Composite Envelope (ICE) Panels.

AUTHORIZATION: Authorized by Ed Dornn, President on December 20, 2017 per QAI proposal 17NT122002 dated December 20, 2017. Update for evaluation based on application by Tilda Fortier signed March 7, 2025.

EVALUATION REQUESTED: Evaluation of Greenstone ICE Panels for use in exterior walls, interior walls, foundation, floor and roof applications of the following building types:

1. Housing and Small Buildings within the scope of Part 9.
2. Buildings that fall within the scope of Part 3, Part 4, Part 5.

REFERENCE METHODS: The evaluation was conducted following the applicable sections from Part 9, Part 3 Part 4 and Part 5 of the National Building Code of Canada 2020 (NBC 2020).

CONCLUSIONS: Based on review by QAI of Greenstone ICE Panels to applicable sections from Part 3, 4, 5 & 9 from the NBC 2020, QAI considers Greenstone ICE Panels have demonstrated compliance with applicable sections of Part 3, Part 4, Part 5 and Part 9 of the NBC 2020 per limitations outlined in this evaluation.

Signed for and on behalf of
QAI Laboratories Ltd.

Matt Lansdowne, P.Eng.
Director of Engineering

Kent Adamson
President

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EVALUATION PURPOSE

QAI Laboratories Ltd. (QAI) has been contracted by Greenstone Building Products (GBP) to conduct a review of the requirements of the National Building Code of Canada 2020 (NBC 2020) as it pertains to the usage of Greenstone Insulated Composite Envelope (ICE) structural panels with Tongue and Groove (T&G) and Ship Lap (S-L) joints for use in exterior wall, interior wall, and roof applications for the following type of buildings:

1) Housing and Small Buildings within the scope of Part 9.
2) Buildings that fall within the scope of Part 3, Part 4 and Part 5

Note, this evaluation considers Greenstone ICE panels considers the following limitations:

- ICE panels are installed with code complying weather and air barriers and flashings. As such, Part 5 compliance for environmental separation is not considered in this evaluation.
- ICE panels load capacity is to be determined by registered design professional. As such, Part 4 structural considerations and compliance is not considered in this evaluation.

This report outlines all the applicable sections from Part 9 & Part 3 of the NBC 2015 to demonstrate compliance with the applicable sections of the code for the noted Greenstone product.

PRODUCT DESCRIPTION

Greenstone ICE panels are factory manufactured with galvanized steel framing members and Type 2 expanded polystyrene (EPS) foam plastic insulation. The framing members of the panels consist of Stiffeners (the vertical member) and L-shaped metal brackets (horizontal members providing lateral support for the stiffeners). The stiffeners are 89 mm (3-1/2 inch) in width by 19 mm (¾ inch) in depth, by minimum 0.68 mm (24-gauge (0.0269 inch) thickness U-shaped steel, spaced at 406 mm (16 inch) or 610 mm (24 inch) on center (O.C.) along the width of panel depending on the design. Stiffeners are installed on both faces of the panel creating double stiffeners at each stud location. The stiffeners are braced with L-shaped brackets on either side of the panel to provide the racking shear and lateral bracing. The L-shaped metal brackets are 57.2 mm (2-1/4 inch) in length by 19 mm (¾ inch) in depth, 0.68 mm (24-gauge, 0.0269 inch) thick and are fastened around the perimeter of the panel. Refer to **Appendix A** for a diagram of the panel.

The cavities between the stiffeners are filled with factory installed Type 2 EPS insulation, complying with CAN/ULC S701.1-17, creating a thermal break between both sides of the panel. The EPS is bonded to the stiffeners during the manufacturing process by applying a thermosetting adhesive to the steel and the subjecting the framing members to low-pressure molding, forming the finished insulation around and to the stiffeners.

The standard width of panel is 1219 mm (4 ft) and are available in different lengths: 1829 mm (6 ft), 2438 mm (8 ft), 2743 mm (9 ft), 3049 mm (10 ft) and 3658 mm (12 ft). The standard panel thicknesses are outlined in the table below:

PRODUCT	CAN/ULC S701.1:17
Panel 140 mm (5 ½ Inch) Thickness EPS	Type 2
Panel 191 mm (7 ½ Inch) Thickness EPS	Type 2
Panel 235 mm (9 ¼ Inch) Thickness EPS	Type 2
Panel 292 mm (11 ½ Inch) Thickness EPS	Type 2

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The EPS at each end of the panel is shaped in tongue and groove or ship-lap contours to allow connection with adjacent panels. has flame spread index of ≤ 250, and smoke developed index ≥ 500 when tested in accordance with CAN/ULC S102.2-18

Greenstone ICE panels are evaluated and listed by QAI (listing B1100-1). Under this program, inspections are conducted at Greenstone's manufacturing facility to ensure consistent product quality. A copy of QAI's listing can be found in **Appendix B.**

Greenstone Structural Composite Panels vertical steel stiffeners, tracks, and L-brackets are detailed as ASTM A653, SS grade 37, complying steel with G90 galvanized coating per QAI listing program.

For fire resistance applications, Greenstone ICE panels achieved a load bearing 1-hour fire resistance rating with an applied 3,800 lbs/ft (55 kN/m) when tested to the CAN/ULC S101-14 "Standard Methods of Fire Endurance Tests of Building Construction and Materials" per QAI test report T1090-2a Rev.1 reissued November 2, 2017 with the test assembly constructed in the following manner:

Gypsum (Interior face)	Minimum 2 layers of 16 mm (5/8 inch) thick, Type X, complying with ASTM C1396 and listed by an approved agency. Both layers were fastened 203 mm (8 inch) on center (OC). The first layer was fastened using #6 x 32 mm (1-1/4 in.) Type S drywall screws and the second layer was fastened using #6 x 51 mm (2 in.) Type S drywall screws. All screw heads were covered with CGC Durabond 90 drywall compound. A 0.56 mm (24 Gauge) x 130 mm (5-1/8 in.) flat strapping was placed at each horizontal joint location of the first layer and screwed to the wall studs. CGC Durabond 90 drywall compound and 51 mm (2 in.) paper tape was used on the second layer.
Steel Framing	1.25 mm (18-gauge)_x 64 mm (2-1/2 inch) x 30 mm (1-3/16 inch) C-channel wall studs. The end studs at the joint have a 3mm (1/8 inch) x 25 mm (1 inch) jog in the channel along the 64 mm (2-1/2 inch) dimension. There is one row of studs on each side of the panels spaced 406 mm (16 inch) OC.
Insulation	191 mm (7-1/2 inch) thick Type 2 EPS with density of 24 kg/m^3 (1.5 lbs/ft^3).
Gypsum (Exterior Face)	Minimum 1 layer of 16 mm (5/8 inch) thick, Type X, exterior gypsum complying with ASTM C1177 and listed by an approved agency. The boards were fastened with #6 x 32 mm (1-1/4 inch) Type S drywall screws spaced 203 mm (8 inch) OC.

Greenstone ICE Panels have been found to have the following transverse load deflection performance when evaluated to ASTM E72-2015.

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140 mm (5.5 inch) Greenstone ICE Panels Transverse Load Resistance 406 mm (16'') Stud Spacing

STEEL GAUGE	PANEL HEIGHT	LOAD @ L/360 psf	Φ = 0.67 DEFLECTION psf
22	8	55.3	37.0
	10	37.4	25.1
	12	26.9	18.0
20	8	62.8	42.1
	10	39.5	26.4
	12	28.2	18.9
18	8	59.3	39.7
	10	36.4	24.4
	12	32.1	21.5
16	8	74.0	49.6
	10	45.8	30.7
	12	34.6	23.2

191 mm (7.5 inch) Greenstone ICE Panels Transverse Load Resistance 406 mm (16'') Stud Spacing

STEEL GAUGE	PANEL HEIGHT	LOAD @ L/360 psf	Φ = 0.67 DEFLECTION psf
22	8	77.5	51.9
	10	54.6	36.6
	12	43.8	29.3
20	8	83.2	55.8
	10	59.9	40.1
	12	49.0	32.8
18	8	87.1	58.4
	10	57.0	38.2
	12	48.2	32.3
16	8	89.4	59.9
	10	63.6	42.6
	12	56.4	37.8

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235 mm (9.25 inch) Greenstone ICE Panels Transverse Load Resistance 305 mm (12'') Stud Spacing

STEEL GAUGE	PANEL HEIGHT	LOAD @ L/360 psf	Φ = 0.67 DEFLECTION psf
20	8	127.7	85.6
	10	92.6	62.0
	12	75.6	50.7

292 mm (11.5 inch) Greenstone ICE Panels Transverse Load Resistance 305 mm (12'') Stud Spacing

STEEL GAUGE	PANEL HEIGHT	LOAD @ L/360 psf	Φ = 0.67 DEFLECTION psf
20	12	93.3	62.5

LIMITATIONS FOR USE

Greenstone ICE panel load capacity and site connection details are to be determined by registered design professional, registered in the province where the panels are to be installed, in accordance with Part 4 of the NBC 2020. Evaluation of the load carrying capacity of Greenstone ICE panels are outside the scope of this evaluation.

Installation and modification of Greenstone ICE panels including, but not limited too of electrical conduits, installation ducting, piping etc. are to be installed in accordance with the appropriate model code, and approved by the Authority Having Jurisdiction (AHJ).

The installation of building envelope components, including, but not limited to flashing, opening protectives, exterior sheathing, exterior cladding, air/vapour barriers, and roof coverings are to be in accordance with Part 3, Part 4, Part 5 or Part 9 as applicable of the NBC 2020 and approved by the AHJ.

Greenstone ICE are intended for use with a code prescribed thermal barrier as outlined in Part 3 or Part 9 as applicable of the NBC 2020.

REFERENCED STANDARDS AND REPORTS

1. National Building Code of Canada 2020 (NBC 2020).
2. QAI certification listing B1100-1.
3. CAN/ULC S701.1:17 "*Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering*".
4. CAN/ULC S102.2-17 "*Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies".*
5. CAN/ULC S101-14 "*Standard Methods of Fire Endurance Tests of Building Construction and Materials".*
6. ASTM E72-15 "*Standard Test Methods of Conducting Strength Tests of Panels for Building Construction*".
7. QAI test report T1100-2a Rev.1 revised November 2, 2017.

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NBC 2020 SECTIONS FOR REVIEW

The following sections from Part 3 and 9 of the NBC 2020 have been identified for review:

Part 9

9.4 Deflection
- 9.4.3.1 Defections

9.10 Fire Protection
- 9.10.3.1 Fire Resistance and Fire Protection Ratings

9.24 Sheet Steel Stud Wall Framing
- 9.24.1.2 Material Standards
- 9.24.1.3 Metal Thickness
- 9.24.2.1 Size of Framing
- 9.24.2.2 Thickness of Studs
- 9.24.2.3 Runners
- 9.24.2.5 Size and Spacing of Studs in Exterior Walls

9.25 Heat Transfer, Air Leakage, and Condensation Control
- 9.25.2.1 Required Insulation
- 9.25.2.2 Insulation Materials
- 9.25.3.1 Required Air Barrier to Air Leakage
- 9.25.3.2 Air Barrier Systems Properties
- 9.25.4.1 Required Barrier to Vapour Diffusion
- 9.25.4.2 Vapour Barrier Materials

Part 3

3.1.5 Noncombustible Construction
- 3.1.5.14 Combustible Insulation

3.1.7 Fire-Resistance ratings
- 3.1.7.1 Determination of Ratings

ICE panels are considered installed with code complying weather and air barriers and flashings, or design by a approved building envelope engineer is required for air leakage, water resistance and ensuring compliance for thermal performance. As such, Part 5 compliance for environmental separation is not considered in this evaluation.

ICE panels are intended for use with Engineering Design by an approved registered design professional, conducted in accordance with the applicable codes, including service loads, ICE panel capacities, and connection details. Greenstone ICE panels are not to exceed capacities outlined in transverse load capacities outlined in this report. As such, Part 4 structural considerations and compliance is not considered in this evaluation.

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ENGINEERING EVALUATION

This evaluation considers Greenstone ICE Panels of joint configuration Tongue and Groove (T&G) and Ship Lap (S-L) Panels for compliance with the NBC 2020 Part 9 & 3 for the sections listed below.

Please see Section 3) Limitations for details regarding areas not considered for evaluation by QAI.

