

CPA schematic, BOM, and drawings update

HVS meeting on 2024-04-02
Glenn Horton-Smith

Updated CPA overview schematic

- The schematic on the next page reflects what we did in PD-HD-2:
 - We wanted to connect HV bus to the endwall FC like we do on top and bottom FC: miniboard on the frame to FSS, FSS to board on the EW.
 - Ohmite doesn't make Slimmox 2.5 G resistors in the same size as the 5 G resistors we use in the TB "miniboards".
 - New interior vertical bus only has brass connection tab at bottom end of each bus segment.
- Result: we need 4-resistor miniboards for EW, slightly taller than TB.

CPA. Panel 50

CPA. Panel 2 - 49

CPA. Panel 1

R: 5G, Ohmite SM104035007FE
MOV: Panasonic ERZ-V14D182

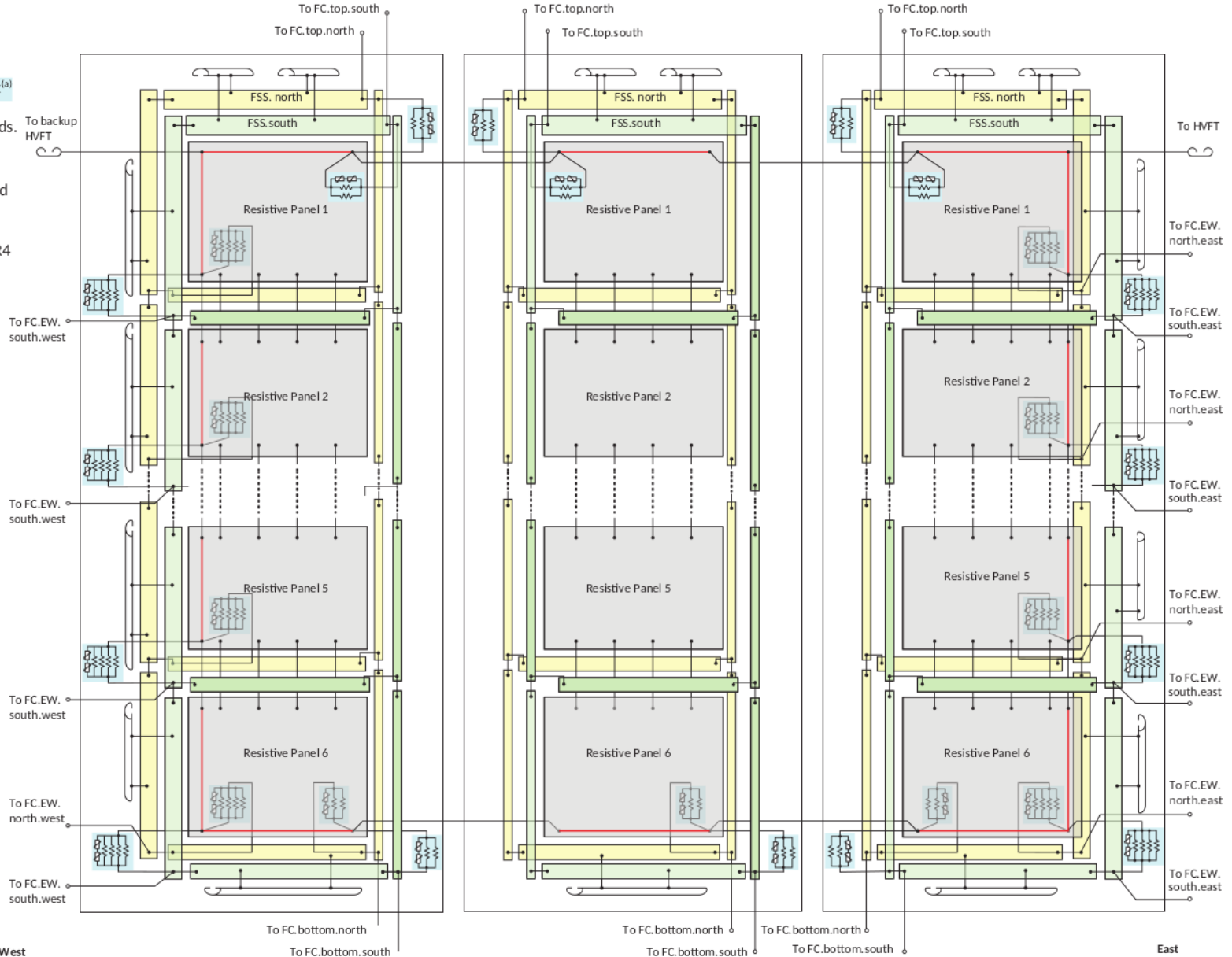
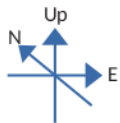
The connections between HV Bus and the FSS are made using TBFC-CPA interconnect^(a) boards at the top and bottom and EWFC-CPA interconnect^(b) boards at the ends.

The Resistive Panels^(c) are 3mm FR4 sheet with DuPont resistive Kapton film laminated on both sides.

All FSS.south^(d) and FSS.north^(d) are 3mm FR4 with resistive Kapton on one side.

The HV Bus^(e) is constructed from segments of HV cable (Dielectric Sciences 2134).

Mechanical assembly drawing part numbers:
(a) DFD-20-A021 and DFD-20-A040
(b) [part number pending]
(c) DFD-20-A403
(d) DFD-20-A101, -A102, -A103, -A104, -A105, -A106, -A107, -A108, -A109, -A110, -A118, -A301, -A302, -A303, -A304, -B101. All are electrically similar, but different mechanically.
(e) DFD-20-A409 horizontal, DFD-20-A411 vertical.



West

East

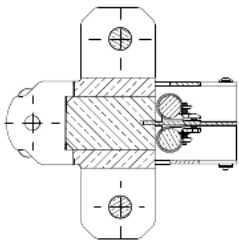
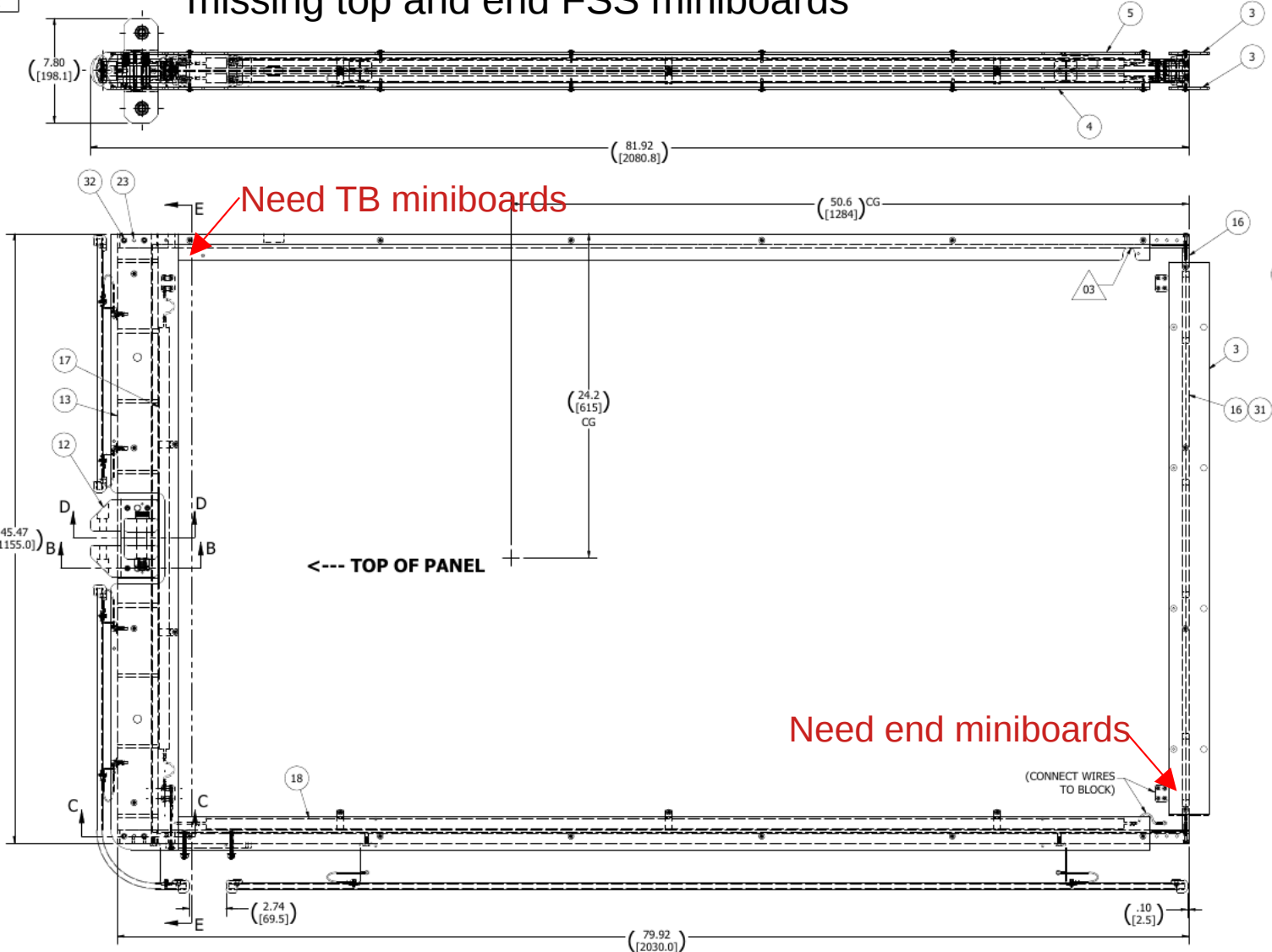
HV connection drawing fixes needed

