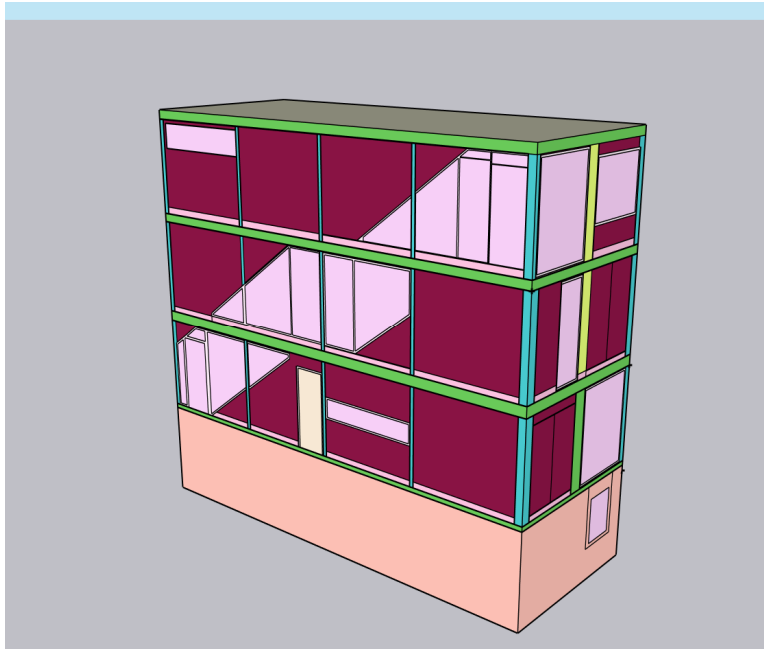

BUILDING ENVELOPE ANALYSIS

3508 96th Ave SE
MERCER ISLAND, WASHINGTON 98040

PROJECT: HEP-24-04



FOR:

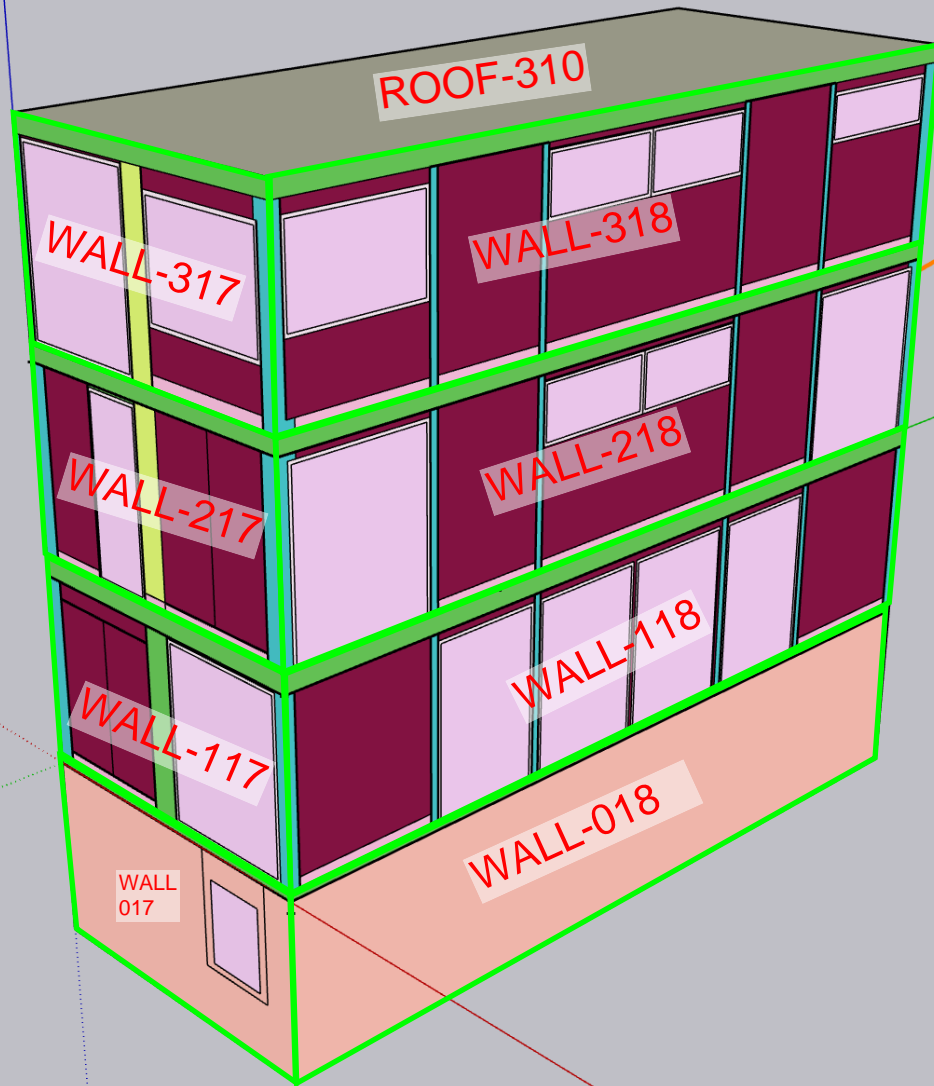
SAM ADAMS
2622 123rd Ave SE, Bellevue, WA 98005

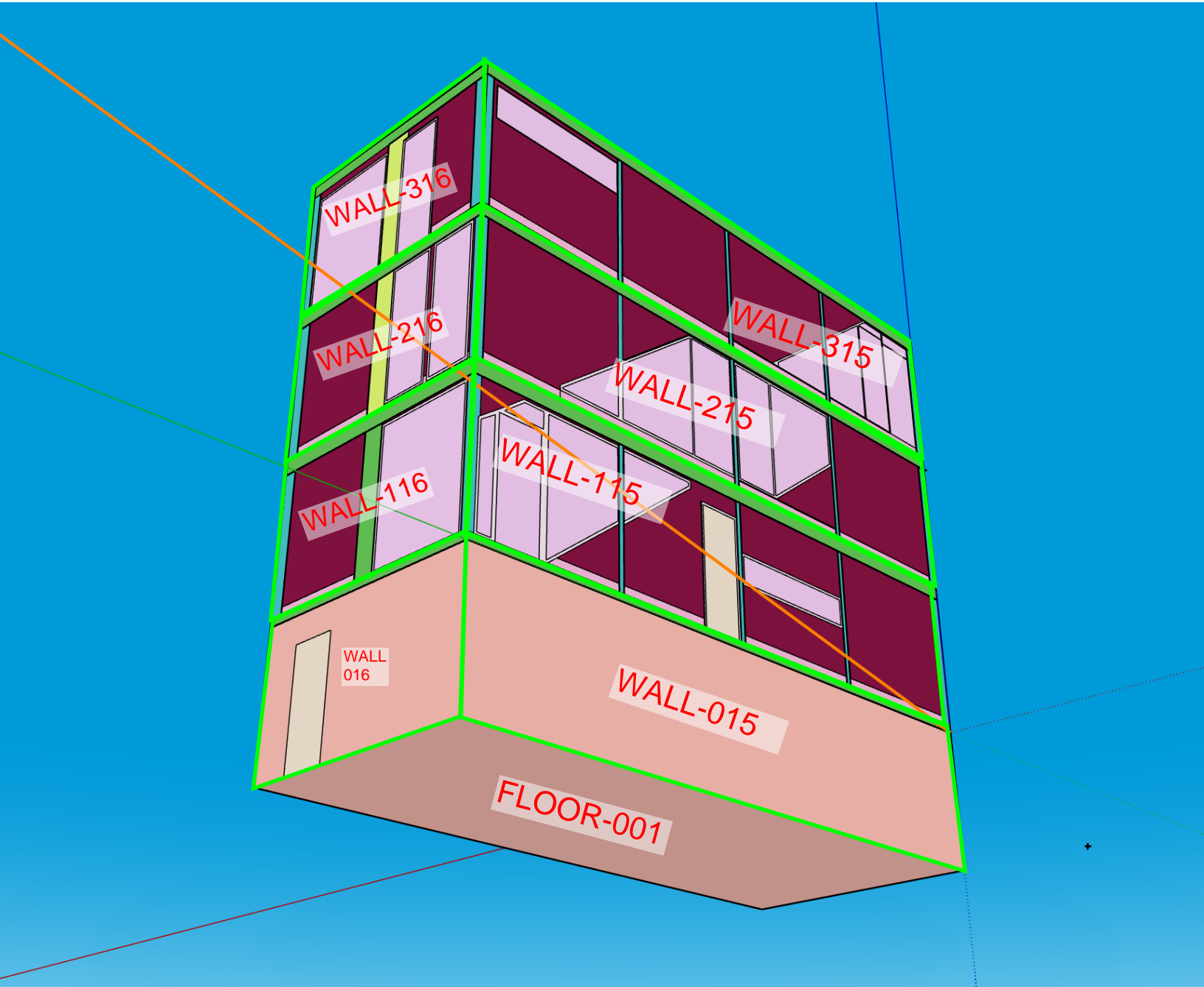
SUBMITTED BY:
HELIX ENERGY PARTNERS LLC

APRIL 12th, 2025
v004



RENEWAL DATE DEC. 31, 2026





BUILDING SUMMARY

	R-Value	
Above-Grade Wall U-Factor	0.049526	20.1914603
Ceiling (Roof) U-Factor	0.012	83.3333333
Below Grade Wall U-Factor	0.048384	20.667961
Floor U-Factor	0.056	17.8571429
Opaque Doors U-Factor	0.242	4.1322314
Fenestration U-Factor	0.28	3.57142857

R402.1.5 Total UA alternative

UAT	TARGET	PROPOSED
	1065.1	980.7
UW	0.056	0.04952589
AW	5572	5572
UBGW	0.035	0.04838407
ABGW	1378	1378
UVG	0.3	0.28
AVG	1961	1961
UOG	-	-
AOG	-	-
UF	0.029	0.045
AF	935	935
URC	0.024	0.012
ARC	3117	3117
UD	0.37	0.242
AD	39.44	39.44
FS	-	-
PS	-	-
FBGS	-	-
PBGS	-	-

$$UA_T = U_W A_W + U_{BGW} A_{BGW} + U_{VG} A_{VG} + U_{OG} A_{OG} + U_F A_F + U_{RC} A_{RC} + U_D A_D + F_S P_S + F_{BGS} P_{BGS}$$

Where:

- UA_T = the target combined thermal transmittance of the gross exterior wall, floor and roof/ceiling area.
- U_W = the thermal transmittance value of the opaque above grade wall found in Table R402.1.2.
- A_W = opaque above grade wall area.
- U_{BGW} = the thermal transmittance value of the below grade opaque wall found in Table R402.1.2.
- A_{BGW} = opaque below grade wall area.
- U_{VG} = the thermal transmittance value of the fenestration found in Table R402.1.2.
- A_{VG} = (a) The proposed glazing area; where proposed fenestration glazing area is less than 15% of the conditioned floor area, minus A_{OG}.
(b) 15% of the conditioned floor area; where the proposed fenestration glazing area is 15% or more of the conditioned floor area, minus A_{OG}.
- U_{OG} = the thermal transmittance value of the skylight glazing found in Table R402.1.2.
- A_{OG} = skylight glazing area (if the proposed A_{OG} exceeds 15 percent, the target A_{OG} shall be 15 percent of the total floor area of the conditioned space).
- U_F = the thermal transmittance value of the floor found in Table R402.1.2.
- A_F = floor area over unconditioned space.
- U_{RC} = the thermal transmittance value of the ceiling found in Table R402.1.2.
- A_{RC} = roof/ceiling area.
- U_D = the thermal transmittance value of the fenestration found in Table R402.1.2.
- A_D = opaque door area.
- F_S = concrete slab on grade component F-factor found in Table R402.1.2.
- P_S = lineal ft. of concrete slab on grade perimeter.
- F_{BGS} = concrete below grade slab component F-factor found in Table R402.1.2.
- P_{BGS} = lineal ft. of concrete below grade slab perimeter.

Exterior Door (Opaque)

	Construction	U-Factor with Film [Btu/h-ft ² -F]	U-Factor no Film [Btu/h-ft ² -F]	Gross Area [ft ²]	Parent Surface
DOOR-115-001	D2-STEEL DOOR BLACK	0.233	0.29	19.36	WALL-115-001 58
DOOR-016-001	D2-STEEL DOOR BLACK	0.242	0.29	20	WALL-016-001

Opaque Exterior

FLOOR-001

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
FLOOR-001-001 CONSTR-DET13.1	0.5	0.056	0.059	613.83	613.83	12.5	180		34.37448
TOTAL					613.83				34.37448

U-FACTOR: 0.056

R-VALUE: 17.857

WALL-015

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-015-001 CONSTR-DET4.1	0.5	0.063	0.066	16.48	16.48	282.5	90 W		1.03824
WALL-015-001 CONSTR-DET13.1	0.5	0.057	0.059	336.18	336.18	282.5	90 W		19.16226
TOTAL					352.66				20.2005

U-FACTOR: 0.057

R-VALUE: 17.458

WALL-016

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-016-001 CONSTR-DET4.1	0.5	0.063	0.066	6.47	6.47	12.5	90 N		0.40761
WALL-016-001 CONSTR-DET13.1	0.5	0.057	0.059	131.93	111.94	12.5	90 N		6.38058
TOTAL					138.4				6.78819

U-FACTOR: 0.049

R-VALUE: 20.388

WALL-017

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-017-001 CONSTR-DET4.1	0.5	0.063	0.066	6.47	6.47	192.5	90 S		0.40761
WALL-017-001 CONSTR-DET13.1	0.5	0.057	0.059	109.74	109.74	192.5	90 S		6.25518
WALL-017-001 1 CONSTR-DET13.1	0.5	0.056	0.059	22.19	10.19	192.5	90 S		0.57064
TOTAL					138.4				0.57064

U-FACTOR: 0.004

R-VALUE: 242.535

WALL-018

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-018-001 CONSTR-DET4.1	0.5	0.063	0.066	16.48	16.48	102.5	90 E		1.03824
WALL-018-001 CONSTR-DET13.1	0.5	0.057	0.059	336.18	336.18	102.5	90 E		19.16226
TOTAL					336.18				19.16226

U-FACTOR: 0.057

R-VALUE: 17.544

FLOOR-115

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
FLOOR-115-001 BASEMENT FLOOR	0.5	0.056	0.059	613.83	613.83	12.5	180		34.37448
TOTAL					613.83				34.37448

U-FACTOR: 0.056

R-VALUE: 17.857

WALL-115

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-115-001 CONSTR-DET4.1	0.5	0.063	0.066	37.28	37.28	282.5	90 W		2.34864
WALL-115-001 CONSTR-DET3.1	0.5	0.405	0.618	13.21	2.25	282.5	90 W		0.91125
WALL-115-001 17 CONSTR-DET2.1	0.5	0.072	0.077	2.34	2.34	282.5	90 W		0.16848
WALL-115-001 29 CONSTR-DET2.1	0.5	0.072	0.077	4.55	4.55	282.5	90 W		0.3276
WALL-115-001 30 CONSTR-DET1.2	0.5	0.074	0.079	2.93	2.93	282.5	90 W		0.21682
WALL-115-001 33 CONSTR-DET3.1	0.5	0.405	0.618	17.85	3.58	282.5	90 W		1.4499
WALL-115-001 38 CONSTR-DET1.2	0.5	0.074	0.079	5.58	5.58	282.5	90 W		0.41292
WALL-115-001 42 CONSTR-DET1.0	0.5	0.033	0.033	27	27	282.5	90 W		0.891
WALL-115-001 43 CONSTR-DET1.0	0.5	0.033	0.033	28	28	282.5	90 W		0.924
WALL-115-001 45 CONSTR-DET3.1	0.5	0.405	0.618	68.19	10.29	282.5	90 W		4.16745
WALL-115-001 48 CONSTR-DET1.2	0.5	0.074	0.079	3.45	3.45	282.5	90 W		0.2553
WALL-115-001 49 CONSTR-DET2.1	0.5	0.072	0.077	4.79	4.79	282.5	90 W		0.34488
WALL-115-001 50 CONSTR-DET1.0	0.5	0.033	0.033	76.67	76.67	282.5	90 W		2.53011
WALL-115-001 53 CONSTR-DET2.1	0.5	0.072	0.077	3.07	3.07	282.5	90 W		0.22104
WALL-115-001 55 CONSTR-DET1.0	0.5	0.033	0.033	39	39	282.5	90 W		1.287
WALL-115-001 56 CONSTR-DET1.2	0.5	0.074	0.079	2.92	2.92	282.5	90 W		0.21608
WALL-115-001 57 CONSTR-DET1.2	0.5	0.074	0.079	2.98	2.98	282.5	90 W		0.22052
WALL-115-001 58 CONSTR-DET3.1	0.5	0.405	0.618	22.28	2.93	282.5	90 W		1.18665
WALL-115-001 8 CONSTR-DET1.0	0.5	0.033	0.033	7.18	7.18	282.5	90 W		0.23694
WALL-115-001 9 CONSTR-DET1.0	0.5	0.033	0.033	4.18	4.18	282.5	90 W		0.13794