NBC 2020 Part 9

Section	Evaluation	Compliance Yes / No
Section 9.4 Defection		
9.4.3.1 Defections (1) The maximum deflection of structural members shall conform to Table 9.4.3.1 Maximum defection ratio is 1/360	Transverse loads in PSF with limiting allowable deflection limits of 1/360 for 5-1/2 inch (140 mm), 7-1/2 inch (191 mm), 9-1/4 inch (235 mm) and 11-1/2 in. (292 mm) thick panels are as described in this report.	Yes
Section 9.10 Fire Protection		
9.10.3.1 Fire Resistance and Fire Protection Ratings (1) Where fire resistance rating or fire protection rating is required in this section for an element of a building, such rating shall be determine in conformance with: a) Test method from Part 3 b) Calculation Method from Appendix D c) Construction specifications from tables 9.10.3.1-A and 9.10.3.1-B	Greenstone ICE panels of minimum 7-1/2 inch (191 mm) thickness, achieved a 1-hour load bearing fire-resistance rating with applied load of 3,800 lbs/ft (55 kN/m) when tested to CAN/ULC S101 as detailed in QAI test report T1100-2a Rev.1 dated November 2, 2017 when constructed as described for use in fire-resistance ratings outlined in this report Assemblies of different construction and loading should be designed by a registered design professional or accredited certification body competent in evaluation of fire resistance rated assemblies and approved by the authority having jurisdiction.	Yes
Section 9.24 Sheet Steel Stud Wall Framing		
9.24.1.2 Material Standards (1) Steel studs and runners shall conform to AISI S201 “North American Standard for Cold-Formed Steel Framing”	Base thickness 22, 20, 18, 16 Gauge steel studs meet the base thickness requirements as per the AISI S201 standard per QAI listing program.	Yes
9.24.1.3 Metal Thickness (1) Metal thickness shall be the minimum base steel thickness exclusive of coatings	Base thickness 22, 20, 18, 16 Gauge meet the base thickness requirements as per the AISI S201 standard per QAI listing program.	Yes

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9.24.2.1 Size and Spacing of studs in Interior Walls (1) Size and spacing of steel studs for non-loadbearing interior walls shall conform to table 9.24.2.1	Greenstone ICE Panels utilize double studs at each stud location of 2-1/2 in. (63.5 mm) x 1-3/16" inch (30.16 mm) dimensions spaced at maximum 406 mm (16 inch) or 600 mm (24 inch) spacing. While not conforming to the prescriptive requirement of the NBC 2020, this assembly includes greater steel cross section overall at each stud location, providing greater structural integrity during loading events. QAI considers this assembly to meet the requirements of the NBC 2020 noted.	Yes
9.24.2.2 Thickness of Studs (1) Steel Studs in non-loadbearing interior walls shall have a metal thickness not less than 0.46 mm	The thickness of Greenstone ICE panel framing members are of minimum 0.64 mm (22-gauge) > 0.46 mm required by NBC 2020.	Yes
9.24.2.3 Runners (1) Runners for interior non-loadbearing walls shall have a thickness not less than the thickness of the corresponding studs and shall have not less than 30mm flanges.	The thickness of runners is minimum 1.21 mm (18-gauge) with flanges of > 30mm > 0.46 mm required by the NBC 2020.	Yes
9.24.2.5 Size and Spacing of Studs in Exterior Walls (1) The size and spacing of non-loadbearing steel studs for exterior walls shall conform to Table 9.24.2.5	Greenstone ICE panels utilize double studs at each stud location of 2-1/2 inches (63.1 mm) x 1-3/16 inches (30.16 mm) dimensions spaced at maximum 406 mm (16 inch) or 600 mm (24 inch) spacing. While not conforming to the prescriptive requirement of the NBC 2020, this assembly includes greater steel cross sections, providing greater structural integrity during loading events. QAI considers this assembly to meet the requirements of the NBC 2020 noted. Note, Greenstone ICE panels require Engineering Design for ICE panel heights to be used.	Yes

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Section 9.25 Heat Transfer, Air Leakage, and Condensation Control		
9.25.1.1 Scope 2) All walls, ceilings and floors separating conditioned space from unconditioned space, the exterior air or the ground shall be a) provided with i) thermal insulation conforming to Subsection 9.25.2 and Section 9.36. ii) an air barrier conforming to Subsection 9.25.3 and Section 9.36, and III) a vapour barrier conforming to Subsection 9.25.4 and b) constructed in such a way that the properties and relative position of all materials conform to Subsection 9.25.5.	Greenstone ICE are constructed of complying Type 2 EPS insulation. Finished panels are installed to create a uniform thermally resistance exterior assembly over the entire building envelope. ICE panels are intended for installation with a code complying air-barrier, or for Engineering Design of air leakage based by a registered building envelope design professional, or for after construction blower door testing to ensure air-leakage resistance construction. Type 2 EPS at the noted ICE panels is a vapour barrier as outlined below.	
9.25.2.1 Required Insulation (1) All walls, ceilings, floors separating heated space from unheated space, the exterior air or the exterior soil shall be provided with sufficient thermal insulation to prevent moisture condensation on their room side during the winter and to ensure comfortable conditions for the occupants.	Expanded EPS foam plastic insulation molded between stiffeners meets Type 2 per CAN/ULC S701.1:2017 as noted in Section 2) Product Description. Greenstone ICE are installed to provide a uniform insulating value over the entire insulating wall and roof area.	Yes
9.25.2.2 Insulation Materials (1) Thermal Insulation shall conform to the requirements of CAN/ULC S701.1 “Standard for Thermal Insulation, Polystyrene Boards”.	Per Section 2) of this evaluation, Greenstone ICE Panel EPS component is listed by QAI as Type 2 compliant, per CAN/ULC S701.1.	Yes
9.25.3 Air Barrier Systems 1) Wall, ceiling and floor assemblies separating conditioned space from unconditioned space or from the ground shall be constructed so as to include an air barrier that will provide a continouous barrier to air leakage a) From the interior of the building into wall, floor, attic or roof spaces, sufficient to prevent excessive moisture condensation in such spaces during the winter, and b) Form the exterior or the ground inward sufficient to i) prevent moisture condensation on the room side during winter, ii) ensure comfortable conditions for the occupants, and iii) minimize the ingress of soil gas	ICE panels are intended for installation with a code complying air-barrier, or for Engineering Design of air leakage based by a registered building envelope design professional, or for after construction blower door testing to ensure air-leakage resistance construction. Greenstone ICE panels are a continuous building envelope assembly, with joints taped, including all intersections. Penetrations and openings installed in Greenstone ICE requiring sealing to maintain the integrity of the air barrier system.	Yes

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<table>
<tr>
<td>9.25.4 Vapour Barriers
9.25.4.1 Required Barrier to Vapour Diffusion
(1) Thermally insulated wall, ceiling and floor assemblies shall be constructed with a vapour barrier so as to provide a barrier to diffusion of water vapour from the interior into wall spaces, floor spaces and attic or roof spaces.</td>
<td>Type 2 EPS insulation of the Greenstone ICE panel assembly, meets vapour barrier material requirements as outlined below.</td>
<td>Yes</td>
</tr>
<tr>
<td>9.25.4.2 Vapour Barrier Materials
(1) Vapour Barriers Shall have a permeance not greater than 60 ng/(Pa*s*m^2) measured in accordance with ASTM E96 “Water Vapour Transmission of Materials” using the desiccant method</td>
<td>Greenstone ICE Panel EPS component complies with CAN/ULC S701.1 Type 2 specifications.

Per CAN/ULC S701.1, 25 mm (1-inch thick) Type 2 EPS has maximum vapour permeance of 200 ng/(Pa*s*m^2).

The estimated vapour permeance of Greenstone ICE Panel EPS core materials of Type 2 specification considering the relationship between vapor permeance and thickness is shown as follows:

<table>
<tr><th>PANEL THICKNESS</th><th>VAPOR PERMEANCE ng/(Pa*s*m^2)</th></tr>
<tr><td>5 ½ (140 mm)</td><td>36</td></tr>
<tr><td>7 ½ (191 mm)</td><td>27</td></tr>
<tr><td>9 ¼ (235 mm)</td><td>22</td></tr>
<tr><td>11 ½ (292 mm)</td><td>17</td></tr>
</table>

Greenstone ICE Panels of 5 ½ in. (140 mm), 7 ½ in. (191 mm), 9 ¼ in. (235 mm)and 11 ½ in. (292 mm) EPS core thickness meet Vapour Barrier Material classification per the NBC 2020.</td>
<td>Yes</td>
</tr>
</table>

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NBC 2020 Part 3

Section	Evaluation	Compliance Yes or No
Section 3.1.5 Noncombustible Construction		
3.1.5.14 Combustible Insulation (4) Combustible insulation with a flame-spread rating more than 25 but less than 500 is permitted in the exterior walls of a building required to be of non-combustible construction, provided the insulation is protected from adjacent space in the building by a thermal barrier consisting of : a) gypsum board not less than 12.7mm thick mechanically fastened to a supporting assembly independent of the insulation (5) Combustible insulation with a flame-spread rating more than 25 but less than 500 is permitted in the exterior walls of a building required to be of non-combustible construction and not sprinklered and is more than 18 m high provided the insulation is protected from adjacent space in the building by a thermal barrier consisting of : a) gypsum board not less than 12.7mm thick, mechanically fastened to a supporting assembly independent of the insulation and with all joints either backed or taped and filled (6) Combustible insulation with a flame-spread rating more than 25 but less than 500 is permitted in the interior walls within ceiling and within roof assemblies of a building required to be of non-combustible construction and not sprinklered and is more than 18 m high provided the insulation is protected from adjacent space in the building by a thermal barrier consisting of: a) Type X gypsum board not less than 15.9mm thick, mechanically fastened to a support assembly independent of the insulation and with all joints either backed or taped and filled.	Greenstone ICE panels include Type 2 EPS with a flame spread ≤ 250 and smoke developed ≥ 500 when evaluated to CAN/ULC S102.2 at 4 inches (102 mm) thickness. Greenstone ICE panels are intended for installation with a code prescribed Thermal barrier in accordance to Sections 3.1.4, 3.1.5 and 9.10.17 to conform to sentences 3.1.5.14 (4), (5), and (6). The noted thermal barrier is anchored to the supporting assembly with thermal barrier attached to the framing members, and framing members attached to the runners, independent of the underlying insulation.	Yes
Section 3.1.7 Fire-Resistance Ratings		
3.1.7.1 (1) The ratings of an assembly or	Refer to section 9.10 Fire Protection	Yes

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Section	Evaluation	Compliance Yes or No
materials or structural member that is required to have a fire-resistance rating, shall be determined on the basis of the results of tests conducted in conformance with CAN/ULC S101 “Fire Endurance Tests of Buildings Construction and Materials”	outlining compliance of Greenstone Structural Composite Panels for use in 1-hour load bearing fire-resistance-rated applications where installed in accordance with Section 2) of this evaluation.	

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CONCLUSIONS

Applicable sections from Part 3 & 9 from the NBC 2020 were chosen to evaluate Greenstone ICE Panel of joint type Tongue and Groove (T&G) and Ship Lap.

The evaluation results described in this report demonstrate that Greenstone ICE panels in both T&G and S-L meet the applicable sections from both Part 3 & Part 9 of the NBC 2020:

1) Greenstone ICE Panel Steel stiffeners meet AISI S201 and are 18 Gauge or thicker, meeting Section 9.24.1.2 complying for use as interior non-load bearing walls.
2) Greenstone ICE Panel EPS insulation meets Type 2 specifications per CAN/ULC S701.1.
3) Greenstone ICE T&G and S-L Panels meet the requirements for use in buildings per Part 3 of the NBC 2020, where the EPS foam plastic insulation is protected by a thermal barrier of minimum ½" (12.7 mm) thick ASTM C1396 complying gypsum board or equivalent in accordance with Sections 3.1.5.14 & 3.1.5.15 where applicable. Panels are eligible for use in accordance with Section 3.1.5 of Part 3, where installation and components are in compliance with the appropriate sections of the code.
4) Greenstone ICE Panel meet requirements for use as environmental separators for separating conditioned space from unconditioned space when installed in combination with other materials and conform to Section 9.25.3 Air Barrier Systems.
5) Greenstone ICE Panels of 5 ½ inches (140 mm), 7 ½ inches (191 mm), 9 ¼ inches (235 mm) and 11 ½ inches (292 mm) thickness have a vapour pemeance of < 60 ng/Pa*s*m^2, and meet the requirements for vapour permeance.
6) Greenstone ICE panels maintain a 1-hour load bearing fire-resistance-rating in accordance with CAN/ULC S101 where the assembly is constructed in accordance with Product Description section of this evaluation and can be used where a 1-hour fire separation is required. Alternate installations outside this evaluation for loading or Greenstone panel configuration should be evaluated by a registered design professional or body competent in the review of fire rated assemblies and approved by the authority having jurisdiction.
7) Greenstone Structural Composite Panels meet the requirements for use in roofing applications, where the following is provided:

    a. Load carrying capacity is designed by a registered design engineer and approved by the Authority Having Jurisdiction.
    b. Roof panels are installed in accordance with section 9.25 Heat transfer, Air leakage, and condensation control to ensure the integrity of the air barrier system.
    c. roof coverings and underlayment are installed as per section 9.26 Roofing

As outlined in Section 3) Limitations of this evaluation, building envelope components including but not limited to flashing, opening protection, sheathing, secondary plane of protection and cladding are to be installed in accordance with the NBC 2020 and are outside the scope of this evaluation.

The load carrying capacity of the Greenstone ICE panels are to be determined by a registered design professional and approved by the Authority Having Jurisdiction.

Field installation of services including but not limited too electrical wiring, conduits, piping, ducting etc. are to be done in accordance with the NBC 2020 and the manufacturer's installation instructions. Where in conflict, the NBC 2020 takes precedence.