This slide and next 8 slides copied from
HVS meeting 2023-09-19
Glenn Horton-Smith

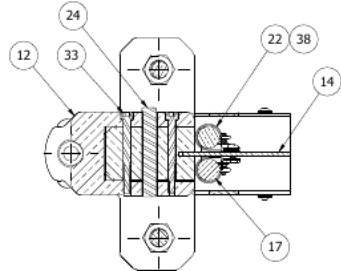
All drawing numbers refer to [EDMS doc 2633164 v.1 file DFD_CPA_071123.pdf](#)

DFD-20-G100 rev 03 UPPER PANEL ASSEMBLY, TYPE "G": missing top and end FSS miniboard

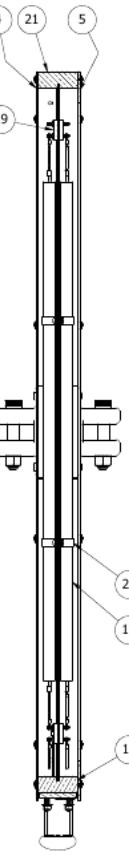
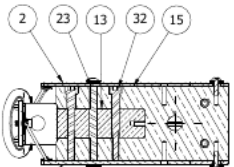
REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
BoM	01	revised per supporting components	9/9/2021	RTK
BoM	02	revised per supporting components	8/9/2022	RTK
BoM	03	New Diffuser Geometry; FSS Mods	6/29/2023	RTK



SECTION D-D



SECTION B-B

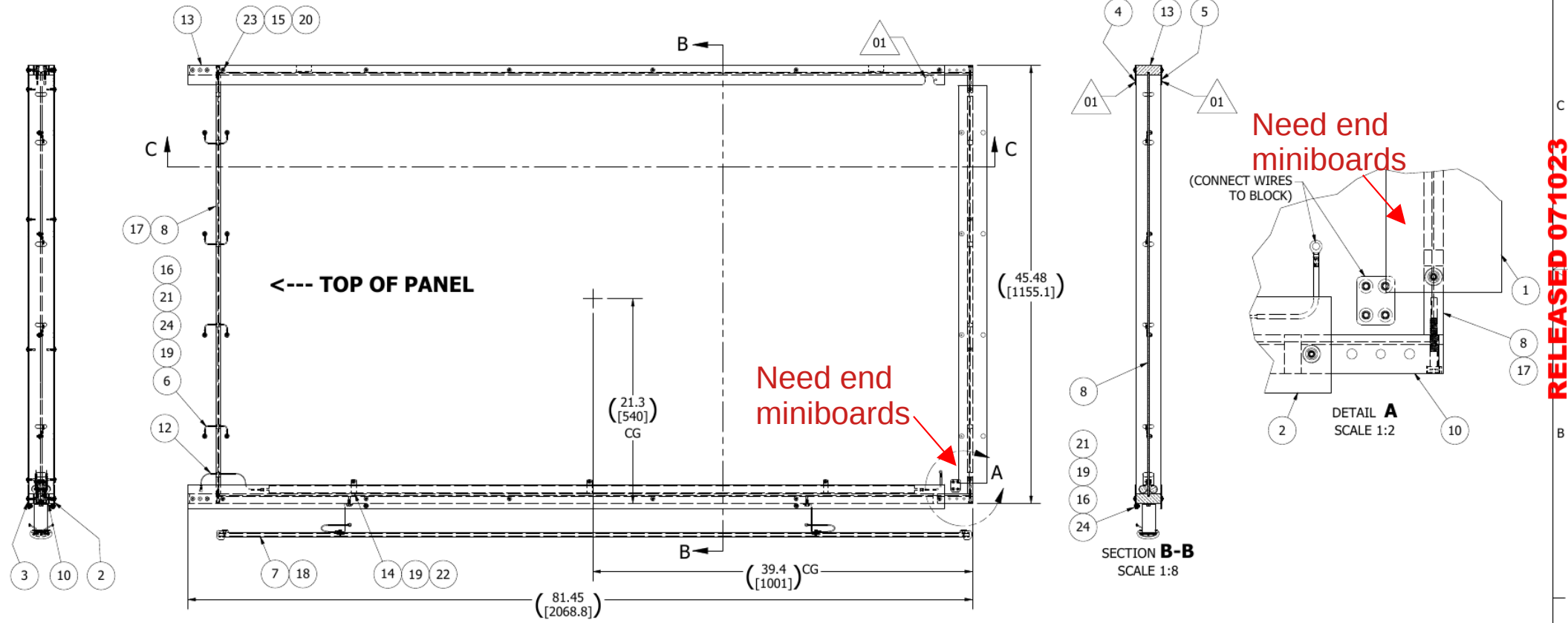


SECTION E-E

2024-04-02

CPA schematic, BOM, and drawing status

DFD-20-G200 rev 01 MIDDLE PANEL ASSEMBLY, TYPE "G": missing end FSS miniboard

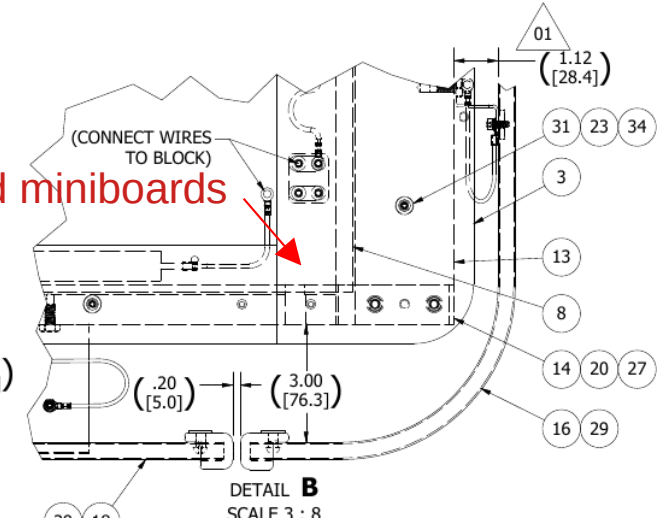
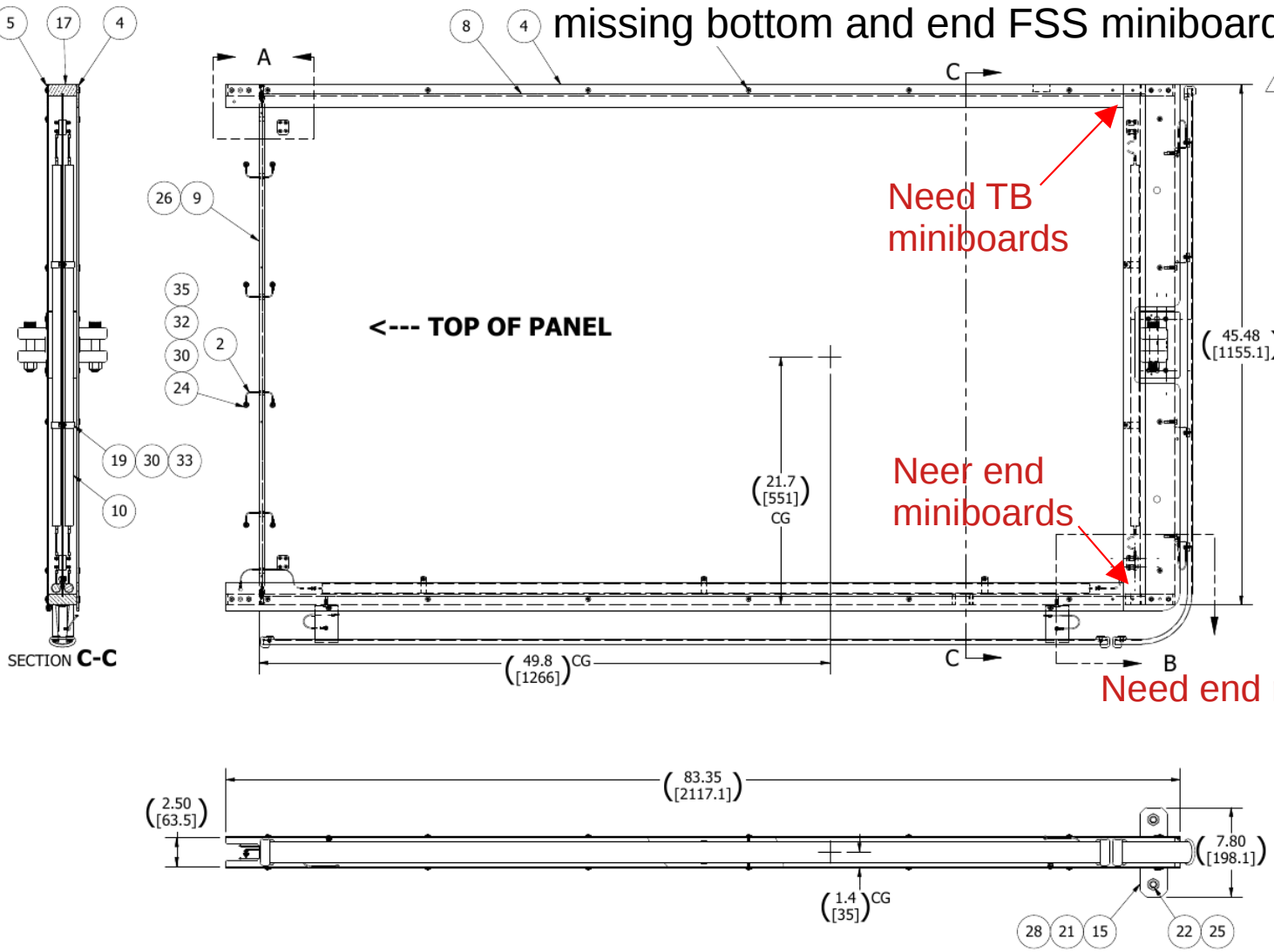