TOTAL

373.45

18.45452

U-FACTOR: 0.049
R-VALUE: 20.236

WALL-116

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-116-001 CONSTR-DET4.1	0.5	0.063	0.066	14.63	14.63	12.5	90 N		0.92169
WALL-116-001 CONSTR-DET1.2	0.5	0.074	0.079	7.44	7.44	12.5	90 N		0.55056
WALL-116-001 1 CONSTR-DET3.1	0.5	0.405	0.618	55.75	4.9	12.5	90 N		1.9845
WALL-116-001 2 CONSTR-DET1.0	0.5	0.033	0.033	49.11	49.11	12.5	90 N		1.62063
WALL-116-001 3 CONSTR-DET1.0	0.5	0.033	0.033	0.75	0.75	12.5	90 N		0.02475
WALL-116-001 4 CONSTR-DET4.1A	0.5	0.802	2.518	11.87	11.87	12.5	90 N		9.51974
WALL-116-001 5 CONSTR-DET2.1	0.5	0.072	0.077	3.07	3.07	12.5	90 N		0.22104
WALL-116-001 6 CONSTR-DET1.2	0.5	0.074	0.079	3.95	3.95	12.5	90 N		0.2923
TOTAL				146.57					15.13521

U-FACTOR: 0.103
R-VALUE: 9.684

WALL-117

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-117-001 CONSTR-DET4.1	0.5	0.063	0.066	14.63	14.63	192.5	90 S		0.92169
WALL-117-001 12 CONSTR-DET1.0	0.5	0.033	0.033	4.77	4.77	192.5	90 S		0.15741
WALL-117-001 13 CONSTR-DET2.1	0.5	0.072	0.077	3.01	3.01	192.5	90 S		0.21672
WALL-117-001 14 CONSTR-DET4.1A	0.5	0.802	2.518	11.87	11.87	192.5	90 S		9.51974
WALL-117-001 15 CONSTR-DET1.0	0.5	0.033	0.033	21.7	21.7	192.5	90 S		0.7161
WALL-117-001 16 CONSTR-DET1.2	0.5	0.074	0.079	7.44	7.44	192.5	90 S		0.55056
WALL-117-001 17 CONSTR-DET1.0	0.5	0.033	0.033	21.7	21.7	192.5	90 S		0.7161
WALL-117-001 18 CONSTR-DET2.1	0.5	0.072	0.077	0.53	0.53	192.5	90 S		0.03816
WALL-117-001 19 CONSTR-DET1.2	0.5	0.074	0.079	4.96	4.96	192.5	90 S		0.36704
WALL-117-001 21 CONSTR-DET1.0	0.5	0.033	0.033	0.59	0.59	192.5	90 S		0.01947
WALL-117-001 22 CONSTR-DET3.1	0.5	0.405	0.618	55.36	4.88	192.5	90 S		1.9764
TOTAL				146.56					15.19939

U-FACTOR: 0.104
R-VALUE: 9.642

WALL-118

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-118-001 CONSTR-DET4.1	0.5	0.063	0.066	37.28	37.28	102.5	90 E		2.34864
WALL-118-001 CONSTR-DET3.1	0.5	0.405	0.618	45.04	3.59	102.5	90 E		1.45395
WALL-118-001 10 CONSTR-DET1.2	0.5	0.074	0.079	4.07	4.07	102.5	90 E		0.30118
WALL-118-001 11 CONSTR-DET1.0	0.5	0.033	0.033	56.12	56.12	102.5	90 E		1.85196
WALL-118-001 13 CONSTR-DET1.2	0.5	0.074	0.079	3.39	3.39	102.5	90 E		0.25086
WALL-118-001 16 CONSTR-DET1.0	0.5	0.033	0.033	56.56	56.56	102.5	90 E		1.86648
WALL-118-001 17 CONSTR-DET2.1	0.5	0.072	0.077	3.54	3.54	102.5	90 E		0.25488
WALL-118-001 18 CONSTR-DET1.0	0.5	0.033	0.033	1.84	1.84	102.5	90 E		0.06072
WALL-118-001 19 CONSTR-DET1.2	0.5	0.074	0.079	3.04	3.04	102.5	90 E		0.22496
WALL-118-001 20 CONSTR-DET1.0	0.5	0.033	0.033	6.57	6.57	102.5	90 E		0.21681
WALL-118-001 21 CONSTR-DET3.1	0.5	0.405	0.618	47.8	3.46	102.5	90 E		1.4013
WALL-118-001 22 CONSTR-DET3.1	0.5	0.405	0.618	46.4	2.65	102.5	90 E		1.07325
WALL-118-001 23 CONSTR-DET1.2	0.5	0.074	0.079	3.03	3.03	102.5	90 E		0.22422
WALL-118-001 24 CONSTR-DET1.0	0.5	0.033	0.033	1.84	1.84	102.5	90 E		0.06072
WALL-118-001 25 CONSTR-DET3.1	0.5	0.405	0.618	45.19	3.59	102.5	90 E		1.45395
WALL-118-001 26 CONSTR-DET1.2	0.5	0.074	0.079	3.19	3.19	102.5	90 E		0.23606
WALL-118-001 6 CONSTR-DET1.2	0.5	0.074	0.079	5.05	5.05	102.5	90 E		0.3737
WALL-118-001 9 CONSTR-DET2.1	0.5	0.072	0.077	3.51	3.51	102.5	90 E		0.25272
TOTAL				373.46					13.90636

U-FACTOR: 0.037
R-VALUE: 26.855

WALL-215

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-215-001 CONSTR-DET4.1	0.5	0.063	0.066	30.69	30.69	282.5	90 W		1.93347
WALL-215-001 CONSTR-DET1.0	0.5	0.033	0.033	68.27	68.27	282.5	90 W		2.25291
WALL-215-001 41 CONSTR-DET1.2	0.5	0.074	0.079	2.93	2.93	282.5	90 W		0.21682
WALL-215-001 43 CONSTR-DET1.2	0.5	0.074	0.079	5.58	5.58	282.5	90 W		0.41292
WALL-215-001 57 CONSTR-DET1.2	0.5	0.074	0.079	4.07	4.07	282.5	90 W		0.30118
WALL-215-001 59 CONSTR-DET2.1	0.5	0.072	0.077	2.64	2.64	282.5	90 W		0.19008
WALL-215-001 62 CONSTR-DET2.1	0.5	0.072	0.077	6.88	6.88	282.5	90 W		0.49536
WALL-215-001 72 CONSTR-DET3.1	0.5	0.405	0.618	70.37	7.56	282.5	90 W		3.0618
WALL-215-001 74 CONSTR-DET1.2	0.5	0.074	0.079	0.34	0.34	282.5	90 W		0.02516
WALL-215-001 75 CONSTR-DET1.2	0.5	0.074	0.079	1.52	1.52	282.5	90 W		0.11248
WALL-215-001 76 CONSTR-DET1.0	0.5	0.033	0.033	11.79	11.79	282.5	90 W		0.38907
WALL-215-001 77 CONSTR-DET1.2	0.5	0.074	0.079	2.92	2.92	282.5	90 W		0.21608

WALL-215-001 78	CONSTR-DET2.1	0.5	0.072	0.077	4.55	4.55	282.5	90 W	0.3276
WALL-215-001 79	CONSTR-DET3.1	0.5	0.405	0.618	59.68	6.35	282.5	90 W	2.57175
WALL-215-001 80	EXTWALL	0.08	0.051	0.053	0.87	0.87	282.5	90 W	0.04437
WALL-215-001 82	CONSTR-DET1.0	0.5	0.033	0.033	12.31	12.31	282.5	90 W	0.40623
WALL-215-001 83	CONSTR-DET1.0	0.5	0.033	0.033	76.67	76.67	282.5	90 W	2.53011
WALL-215-001 84	CONSTR-DET2.1	0.5	0.072	0.077	4.79	4.79	282.5	90 W	0.34488
TOTAL					366.87				15.83227

U-FACTOR: 0.043
R-VALUE: 23.172

WALL-216

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-216-001	CONSTR-DET4.1	0.5	0.063	0.066	12.05	12.05	12.5	90 N	0.75915
WALL-216-001	CONSTR-DET2.1	0.5	0.072	0.077	1.03	1.03	12.5	90 N	0.07416
WALL-216-001 11	CONSTR-DET2.1	0.5	0.072	0.077	3.07	3.07	12.5	90 N	0.22104
WALL-216-001 12	CONSTR-DET3.1	0.5	0.405	0.618	25.67	3.22	12.5	90 N	1.3041
WALL-216-001 14	CONSTR-DET1.1	0.5	0.083	0.089	11.96	11.96	12.5	90 N	0.9268
WALL-216-001 15	CONSTR-DET1.0	0.5	0.033	0.033	49.11	49.11	12.5	90 N	1.62063
WALL-216-001 16	CONSTR-DET1.2	0.5	0.074	0.079	7.44	7.44	12.5	90 N	0.55056
WALL-216-001 17	CONSTR-DET1.2	0.5	0.074	0.079	3.8	3.8	12.5	90 N	0.2812
WALL-216-001 18	CONSTR-DET3.1	0.5	0.405	0.618	26.17	3.72	12.5	90 N	1.5066
WALL-216-001 19	CONSTR-DET1.0	0.5	0.033	0.033	3.59	3.59	12.5	90 N	0.11847
TOTAL					143.89				7.42859

U-FACTOR: 0.052
R-VALUE: 19.370

WALL-217

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-217-001	CONSTR-DET4.1	0.5	0.063	0.066	12.05	12.05	192.5	90 S	0.75915
WALL-217-001	CONSTR-DET3.1	0.5	0.405	0.618	25.49	3.05	192.5	90 S	1.23525
WALL-217-001 10	CONSTR-DET2.1	0.5	0.072	0.077	0.66	0.66	192.5	90 S	0.04752
WALL-217-001 13	CONSTR-DET1.1	0.5	0.083	0.089	10.57	10.57	192.5	90 S	0.87731
WALL-217-001 15	CONSTR-DET1.0	0.5	0.033	0.033	24.18	24.18	192.5	90 S	0.79794
WALL-217-001 17	CONSTR-DET2.1	0.5	0.072	0.077	1.51	1.51	192.5	90 S	0.10872
WALL-217-001 18	CONSTR-DET1.2	0.5	0.074	0.079	7.44	7.44	192.5	90 S	0.55056
WALL-217-001 19	CONSTR-DET1.0	0.5	0.033	0.033	25.42	25.42	192.5	90 S	0.83886
WALL-217-001 2	CONSTR-DET4.1	0.5	0.063	0.066	0.39	0.39	192.5	90 S	0.02457
WALL-217-001 20	CONSTR-DET1.0	0.5	0.033	0.033	25.42	25.42	192.5	90 S	0.83886
WALL-217-001 4	CONSTR-DET1.2	0.5	0.074	0.079	7.44	7.44	192.5	90 S	0.55056
WALL-217-001 5	CONSTR-DET2.1	0.5	0.072	0.077	0.23	0.23	192.5	90 S	0.01656
WALL-217-001 9	CONSTR-DET2.1	0.5	0.072	0.077	3.18	3.18	192.5	90 S	0.22896
TOTAL					143.98				6.87482

U-FACTOR: 0.048
R-VALUE: 20.943

WALL-218

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-218-001	CONSTR-DET4.1	0.5	0.063	0.066	30.69	30.69	102.5	90 E	1.93347
WALL-218-001	CONSTR-DET3.1	0.5	0.405	0.618	57.65	3.86	102.5	90 E	1.5633
WALL-218-001 10	CONSTR-DET1.2	0.5	0.074	0.079	4.26	4.26	102.5	90 E	0.31524
WALL-218-001 18	CONSTR-DET3.1	0.5	0.405	0.618	17.07	2.89	102.5	90 E	1.17045
WALL-218-001 23	CONSTR-DET3.1	0.5	0.405	0.618	16.39	2.58	102.5	90 E	1.0449
WALL-218-001 27	CONSTR-DET1.2	0.5	0.074	0.079	3.03	3.03	102.5	90 E	0.22422
WALL-218-001 28	CONSTR-DET1.2	0.5	0.074	0.079	3.19	3.19	102.5	90 E	0.23606
WALL-218-001 29	CONSTR-DET1.2	0.5	0.074	0.079	5	5	102.5	90 E	0.37
WALL-218-001 32	CONSTR-DET1.0	0.5	0.033	0.033	1.84	1.84	102.5	90 E	0.06072
WALL-218-001 33	CONSTR-DET3.1	0.5	0.405	0.618	58.3	3.87	102.5	90 E	1.56735
WALL-218-001 34	CONSTR-DET1.0	0.5	0.033	0.033	44.27	44.27	102.5	90 E	1.46091
WALL-218-001 36	CONSTR-DET1.0	0.5	0.033	0.033	3.21	3.21	102.5	90 E	0.10593
WALL-218-001 37	CONSTR-DET1.2	0.5	0.074	0.079	3.04	3.04	102.5	90 E	0.22496
WALL-218-001 38	CONSTR-DET1.0	0.5	0.033	0.033	44.12	44.12	102.5	90 E	1.45596
WALL-218-001 39	CONSTR-DET1.0	0.5	0.033	0.033	1.79	1.79	102.5	90 E	0.05907
WALL-218-001 4	CONSTR-DET1.2	0.5	0.074	0.079	3.39	3.39	102.5	90 E	0.25086
WALL-218-001 43	CONSTR-DET1.0	0.5	0.033	0.033	58.16	58.16	102.5	90 E	1.91928
WALL-218-001 44	CONSTR-DET2.1	0.5	0.072	0.077	2.76	2.76	102.5	90 E	0.19872
WALL-218-001 45	CONSTR-DET2.1	0.5	0.072	0.077	5.93	5.93	102.5	90 E	0.42696
WALL-218-001 46	CONSTR-DET2.1	0.5	0.072	0.077	2.77	2.77	102.5	90 E	0.19944
TOTAL					366.86				14.7878

U-FACTOR: 0.040
R-VALUE: 24.808

WALL-315

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
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PLENWALL-315-001	CONSTR-DET4.1	0.5	0.063	0.066	31.72	31.72	282.5	90 W	1.99836
WALL-315-001	CONSTR-DET1.2	0.5	0.074	0.079	4.07	4.07	282.5	90 W	0.30118
WALL-315-001 1	CONSTR-DET2.1	0.5	0.072	0.077	5.83	5.83	282.5	90 W	0.41976
WALL-315-001 10	CONSTR-DET1.2	0.5	0.074	0.079	2.98	2.98	282.5	90 W	0.22052
WALL-315-001 11	CONSTR-DET2.1	0.5	0.072	0.077	5.55	5.55	282.5	90 W	0.3996
WALL-315-001 12	CONSTR-DET1.2	0.5	0.074	0.079	2.92	2.92	282.5	90 W	0.21608
WALL-315-001 13	CONSTR-DET1.2	0.5	0.074	0.079	2.93	2.93	282.5	90 W	0.21682
WALL-315-001 14	CONSTR-DET3.1	0.5	0.405	0.618	11.24	1.23	282.5	90 W	0.49815
WALL-315-001 15	CONSTR-DET1.0	0.5	0.033	0.033	8.02	8.02	282.5	90 W	0.26466
WALL-315-001 16	CONSTR-DET1.2	0.5	0.074	0.079	5.67	5.67	282.5	90 W	0.41958
WALL-315-001 17	CONSTR-DET3.1	0.5	0.405	0.618	44.13	3.01	282.5	90 W	1.21905
WALL-315-001 18	CONSTR-DET3.1	0.5	0.405	0.618	23.39	1.15	282.5	90 W	0.46575
WALL-315-001 2	CONSTR-DET1.0	0.5	0.033	0.033	54.34	54.34	282.5	90 W	1.79322
WALL-315-001 20	CONSTR-DET2.1	0.5	0.072	0.077	5.84	5.84	282.5	90 W	0.42048
WALL-315-001 4	CONSTR-DET3.1	0.5	0.405	0.618	21.09	0.96	282.5	90 W	0.3888
WALL-315-001 6	CONSTR-DET1.0	0.5	0.033	0.033	72	72	282.5	90 W	2.376
WALL-315-001 8	CONSTR-DET1.0	0.5	0.033	0.033	60.61	60.61	282.5	90 W	2.00013
WALL-315-001 9	CONSTR-DET2.1	0.5	0.072	0.077	5.56	5.56	282.5	90 W	0.40032
TOTAL					367.89				14.01846