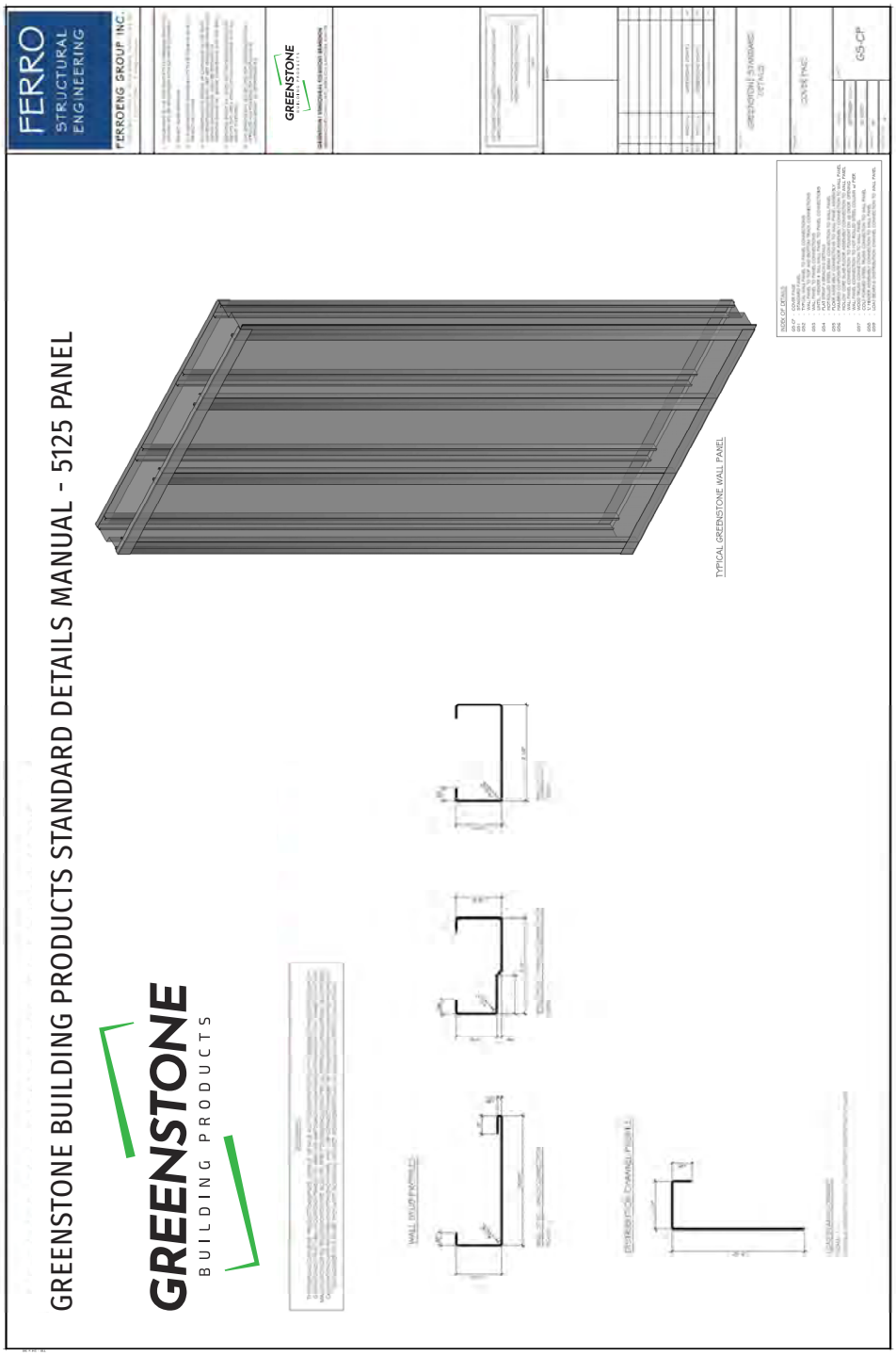
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It should be noted that specific jurisdiction, owners, architects, or engineers may have different interpretations and require additional testing to meet regional or other project specific needs; these additional requirements are considered beyond the scope of this project.

This report relates only to Greenstone T&G and S-L panels evaluated to the applicable sections from Part 3 & 9 of the NBC 2020.

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Appendix A



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Appendix B QAI LISTINGS

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BUILDING PRODUCTS LISTING PROGRAM

Customer: Greenstone Building Products Ltd.
Class: Insulated Structural Panels
Website: www.gsbp.ca

Locations: Brandon, Manitoba, Canada

Listing No. B1122-1
Project No. B1122-1 Edition 3

Effective Date: November 5, 2020
Last Revised Date: September 20, 2021
Expires: N/A

Standards:		
	ASTM C578	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
	CAN/ULC-S701.1	Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
	UL 723	Standard for Test for Surface Burning Characteristics of Building Materials.
	CAN/ULC-S102.2	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
	CAN/ULC-S101	Standard Methods of Fire Endurance Tests of Building Construction and Materials.
	ASTM E119	Standard Test Methods for Fire Tests of Building Construction and Materials.
	ASTM E72	Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
	ASTM E564	Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings.

Product: Greenstone Insulated Composite Envelope (ICE) Panel, and Black ICE Panels.

Markings: Each panel is marked with a permanent label containing the following information:

a) Manufacturers name or recognized trademark
b) Product name
c) Date of manufacture
d) QAI file number: B1122
e) UL 723 / CAN/ULC S102.2 Flame Spread Index and Smoke Developed Index (UL 723 FSI ≤ 25 / SDI ≤ 450) (S102.2 FSI ≤ 250 SDI ≥ 500).
f) QAI logo shown here:



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Models / Ratings: **The following outlines Greenstone Building Products ICE Panel and Black ICE Panel performance determined in accordance with the noted standards.**

Greenstone Building Products ICE Panel and Black ICE Panel thermal insulation specifications per CAN/ULC-S701.1:

PROPERTY	Expanded Polystyrene Insulation	
	ICE PANEL TYPE 2	BLACK ICE PANEL TYPE 2
Thermal Resistance Minimum at 25 mm Thickness (m^2*°C/W)	0.70	0.83
Water Vapour Permeance Maximum at 25 mm Thickness (Ng/Pa*s*m^2)	200	
Dimensional Stability Maximum Linear Change (%)	1.5	
Flexural Strength Minimum (kPa)	240	
Water Absorption By Volume Maximum (%)	4.0	
Compressive Strength Minimum at 10% Deformation (kPa)	110	
Limiting Oxygen Index Minimum (%)	24	

Greenstone Building Products ICE Panel and Black ICE Panel thermal insulation surface burning characteristics determined in accordance with CAN/ULC S102.2:

EXPANDED POLYSTYRENE (EPS) INSULATION	DENSITY	MAXIMUM THICKNESS	FLAME SPREAD INDEX (FSI)	SMOKE DEVELOPED INDEX (SDI)
Type 2 (Type II) EPS	Maximum 32 kg/m^3	100 mm Maximum	≤ 250	≥ 500

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Greenstone Building Products ICE Panel and Black ICE Panel thermal insulation specifications per ASTM C578:

PROPERTY	Expanded Polystyrene Insulation	
	ICE PANEL TYPE II	BLACK ICE PANEL TYPE II
Compressive Strength Minimum @ 10% Deformation (psi)	15.0	
Thermal Resistance Minimum @ 1 inch Thick ($F*ft^2*h/Btu$)	4.0	4.7
Flexural Strength Minimum (psi)	35.0	
Water Vapor Permeance @ 1 inch Thickness Maximum (Perms)	3.5	
Water Absorption By Volume Maximum (%)	3.0	
Dimensional Stability Linear Change Maximum (%)	2.0	
Oxygen Index Minimum (%)	24.0	
Density Minimum (lbs/ft^3)	1.35	

Greenstone Building Products ICE Panel and Black ICE Panel thermal insulation surface burning characteristics determined in accordance with UL 723:

EXPANDED POLYSTYRENE (EPS) INSULATION	DENSITY	MAXIMUM THICKNESS	FLAME SPREAD INDEX (FSI)	SMOKE DEVELOPED INDEX (SDI)
Type 2 (Type II) EPS	Maximum 2.0 lbs/ft^3	6.0 Inches Maximum	≤ 25	≤ 450

Greenstone Building Products ICE Panels fire-resistance ratings per CAN/ULC-S101 & ASTM E119 – Loadbearing† Walls and Partitions:

QAI Design #	Fire Resistance Rating	Sheathing
B1122-1a	**CAN/ULC-S101/ASTM E119 1 Hour Restricted – Load Bearing[1] Fire Resistance-Rated Wall Assembly**	**2 Layers Gypsum Board facing interior**
B1122-1b	**CAN/ULC-S101/ASTM E119 2 Hour Non-Load Bearing Fire Resistance-Rated Wall Assembly**	**2 Layers Gypsum Board over 25 mm (1 inch) mineral wool insulation on interior face. 1 layer gypsum board on unexposed face.**

[1] Restricted-Load Bearing - Load rating for this assembly is 50% of the design load determined in accordance with CSA S136 or AISI S100.

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Greenstone Building Products ICE Panels Transverse Load Resistance determined in accordance with ASTM E72:

Transverse Load Resistance Imperial[1,2,3,4]
Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels

PANEL THICKNESS inches	STUD SPACING Inches	STEEL GAUGE	PANEL HEIGHT ft	DEFLECTION LIMIT lbs/ft²			MAX PRESSURE lbs/ft²
				L/360	L/240	L/180	
5.5	16	20	8	42.1	60.1	74.3	125.9
			10	26.4	39.7	48.6	94.5
			12	18.9	27.6	35.7	69.7
		18	8	39.7	59.0	77.9	130.6
			10	24.4	38.3	50.7	76.7
			12	21.5	32.0	40.2	76.7
		16	8	49.6	69.6	87.7	144.0
			10	30.7	45.2	57.5	79.4
			12	23.2	34.6	45.4	79.4
7.5	12	20	10	53.6	79.0	103.0	162.7
		16	8	81.8	120.8	157.0	240.7
			10	63.7	91.1	114.8	168.7
			12	45.1	69.4	88.4	158.8
7.5	16	20	8	55.8	78.5	99.6	174.5
			10	39.7	59.2	79.7	118.8
			12	32.8	47.4	60.2	94.0
		18	8	58.4	83.7	107.1	141.9
			10	38.2	57.0	76.4	106.1
			12	32.3	48.4	63.3	90.2
		16	8	59.9	85.9	107.9	159.5
			10	42.6	64.0	81.9	107.3
			12	37.8	54.5	70.5	95.9
9.25	12	20	8	85.5	121.6	153.9	267.2
			10	62.0	90.2	116.0	189.4
			12	50.7	74.0	93.9	151.5
11.5	12	20	12	62.5	91.0	113.5	173.3

Transverse Load Resistance Imperial[1,2,3,4]
Greenstone ICE Type 2 / Type II (32.0 kg/m³, 2.0 lbs/ft³ Density) Panels

PANEL THICKNESS inches	STUD SPACING Inches	STEEL GAUGE	PANEL HEIGHT ft	DEFLECTION LIMIT lbs/ft²			MAX PRESSURE lbs/ft²
				L/360	L/240	L/180	
7.5	8	20	10	83.4	121.9	162.3	307.4
9.25	8	20	10	101.1	143.8	186.6	303.5

Transverse Load Resistance Imperial[1,2,3,4]
Greenstone ICE Type 2 / Type II (40.0 kg/m³, 2.5 lbs/ft³ Density) Panels

PANEL THICKNESS inches	STUD SPACING Inches	STEEL GAUGE	PANEL HEIGHT ft	DEFLECTION LIMIT lbs/ft²			MAX PRESSURE lbs/ft²
				L/360	L/240	L/180	
7.5	8	20	8	127.6	186.2	240.7	372.1
			10	94.7	139.9	181.7	352.7
7.5	12	20	10	76.1	107.6	138.0	230.4

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Transverse Load Resistance Metric[1,2,3,4] Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels							
PANEL THICKNESS mm	STUD SPACING mm	STEEL GAUGE	PANEL HEIGHT mm	DEFLECTION LIMIT kPa			MAX PRESSURE kPa
				L/360	L/240	L/180	
140	406	20	2438	2.0	2.9	3.6	6.0
			3048	1.3	1.9	2.3	4.5
			3658	0.9	1.3	1.7	3.3
		18	2438	1.9	2.8	3.7	6.3
			3048	1.2	1.8	2.4	3.7
			3658	1.0	1.5	1.9	3.7
		16	2438	2.4	3.3	4.2	6.9
			3048	1.5	2.2	2.8	3.8
			3658	1.1	1.7	2.2	3.8
191	305	20	3048	2.6	3.8	4.9	7.8
		16	2438	3.9	5.8	7.5	11.5
			3048	3.0	4.4	5.5	8.1
			3658	2.2	3.3	4.2	7.6
191	406	20	2438	2.7	3.8	4.8	8.4
			3048	1.9	2.8	3.8	5.7
			3658	1.6	2.3	2.9	4.5
		18	2438	2.8	4.0	5.1	6.8
			3048	1.8	2.7	3.7	5.1
			3658	1.5	2.3	3.0	4.3
		16	2438	2.9	4.1	5.2	7.6
			3048	2.0	3.1	3.9	5.1
			3658	1.8	2.6	3.4	4.6
235	305	20	2438	4.1	5.8	7.4	12.8
			3048	3.0	4.3	5.6	9.1
			3658	2.4	3.5	4.5	7.3
292	305	20	3658	3.0	4.4	5.4	8.3

Transverse Load Resistance Metric[1,2,3,4] Greenstone ICE Type 2 / Type II (32.0 kg/m³, 2.0 lbs/ft³ Density) Panels							
PANEL THICKNESS mm	STUD SPACING mm	STEEL GAUGE	PANEL HEIGHT mm	DEFLECTION LIMIT kPa			MAX PRESSURE kPa
				L/360	L/240	L/180	
191	203	20	3048	4.0	5.8	7.8	14.7
235	203	20	3048	4.8	6.9	8.9	14.5

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Transverse Load Resistance Metric[1,2,3,4] Greenstone ICE Type 2 / Type II (40.0 kg/m^3, 2.5 lbs/ft^3 Density) Panels							
PANEL THICKNESS Mm	STUD SPACING mm	STEEL GAUGE	PANEL HEIGHT mm	DEFLECTION LIMIT kPa			MAX PRESSURE kPa
				L/360	L/240	L/180	
191	203	20	2438	6.1	8.9	11.5	17.8
			3048	4.5	6.7	8.7	16.9
191	305	20	3048	3.6	5.2	6.6	11.0

1. Transverse load capacity is determined based on minimum bearing of 3 inches at panel ends. Alternate bearing conditions for connection of panels for transferring loads to the underlying structure are outside the scope of this listing and are to follow the approved Engineering Design and project specifications.
2. Transverse loads are determined for Greenstone ICE panels only and do not consider the contribution from sheathing materials.
3. Allowable pressure determined based on CSA S136 Limit State Design (LS) methodology with $\Phi = 0.67$ for use in Canada.
4. Load capacities for Greenstone ICE panels used in the USA are directed to follow QAI Code Evaluation Report CER_{US}-1002.