RELEASED 071023

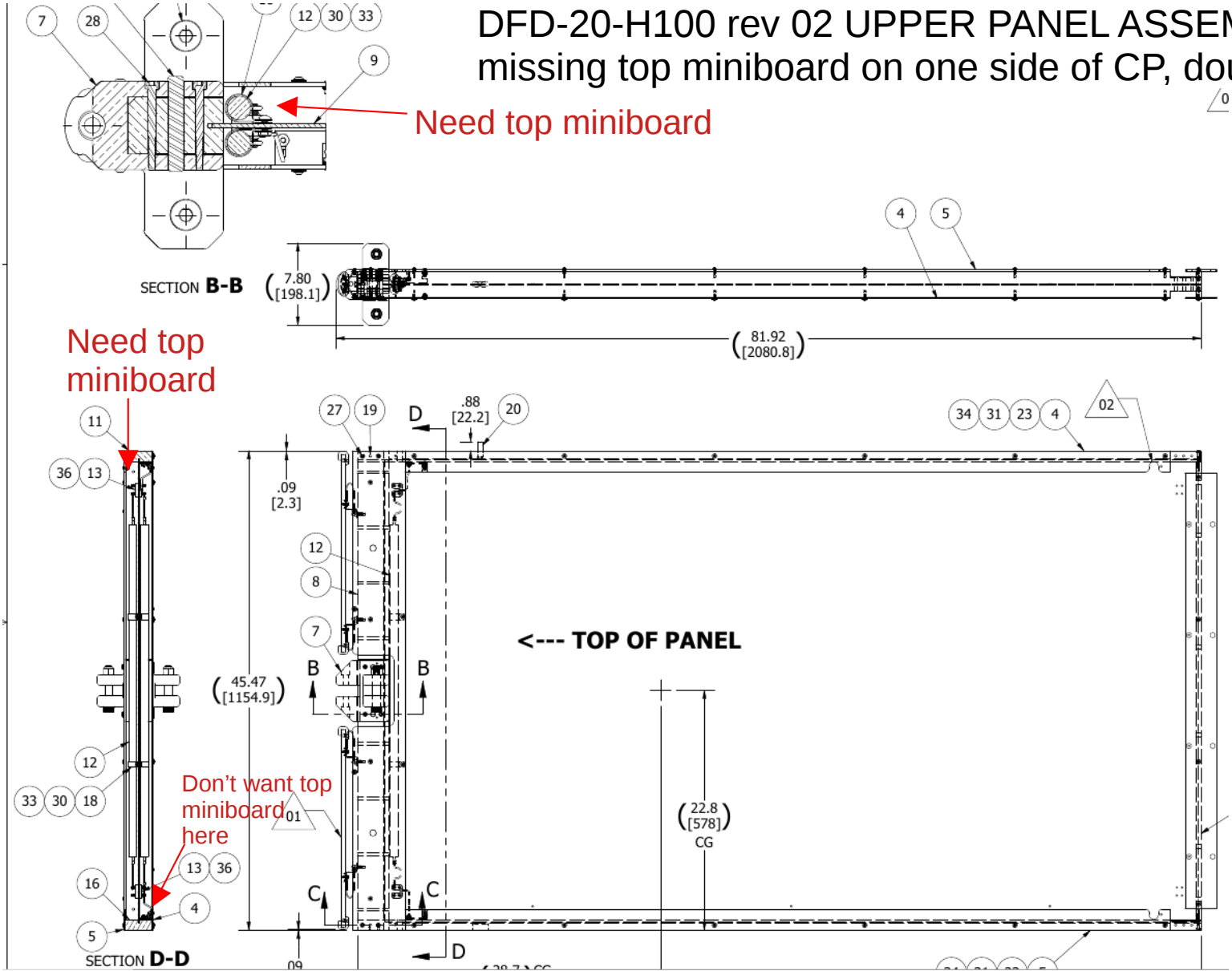
DFD-20-G300 rev 03 LOWER PANEL ASSEMBLY, TYPE "G":