U-FACTOR: 0.038

R-VALUE: 26.243

WALL-316

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-316-001	CONSTR-DET4.1	0.5	0.063	0.066	12.45	12.45	12.5	90 N	0.78435
WALL-316-001	CONSTR-DET1.1	0.5	0.083	0.089	11.61	11.61	12.5	90 N	0.96363
WALL-316-001 12	CONSTR-DET1.0	0.5	0.033	0.033	26.88	26.88	12.5	90 N	0.88704
WALL-316-001 13	CONSTR-DET1.2	0.5	0.074	0.079	7.44	7.44	12.5	90 N	0.55056
WALL-316-001 16	CONSTR-DET3.1	0.5	0.405	0.618	24.01	3.11	12.5	90 N	1.25955
WALL-316-001 18	CONSTR-DET3.1	0.5	0.405	0.618	51.49	3.68	12.5	90 N	1.4904
WALL-316-001 19	CONSTR-DET1.0	0.5	0.033	0.033	3.33	3.33	12.5	90 N	0.10989
WALL-316-001 20	CONSTR-DET1.2	0.5	0.074	0.079	5.53	5.53	12.5	90 N	0.40922
WALL-316-001 22	CONSTR-DET2.1	0.5	0.072	0.077	1.65	1.65	12.5	90 N	0.1188
TOTAL					144.39				6.57344

U-FACTOR: 0.046

R-VALUE: 21.966

WALL-317

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-317-001	CONSTR-DET4.1	0.5	0.063	0.066	12.45	12.45	192.5	90 S	0.78435
WALL-317-001	CONSTR-DET1.1	0.5	0.083	0.089	10.79	10.79	192.5	90 S	0.89557
WALL-317-001 10	CONSTR-DET1.2	0.5	0.074	0.079	3.32	3.32	192.5	90 S	0.24568
WALL-317-001 15	CONSTR-DET3.1	0.5	0.405	0.618	34.45	4.19	192.5	90 S	1.69695
WALL-317-001 17	CONSTR-DET1.0	0.5	0.033	0.033	12.14	12.14	192.5	90 S	0.40062
WALL-317-001 18	CONSTR-DET1.2	0.5	0.074	0.079	6.1	6.1	192.5	90 S	0.4514
WALL-317-001 19	CONSTR-DET2.1	0.5	0.072	0.077	4.01	4.01	192.5	90 S	0.28872
WALL-317-001 20	CONSTR-DET1.0	0.5	0.033	0.033	5.2	5.2	192.5	90 S	0.1716
WALL-317-001 7	CONSTR-DET3.1	0.5	0.405	0.618	54.74	4.86	192.5	90 S	1.9683
WALL-317-001 8	CONSTR-DET2.1	0.5	0.072	0.077	0.66	0.66	192.5	90 S	0.04752
WALL-317-001 9	CONSTR-DET1.0	0.5	0.033	0.033	0.54	0.54	192.5	90 S	0.01782
TOTAL					144.4				6.96853

U-FACTOR: 0.048

R-VALUE: 20.722

WALL-318

Construction	Reflectance	U-Factor with Film [Btu/h-ft2-F]	U-Factor no Film [Btu/h-ft2-F]	Gross Area [ft2]	Net Area [ft2]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
PLENWALL-318-001	CONSTR-DET4.1	0.5	0.063	0.066	31.72	31.72	102.5	90 E	1.99836
WALL-318-001	CONSTR-DET1.2	0.5	0.074	0.079	4.24	4.24	102.5	90 E	0.31376
WALL-318-001 1	CONSTR-DET2.1	0.5	0.072	0.077	3.42	3.42	102.5	90 E	0.24624
WALL-318-001 10	CONSTR-DET1.0	0.5	0.033	0.033	57.97	57.97	102.5	90 E	1.91301
WALL-318-001 11	CONSTR-DET2.1	0.5	0.072	0.077	6.12	6.12	102.5	90 E	0.44064
WALL-318-001 12	CONSTR-DET3.1	0.5	0.405	0.618	17.07	2.89	102.5	90 E	1.17045
WALL-318-001 13	CONSTR-DET3.1	0.5	0.405	0.618	16.39	2.58	102.5	90 E	1.0449
WALL-318-001 14	CONSTR-DET1.2	0.5	0.074	0.079	3.03	3.03	102.5	90 E	0.22422
WALL-318-001 15	CONSTR-DET1.0	0.5	0.033	0.033	44.18	44.18	102.5	90 E	1.45794
WALL-318-001 16	CONSTR-DET2.1	0.5	0.072	0.077	2.86	2.86	102.5	90 E	0.20592
WALL-318-001 17	CONSTR-DET1.2	0.5	0.074	0.079	3.19	3.19	102.5	90 E	0.23606
WALL-318-001 18	CONSTR-DET2.1	0.5	0.072	0.077	3.51	3.51	102.5	90 E	0.25272
WALL-318-001 19	CONSTR-DET3.1	0.5	0.405	0.618	15.47	2.91	102.5	90 E	1.17855
WALL-318-001 2	CONSTR-DET1.0	0.5	0.033	0.033	20.81	20.81	102.5	90 E	0.68673
WALL-318-001 20	CONSTR-DET1.0	0.5	0.033	0.033	2.77	2.77	102.5	90 E	0.09141
WALL-318-001 21	CONSTR-DET1.2	0.5	0.074	0.079	7.44	7.44	102.5	90 E	0.55056
WALL-318-001 3	CONSTR-DET3.1	0.5	0.405	0.618	31.18	3.71	102.5	90 E	1.50255
WALL-318-001 4	CONSTR-DET1.0	0.5	0.033	0.033	4.06	4.06	102.5	90 E	0.13398

WALL-318-0015	CONSTR-DET1.2	0.5	0.074	0.079	3.39	3.39	102.5	90 E	0.25086
WALL-318-0016	CONSTR-DET1.0	0.5	0.033	0.033	44.03	44.03	102.5	90 E	1.45299
WALL-318-0017	CONSTR-DET2.1	0.5	0.072	0.077	2.85	2.85	102.5	90 E	0.2052
WALL-318-0018	CONSTR-DET1.2	0.5	0.074	0.079	3.04	3.04	102.5	90 E	0.22496
WALL-318-0019	CONSTR-DET1.0	0.5	0.033	0.033	3.21	3.21	102.5	90 E	0.10593
TOTAL					331.95				15.88794

U-FACTOR: 0.048

R-VALUE: 20.893

ROOF-310

	Construction	Reflectance	U-Factor with Film [Btu/h-ft ² -F]	U-Factor no Film [Btu/h-ft ² -F]	Gross Area [ft ²]	Net Area [ft ²]	Azimuth [deg]	Tilt [deg]	Cardinal Direction	UA
ROOF-310-001	CONSTR-DET8.1A	0.5	0.012	0.013	613.83	613.83	12.5	0		7.36596
TOTAL					613.83					7.36596

U-FACTOR: 0.012

R-VALUE: 83.333

Exterior Fenestration

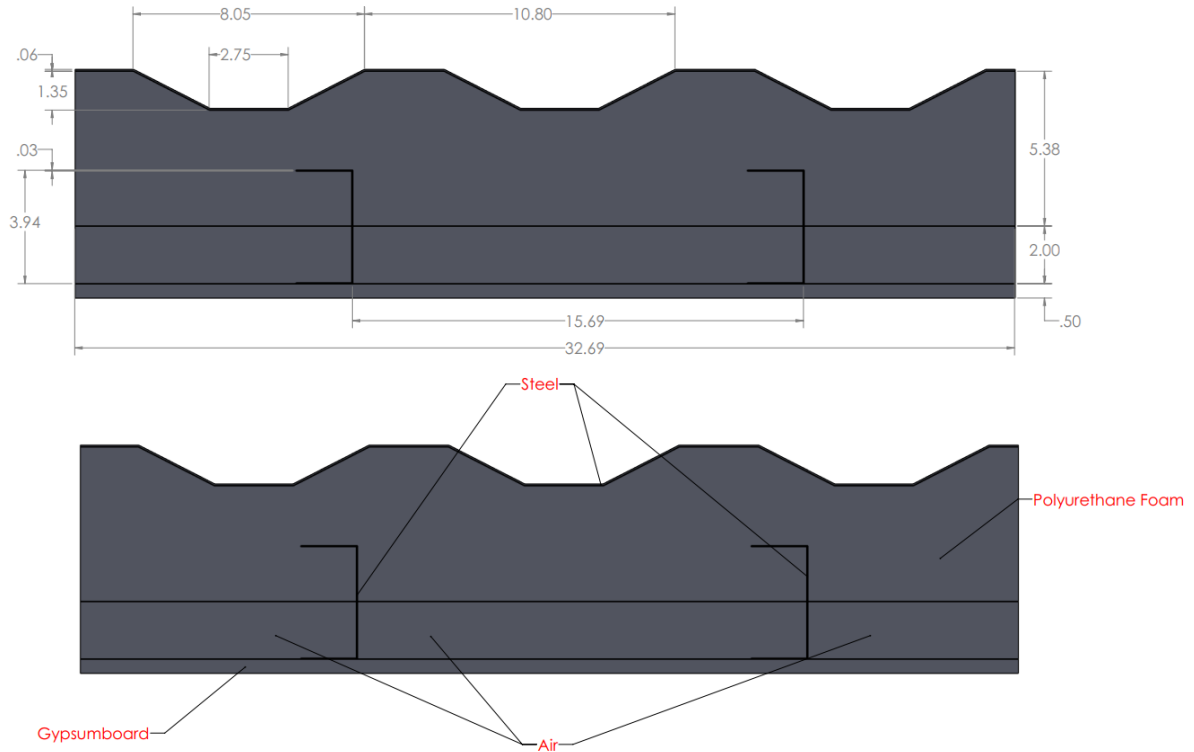
	Construction	Frame and Glass Area [ft2]	Frame Area	Divider Area	Area of One Opening [ft2]	Glass U-Factor [Btu/h-ft2-F]	Glass SHGC	Glass Visible Transmittance
WINDOW-115-002 1	W1-DUAL PANE LOW E	10.97	0	0	10.97	0.28	0.18	0.401
WINDOW-115-001	W1-DUAL PANE LOW E	14.27	0	0	14.27	0.28	0.18	0.401
GLASSDOOR-115-001	D1-DUAL PANE LOW E	19.72	0	0	19.72	0.28	0.18	0.401
WINDOW-115-003	W1-DUAL PANE LOW E	30.63	0	0	30.63	0.28	0.18	0.401
WINDOW-115-004	W1-DUAL PANE LOW E	1.95	0	0	1.95	0.28	0.18	0.401
WINDOW-115-005	W1-DUAL PANE LOW E	5.6	0	0	5.6	0.28	0.18	0.401
WINDOW-116-001	D1-DUAL PANE LOW E	50.84	0	0	50.84	0.28	0.18	0.401
WINDOW-117-001	W1-DUAL PANE LOW E	50.48	0	0	50.48	0.28	0.18	0.401
GLASSDOOR-118-001	D1-DUAL PANE LOW E	41.46	0	0	41.46	0.28	0.18	0.401
GLASSDOOR-118-002	D1-DUAL PANE LOW E	44.33	0	0	44.33	0.28	0.18	0.401
GLASSDOOR-118-003	D1-DUAL PANE LOW E	43.75	0	0	43.75	0.28	0.18	0.401
GLASSDOOR-118-004	D1-DUAL PANE LOW E	41.6	0	0	41.6	0.28	0.18	0.401
WINDOW-215-001	W1-DUAL PANE LOW E	6.6	0	0	6.6	0.28	0.18	0.401
WINDOW-215-002	W1-DUAL PANE LOW E	30.91	0	0	30.91	0.28	0.18	0.401
WINDOW-215-003	W1-DUAL PANE LOW E	25.29	0	0	25.29	0.28	0.18	0.401
WINDOW-215-004	W1-DUAL PANE LOW E	23.1	0	0	23.1	0.28	0.18	0.401
WINDOW-215-005	W1-DUAL PANE LOW E	30.23	0	0	30.23	0.28	0.18	0.401
WINDOW-216-001	W1-DUAL PANE LOW E	22.45	0	0	22.45	0.28	0.18	0.401
WINDOW-216-002	W1-DUAL PANE LOW E	22.45	0	0	22.45	0.28	0.18	0.401
WINDOW-217-001	W1-DUAL PANE LOW E	22.44	0	0	22.44	0.28	0.18	0.401
GLASSDOOR-218-001	D1-DUAL PANE LOW E	53.8	0	0	53.8	0.28	0.18	0.401
WINDOW-218-001	W1-DUAL PANE LOW E	14.19	0	0	14.19	0.28	0.18	0.401
WINDOW-218-002	W1-DUAL PANE LOW E	13.81	0	0	13.81	0.28	0.18	0.401
GLASSDOOR-218-002	D1-DUAL PANE LOW E	54.43	0	0	54.43	0.28	0.18	0.401
WINDOW-315-002	W1-DUAL PANE LOW E	10.01	0	0	10.01	0.28	0.18	0.401
WINDOW-315-003	W1-DUAL PANE LOW E	21.44	0	0	21.44	0.28	0.18	0.401
WINDOW-315-004	W1-DUAL PANE LOW E	1.18	0	0	1.18	0.28	0.18	0.401
WINDOW-315-004 2	W1-DUAL PANE LOW E	18.5	0	0	18.5	0.28	0.18	0.401
GLASSDOOR-315-001	D1-DUAL PANE LOW E	20.02	0	0	20.02	0.28	0.18	0.401
WINDOW-315-005	W1-DUAL PANE LOW E	2.22	0	0	2.22	0.28	0.18	0.401
WINDOW-315-001	W1-DUAL PANE LOW E	20.13	0	0	20.13	0.28	0.18	0.401
WINDOW-316-001	W1-DUAL PANE LOW E	20.9	0	0	20.9	0.28	0.18	0.401
GLASSDOOR-316-001	D1-DUAL PANE LOW E	47.81	0	0	47.81	0.28	0.18	0.401
WINDOW-317-002	W1-DUAL PANE LOW E	30.26	0	0	30.26	0.28	0.18	0.401
WINDOW-317-001	W1-DUAL PANE LOW E	49.88	0	0	49.88	0.28	0.18	0.401
WINDOW-318-002	W1-DUAL PANE LOW E	14.19	0	0	14.19	0.28	0.18	0.401
WINDOW-318-003	W1-DUAL PANE LOW E	13.81	0	0	13.81	0.28	0.18	0.401
WINDOW-318-004	W1-DUAL PANE LOW E	12.56	0	0	12.56	0.28	0.18	0.401
WINDOW-318-001	W1-DUAL PANE LOW E	27.47	0	0	27.47	0.28	0.18	0.401
WINDOW-017-001	W1-DUAL PANE LOW E	12	0	0	12	0.28	0.18	0.401
Total or Average						0.28	0.18	0.401
North Total or Average						0.28	0.18	0.401
Non-North Total or Average						0.28	0.18	0.401

DET1.0 Wall R-value Estimate

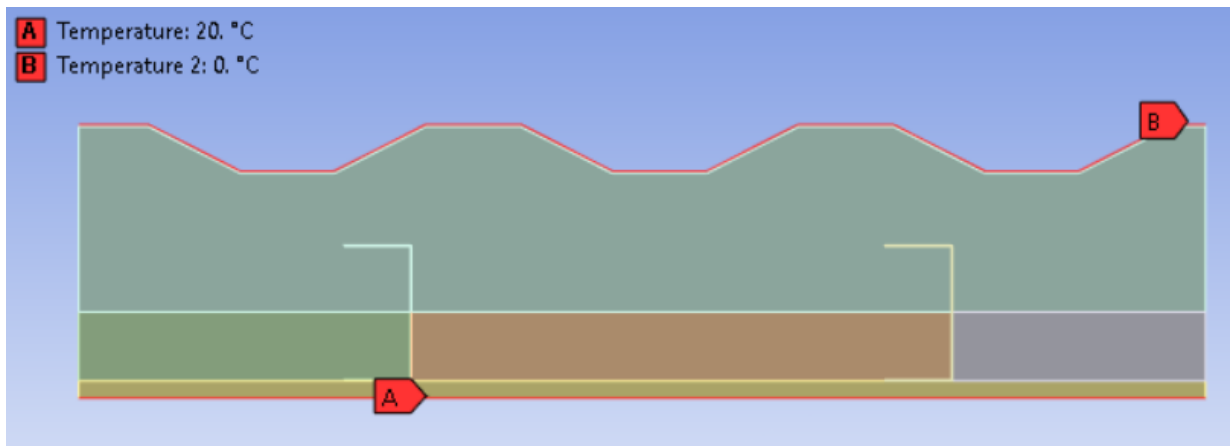
1. Geometry

The 2D geometry was made according to the attached geometry sent.