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Greenstone Building Products ICE Panels Axial Load Resistance determined in accordance with ASTM E72:

Axial Load Capacity Imperial[5,6,7,8,9] Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels					
PANEL THICKNESS inches	STUD SPACING Inches	GAUGE	MAXIMUM HEIGHT ft	LOAD @ COMPRESSION LIMIT Δ = 1/8 inch lbs/ft	MAXIMUM ALLOWABLE LOAD [10] lbs/ft
5.5	16	20	≤ 12	6,571	6,571
		18		8,639	8,639
		16		10,674	10,674
7.5	12	20	≤ 12	8,214	8,214
		18		10,799	10,799
		16		13,343	13,343
7.5	16	20	≤ 12	6,571	6,571
		18		8,639	8,639
		16		10,674	10,674

Axial Load Capacity Metric[5,6,7,8,9] Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels					
PANEL THICKNESS mm	STUD SPACING mm	GAUGE	MAXIMUM HEIGHT mm	LOAD @ COMPRESSION LIMIT Δ = 1/8 inch kN/m	MAXIMUM ALLOWABLE LOAD [10] kN/m
140	406	20	3658	95.9	95.9
		18		126.1	126.1
		16		155.8	155.8
191	305	20	3658	119.9	119.9
		18		157.6	157.6
		16		194.7	194.7
191	406	20	3658	95.9	95.9
		18		126.1	126.1
		16		155.8	155.8

5. Allowable loads are determined for Greenstone ICE Panels without sheathing, thermal barrier or ignition barrier.
6. Allowable loads are determined for uniformly distrubuted load over Greenstone ICE Panels. For point loads, top track (LBC) or additional reinforcing may be added where supported by by Engineering Design and approved by the authority having jurisdiction.
7. Connection details including attachment of floor and roof panels, and connection of wall panels to the underlying structure is outside the scope of this report, and is to be in accordance with Engineering Design and project specifications
8. Allowable loads determined based on CSA S136 Limit State Design (LS) methodology with $\Phi = 0.67$ for use in Canada.
9. Load capacities for Greenstone ICE Panels used in the USA are directed to follow QAI Code Evaluation Report CER_{US}-1002.

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Greenstone Building Products ICE Panels Racking Shear Load Resistance determined in accordance with ASTM E564:

Racking Shear Capacity Imperial Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels[10,11,12]							
PANEL THICKNESS inches	STUD SPACING Inches	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT lbs/ft			MAXIMUM ALLOWABLE LOAD [10] lbs/ft
				H/500	H/360	H/240	
7.5	16	20	1:1	153	180	226	414
Racking Shear Capacity Imperial Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels with 7/16 PS2 Rated Exterior Grade Oriented Strand Board on Exterior Face[10,11,12,13]							
PANEL THICKNESS inches	STUD SPACING Inches	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT lbs/ft			MAXIMUM ALLOWABLE LOAD [10] lbs/ft
				H/500	H/360	H/240	
7.5	16	20	1:1	594	594	594	594
Racking Shear Capacity Imperial Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels with 16 Gauge, 33 ksi G60 Steel Strapping Exterior Face[10,11,12,14]							
PANEL THICKNESS inches	STUD SPACING Inches	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT lbs/ft			MAXIMUM ALLOWABLE LOAD [10] lbs/ft
				H/500	H/360	H/240	
7.5	16	20	1:1	381	507	567	567

Racking Shear Capacity Metric Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels[10,11,12]							
PANEL THICKNESS mm	STUD SPACING mm	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT kN/m			MAXIMUM ALLOWABLE LOAD [10] kN/m
				H/500	H/360	H/240	
191	406	20	1:1	2.2	2.6	3.3	6.0
Racking Shear Capacity Metric Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels with 7/16 PS2 Rated Exterior Grade Oriented Strand Board on Exterior Face[10,11,12,13]							
PANEL THICKNESS mm	STUD SPACING mm	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT kN/m			MAXIMUM ALLOWABLE LOAD [10] kN/m
				H/500	H/360	H/240	
191	406	20	1:1	8.7	8.7	8.7	8.7
Racking Shear Capacity Metric Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels with 16 Gauge, 33 ksi G60 Steel Strapping Exterior Face[10,11,12,13,14]							
PANEL THICKNESS mm	STUD SPACING mm	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT kN/m			MAXIMUM ALLOWABLE LOAD [10] kN/m
				H/500	H/360	H/240	
191	406	20	1:1	5.6	7.4	8.3	8.3

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10. Connection details including attachment of floor and roof panels, and connection of wall panels to the underlying structure is outside the scope of this report, and is to be in accordance with Engineering Design and project specifications.
11. Allowable loads determined based on CSA S136 Limit State Design (LS) methodology with $\Phi = 0.50$ for use in Canada.
12. Load capacities for Greenstone ICE panels used in the USA are directed to follow QAI Code Evaluation Report CER_{US}-1002.
13. OSB is to be installed with minimum #6- 1-1/2 in. (38 mm) self-tapping screws, spaced at 6 in. (153 mm) around the perimeter, and 12 in. (305 mm) in the field with minimum 1 in. (25 mm) distance from OSB panel edges at perimeter installation. OSB joints are to be blocked with 16 Ga. steel straps, with fasteners staggered along each panel joint at 6 in. (152 mm) where OSB joints are not over studs.
14. Steel straps are required to be minimum 5-1/4 in. (133 mm) width and extend from panel corner to panel corner at maximum 8 ft (2432 mm) lengths. Steel straps are required to be connected to Greenstone ICE panels with three minimum #10-3/4 in. (19 mm) self-tapping screws at each strap end, and two #10-3/4 in. (19 mm) self-tapping screws installed at each stud location

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Greenstone Building Products ICE Panel header components have the following structural capacities:

Header Z-Channel Strength [15]														
Z-Channel Designation	Height (h)		Gauge Thickness (t)		S_x		I_x		A_w	F_y	Moment Resistance		Shear Resistance	
Height-Shape-Gauge	inches	mm	inches	mm	in^3	mm^3	in^4	mm^4	mm^2	mPa	kN m	ft lbs	kN	lbs
4Z16	4	101.6	0.063	1.588	0.441	7.23E+03	0.954	4.0E+05	161.29	412.27	1.48	1089	59.85	13.4
4Z14	4	101.6	0.078	1.984	0.540	8.85E+03	1.169	4.9E+05	201.61	644.18	1.81	1333	116.89	26.2
4Z12	4	101.6	0.109	2.778	0.727	1.19E+04	1.574	6.6E+05	282.26	1262.59	2.44	1795	320.74	71.9
6Z16	6	152.4	0.063	1.588	0.806	1.32E+04	2.578	1.1E+06	241.94	183.23	2.71	1995	39.90	8.9
6Z14	6	152.4	0.078	1.984	0.994	1.63E+04	3.173	1.3E+06	302.42	286.30	3.34	2454	77.92	17.5
6Z12	6	152.4	0.109	2.778	1.349	2.21E+04	4.305	1.8E+06	423.39	561.15	4.53	3331	213.82	48.0
8Z16	8	203.2	0.063	1.588	1.261	2.07E+04	5.302	2.2E+06	322.58	103.07	4.23	3114	29.92	6.7
8Z14	8	203.2	0.078	1.984	1.555	2.55E+04	6.543	2.7E+06	403.23	161.04	5.22	3839	58.44	13.1
8Z12	8	203.2	0.109	2.778	2.120	3.47E+04	8.923	3.7E+06	564.52	315.65	7.11	5234	160.37	36.0
10Z16	10	254	0.063	1.588	1.797	2.94E+04	9.378	3.9E+06	403.23	65.96	6.03	4437	23.94	5.4
10Z14	10	254	0.078	1.984	2.221	3.64E+04	11.592	4.8E+06	504.03	103.07	7.45	5484	46.75	10.5
10Z12	10	254	0.109	2.778	3.039	4.98E+04	15.864	6.6E+06	705.64	202.01	10.20	7504	128.29	28.8
12Z16	12	304.8	0.063	1.588	2.418	3.96E+04	15.056	6.3E+06	483.87	45.81	8.11	5970	19.95	4.5
12Z14	12	304.8	0.078	1.984	2.992	4.90E+04	18.634	7.8E+06	604.84	71.58	10.04	7388	38.96	8.7
12Z12	12	304.8	0.109	2.778	4.105	6.73E+04	25.567	1.1E+07	846.77	140.29	13.77	10136	106.91	24.0
14Z16	14	355.6	0.063	1.588	3.122	5.12E+04	22.585	9.4E+06	564.52	33.65	10.48	7708	17.10	3.8
14Z14	14	355.6	0.078	1.984	3.868	6.34E+04	27.980	1.2E+07	705.64	52.59	12.98	9550	33.40	7.5
14Z12	14	355.6	0.109	2.778	5.317	8.71E+04	38.470	1.6E+07	987.90	103.07	17.84	13128	91.64	20.6

15. Allowable loads determined based on CSA S136 Limit State Design (LS) methodology.

Notes: Products must be installed with the manufacturer's published installation instructions and in accordance with the building codes recognized by the authority having jurisdiction.

Product is to be installed in accordance with the QAI Design Listing and manufacturer's published installation instructions by qualified installing personnel.

Listed manufacturers are subject to on-going inspections by QAI to ensure that the products outlined above remains as it is listed.

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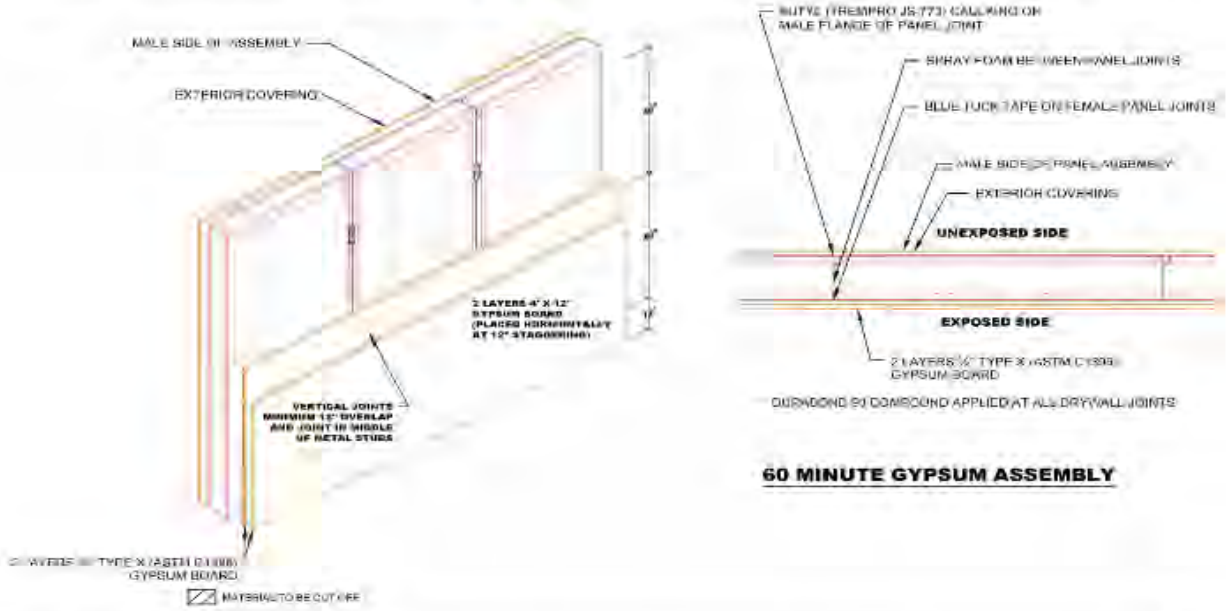
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QAI Design B1122-1a – Greenstone Building Products Ltd. – CAN/ULC-S101 / ASTM E119
1 Hour Fire-Resistance Rated Load Bearing[1] Prefabricated Wall Assembly – Interior Facing Fire



60 MINUTE GYPSUM ASSEMBLY

COMPONENT	DESCRIPTION	
Wall Assembly	Manufacturer:	Greenstone Insulated Composite Envelope (ICE) Panel.
	Minimum Thickness:	7.5 in. (191 mm).
	Installation Description:	ICE panels installed with 2 layers of 5/8 in. (16 mm) Type X gypsum on each panel face. Panel connections to top track, bottom track and adjacent panels per Greenstone Connection details manual and this report. Exterior coverings as outlined below.
Wall Stud[1]	Minimum 20 Ga (1.25 mm[1]) x 2-1/2 in. (64 mm) x 1-3/16 in. (30 mm) steel C-channel wall studs. The end studs at the joint have a 1/8 in. (3 mm) x 1 in. (25 mm) jog in the channel along the 2-1/2 in. (64 mm) dimension. Studs are to be spaced at maximum 16 in. (406 mm) on center (OC).	
Top Track[1]	Minimum 18 Gauge (1.65 mm) x 3-1/2 in. (89 mm) x 1-1/4 in. (32 mm) J-shaped steel channel with a 1/2 in. (13 mm) return. Fastened to the wall studs with #10x3/4 in. length (19 mm) self-tapping pan head screws.	
Bottom Track[1]	Minimum 2 in. (51 mm) x 2 in. (51 mm) steel angle shall be placed underneath the bottom track on both sides of the wall. Fastened to each stud with one #10x3/4 in. (19 mm) length self-tapping pan head screw.	
Connection Plates[1]	Minimum 18 Gauge (1.25 mm) x 6 in. (152 mm) x 2 in. (51 mm) steel plates fastened using six #10 x ¾ in. (19 mm) self-tapping pan head screws. The plates are to be placed at maximum 2 ft (610 mm) starting 6 in. (152 mm) from panel top.	

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Foam Insulation	Type:	Type 2 (Type II) Expanded Polystyrene (EPS) per CAN/ULC S701 / ASTM C578, listed by approved agency.
	Density:	1.65 lbs/ft^3
Interior Sheathing	Type:	2 layers of Type X gypsum board compliant with ASTM C1396, listed by approved agency.
	Minimum Thickness:	5/8 in. (16 mm).
	Fastener Detail:	Both layers are to be fastened at maximum 8 in. (203 mm) OC around the perimeter and in the field. The first layer is to be fastened using #6 x 1-1/4 in. (32 mm.) Type S drywall screws. The second layer shall be fastened using #6 x 2 in. (51 mm) Type S drywall screws. All screw heads are to be covered with code compliant drywall compound.
Exterior Coverings[4]	Type:	Exterior Coverings of the Following Types: • Fiber-cement, minimum ¼ inch (6 mm) thickness meeting ASTM C1186 Type A Grade II. • Cementitious stucco installed in accordance ASTM C926 or in accordance with the local building code per site. • Exterior Gypsum complying with ASTM C1177 of minimum ½ inch (13 mm) thickness. • Exposure 1 rated plywood of minimum 3/8 inch (11 mm) thickness or per Engineering Design. • Metal claddings complying with 2018 / 2015 International Building Code Table 1405.2 or 2015 National Building Code of Canada, or per Engineering Design.
	Fastener Detail:	Exterior cladding materials are to be installed in accordance with site designs to resist the anticipated loads per the Engineering Design, or as approved by the Authority Having Jurisdiction.