missing bottom and end FSS miniboard

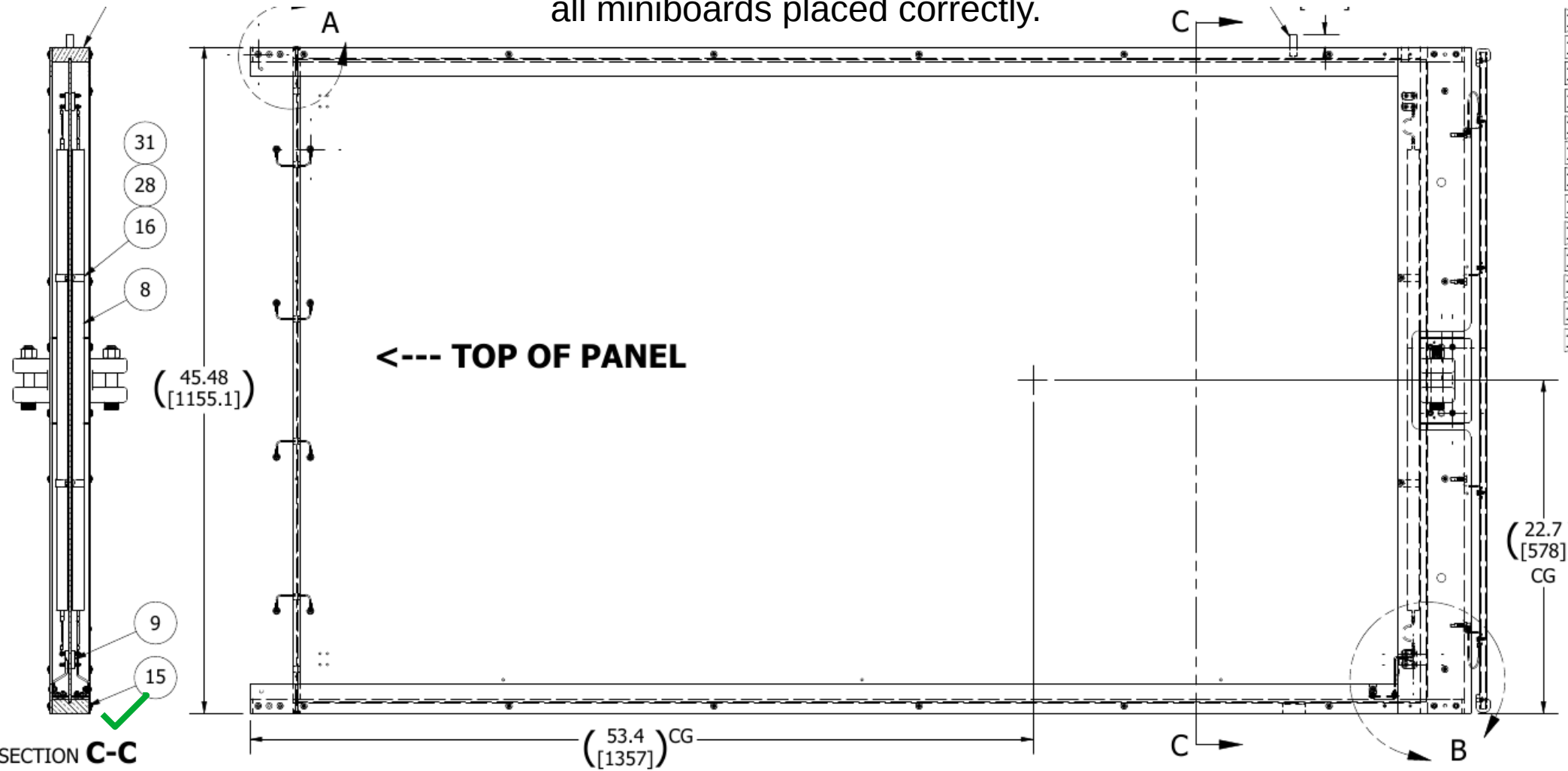
QTY	DESCRIPTION	UNIT	REMARKS
13	DFD-20-A601	02	BOTTOM SUPPORT BAR
14	DFD-20-A602	03	LOWER SIDE BAR (L.H.)
15	DFD-20-A603	01	BOTTOM CENTER SUPPORT TAB
16	DFD-20-D117	04	PROFILE ASSEMBLY; 90° [CPA-D-BOT]
17	DFD-20-G302	02	LOWER SIDE BAR
18	DFD-20-G320	01	PROFILE ASSY 1885 mm (74.2") NOM
19	3177T54		Loop Clamp; Ø3/4" - REMOVE RUBBER
20	90145A551	-	Dowel Pin; Ø.25 x, 2.5 LG
21	90145A725	-	DOWEL PIN; Ø.5 x 3.0 LG
22	90298A847		SHOULDER SCR; Ø.75 x 3.0 LG
23	91235A105		WASHER, BELLEVILLE; #8 xØ.403
24	91235A109		WASHER, BELLEVILLE; #10 xØ.465
25	91831A144		LOCKNUT, HEX; 5/8-11UNC
26	92196A249		SHCS; #10-24UNC x 1.25 LG
27	92196A551		SHCS; 1/4-20UNC x 2.25 LG
28	92196A552		SHCS; 1/4-20UNC x 2.5 LG
29	92240A537	-	HHCS; 1/4-20UNC x .5 LG
30	92671A011	-	HEX NUT; #10-24
31	92916A340	-	FLAT WASHER; #8 x Ø.438 x .03
32	92916A350	-	FLAT WASHER; #10 x Ø.5 x .04
33	94070A242	-	PAN HD SCR; #10-24 x .5 LG
34	97715A143		BHSCS; #8-32 x .5 LG
35	97715A178		BHSCS; #10-30 x .5 LG
36	97715A801		BHSCS; #10-24UNC x 1.0 LG



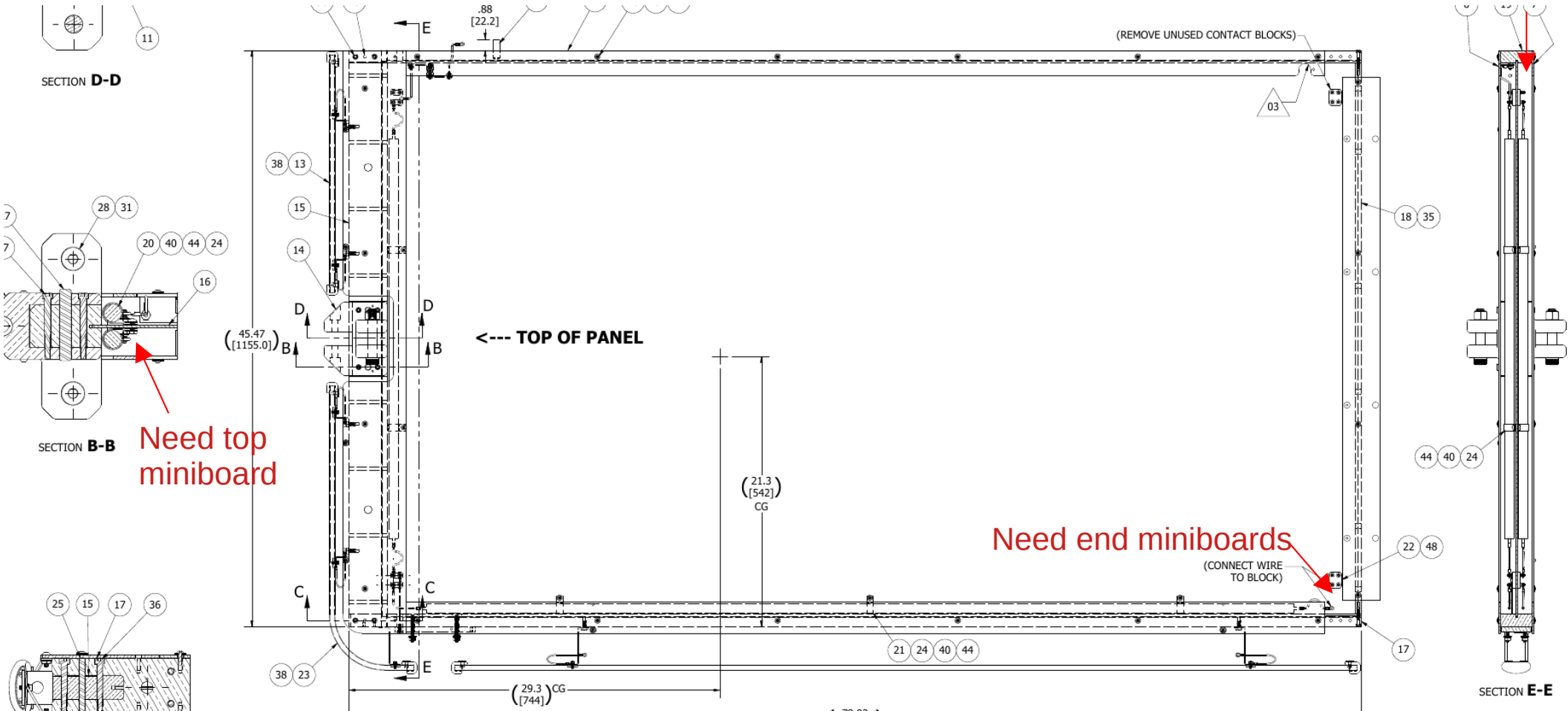
DFD-20-H100 rev 02 UPPER PANEL ASSEMBLY, TYPE "H":
 missing top miniboard on one side of CP, doubled on other.



DFD-20-H300 rev 03 LOWER PANEL ASSEMBLY, TYPE "H": all miniboard placed correctly.