Dimensions are in inches.



2. Boundary Conditions



3. Materials

Name	Thermal Conductivity(W/m.°C)
Gypsum Board	0.2
Air	0.026
Polyurethane Foam	0.025
Steel	60

4. Results

4.1 R-value

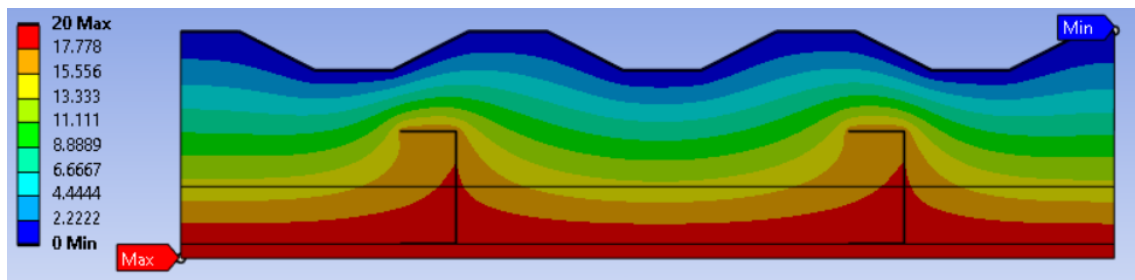
Average 16.622 W/m²

Average Directional Heat Flux (W/m²) = 16.622

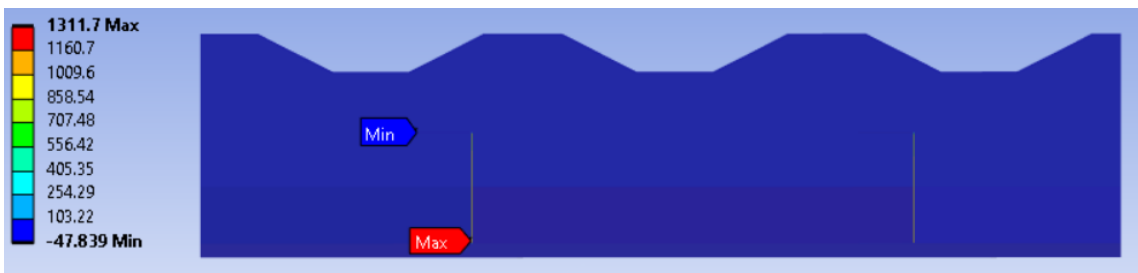
R-value for the combined wall = Temperature Difference / Heat Flux

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
16.622	20	1.203224642	6.831909518

4.2 Temperature Distribution (°C)



4.3 Y-Axis Directional Heat Flux (W/m²)



5. Conclusion

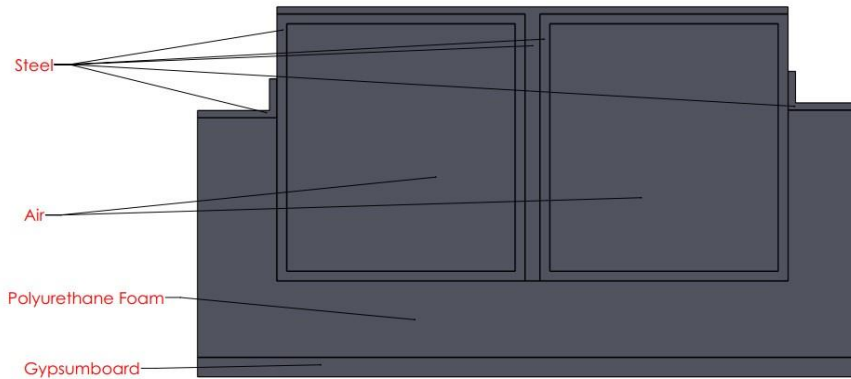
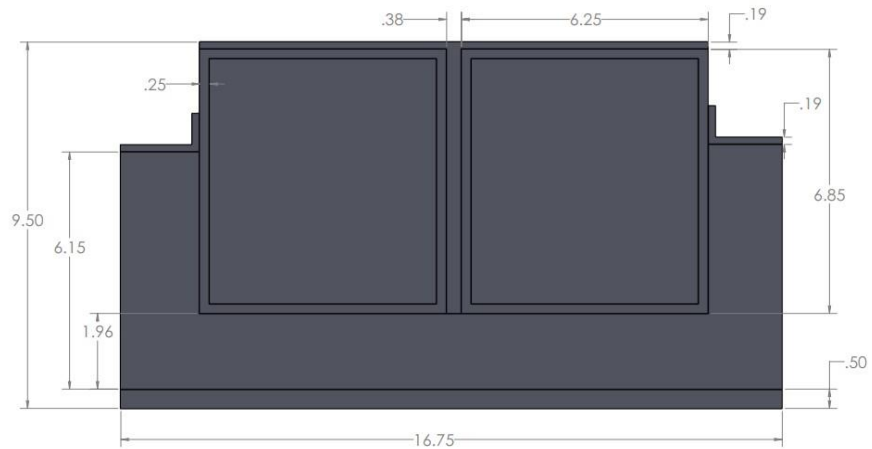
The calculated R-value for this combined wall is 8.319 (hr ft² F/Btu)

DET1.1 Wall R-value Estimate

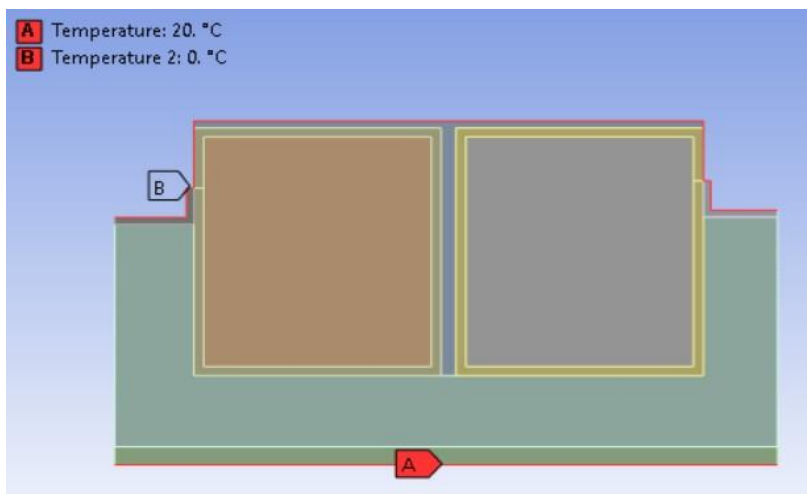
1. Geometry

The 2D geometry was made according to the attached geometry sent.

Dimensions are in inches.



2. Boundary Conditions



3. Materials

Name	Thermal Conductivity(W/m.°C)
Gypsum Board	0.2
Air	0.026
Polyurethane Foam	0.025
Steel	60

4. Results

4.1 R-value

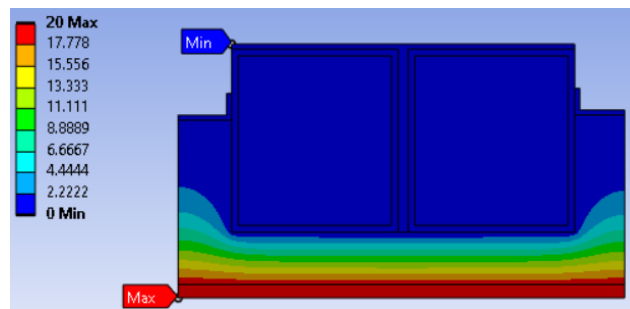
Average 8.8057 W/m²

Average Heat Flux (W/m²) = 8.8057

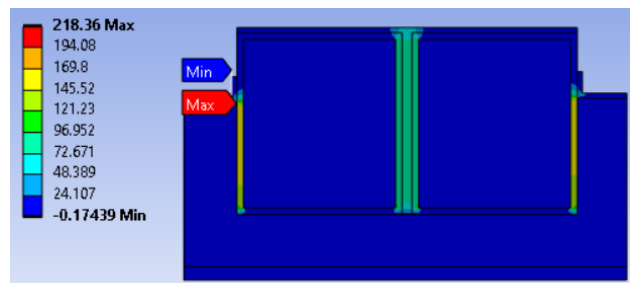
R-value for the combined wall = Temperature Difference / Heat Flux

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
8.8057	20	2.271256118	12.89619224

4.2 Temperature Distribution (°C)



4.3 Directional Heat Flux (W/m²)



5. Conclusion

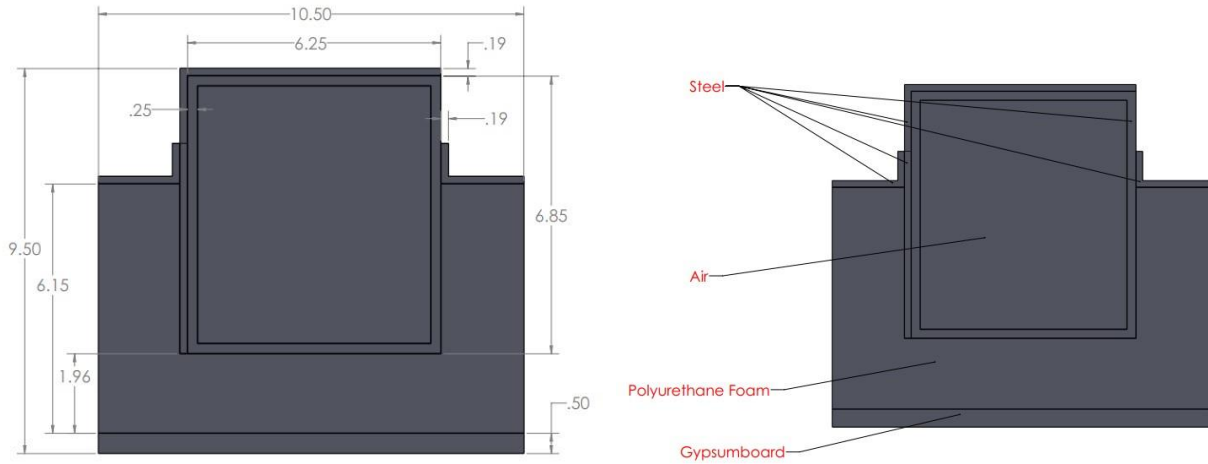
The calculated R-value for this combined wall is 12.896 (hr ft² F/Btu)

DET1.2 Wall R-value Estimate

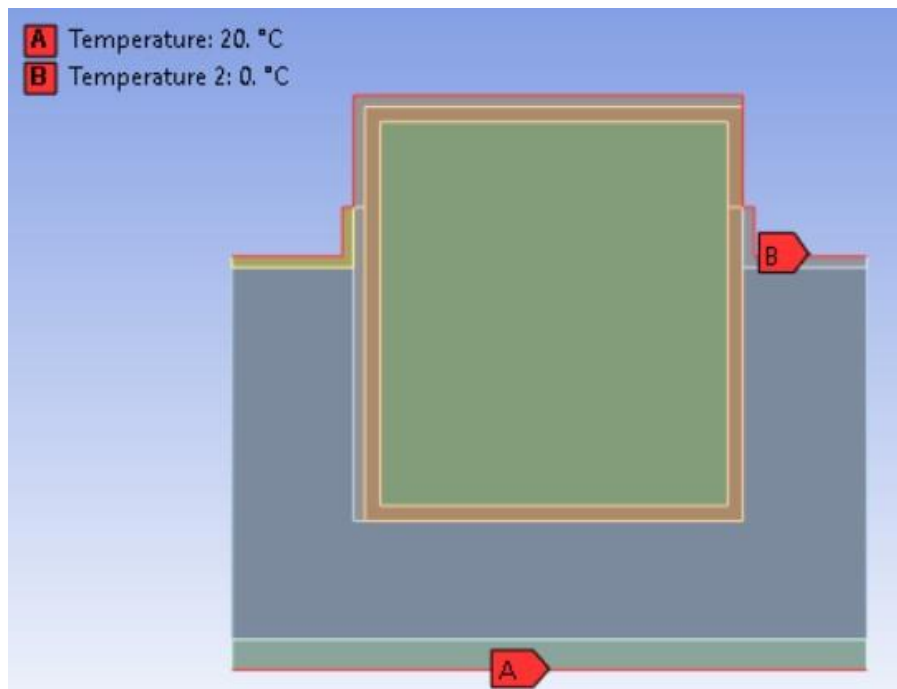
1. Geometry

The 2D geometry was made according to the attached geometry sent.

Dimensions are in inches.



2. Boundary Conditions



3. Materials

Name	Thermal Conductivity(W/m.°C)
Gypsum Board	0.2
Air	0.026
Polyurethane Foam	0.025
Steel	60

4. Results

4.1 R-value

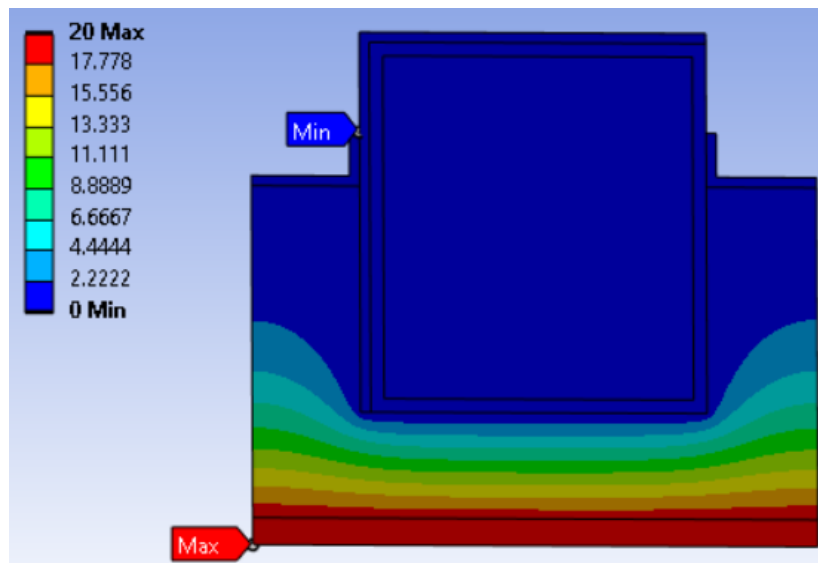
Average 7.705 W/m²

Average Heat Flux (W/m²) = 7.705

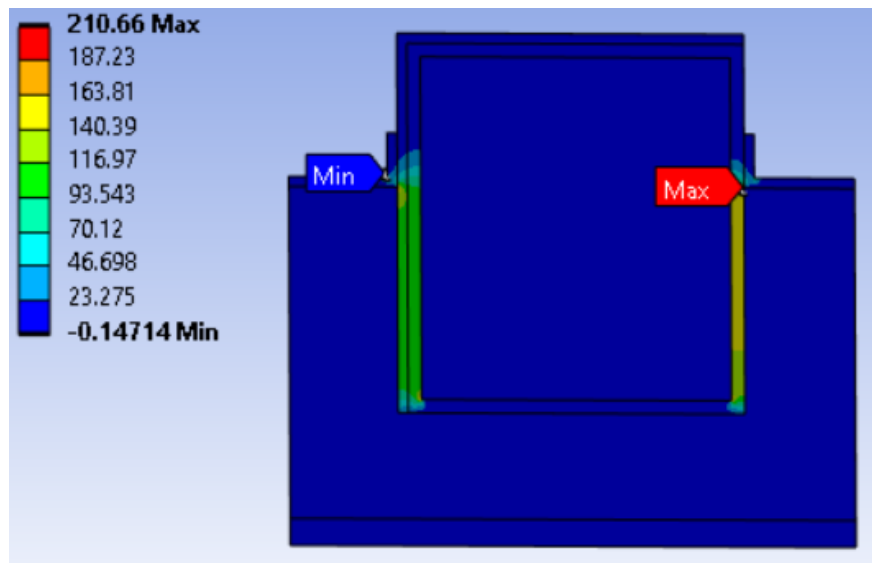
R-value for the combined wall = Temperature Difference / Heat Flux