Notes:

1. The maximum allowable loading for the fire-resistance rated assembly is 50% of the allowable calculated per AISI S100 or CSA S136 based on Load and Factor Reduction (LRFD) methodology.
2. All steel materials shall be size determined in accordance with CSA S136 or AISI S100 for anticipated service loading, with minimum Gauges and dimensions noted above required for fire-resistance rating.
3. The listed assembly is evaluated for interior fire only.
4. Exterior coverings shall not considered as load-bearing elements when used in fire-resistance rated applications. Consideration of structural capacity for resisting wind and seismic forces is outside the scope of this listing. Connection details for resisting anticipated service loadings are to be determined in accordance with the applicable code and approved by the authority having jurisdiction.

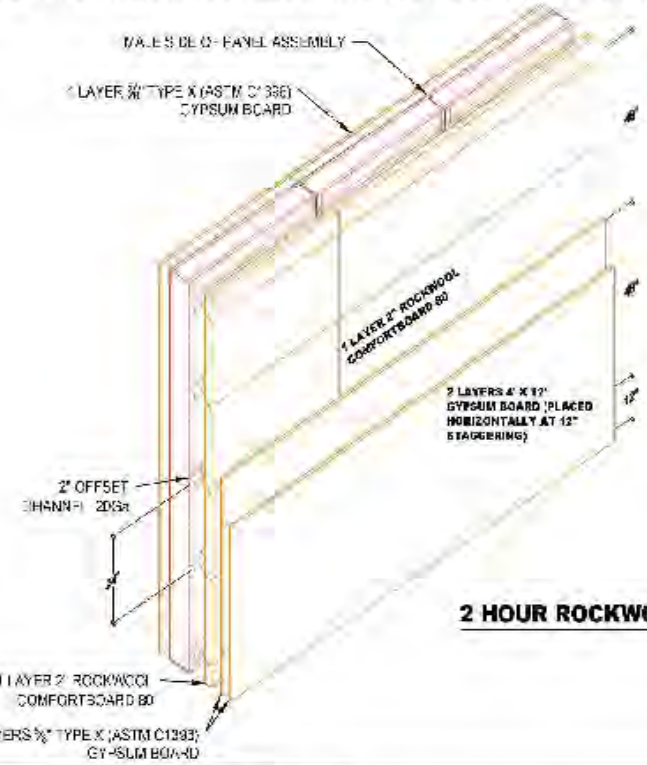
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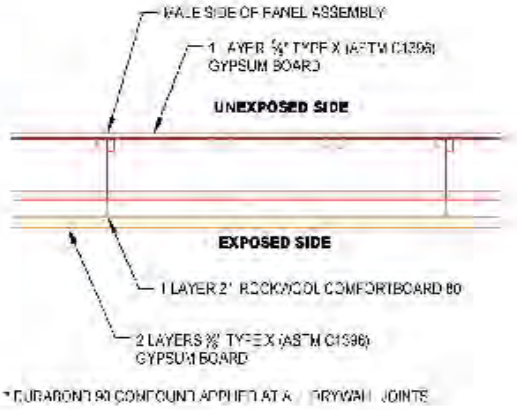
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QAI Design B1122-1b – Greenstone Building Products Ltd. – CAN/ULC-S101 / ASTM E119
2 Hour Fire-Resistance Rated Non-Load Bearing Prefabricated Wall Assembly – Interior Facing Fire





2 HOUR ROCKWOOL BOARD & GYPSUM ASSEMBLY

COMPONENT	DESCRIPTION	
Wall Assembly	Manufacturer:	Greenstone Insulated Composite Envelope (ICE) Panel.
	Minimum Thickness:	7.5 in. (191 mm).
	Installation Description:	ICE panels installed with 2 layers of 5/8 in. (16 mm) Type X gypsum on each panel face. Panel connections to top track, bottom track and adjacent panels per Greenstone Connection details manual and this report. Assembly incorporates mineral batt insulation at 2 in. (51 mm) thickness on assembly side exposed to fire (interior).
Wall Stud[1]	Minimum 20 Ga (1.25 mm[1]) x 2-1/2 in. (64 mm) x 1-3/16 in. (30 mm) steel C-channel wall studs. The end studs at the joint have a 1/8 in. (3 mm) x 1 in. (25 mm) jog in the channel along the 2-1/2 in. (64 mm) dimension. Studs are to be spaced at maximum 16 in. (406 mm) on center (OC).	
Top Track[1]	Minimum 16 Gauge (1.65 mm) x 3-1/2 in. (89 mm) x 1-1/4 in. (32 mm) J-shaped steel channel with a 1/2 in. (13 mm) return. Fastened to the wall studs with #10x3/4 in. length (19 mm) self-tapping pan head screws.	
Bottom Track[1]	Minimum 2 in. (51 mm) x 2 in. (51 mm) steel angle shall be placed underneath the bottom track on both sides of the wall. Fastened to each stud with one #10x3/4 in. (19 mm) length self-tapping pan head screw.	
Connection Plates[1]	Minimum 18 Gauge (1.25 mm) x 6 in. (152 mm) x 2 in. (51 mm) steel plates fastened using six #10 x ¾ in. (19 mm) self-tapping pan head screws. The plates are to be placed at maximum 2 ft (610 mm) starting 6 in. (152 mm) from panel top.	

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Foam Insulation	Type:	Type II Expanded Polystyrene (EPS) per ASTM C578, listed by approved agency.
	Density:	1.65 lbs/ft³
Interior Insulation Channel	Dimensions:	20 Gauge (0.95 mm) thickness Z-bar of 3 in x 2 in. x 3 in. (76 mm x 51 mm x 76 mm), connected to the Greenstone ICE wall studs.
	Spacing:	24 inches (610 mm) on center, oriented horizontally.
Interior Mineral Wool Insulation	Manufacturer:	Rockwool
	Type:	ComfortBatt 80
	Thickness:	Minimum 2 in. (51 mm)
	Installation:	Insulation is friction fit between interior insulation channel on the interior Greenstone ICE panel face.
Interior Sheathing	Type:	2 layers of Type X gypsum board compliant with ASTM C1396, listed by approved agency. Gypsum is oriented horizontally.
	Minimum Thickness:	5/8 in. (16 mm).
	Fastener Detail:	Both layers are to be fastened at maximum 8 in. (203 mm) OC along the longitudinal perimeter, and at 24 into each Z-bar at vertical gypsum edges. Spacing of fasteners is 12 in. (305 mm) in the field. The first layer is to be fastened using #6 x 1-1/4 in. (32 mm.) Type S drywall screws. The second layer shall be fastened using #6 x 2 in. (51 mm) Type S drywall screws. Screws are anchored into horizontal insulation Z bar channel. All screw heads are to be covered with code compliant drywall compound. Gypsum joints are offset a minimum of 24 in. (610 mm) OC. Vertical joints of the gypsum board do not require blocking.

Notes:

1. If steel materials shall be size determined in accordance with CSA S136 / AISI S100 with thickness and dimensions of steel noted above met.
2. The listed assembly is evaluated for interior fire exposure to fire only.

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REVISION HISTORY

10/04/2025: Update to correct client name, reference NBC 2020, and to correct out of date listings found Appendix B.

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HOMEOWNER INFORMATION SHEET

ENERGUIDE

Your EnerGuide* rating and this report are based on data collected and, where necessary, presumed from your evaluation. Rating calculations are made using standard operating conditions.



Rating: 87 gigajoules per year (GJ/year)

Heated floor area: 473.2 m² (5093.5 ft²)
Rated energy intensity: 0.18 GJ/m²/year
Evaluated by: Gio Robson
Quality assured by: prairieHOUSE Performance Inc.
File number: 8301n00141
Data collected: January 28, 2019
Year built: 2018

NRCan.gc.ca/myenerguide

HOW YOUR RATING IS CALCULATED:

I.	Rated annual energy consumption	87 GJ/year
II.	Minus renewable energy contribution	- 0 GJ/year
	Equals your **EnerGuide rating**	**= 87 GJ/year**

I. Your rated annual energy consumption is the total amount of energy your house would use in a year based on the EnerGuide Rating System standard operating conditions. For your house, this includes 21.16 GJ of passive solar gain.

Energy Sources	Rated Consumption (GJ/year)	Equivalent Units (per year)	Greenhouse Gas Emissions (tonnes/year)
Electricity	49	13606kWh	0.0
Natural gas	38	1022m³	1.9
Total	87		1.9

II. On-site renewable power generation systems can offset some or even all of your home's energy consumption. Renewable energy contributions are factored differently for your rating and your greenhouse gas emissions calculations.[1]

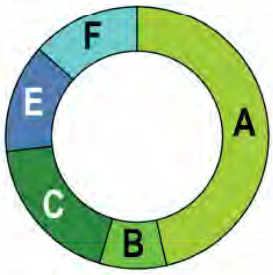
On-Site Renewable Energy	Estimated Contribution (GJ/year)	Equivalent Units (per year)	Offset Greenhouse Gas Emissions (tonnes/year)
Electricity	0	0 kWh	0.0
Solar water heating	0	0	0.0
Total	0		0.0

YOUR RATED GREENHOUSE GAS EMISSIONS CALCULATION:

Total greenhouse gas emissions	1.9 tonnes/year
Minus emissions offset by on-site renewables	- 0.0 tonnes/year
Equals your **rated greenhouse gas emissions**	**= 1.9 tonnes/year**

HOW YOUR RATED ENERGY IS USED:

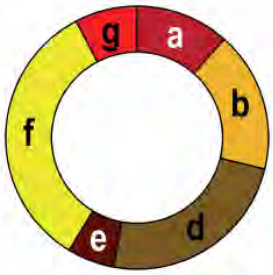
The chart below represents the breakdown of rated annual energy consumption in your home under standard operating conditions. You can use these figures as a guide to help identify where you can lower home energy costs through proper home maintenance, efficient home operation, energy efficiency renovations or equipment replacement.



A.	Space heating	45%
B.	Space cooling	8%
C.	Water heating	18%
D.	Ventilation	0%
E.	Lights & appliances	13%
F.	Other electrical	16%

WHERE YOUR HOME LOSES HEAT:

Houses lose heat through their exterior shell, or building envelope. The chart below shows where and how your home loses heat. The quality and upkeep of your home can have a major impact on the amount of energy your heating and cooling systems use annually.



a.	Attic/Ceiling	12%
b.	Main Walls	18%
c.	Exposed floors	0%
d.	Windows	25%
e.	Exterior doors	2%
f.	Basement/Foundation	35%
g.	Air leakage/ventilation	8%

*EnerGuide is an official mark of Natural Resources Canada.
Refer to the glossary section for an explanation of relevant terms.

HOUSE DETAILS

BUILDING ENVELOPE

ATTIC/CEILING

TYPE	INSULATION VALUE		AREA m² (ft²)
	Nominal RSI (R)	Effective RSI (R)	
Ceiling01: Attic/gable	11.82 (67.1)	11.87 (67.4)	238.5 (2567)

MAIN WALLS

TYPE	INSULATION VALUE		AREA m² (ft²)
	Nominal RSI (R)	Effective RSI (R)	
Main floor	6.51 (37.0)	5.92 (33.6)	195.5 (2105)

WINDOWS

#	TYPE	U-factor W/m² • °C (Btu/h • ft² • °F)	RSI (R)
1	Vinyl, Fixed, Triple, Low E	1.4 (0.24)	0.72 (4.1)
2	Vinyl, Hinged, Triple, Low E	1.4 (0.24)	0.74 (4.2)
2	Vinyl, Hinged, Triple, Low E	1.3 (0.23)	0.77 (4.4)
2	Vinyl, Hinged, Triple, Low E	1.3 (0.23)	0.77 (4.4)
2	Vinyl, Hinged, Triple, Low E	1.3 (0.23)	0.78 (4.4)
4	Vinyl, Hinged, Triple, Low E	1.3 (0.22)	0.79 (4.5)
1	Vinyl, Hinged, Triple, Low E	1.2 (0.21)	0.86 (4.9)
1	Vinyl, Fixed, Triple, Low E	1.1 (0.2)	0.89 (5.1)
1	Vinyl, Fixed, Triple, Low E	1 (0.17)	1.05 (6.0)
Total window area: 29.4 m² (316 ft²)			

EXTERIOR DOORS

#	TYPE	U-factor W/m² • °C (Btu/h • ft² • °F)	RSI (R)
2	Steel medium density spray foam core	0.9 (0.15)	1.14 (6.5)
Total door area: 6.8 m² (74 ft²)			

BASEMENT/FOUNDATION

TYPE	INSULATION VALUE		AREA m² (ft²)
	Nominal RSI (R)	Effective RSI (R)	
Basement - 2 Basement header	5.28 (30.0)	5.77 (32.8)	23.5 (253)
Basement - 2 concrete walls: exterior	N/A	N/A	109.6 (1180)
Basement - 2 concrete walls: interior	5.62 (31.9)	5.51 (31.0)	109.6 (1180)
Basement - 2 slab	2.82 (16.0)	2.82 (16.0)	234.7 (2526)

AIRTIGHTNESS

Air leakage rate at 50 pascals	0.34 air changes/hour
Equivalent leakage area	133.5 cm² (21 in²)
Normalized leakage area	0.2 cm²/m² (0.2 in²/100 ft²)

MECHANICAL SYSTEMS

SPACE HEATING

TYPE	OUTPUT SIZE	EFFICIENCY
Condensing natural gas furnace	8.5 kW 29500 BTU/h	96.2% AFUE
Design heating load: 7.32 kW – refer to glossary for details		

SPACE COOLING

TYPE	OUTPUT SIZE	EFFICIENCY
Central air conditioner	5.1 kW 17500 BTU/h	13 SEER
Design cooling load: 4.63 kW		

WATER HEATING

TYPE	TANK VOLUME	EFFICIENCY
Electric storage tank	318L (84 USG)	98%

WHOLE-HOME VENTILATION

TYPE	AIR FLOW RATE	EFFICIENCY
Heat recovery ventilator certified by the Home Ventilating Institute	27.99 L/s (59 cfm)	75%

HEATED FLOOR AREA

Above-grade area	238.5 m² (2567.2 ft²)
Below-grade area	234.7 m² (2526 ft²)

WARNINGS

The results of the energy simulation determined that this house may not receive sufficient outdoor air to maintain good indoor air quality. Please seek additional information from your energy advisor and a qualified ventilation contractor.