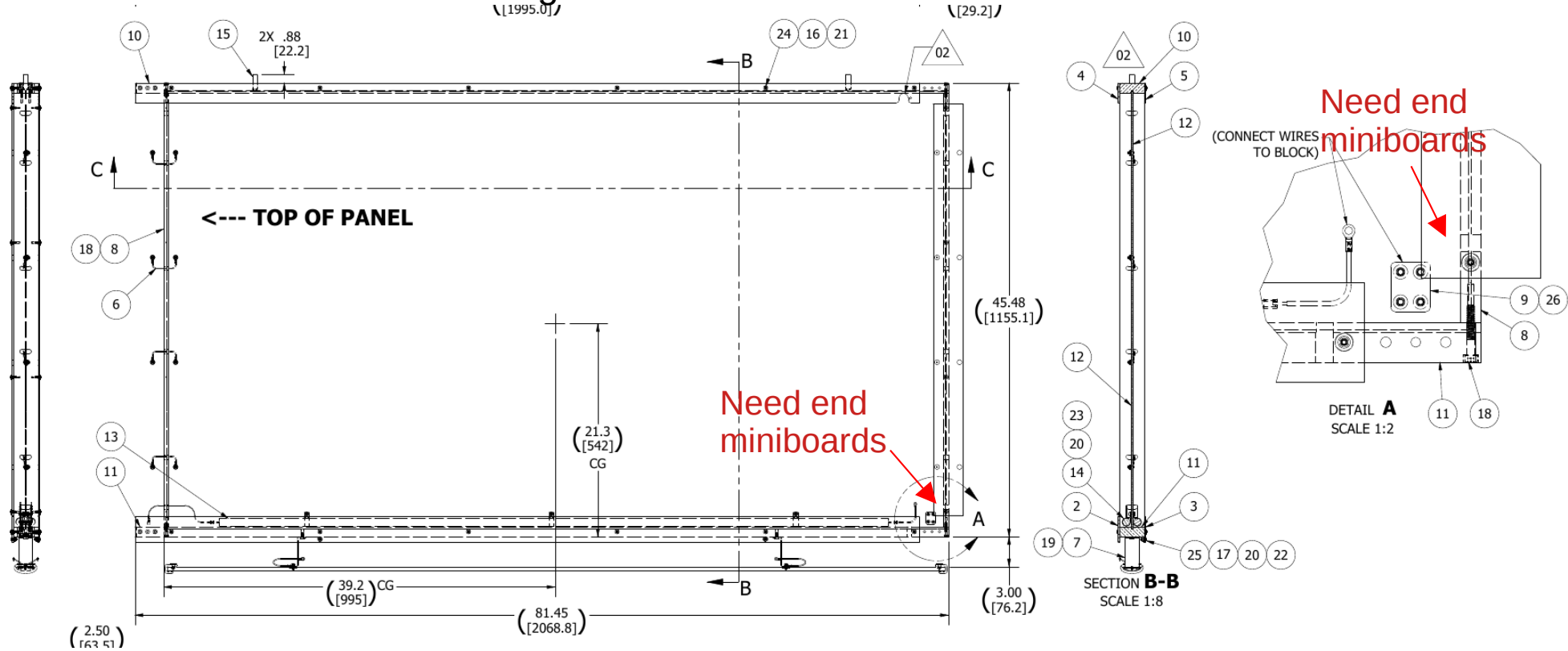


DFD-20-J100 rev 03 UPPER PANEL ASSEMBLY, TYPE "J": missing top miniboard on one side of CP, missing end boards



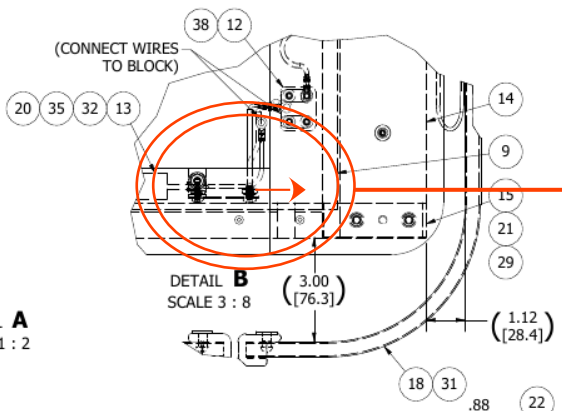
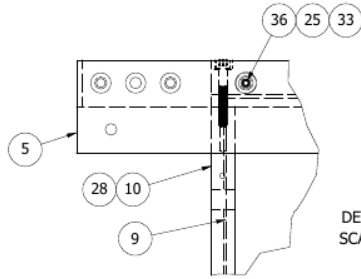
Question: Is it correct for G100 and J100 *both* to have their endwall profiles at the *bottom* of the page? It seems like we're looking at the *south* side of G and the *north* side of J. (Or the other way around.)

DFD-20-J200 rev 02 MIDDLE PANEL ASSEMBLY, TYPE "J": missing end FSS miniboard



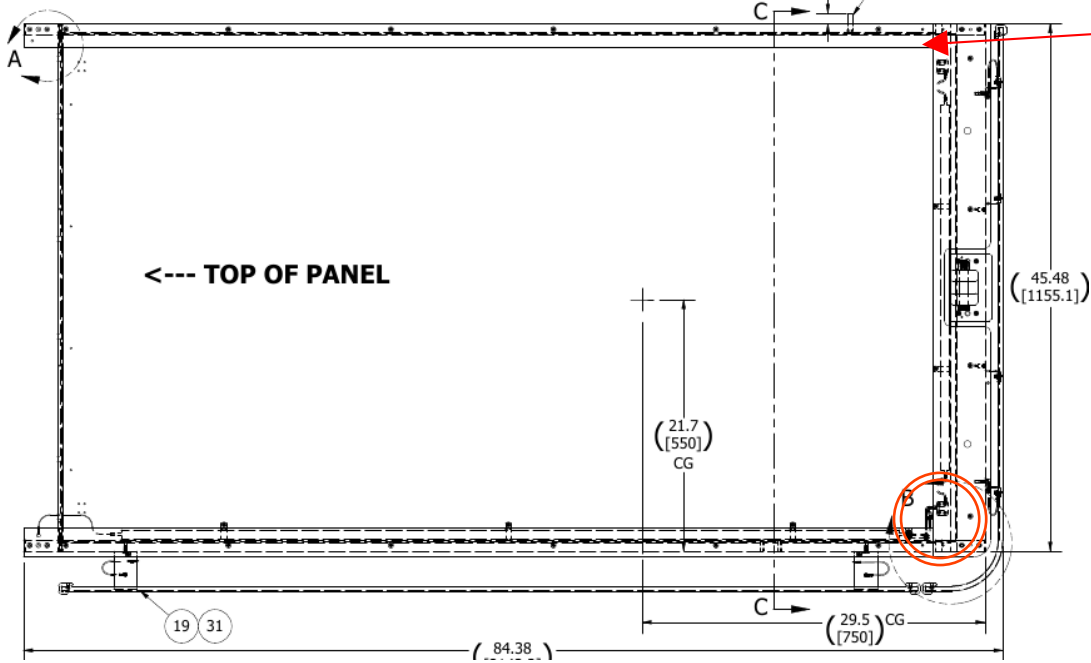
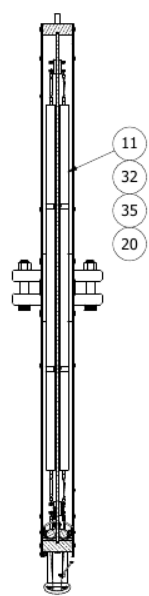
DFD-20-J300 rev 03 LOWER PANEL ASSEMBLY, TYPE "J": has bottom boards, missing end boards

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
BoM	01	revised per supporting components	9/9/2021	RTK
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BoM	03	FSS changes	6/29/2023	RTK



I'd make these end-miniboards and shift towards bottom to avoid HV bus.