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
7.705	20	2.595717067	14.73848151

4.2 Temperature Distribution (°C)



4.3 Directional Heat Flux (W/m^2)



5. Conclusion

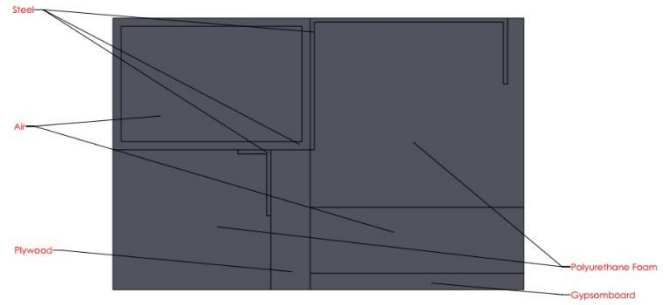
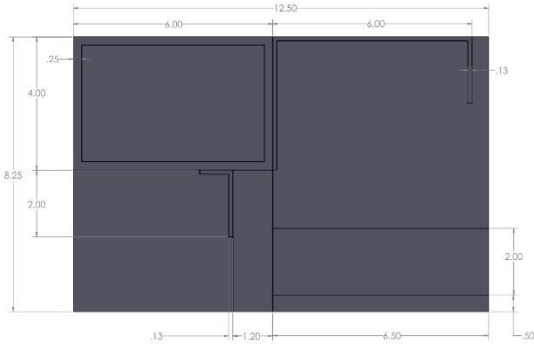
The calculated R-value for this combined wall is 14.738 ($\text{hr ft}^2 \text{ F/Btu}$)

DET2.1 Wall R-value Estimate

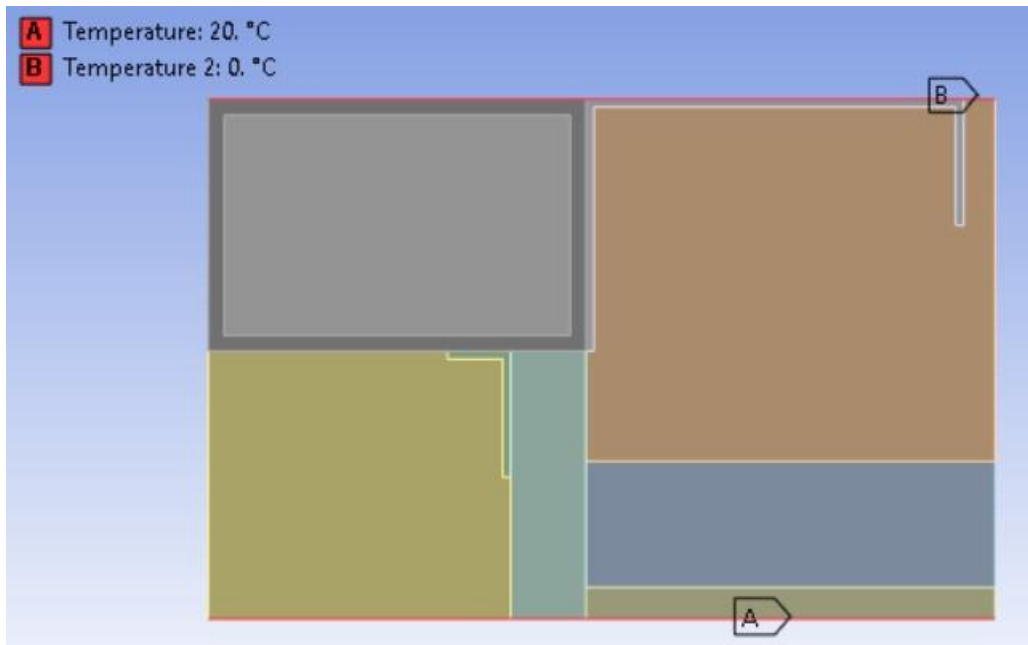
1. Geometry

The 2D geometry was made according to the attached geometry sent.

Dimensions are in inches.



2. Boundary Conditions



3. Materials

Name	Thermal Conductivity(W/m.°C)
Gypsum Board	0.2
Air	0.026
Plywood	0.125
Polyurethane Foam	0.025
Steel	60

4. Results

4.1 R-value

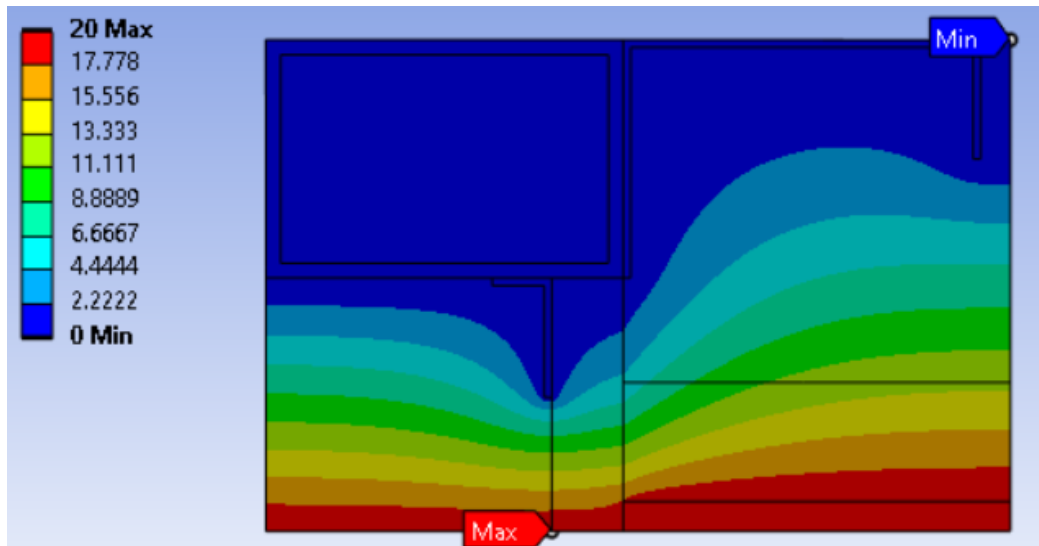
Average 8.254 W/m²

Average Heat Flux (W/m²) = 8.254

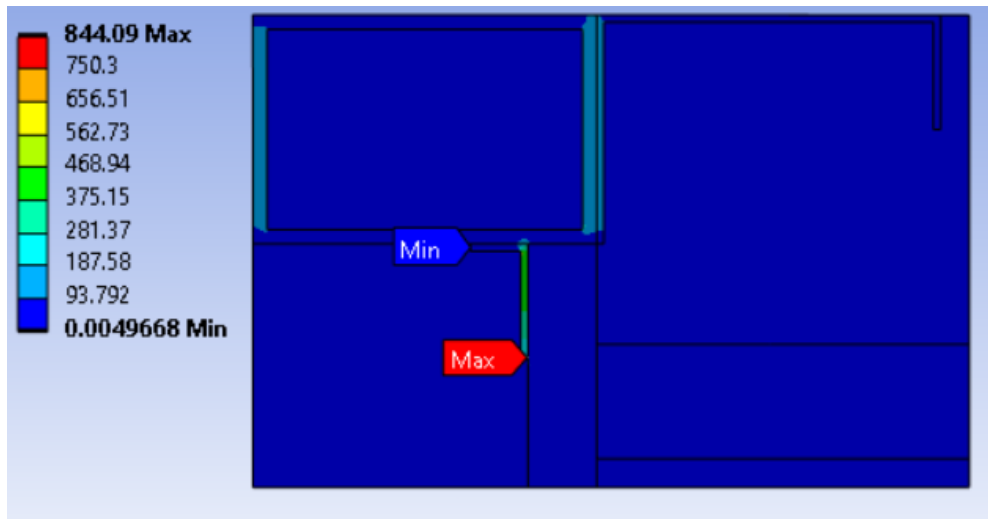
R-value for the combined wall = Temperature Difference / Heat Flux

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
8.254	20	2.423067604	13.75817785

4.2 Temperature Distribution (°C)



4.3 Directional Heat Flux (W/m^2)



5. Conclusion

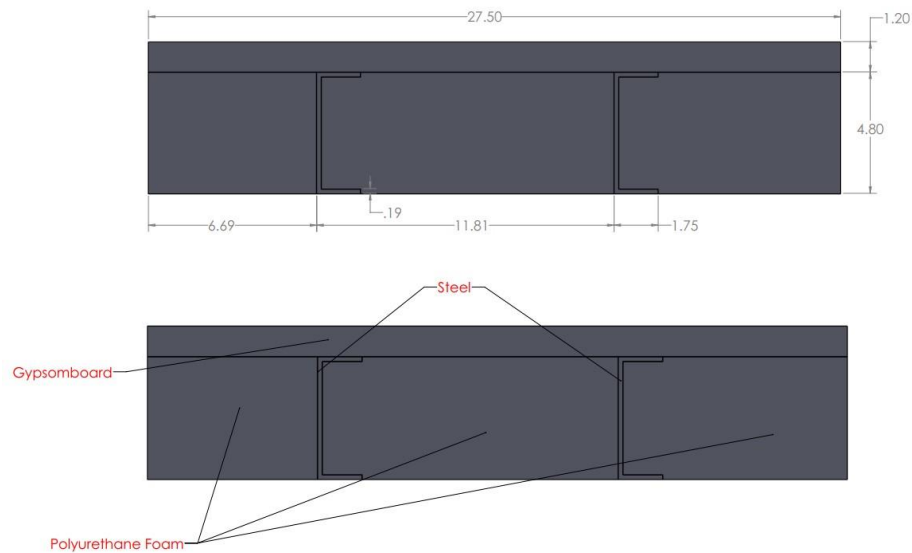
The calculated R-value for this combined wall is $13.758 \text{ (hr ft}^2 \text{ F/Btu)}$

DET2.2 Wall R-value Estimate

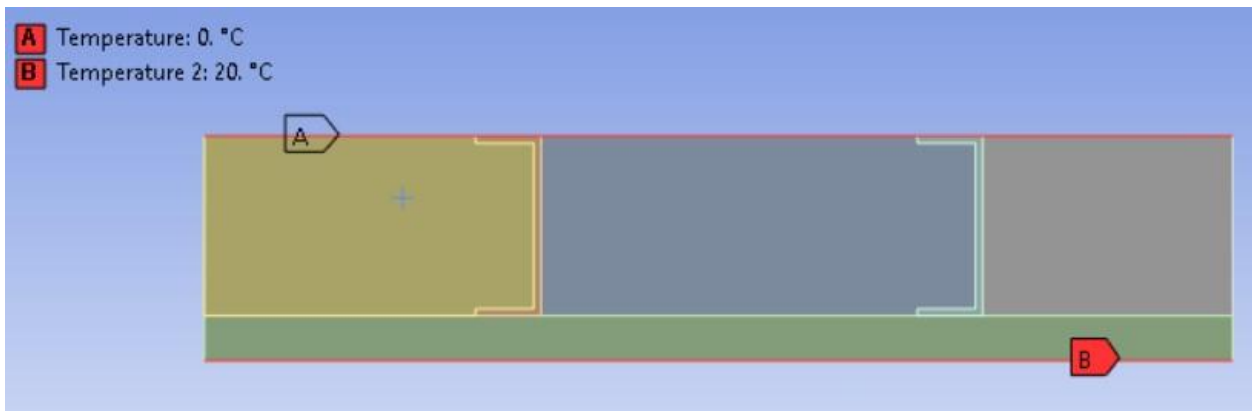
1. Geometry

The 2D geometry was made according to the attached geometry sent.

Dimensions are in inches.



2. Boundary Conditions



3. Materials

Name	Thermal Conductivity(W/m.°C)
Plywood	0.125
Polyurethane Foam	0.025
Steel	60

4. Results

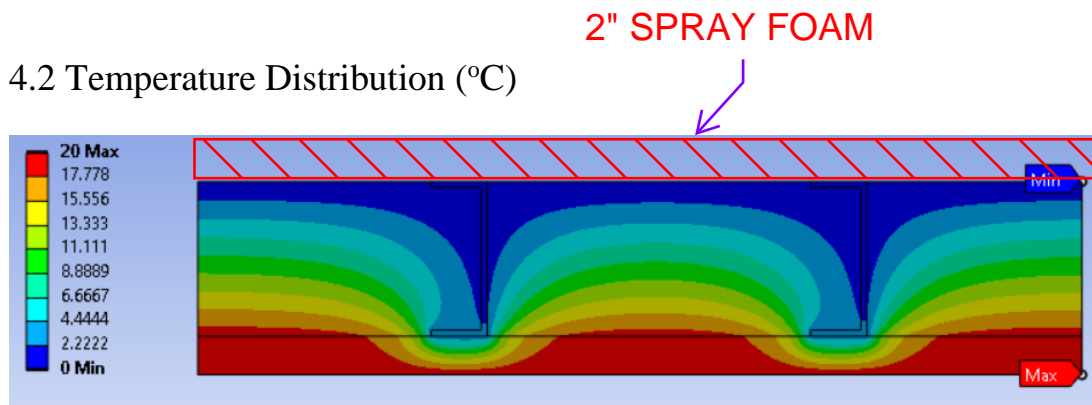
4.1 R-value

Average 22.874 W/m²

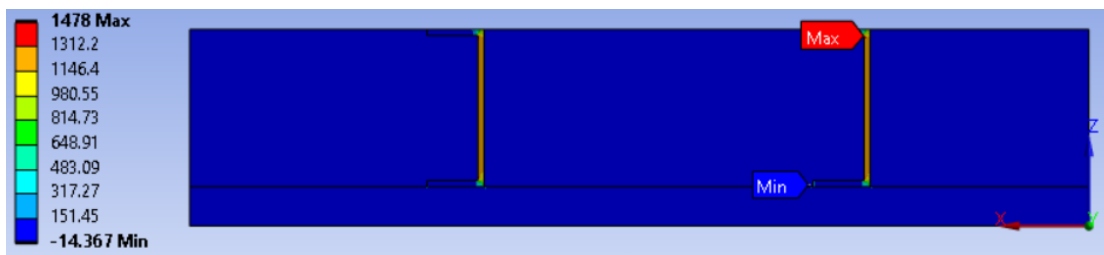
Average Directional Heat Flux (W/m²) = 22.874

R-value for the combined wall = Temperature Difference / Heat Flux

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
22.874	20	0.874355163	4.964588616