Your energy advisor found that there may be a risk of hazardous combustion fumes being drawn into your home. Please refer to *Combustion Gases in Your Home – Things You Should Know About Combustion Spillage* provided by your energy advisor and consult a qualified heating and ventilation contractor. Ensure you have a functioning carbon monoxide detector.

GLOSSARY

Airtightness
describes how well the building envelope resists air leakage and is measured in air changes per hour at 50 pascals (ACH@50 Pa). The fewer air changes per hour, the more airtight the building envelope is. Equivalent leakage area is another way of describing the airtightness of the building envelope. It represents the size of a single hole in your building envelope if all the individual air leakage holes or gaps were added together. The smaller the equivalent leakage area, the less energy you will need to control the temperature of your home (but you will still need to ensure that you have adequate ventilation).

Design heating/cooling loads
provide an estimate of the capacity of the heating and cooling equipment needed to maintain your home at 22 °C in the winter and 24 °C in the summer and are provided for guidance only. Before having a new heating/cooling system installed, your heating/cooling contractor should perform an independent, detailed heat loss/heat gain calculation on your home in order to select the appropriate equipment.

Gigajoule (GJ)
is a unit of energy. It can be used as a measure of any type of energy that is consumed or produced in your home. Specifically, one GJ is the equivalent of 278 kWh of electricity, 27m³ of natural gas, 26 L of oil, 39 L of propane, or 947 817 BTUs. One GJ is roughly equal to the energy from two standard barbeque propane tanks or 30 litres of gas in a car's gas tank.

Greenhouse gas emissions
are the amounts of carbon dioxide, methane and nitrous oxide that are produced directly, by burning fossil and solid fuels, or indirectly, through the production of electricity. Greenhouse gas emissions are expressed in carbon dioxide equivalent units. Greenhouse gas emissions are calculated by multiplying the quantity of fuel or electricity used in your home by the emission factors for the particular energy source. Electricity factors vary by province because there are different emissions associated with each province's method of producing electricity. One tonne of greenhouse gas emissions is equivalent to the CO_2 emissions produced by driving an average efficiency mid-size vehicle from Toronto to Vancouver.

Heated floor area
represents the total useable area of your home that is heated, measured at the interior of the outer walls or of the walls attached to other buildings.

Insulation values
Are expressed in RSI (m² • °C/W) or R-value (h • ft² • °F/Btu) and represent the resistance to the flow of heat of a given thickness of insulation or construction assembly. The higher the RSI-value (R-value), the better the performance.The nominal value represents the resistance to the flow of heat of just the insulation while the effective value represents the resistance to the flow of heat of the entire wall, ceiling or floor assembly considering the structure, insulation, framing, sheathing and all finishing.

On-site renewable energy contributions
are subtracted from the rated annual energy consumption to calculate the EnerGuide rating. For the calculation of the rated greenhouse gas emissions, on-site electricity generation only offsets emissions associated with electricity consumption, whereas a solar water heater reduces the emissions that would have been produced from the source of energy used to heat water.

Passive solar gain
is the heat from the sun that influences your home's heating and cooling requirements. Generally, south facing windows provide more solar gain.

Rated energy intensity
is calculated by dividing your rated annual energy consumption by your home's heated floor area. It allows you to compare the annual energy use of homes of different sizes on a "per square metre" basis.

Standard operating conditions
have been used to calculate your home's EnerGuide Rating. The rating assumes a standard number of occupants and energy use patterns. This allows for comparison of energy use across houses so that the house is rated and not the operation of the house by the occupants. The values are:

- Two adults and one child, at home 50% of the time;
- Hot water use of 178 - 199 L/day, variable depending on incoming ground water temperature;
- Thermostat settings of 21°C for daytime heating, 18°C for nighttime heating and 25°C for cooling; and
- Lighting, appliance and other electrical loads of 19.5 kWh/day.

U-factor
measures heat transferred through windows and doors, expressed in W/m² • °C (BTU/h • ft² • °F). The lower the U-factor, the better the energy efficiency of a window. The inverse of U-factor (1/U-factor) identifies the resistance to the flow of heat, expressed in RSI. The higher the RSI, the better the window is at resisting heat loss. You can use these values to choose more energy efficient windows.

For more details and additional terms, please visit NRCan.gc.ca/myenerguide.

182 9th Avenue West,
Souris, MANITOBA, R0K 2C0

ENERGUIDE

Data collected: January 28, 2019
File number: **8301n00141**
Evaluated by: Gio Robson

87 This House GJ/year

0 GJ/year
Best energy performance

146 GJ/year
A typical new house

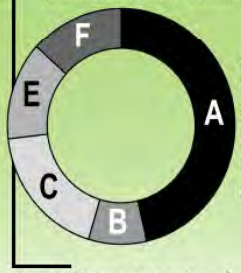
Uses most energy

One gigajoule (GJ) equals the energy from two BBQ propane tanks

Rated Annual Energy Consumption		87 GJ
• Electricity	49	
• Natural gas	38	
On-site renewable energy contributions		- 0 GJ
• Electricity	0	
• Solar water heating	0	
EnerGuide Rating:		**= 87 GJ**

Figures may not add up due to rounding.

Breakdown of Rated Annual Energy Consumption:



A	Space heating	45%
B	Space cooling	8%
C	Water heating	18%
D	Ventilation	0%
E	Lights & appliances	13%
F	Other electrical	16%

Rated Energy Intensity: **0.18 GJ/m²/year**

Rated Greenhouse Gas Emissions: **1.9 tonnes/year**

The energy consumption indicated on your utility bills may be higher or lower than your EnerGuide rating. This is because standard assumptions have been made regarding how many people live in your house and how the home is operated. Your rating is based on the condition of your house on the day it was evaluated.

Quality assured by: prairieHOUSE Performance Inc.

Builder: Rodney Penner

Visit NRCan.gc.ca/myenerguide

Natural Resources Canada | Ressources naturelles Canada | Canada

NEXT STEPS

If you have had a Renovation Upgrade Service, refer to your report for the roadmap to making your home more energy efficient. If you have not yet had a Renovation Upgrade Service, why not contact your service organization to learn what you can do to save on energy costs, reduce greenhouse gas emissions and improve home comfort?

Everyone uses energy in their house differently. This report was developed using standard operating conditions as explained in the glossary. Therefore, your EnerGuide rating will not match your utility bills.

UPGRADE CONSIDERATIONS

Before undertaking upgrades or renovations, find out about appropriate products and installation techniques, and ensure that all renovations meet local building codes and by-laws. Natural Resources Canada does not endorse the services of any contractor, nor any specific product, and accepts no liability in the selection of materials, products, contractors nor performance of workmanship.

Where your energy advisor has identified a potential health or safety concern such as insufficient outdoor air, risk of combustion fumes entering your house or risk of exposure to asbestos, they have endeavoured to provide a warning in this report. However, energy advisors are not required to have expertise in health and safety matters, and homeowners are solely responsible for consulting a qualified professional to determine potential hazards before undertaking any upgrades or renovations.

HOMEOWNER INFORMATION SHEET

ENERGUIDE

Your EnerGuide* rating and this report are based on data collected and, where necessary, presumed from your evaluation. Rating calculations are made using standard operating conditions.



Rating: 90 gigajoules per year (GJ/year)

Heated floor area: 279.4 m² (3007.4 ft²)
Rated energy intensity: 0.32 GJ/m²/year
Evaluated by: Gio Robson
Quality assured by: prairieHOUSE Performance Inc.
File number: 8301n00137
Data collected: June 22, 2018
Year built: 2018

NRCan.gc.ca/myenerguide

HOW YOUR RATING IS CALCULATED:

I.	Rated annual energy consumption	90 GJ/year
II.	Minus renewable energy contribution	- 0 GJ/year
	Equals your **EnerGuide rating**	**= 90 GJ/year**

I. Your rated annual energy consumption is the total amount of energy your house would use in a year based on the EnerGuide Rating System standard operating conditions. For your house, this includes 21.77 GJ of passive solar gain.

Energy Sources	Rated Consumption (GJ/year)	Equivalent Units (per year)	Greenhouse Gas Emissions (tonnes/year)
Electricity	47	13015kWh	0.0
Natural gas	43	1148m³	2.2
Total	90		2.2

II. On-site renewable power generation systems can offset some or even all of your home's energy consumption. Renewable energy contributions are factored differently for your rating and your greenhouse gas emissions calculations.[1]

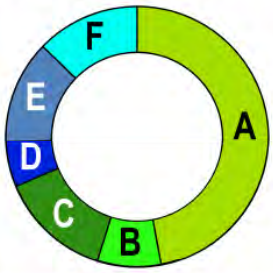
On-Site Renewable Energy	Estimated Contribution (GJ/year)	Equivalent Units (per year)	Offset Greenhouse Gas Emissions (tonnes/year)
Electricity	0	0 kWh	0.0
Solar water heating	0	0	0.0
Total	0		0.0

YOUR RATED GREENHOUSE GAS EMISSIONS CALCULATION:

Total greenhouse gas emissions	2.2 tonnes/year
Minus emissions offset by on-site renewables	- 0.0 tonnes/year
Equals your **rated greenhouse gas emissions**	**= 2.2 tonnes/year**

HOW YOUR RATED ENERGY IS USED:

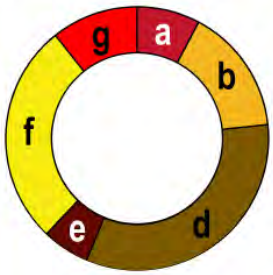
The chart below represents the breakdown of rated annual energy consumption in your home under standard operating conditions. You can use these figures as a guide to help identify where you can lower home energy costs through proper home maintenance, efficient home operation, energy efficiency renovations or equipment replacement.



A.	Space heating	48%
B.	Space cooling	8%
C.	Water heating	14%
D.	Ventilation	1%
E.	Lights & appliances	13%
F.	Other electrical	16%

WHERE YOUR HOME LOSES HEAT:

Houses lose heat through their exterior shell, or building envelope. The chart below shows where and how your home loses heat. The quality and upkeep of your home can have a major impact on the amount of energy your heating and cooling systems use annually.



a.	Attic/Ceiling	8%
b.	Main Walls	16%
c.	Exposed floors	0%
d.	Windows	34%
e.	Exterior doors	3%
f.	Basement/Foundation	28%
g.	Air leakage/ventilation	11%

*EnerGuide is an official mark of Natural Resources Canada.
Refer to the glossary section for an explanation of relevant terms.

HOUSE DETAILS

BUILDING ENVELOPE

ATTIC/CEILING

TYPE	INSULATION VALUE		AREA m² (ft²)
	Nominal RSI (R)	Effective RSI (R)	
10' Ceiling: Attic/gable	9.01 (51.1)	9.03 (51.3)	127.8 (1376)
Vaulted: Scissor	9.01 (51.1)	8.85 (50.3)	16.1 (173)

MAIN WALLS

TYPE	INSULATION VALUE		AREA m² (ft²)
	Nominal RSI (R)	Effective RSI (R)	
VAULT GABLE ENDS	5.44 (30.9)	4.92 (27.9)	1.8 (19)
GARAGE	5.44 (30.9)	4.95 (28.1)	20.3 (218)
Main floor	5.44 (30.9)	4.95 (28.1)	142.9 (1539)

WINDOWS

#	TYPE	U-factor W/m² • °C (Btu/h • ft² • °F)	RSI (R)
2	Vinyl, Fixed, Double, Low E	2 (0)	0.51 (2.9)
1	Vinyl, Fixed, Double, Low E	1.7 (0)	0.58 (3.3)
1	FRONT W-2	1.7 (0)	0.58 (3.3)
2	REAR W-9	1.7 (0)	0.59 (3.3)
1	Vinyl, Fixed, Double, Low E	1.7 (0)	0.59 (3.3)
7	FRONT W-3	1.7 (0)	0.59 (3.4)
4	REAR W-8	1.7 (0)	0.60 (3.4)
1	RIGHT W-5	1.7 (0)	0.61 (3.4)
1	LEFT D-11 (PATIO)	1.5 (0)	0.68 (3.9)
Total window area: 34.37 m² (369.9 ft²)			

EXTERIOR DOORS

#	TYPE	U-factor W/m² • °C (Btu/h • ft² • °F)	RSI (R)
2	Steel medium density spray foam core	0.9 (0)	1.14 (6.5)
Total door area: 6.8 m² (73 ft²)			

BASEMENT/FOUNDATION

TYPE	INSULATION VALUE		AREA m² (ft²)
	Nominal RSI (R)	Effective RSI (R)	
Foundation - 1 Basement header	3.50 (19.9)	3.71 (21.1)	16.1 (174)
Foundation - 1 concrete walls: exterior	1.85 (10.5)	1.85 (11.0)	148.1 (1595)

BASEMENT/FOUNDATION (Continued)

TYPE	INSULATION VALUE		AREA m² (ft²)
	Nominal RSI (R)	Effective RSI (R)	
Foundation - 1 concrete walls: interior	1.85 (10.5)	1.92 (11.0)	148.1 (1595)
Foundation - 1 slab	1.76 (10.0)	1.76 (10.0)	137.1 (1476)

AIRTIGHTNESS

Air leakage rate at 50 pascals	0.88 air changes / hour
Equivalent leakage area	271.3 cm² (42 in²)
Normalized leakage area	0.4 cm² / m² (0.6 in² /100 ft²)

MECHANICAL SYSTEMS

SPACE HEATING

TYPE	OUTPUT SIZE	EFFICIENCY
Condensing natural gas furnace	18.8 kW 64500 BTU/h	95% AFUE
Design heating load: 9.09 kW		

SPACE COOLING

TYPE	OUTPUT SIZE	EFFICIENCY
Central air conditioner	9.65 kW 33000 BTU/h	13 SEER
Design cooling load: 8.36 kW		

WATER HEATING

TYPE	TANK VOLUME	EFFICIENCY
Electric storage tank	287L (76 USG)	98%
Drain water heat recovery	N/A	43.50 %

WHOLE-HOME VENTILATION

TYPE	AIR FLOW RATE	EFFICIENCY
Heat recovery ventilator certified by the Home Ventilating Institute	27.99 L/s (59 cfm)	75%

HEATED FLOOR AREA

Above-grade area	142.3 m² (1531.7 ft²)
Below-grade area	137.1 m² (1476 ft²)

GLOSSARY

Airtightness
describes how well the building envelope resists air leakage and is measured in air changes per hour at 50 pascals (ACH@50 Pa). The fewer air changes per hour, the more airtight the building envelope is. Equivalent leakage area is another way of describing the airtightness of the building envelope. It represents the size of a single hole in your building envelope if all the individual air leakage holes or gaps were added together. The smaller the equivalent leakage area, the less energy you will need to control the temperature of your home (but you will still need to ensure that you have adequate ventilation).