Put TB miniboards here

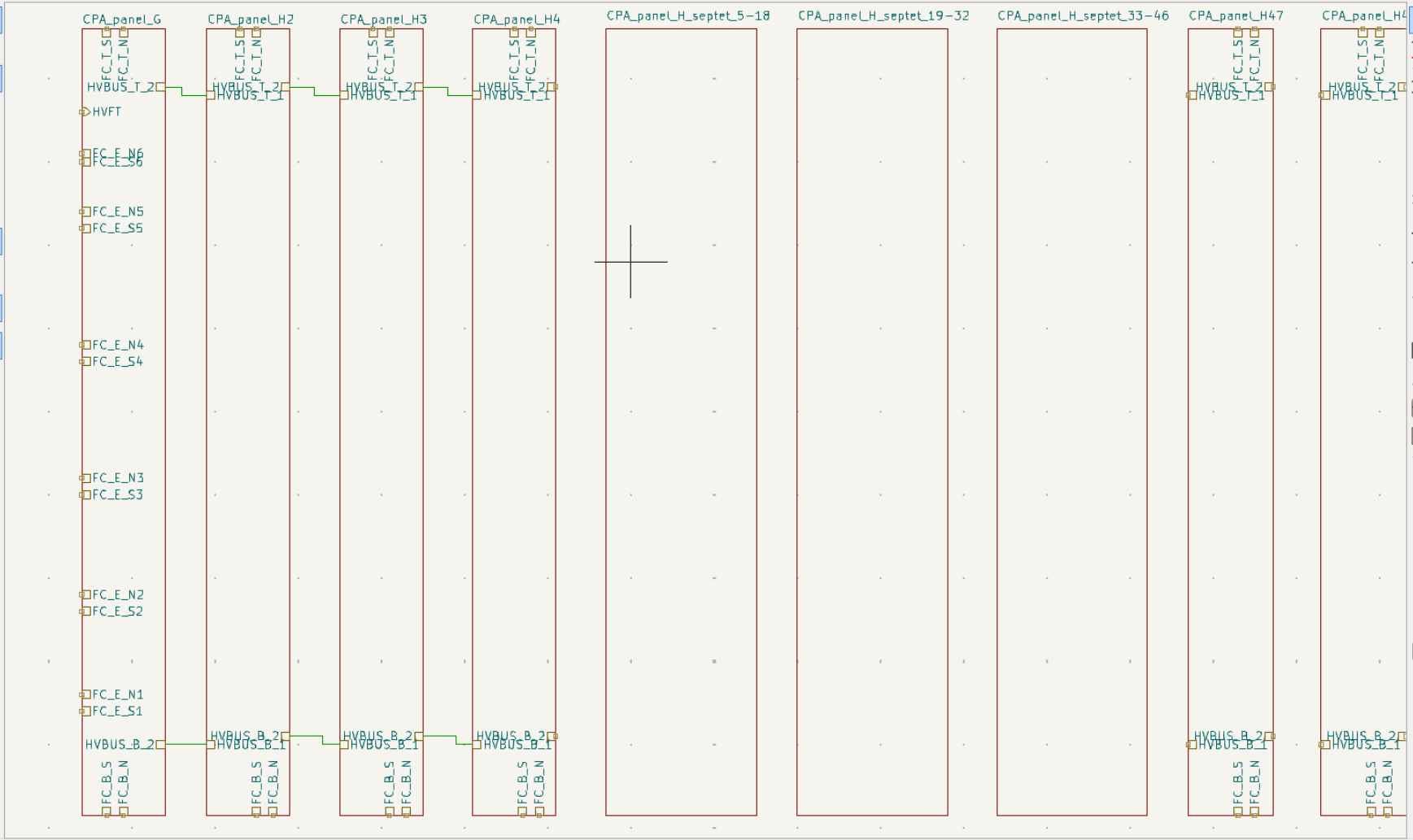


Working on schematic in KiCAD

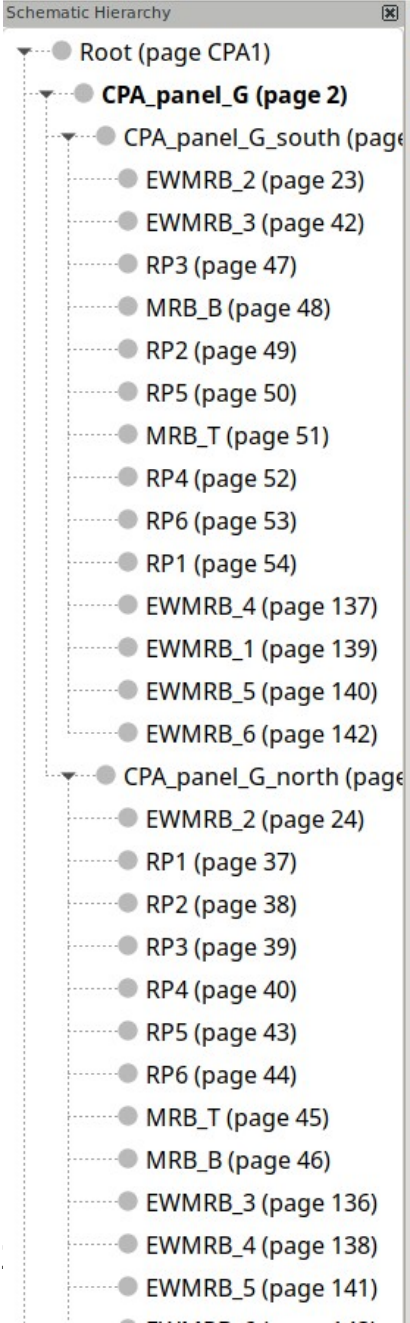
- Goal is to have complete electrical schematic in standard electronic tool.
- Useful for bill of materials, simulations for expected resistances, and reference.
- Hierarchical sheets make it easier to understand.
- About 70% done.



- Schematic Hierarchy
- Root (page CPA1)
 - CPA_panel_G (page 2)
 - CPA_panel_G_south (page 3)
 - EWMRB_2 (page 23)
 - EWMRB_3 (page 42)
 - RP3 (page 47)
 - MRB_B (page 48)
 - RP2 (page 49)
 - RP5 (page 50)
 - MRB_T (page 51)
 - RP4 (page 52)
 - RP6 (page 53)
 - RP1 (page 54)
 - EWMRB_4 (page 137)
 - EWMRB_1 (page 139)
 - EWMRB_5 (page 140)
 - EWMRB_6 (page 142)
 - CPA_panel_G_north (page 4)
 - EWMRB_2 (page 24)
 - RP1 (page 37)
 - RP2 (page 38)
 - RP3 (page 39)
 - RP4 (page 40)
 - RP5 (page 43)
 - RP6 (page 44)
 - MRB_T (page 45)
 - MRB_B (page 46)
 - EWMRB_3 (page 136)
 - EWMRB_4 (page 138)
 - EWMRB_5 (page 141)
 - EWMRB_6 (page 143)



Z 2.00 X 4850.00 Y 2300.00 dx 4850.00 dy 2300.00 dist 5367.73 grid 50.00 mils

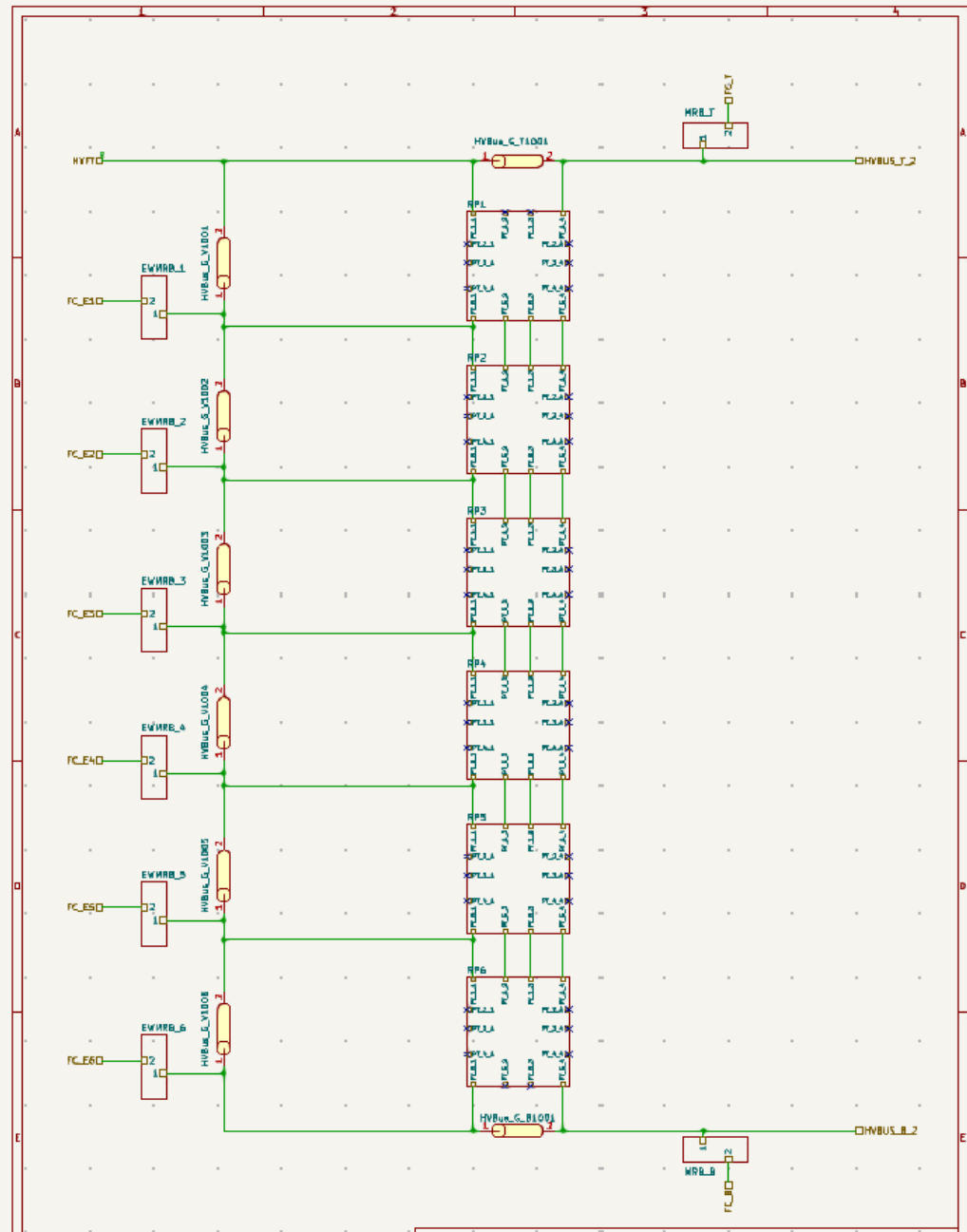
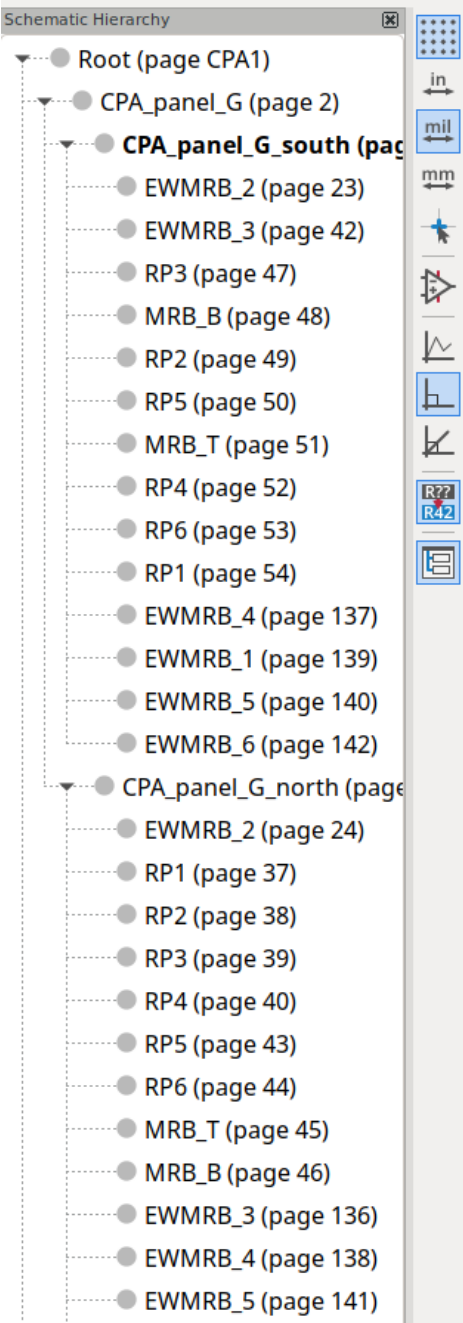