4.3 Z-Axis Directional Heat Flux (W/m²)



5. Conclusion

The calculated R-value for this combined wall is ~~4.96 (hr ft² F/Btu)~~

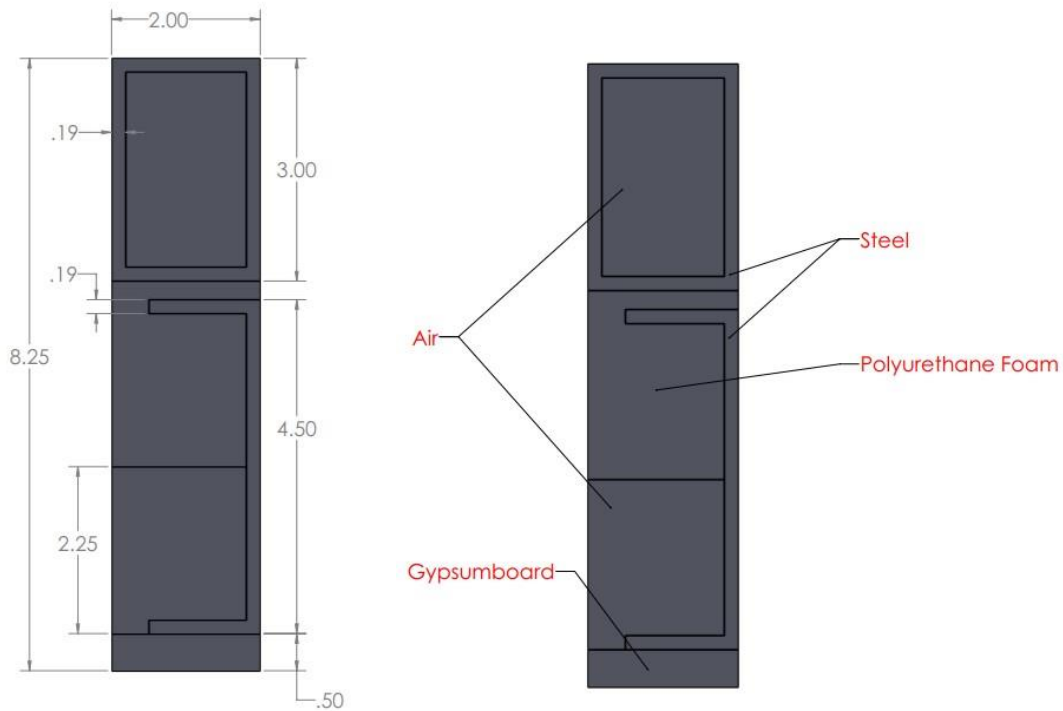
This construction amended with an additional 2" thick of spray foam (R=12). Total construction R-value for this combined assembly is 16.48 (hr ft² F/Btu)

DET3.1 Wall R-value Estimate

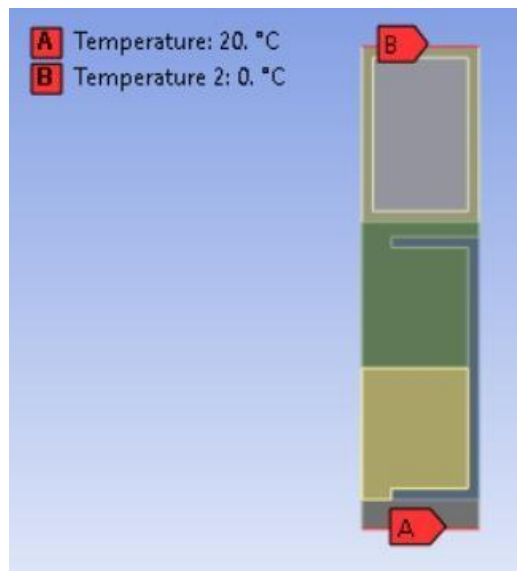
1. Geometry

The 2D geometry was made according to the attached geometry sent.

Dimensions are in inches.



2. Boundary Conditions



3. Materials

Name	Thermal Conductivity(W/m.°C)
Air	0.026
Gypsum Board	0.2
Polyurethane Foam	0.025
Steel	60

4. Results

4.1 R-value

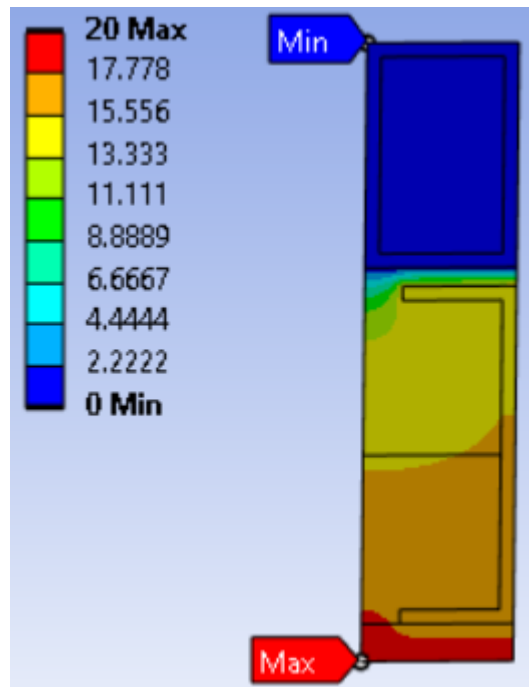
Average 58.727 W/m²

Average Heat Flux (W/m²) = 58.727

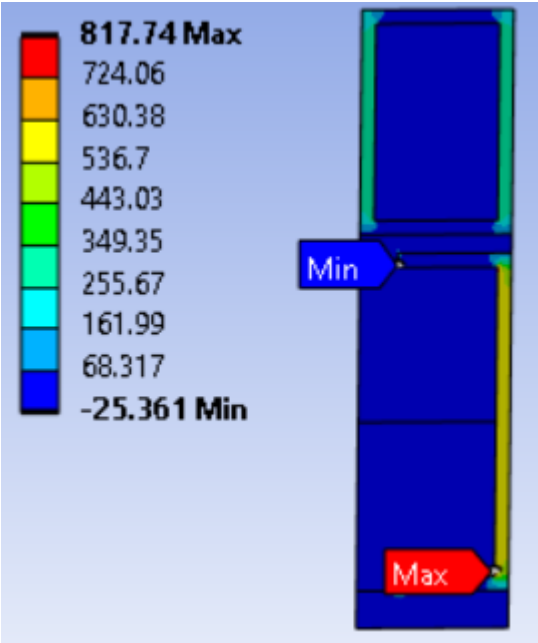
R-value for the combined wall = Temperature Difference / Heat Flux

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
58.727	20	0.340558857	1.933693191

4.2 Temperature Distribution (°C)



4.3 Directional Heat Flux (W/m²)



5. Conclusion

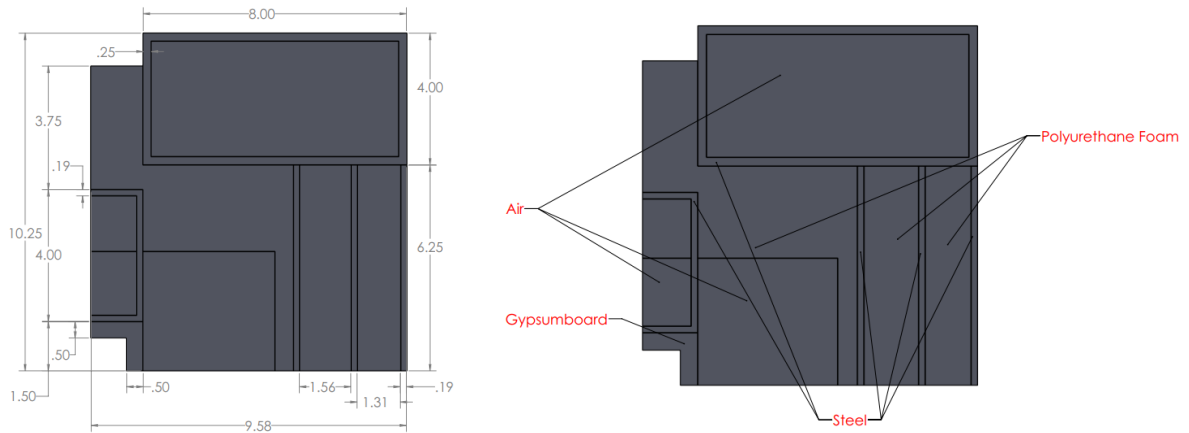
The calculated R-value for this combined wall is 1.9336 (hr ft² F/Btu)

DET4.1 Wall R-value Estimate

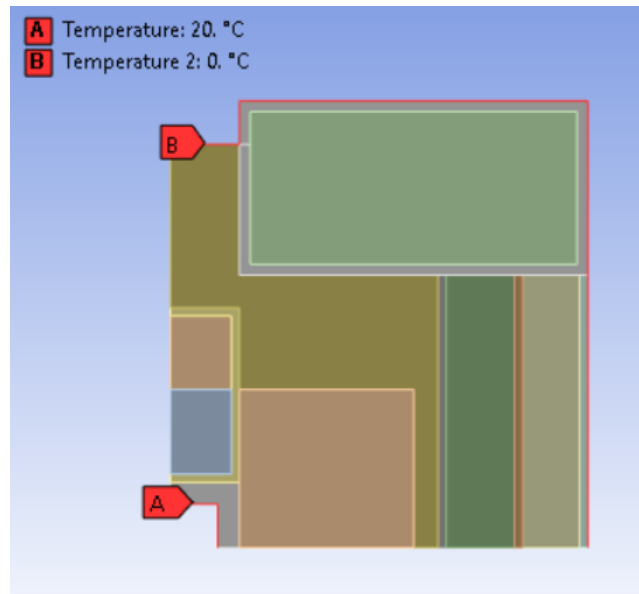
1. Geometry

The 2D geometry was made according to the attached geometry sent.

Dimensions are in inches.



2. Boundary Conditions



3. Materials

Name	Thermal Conductivity(W/m.°C)
Gypsum Board	0.2
Air	0.026
Polyurethane Foam	0.025
Steel	60

4. Results

4.1 R-value

R-value for the combined wall = Temperature Difference / Heat Flux

Average X-Axis Heat Flux (W/m²) = 2.638

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
2.638	20	7.581501137	43.04776346

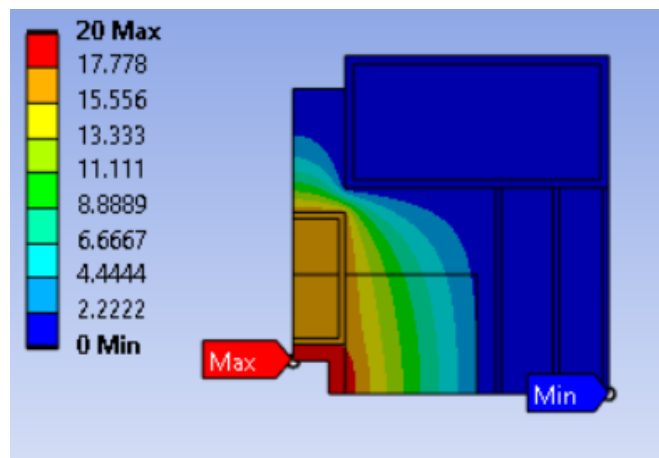
Average Y-Axis Heat Flux (W/m²) = 4.938

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
4.938	20	4.050222762	22.99716484

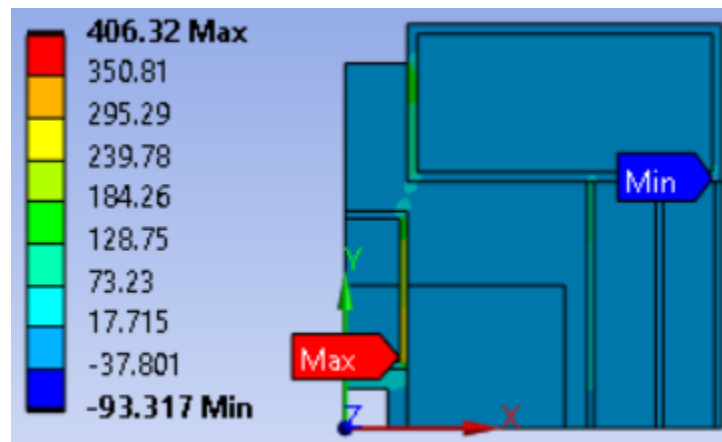
Average Total Heat Flux (W/m²) = 7.5078

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
7.5	20	2.666666667	15.14133333

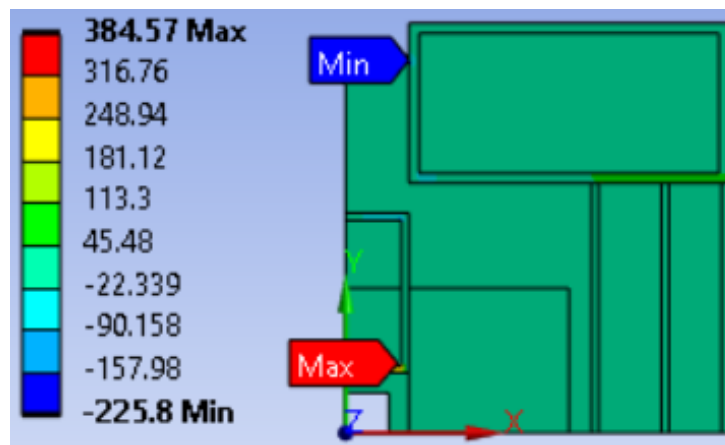
4.2 Temperature Distribution (°C)



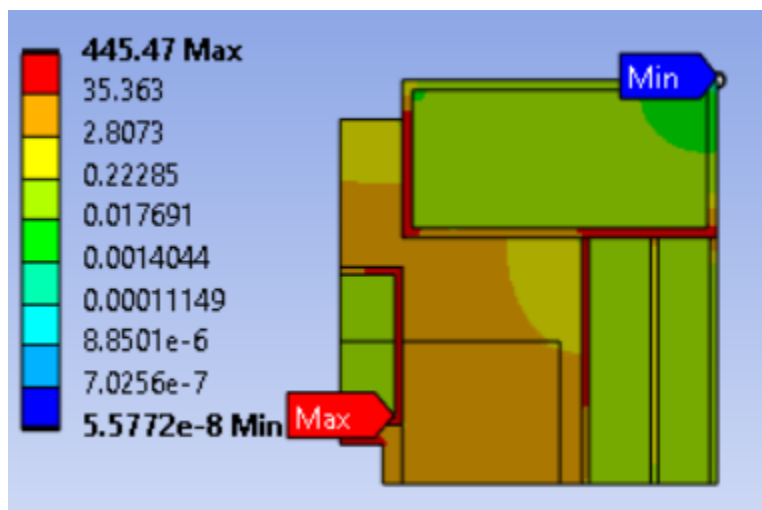
4.3 Y-Axis Directional Heat Flux (W/m²)



4.4 X-Axis Directional Heat Flux (W/m²)



4.5 Total Heat Flux (W/m²)



5. Conclusion

The calculated R-value for this combined wall is:

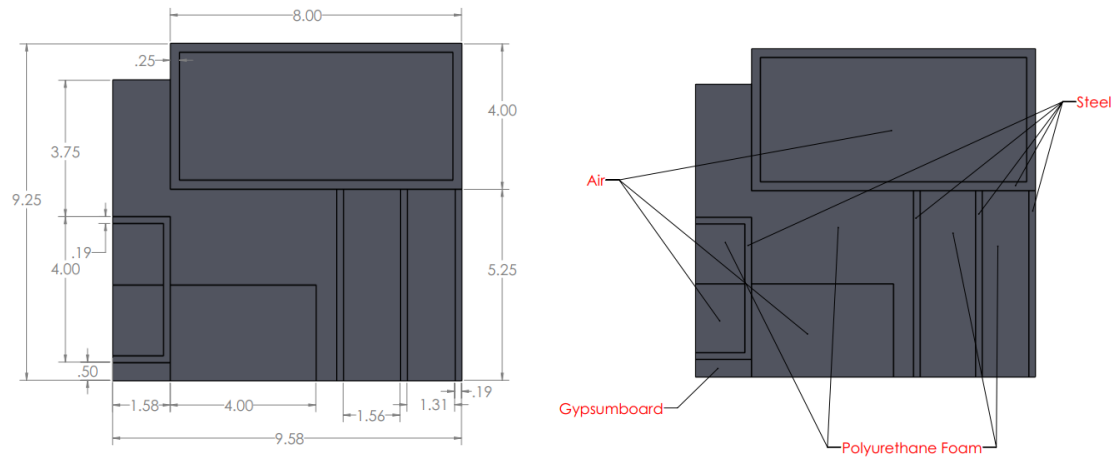
- 1- X-Axis: 43.047 (hr ft² F/Btu)
- 2- Y-Axis: 22.997 (hr ft² F/Btu)
- 3- Total: 15.141 (hr ft² F/Btu)

DET4.1A Wall R-value Estimate

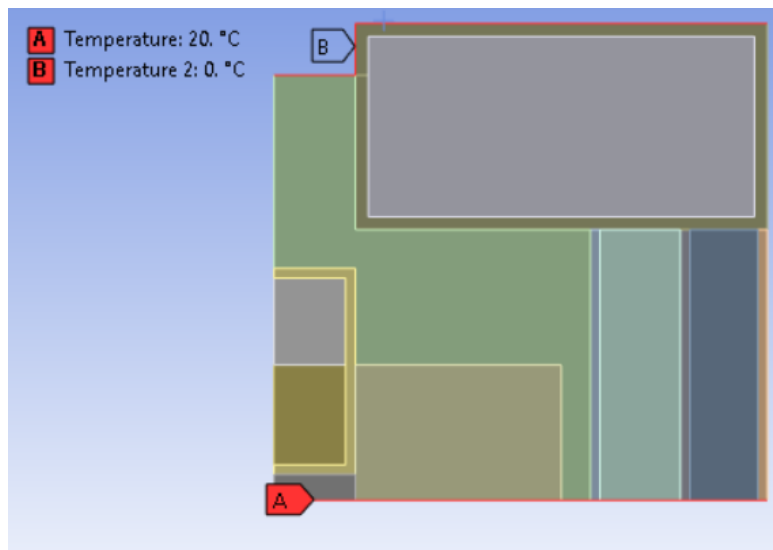
1. Geometry

The 2D geometry was made according to the attached geometry sent.