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is the heat from the sun that influences your home's heating and cooling requirements. Generally, south facing windows provide more solar gain.

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U-factor
measures heat transferred through windows and doors, expressed in W/m² • °C (BTU/h • ft² • °F). The lower the U-factor, the better the energy efficiency of a window. The inverse of U-factor (1/U-factor) identifies the resistance to the flow of heat, expressed in RSI. The higher the RSI, the better the window is at resisting heat loss. You can use these values to choose more energy efficient windows.

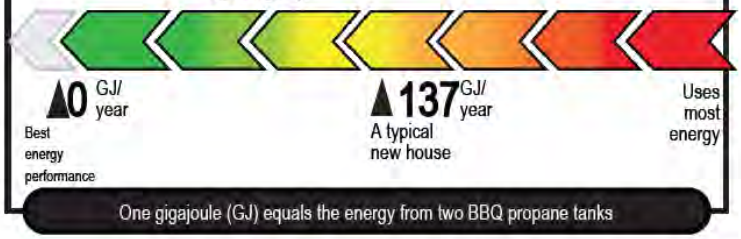
For more details and additional terms, please visit NRCan.gc.ca/myenerguide.

99 Dodds Road,
Headingley, MANITOBA, R4H 1E3

ENERGUIDE

Data collected: June 22, 2018
File number: **8301n00137**
Evaluated by: Gio Robson

90 This House GJ/year

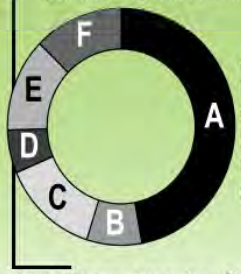


One gigajoule (GJ) equals the energy from two BBQ propane tanks

Rated Annual Energy Consumption		90 GJ
• Electricity	47	
• Natural gas	43	
On-site renewable energy contributions		- 0 GJ
• Electricity	0	
• Solar water heating	0	
EnerGuide Rating:		= 90 GJ

Figures may not add up due to rounding.

Breakdown of Rated Annual Energy Consumption:



A	Space heating	48%
B	Space cooling	8%
C	Water heating	14%
D	Ventilation	1%
E	Lights & appliances	13%
F	Other electrical	16%

Rated Energy Intensity: **0.32 GJ/m²/year**

Rated Greenhouse Gas Emissions: **2.2 tonnes/year**

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Quality assured by: prairieHOUSE Performance Inc.

Builder: Green House Development

Visit NRCan.gc.ca/myenerguide

Natural Resources Canada | Ressources naturelles Canada | Canada

NEXT STEPS

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Greenstone Building Products

9.25” Thick, 16” O.C. Insulated Wall Panel

Effective R_{si} Calculation

Addressed To:

Tilda Fortier and Rodney Penner
Greenstone Building Products
April 29th, 2020

Produced By:

Deva S. Veylan ***MBSc, EA, CPHC***
Building Science Specialist
CoEfficient Building Science Ltd.

Table of Contents

Overview: 29
Scope of Report: 29
Method: 29
Assumptions: 30
Proposed Envelope Assemblies: 30
Wall Assembly 30
Results: 31
Field of Wall 31
Top of Wall With Stud Web 32
Top of Wall Without Stud Web 33
Bottom of Wall With Stud Web 34
Bottom of Wall Without Stud Web 35
Conclusions: 36

Overview:

CoEfficient Building Science was contracted by Tilda Fortier and Rodney Penner of Greenstone Building Products to perform effective envelope Rsi value calculations for a proprietary insulated wall panel system. The wall panel consists of steel stud framing members at 16" O.C. and type 2 expanded polystyrene insulation (EPS II)and is 9.25 inches thick, 12 feet high, and 4 feet wide. The purpose of the calculations is to get an accurate effective insulation value for a proprietary insulated wall panel system used for residential and commercial construction. THERM 7 software is used for a two dimensional, steady-state calculation of effective Rsi values, the results of which are to be provided to energy modelers for more accurate energy modeling of buildings utilizing this wall panel system.

Scope of Report:

This report reviews the proposed assembly, the thermal conductivity and thicknesses of the materials used, and the results from the calculations using THERM 7 software.

Method:

The proposed assemblies were reviewed for clarity and completeness. The assembly details are considered proprietary and are therefore not included in detail in this report. Contact Greenstone for detailed drawings. Assembly components were then listed and material thicknesses and thermal conductivity (k) were determined. Thermal conductivities for the galvanized steel studs was selected based on the default conductivity value in THERM 7. The thermal conductivity of the EPS II foam was determined from averaging the results from the ASTM C578-2016 and CAN/ULC S701-11 tests as per report T1090-1701 Rev 1 performed by QAI Laboratories of Vaughan, ON. Assemblies were drawn in THERM 7 based on provided scale drawings.

THERM 7 is a steady-state, two-dimensional tool that can be used to determine the thermal properties of complex assemblies. In order to determine the effective Rsi value of the wall

assembly, the area weighted average method was used and two-dimensional cross-sections from five locations were simulated, including the following:

- The field of the wall (top view with the wall cut horizontally)
- The top of the wall with no stud web (side view with the wall cut vertically)
- The top of the wall including a stud web (side view with the wall cut vertically)
- The bottom of the wall with no stud web (side view with the wall cut vertically)
- The bottom of the wall with no stud web (side view with the wall cut vertically)

The wall assemblies are modeled without interior or exterior finishes, with the understanding that an energy modeller can add the interior and exterior finishes at the time of modeling and depending on the finishes being used in the specific project.

Assumptions:

Assumptions were required for the THERM 7 simulation, including;

- The relative humidity of the materials was 50%
- The difference in temperature between the inside and the outside of the assembly was set to 20°C
- No air film coefficient was used, as these assemblies are designed to be finished on the interior and exterior, and air films will be included in the energy model
- Corners and fenestration opernings are ignored

Proposed Envelope Assemblies:

Wall Assembly

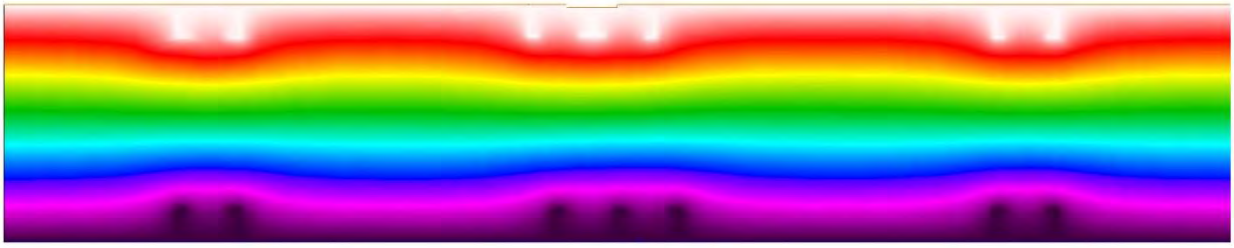
- 9.25” thick, 4’ wide, 12’ tall
- 20 ga. galvanized steel studs, 2.5” wide, 1.19” deep at 16” O.C.
- Proprietary stud shape and layout
- Top and bottom load bearing galvanized steel channels
- EPS II foam as insulation in and between the studs

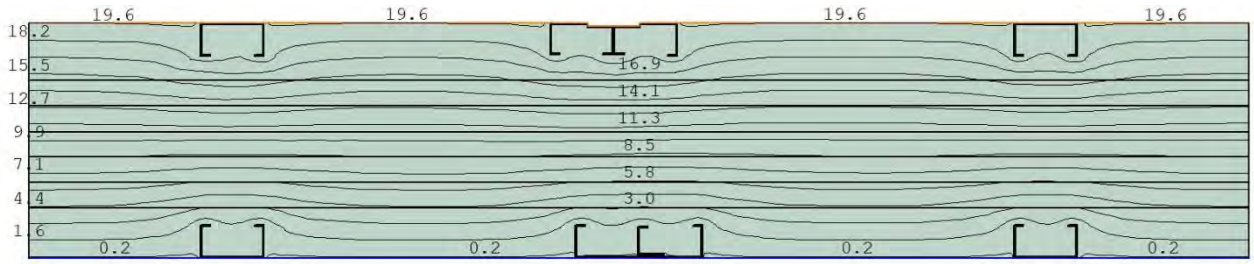
Wall Assembly Materials

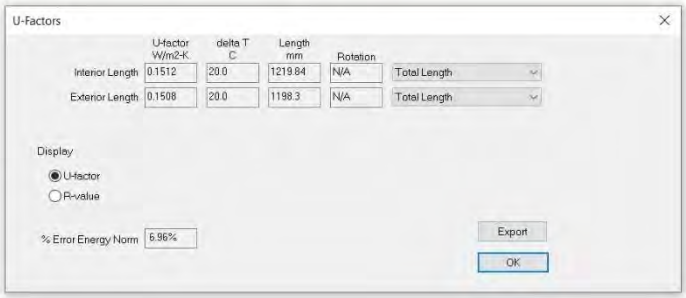
Layer	Material	Thickness	Conductivity (W/m*K)
EPS II Foam	EPS II Foam	9.25" (max)	0.0326
Galvanized Steel	Grade 33 G90 Steel	20 ga	62.000

Results:

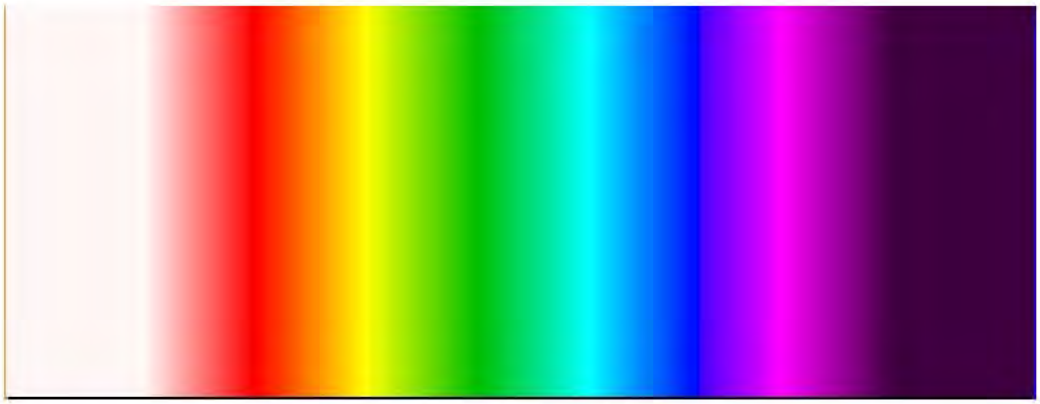
Field of Wall

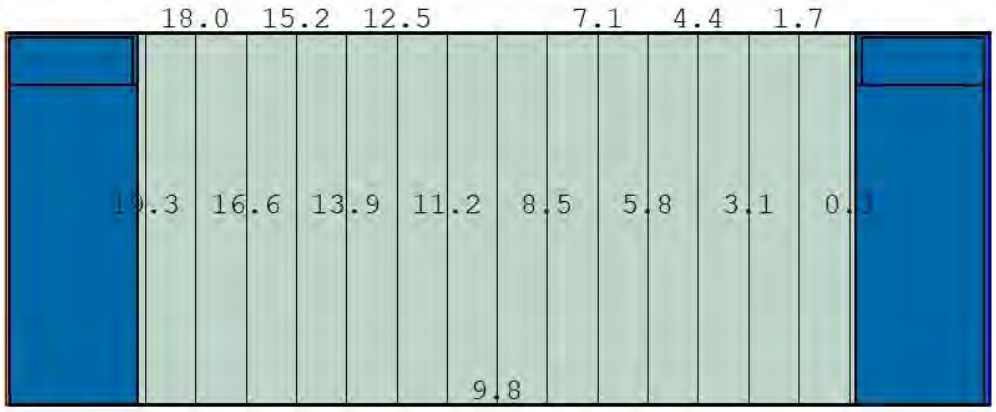


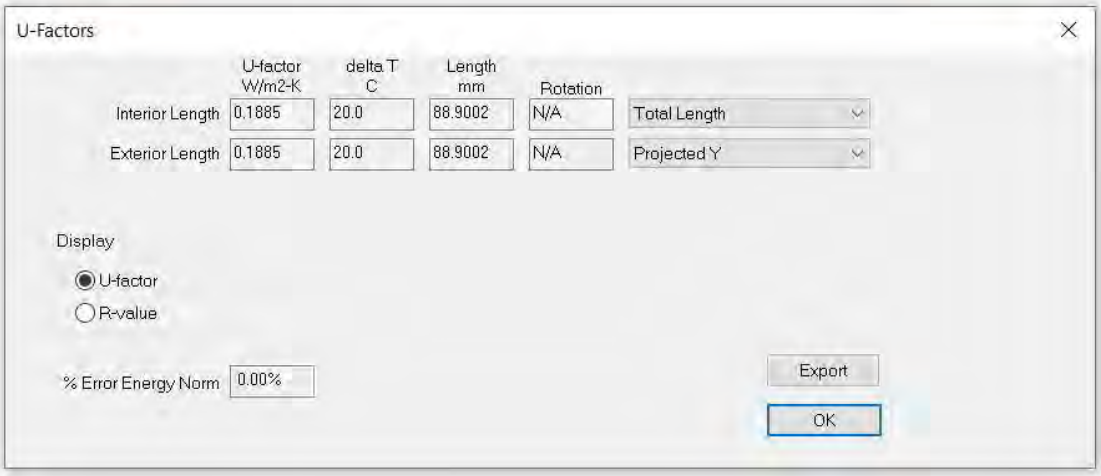




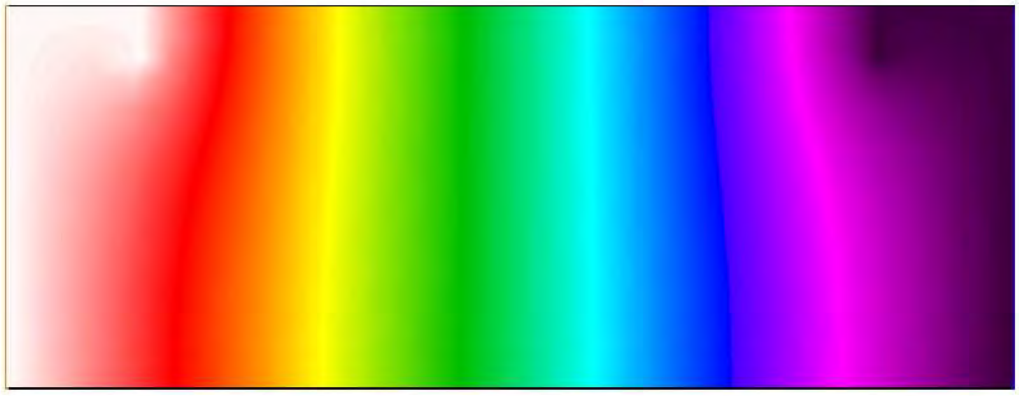
Top of Wall With Stud Web

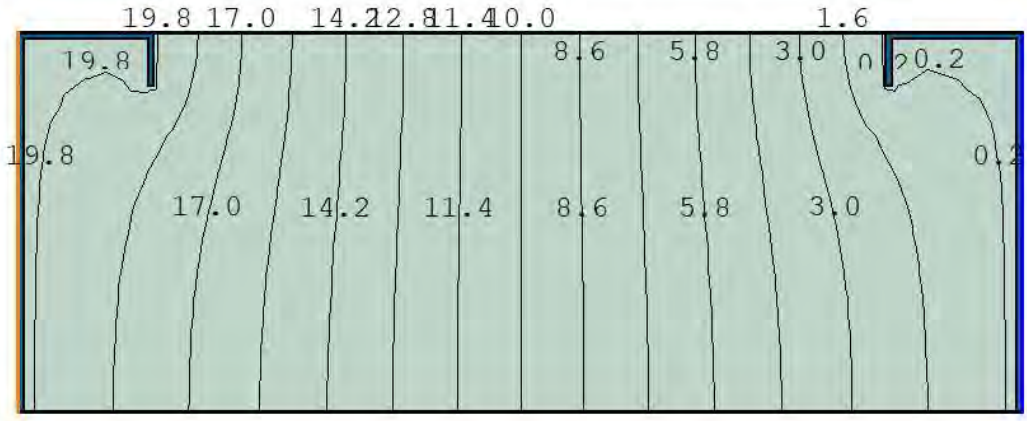


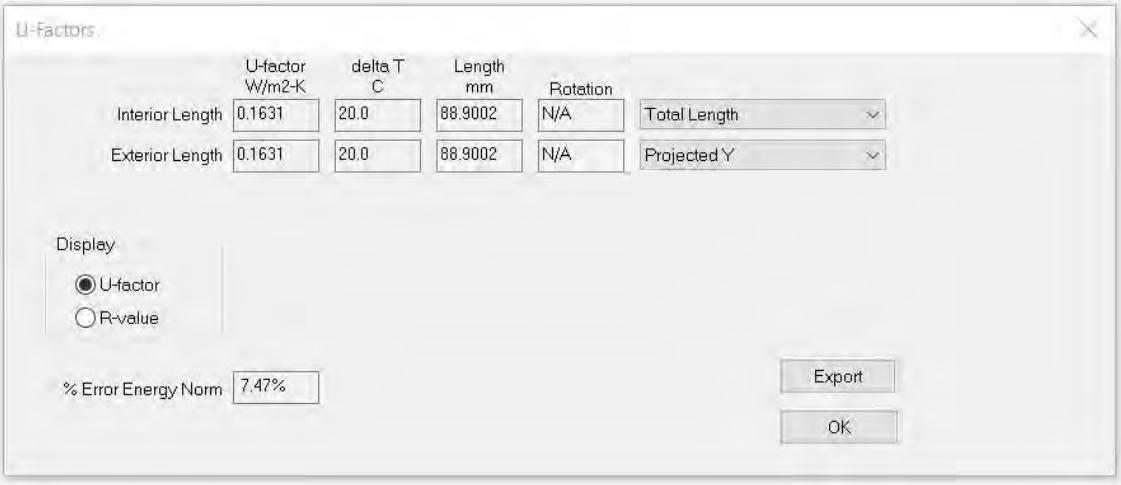




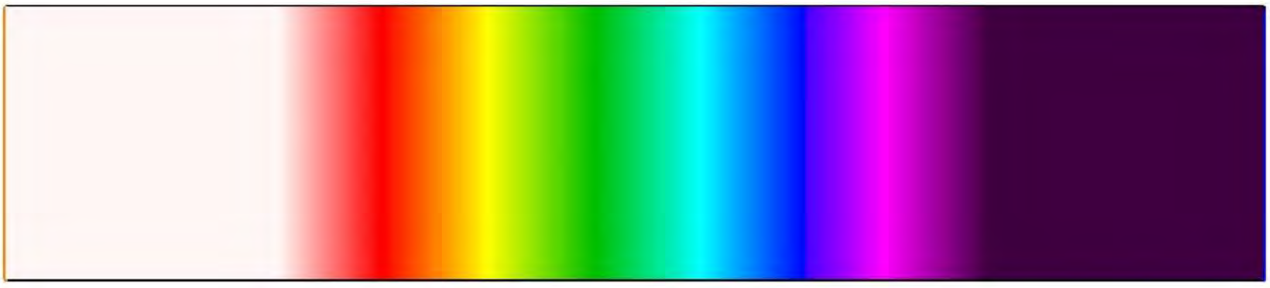
Top of Wall Without Stud Web

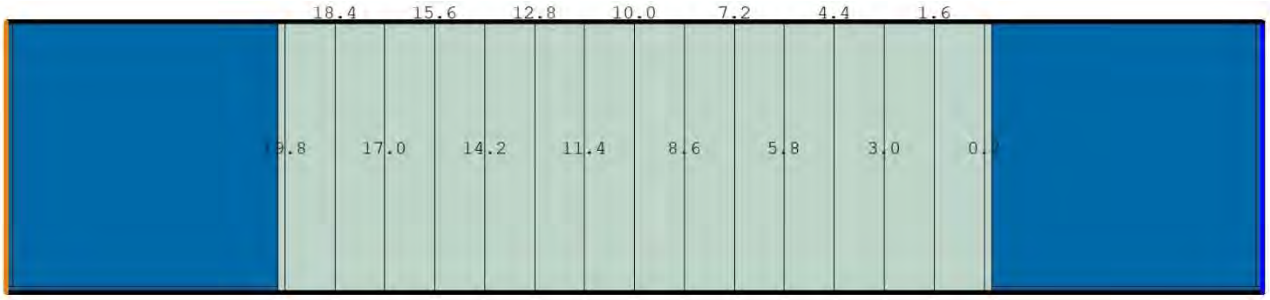


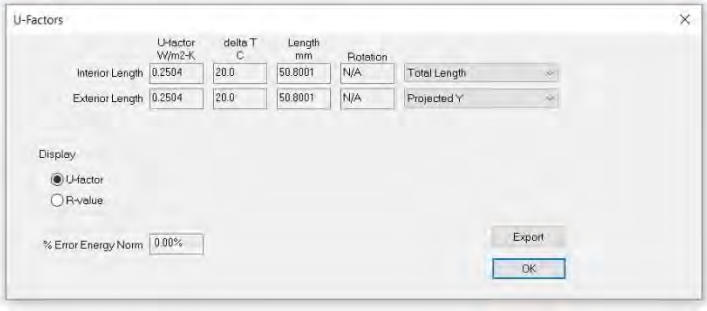




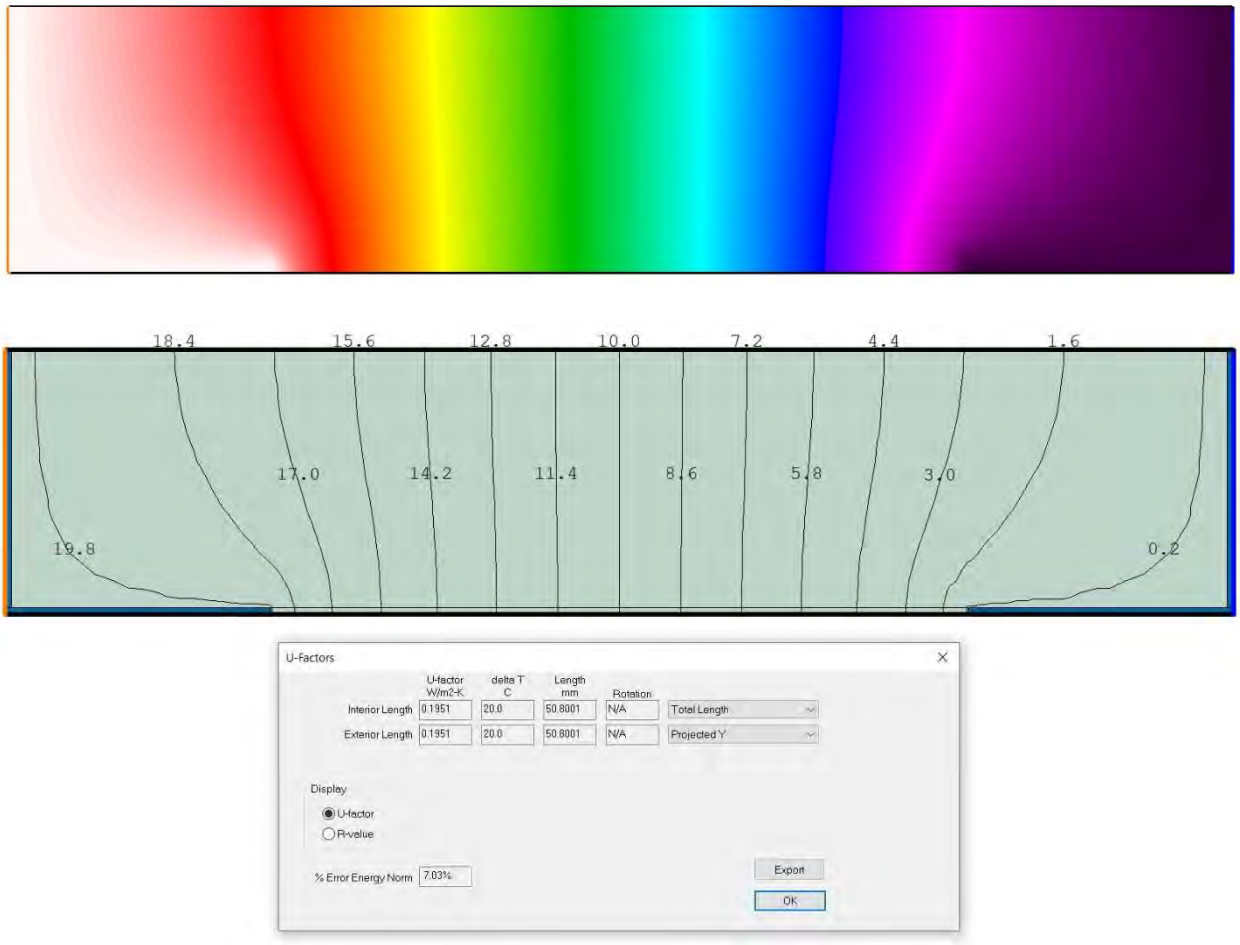
Bottom of Wall With Stud Web







Bottom of Wall Without Stud Web



Wall Assembly Calculation (9.25" thick, 16" O. C. Steel Studs)

Layer	Material	Thickness (inch)	% of Wall Area	Usi-value from THERM 7	U-value from THERM 7
Field of Wall	Steel and EPS II	9.25"	96.18%	0.151	0.027
Top of Wall With Stud Web	Steel and EPS II	9.25"	0.02%	0.189	0.033
Top of Wall Without Stud Web	Steel and EPS II	9.25"	2.41%	0.163	0.029
Bottom of Wall With Stud Web	Steel and EPS II	9.25"	0.01%	0.250	0.044
Bottom of Wall Without Stud Web	Steel and EPS II	9.25"	1.38%	0.195	0.034

Conclusions:

The results from the THERM 7 simulation are summarized in the table below:

Effective Thermal Conductivity Results

Assembly	Overall Effective U_{si}-value	Overall Effective R_{si}	Overall Effective U-value	Overall Effective R-value
12' Tall, 9.25" Thick Wall Assembly w/ 16" O.C. Steel Studs	0.152	6.57	0.027	37.3

The overall effective R-value of a 12' high, 9.25" thick wall system with 16" O.C. stud spacing is R37.3. Though corners and window framing are not factored into the result, due to the nature of the framing system and based on the calculations performed in the intermediate steps of this analysis, it is unlikely they will have a significant impact on the effective R-value of the wall system.

We would be happy to discuss our results with you if you would like. Please feel free to contact me, Deva S. Veylan, at (780) 446-4592 with any questions.

All the best,

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