The “G” type CPA Panel, with north and south sides shown as subsheets.

Connections at top and bottom go to TB FC.

Connections at sides go to EW modules.

Still need to add profiles and corresponding “pin” on subsheet.



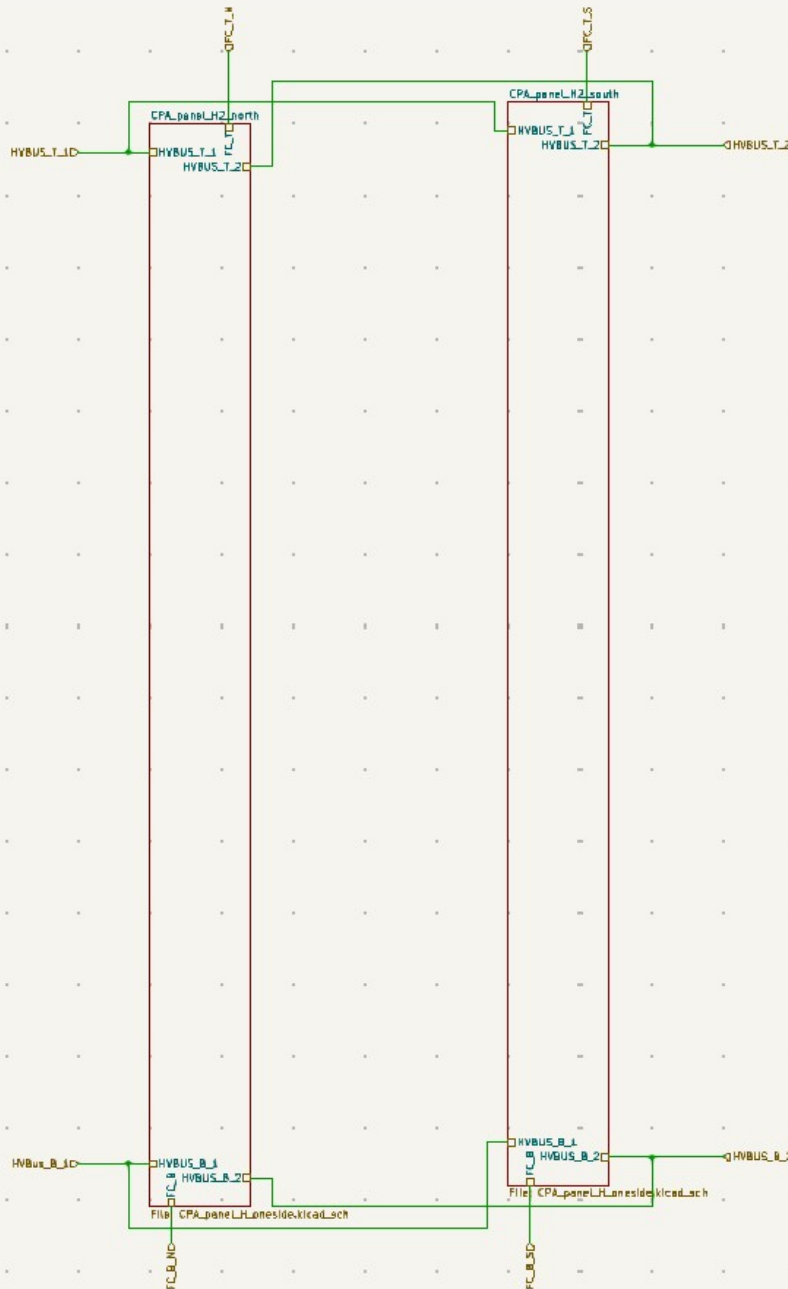
One side of a
“G” type CPA
Panel.

Individual
Resistive Panels
shown as
subsheets.

Still need to add
Field Shaping
Strips to this
sheet.

Schematic Hierarchy

- CPA_panel_H2 (page 3)
 - CPA_panel_H2_north (page 13)
 - MRB_T1 (page 13)
 - RP9 (page 14)
 - RP11 (page 15)
 - RP7 (page 16)
 - RP10 (page 17)
 - RP8 (page 18)
 - MRB_B1 (page 19)
 - RP12 (page 20)
 - FSS_H1 (page 144)
 - FSS_H5 (page 151)
 - FSS_H2 (page 157)
 - FSS_H3 (page 169)
 - FSS_H4 (page 181)
 - TBFSS_B1 (page 193)
 - TBFSS_T1 (page 211)
 - CPA_panel_H2_south (page 17)
 - MRB_T1 (page 83)
 - RP8 (page 84)
 - RP9 (page 85)
 - RP10 (page 86)
 - RP12 (page 87)
 - RP7 (page 88)
 - MRB_B1 (page 89)
 - RP11 (page 90)
 - FSS_H1 (page 145)
 - FSS_H2 (page 158)
 - FSS_H3 (page 170)
 - FSS_H4 (page 182)
 - TBFSS_B1 (page 194)