Dimensions are in inches.



2. Boundary Conditions



3. Materials

Name	Thermal Conductivity(W/m.°C)
Gypsum Board	0.2
Air	0.026
Polyurethane Foam	0.025
Steel	60

4. Results

4.1 R-value

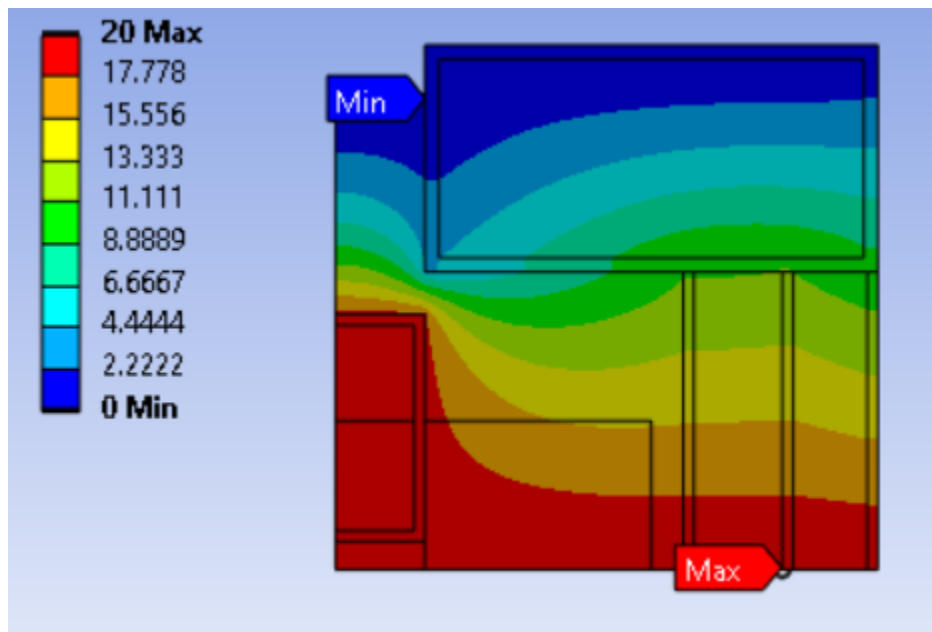
R-value for the combined wall = Temperature Difference / Heat Flux

Average 285.73 W/m²

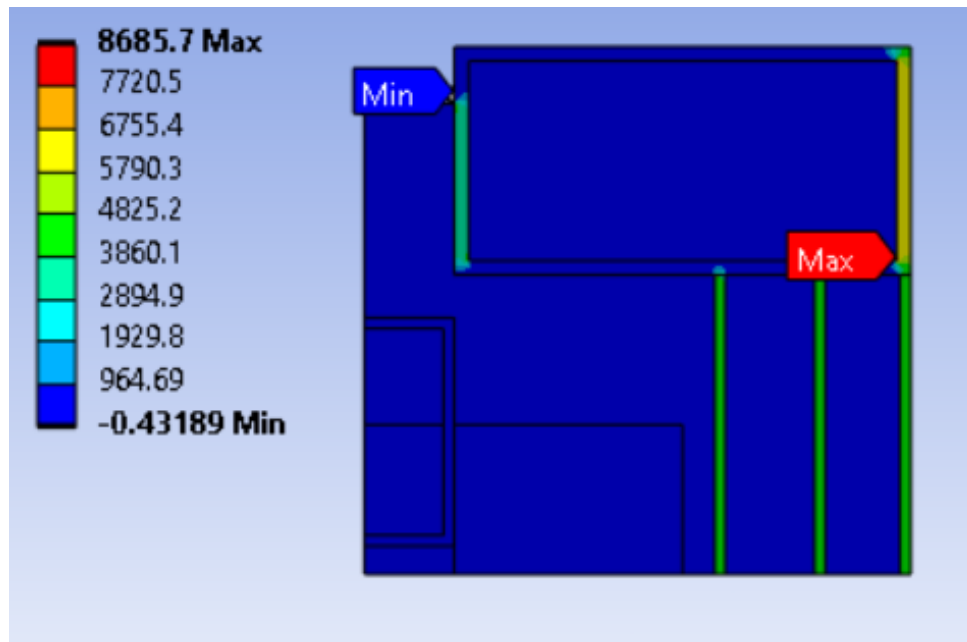
Average Y-Axis Heat Flux (W/m²) = 285.7

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
285.7	20	0.0700035	0.397479874

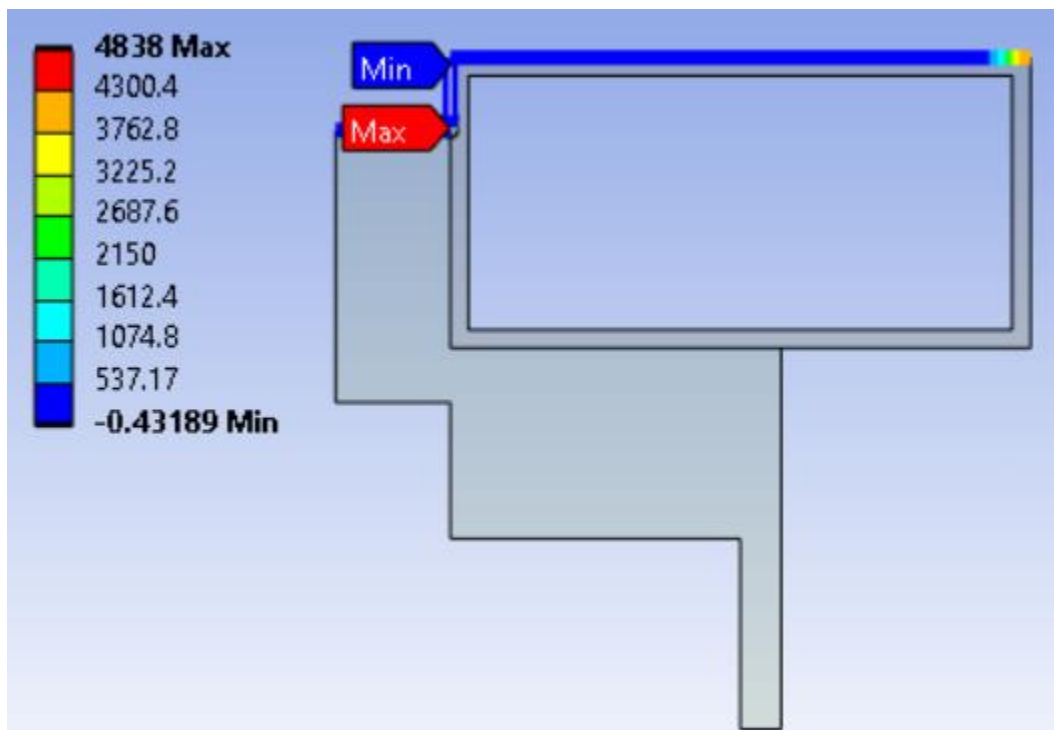
4.2 Temperature Distribution (°C)



4.3 Directional Heat Flux (W/m²)



4.4 Directional Heat Flux at Outside Boundary Condition (W/m²)



5. Conclusion

The calculated R-value for this combined wall is 0.397 hr ft² F/Btu

Note: The temperature distribution at the outside boundary condition is applied on a line and because this simulation is steady-state BVP (Boundary Value Problem) and the outside boundary condition for this problem is 0 °C, the temperature will **Always** be 0 °C, hence there is no temperature distribution at this condition.

If the outside boundary condition is heat flux, there will be a temperature distribution at the outside boundary, which is not the case in this simulation.

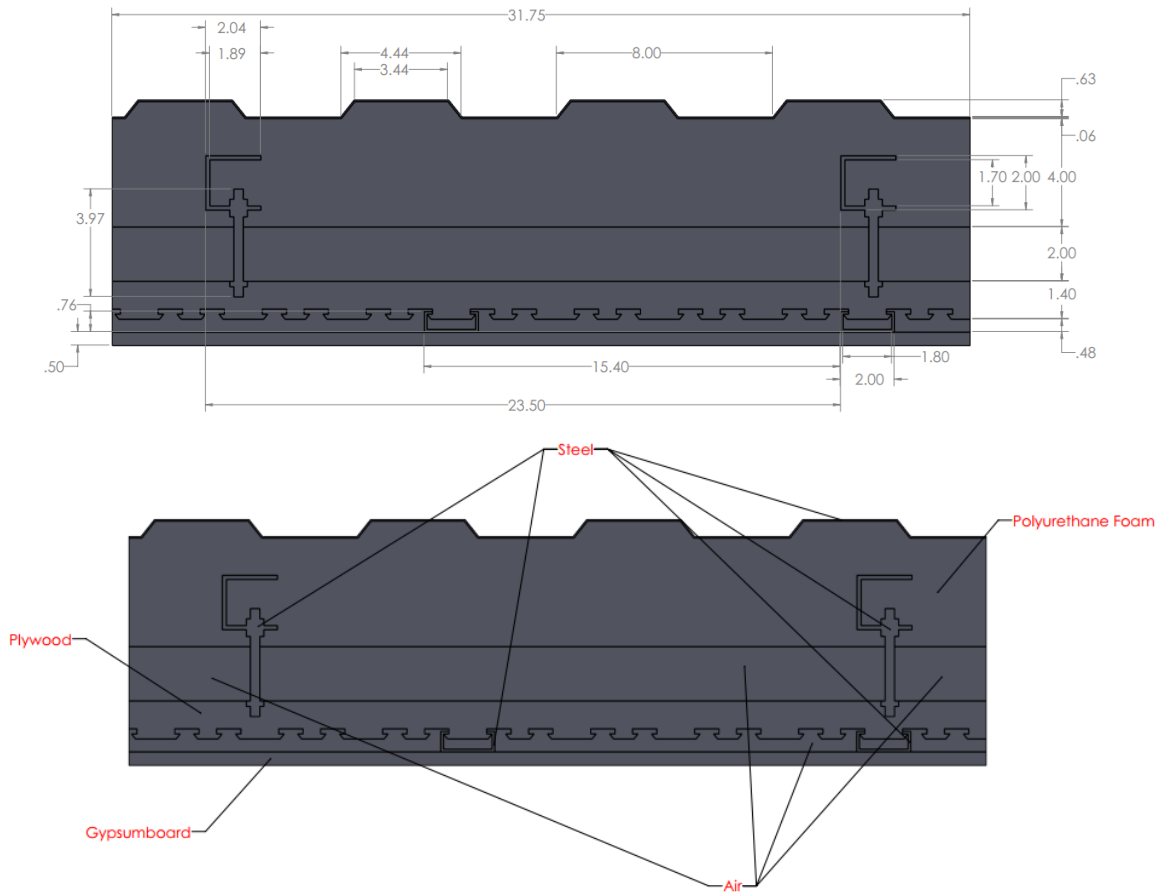
Also, the R-value is low due to the thermal bridging as there are no thermal breaks between the steel parts and the heat source, as the steel is a highly conductive material and the steel facing the heat source is smaller compared to the DET4.1 where there a thermal break and the steel are facing the heat source is wider.

DET5.0 Wall R-value Estimate

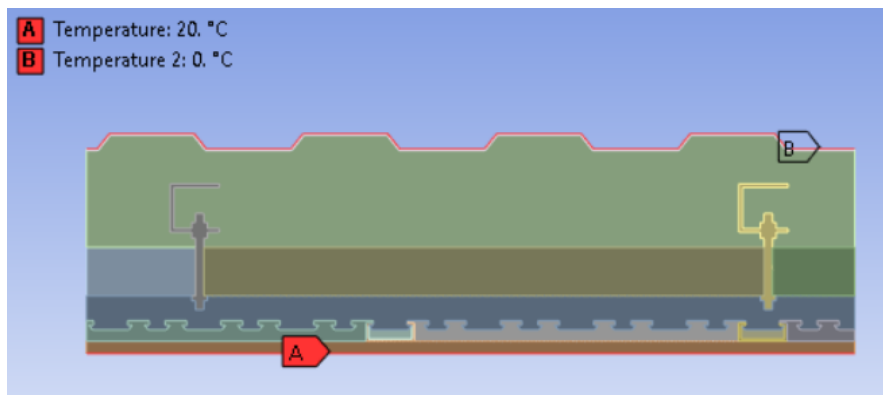
1. Geometry

The 2D geometry was made according to the attached geometry sent.

Dimensions are in inches.



2. Boundary Conditions



3. Materials

Name	Thermal Conductivity(W/m.°C)
Gypsum Board	0.2
Air	0.026
Plywood	0.125
Polyurethane Foam	0.025
Steel	60

4. Results

4.1 R-value

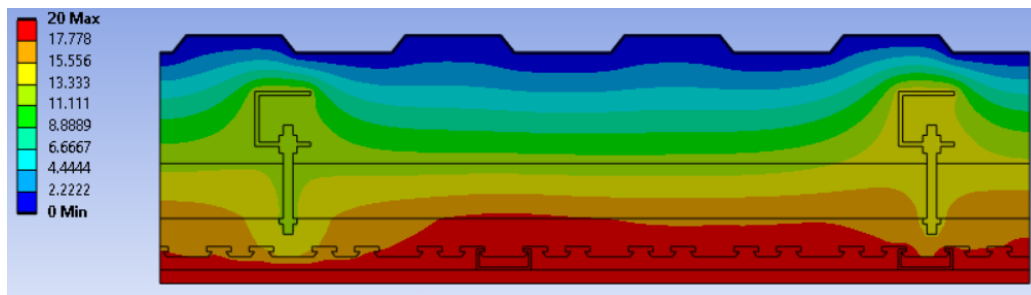
Average 7.2378 W/m²

Average Directional Heat Flux (W/m²) = 7.2378

R-value for the combined wall = Temperature Difference / Heat Flux

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
7.2378	20	2.763270607	15.68985051

4.2 Temperature Distribution (°C)



4.3 Y-Axis Directional Heat Flux (W/m²)



5. Conclusion

The calculated R-value for this combined wall is 15.689 (hr ft² F/Btu)

3. Materials

Name	Thermal Conductivity(W/m.°C)
Gypsum Board	0.2
Air	0.026
Thermoplastic Polyolefin Membrane	0.033
Plywood	0.125
Polyurethane Foam	0.025
Steel	60