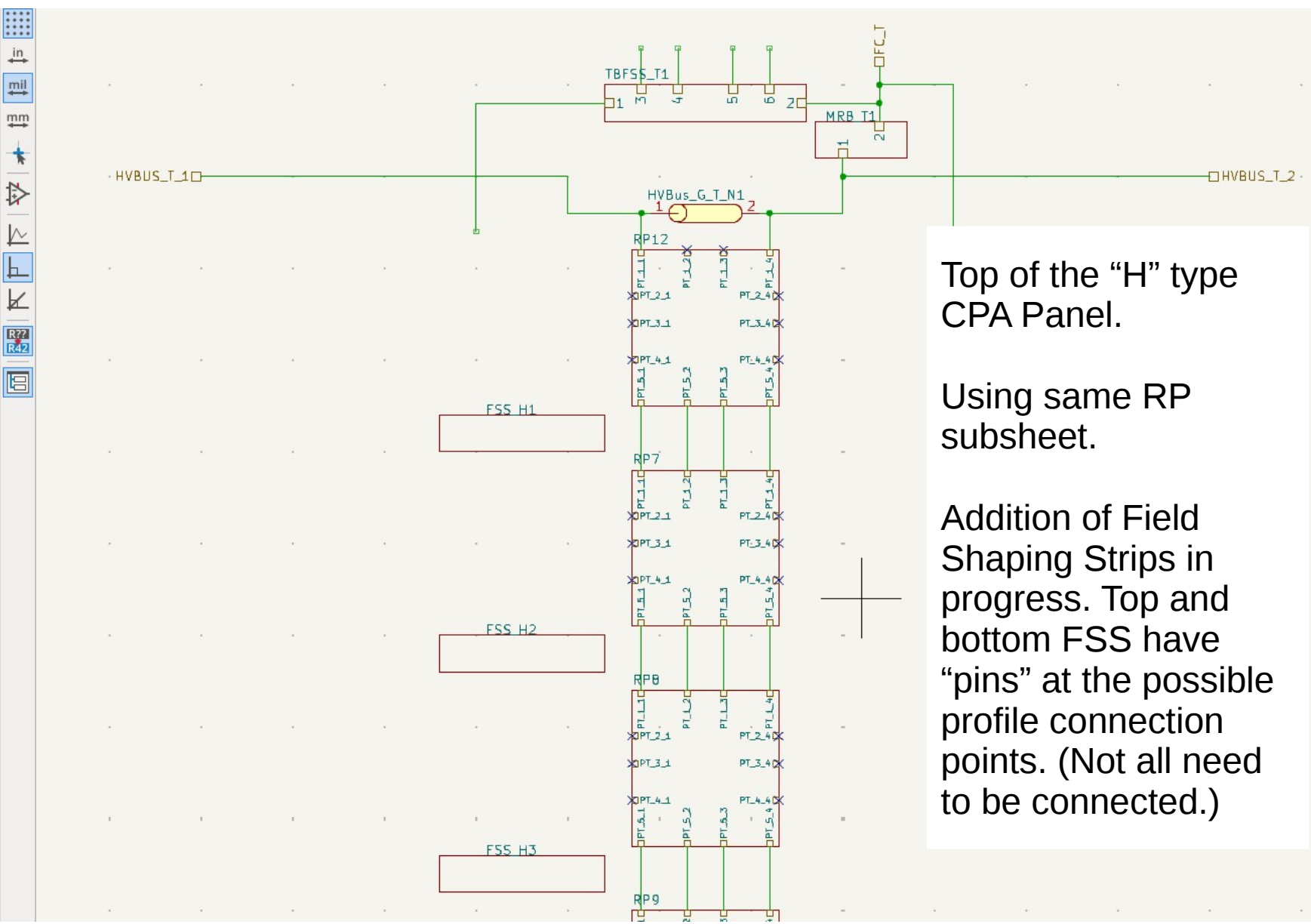
The “H” type CPA Panel, with north and south sides shown as subsheets.

Connections at top and bottom go to TB FC.

No EW modules.

Still need to add profiles and corresponding “pin” on subsheet.

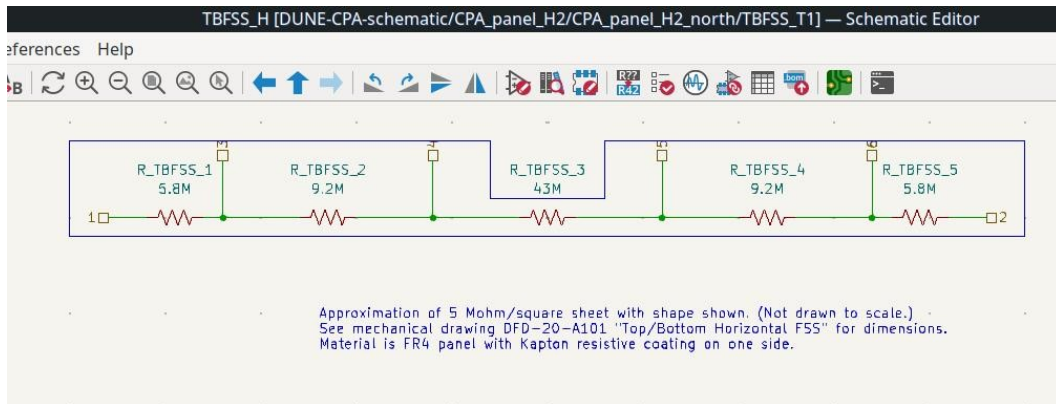
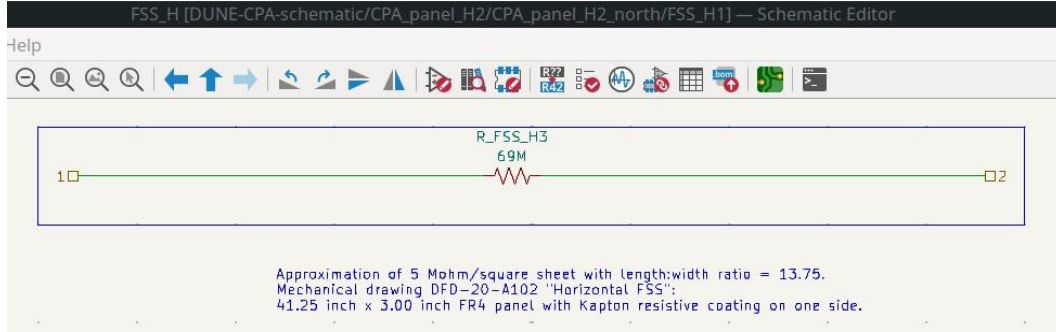
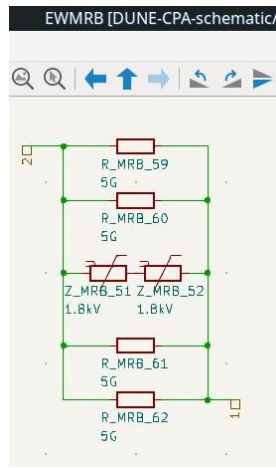
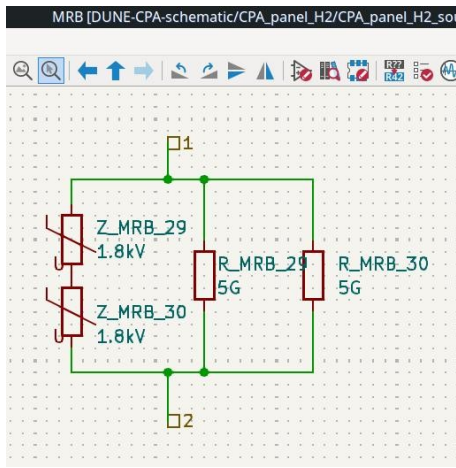
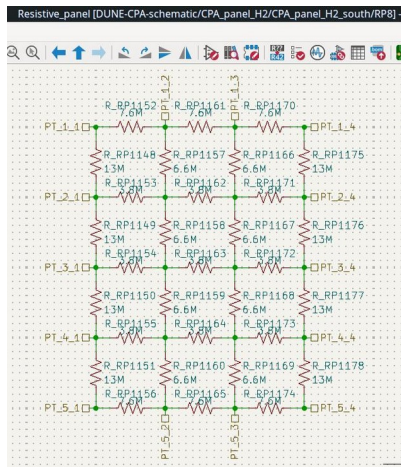
- Schematic Hierarchy
- CPA_panel_H2 (page 3)
 - CPA_panel_H2_north (pa
 - MRB_T1 (page 13)
 - RP9 (page 14)
 - RP11 (page 15)
 - RP7 (page 16)
 - RP10 (page 17)
 - RP8 (page 18)
 - MRB_B1 (page 19)
 - RP12 (page 20)
 - FSS_H1 (page 144)
 - FSS_H5 (page 151)
 - FSS_H2 (page 157)
 - FSS_H3 (page 169)
 - FSS_H4 (page 181)
 - TBFSS_B1 (page 193)
 - TBFSS_T1 (page 211)
 - CPA_panel_H2_south (pag
 - MRB_T1 (page 83)
 - RP8 (page 84)
 - RP9 (page 85)
 - RP10 (page 86)
 - RP12 (page 87)
 - RP7 (page 88)
 - MRB_B1 (page 89)
 - RP11 (page 90)
 - FSS_H1 (page 145)
 - FSS_H2 (page 158)
 - FSS_H3 (page 170)
 - FSS_H4 (page 182)
 - TBFSS_B1 (page 194)



Top of the “H” type CPA Panel.

Using same RP subsheet.

Addition of Field Shaping Strips in progress. Top and bottom FSS have “pins” at the possible profile connection points. (Not all need to be connected.)



When making a BOM, we can count whole RP's and FSS's as one item, not the model resistances inside them. We count the MRBs and EWMRBs to get the PCB count, but also count the varistors and resistors.

I put the HV buses in as "transmission lines" to aid counting, but for screws and wires I still plan to simply multiply by the number of MRBs.