4. Results

4.1 R-value

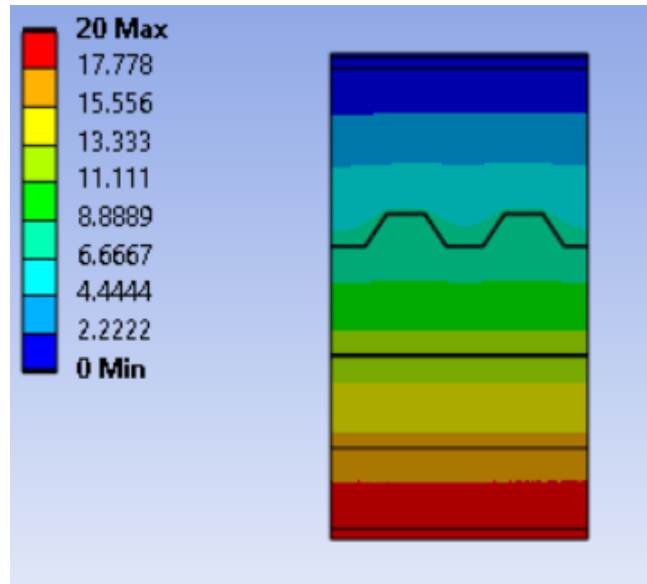
Average 1.2228 W/m²

Average Directional Heat Flux (W/m²) = 1.2228

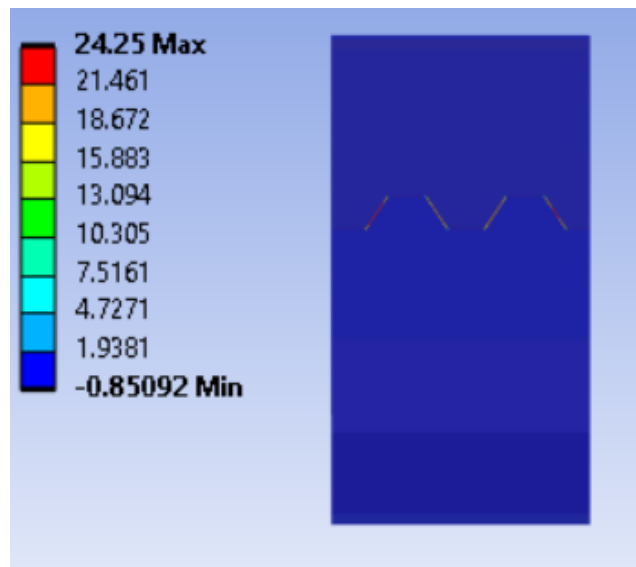
R-value for the combined wall = Temperature Difference / Heat Flux

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
1.2228	20	16.35590448	92.86882565

4.2 Temperature Distribution (°C)



4.3 Y-Axis Directional Heat Flux (W/m^2)



5. Conclusion

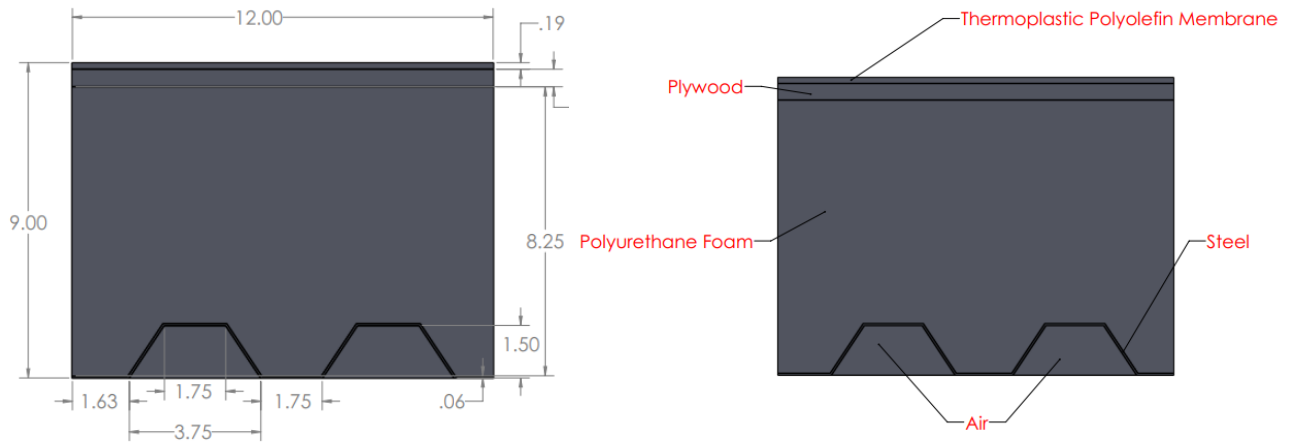
The calculated R-value for this combined wall is 92.868 ($\text{hr ft}^2 \text{ F/Btu}$)

DET8.1B Wall R-value Estimate

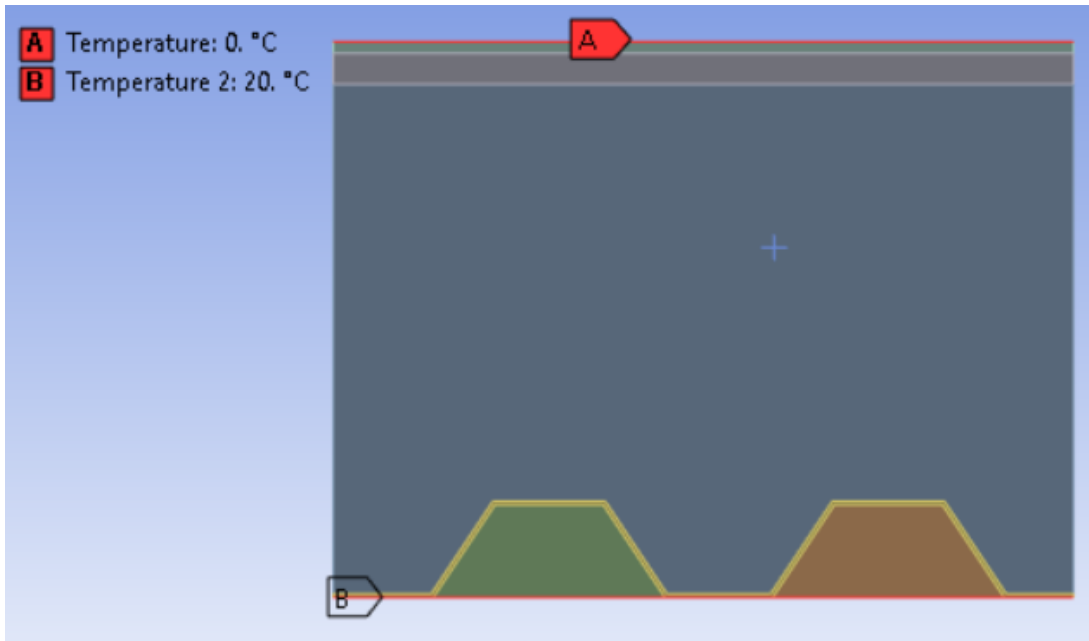
1. Geometry

The 2D geometry was made according to the attached geometry sent.

Dimensions are in inches.



2. Boundary Conditions



3. Materials

Name	Thermal Conductivity(W/m.°C)
Air	0.026
Thermoplastic Polyolefin Membrane	0.033
Plywood	0.125
Polyurethane Foam	0.025
Steel	60

4. Results

4.1 R-value

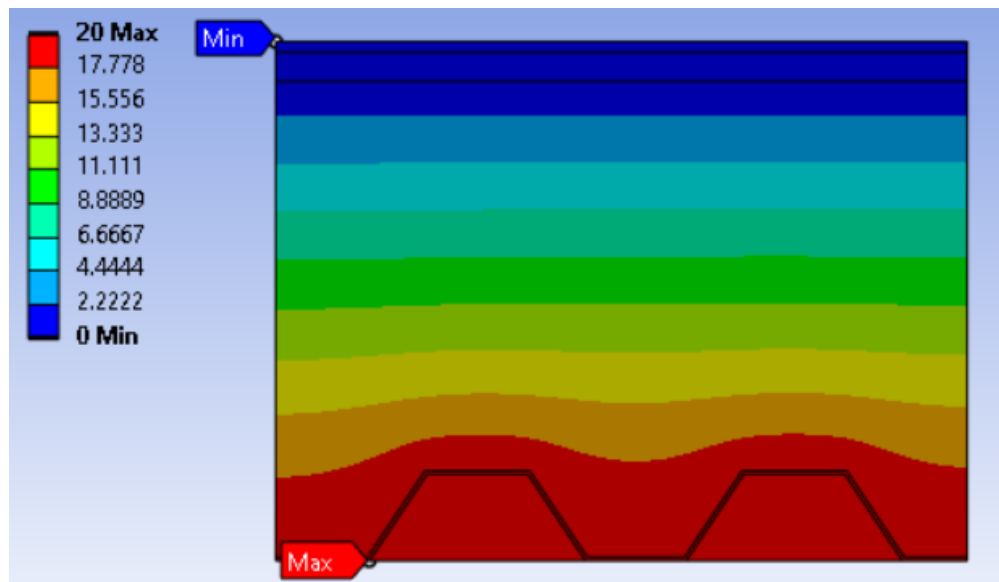
Average 5.1901 W/m²

Average Directional Heat Flux (W/m²) = 5.19

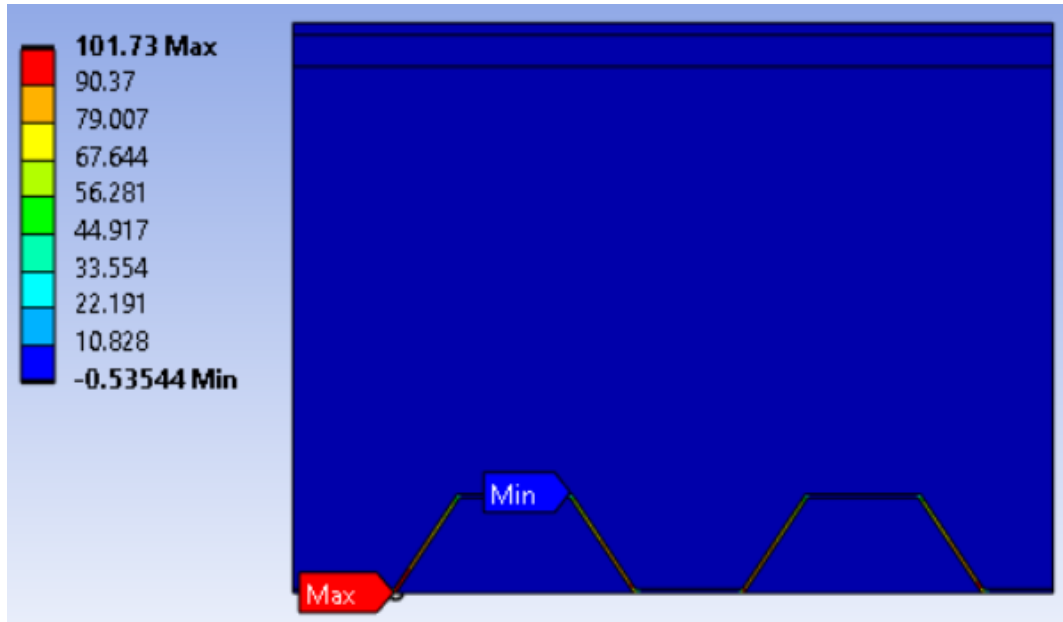
R-value for the combined wall = Temperature Difference / Heat Flux

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
5.19	20	3.853564547	21.8805395

4.2 Temperature Distribution (°C)



4.3 Directional Heat Flux (W/m^2)



5. Conclusion

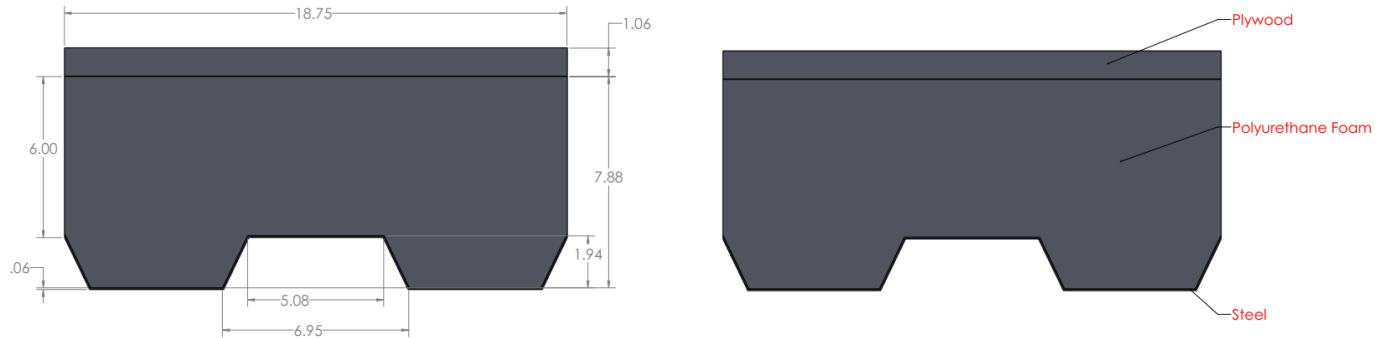
The calculated R-value for this combined wall is 21.88 ($\text{hr ft}^2 \text{ F}/\text{Btu}$)

DET9.0 Wall R-value Estimate

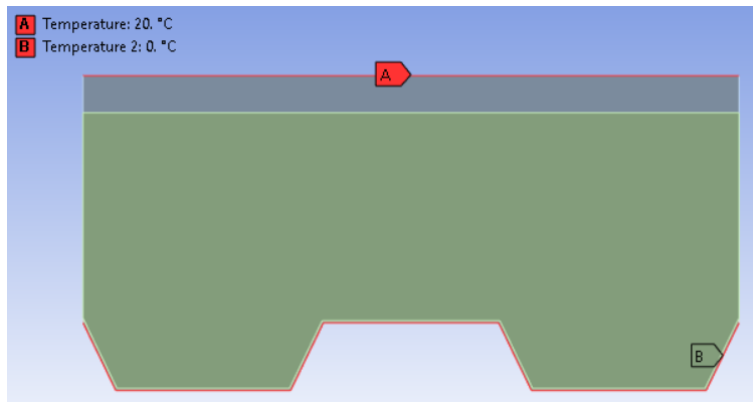
1. Geometry

The 2D geometry was made according to the attached geometry sent.

Dimensions are in inches.



2. Boundary Conditions



3. Materials

Name	Thermal Conductivity(W/m.°C)
Plywood	0.125
Polyurethane Foam	0.025
Steel	60

4. Results

4.1 R-value

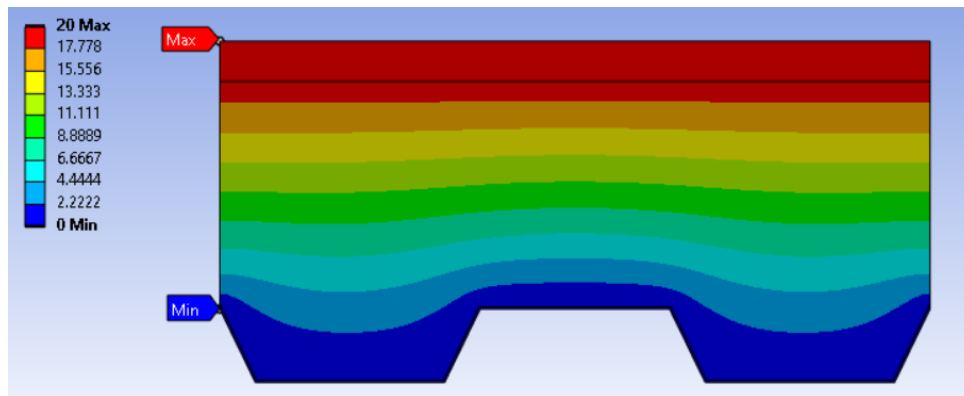
Average 2.4996 W/m²

Average Directional Heat Flux (W/m²) = 2.499

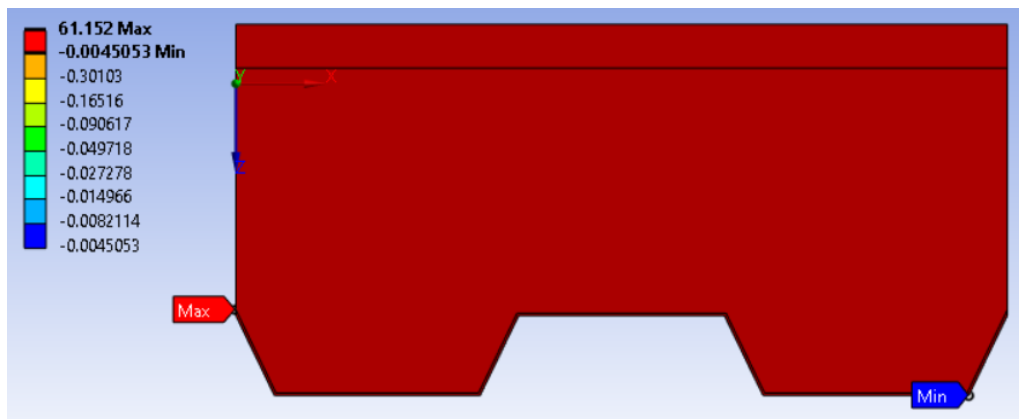
R-value for the combined wall = Temperature Difference / Heat Flux

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
2.499	20	8.003201281	45.44217687

4.2 Temperature Distribution (°C)



4.3 Z-Axis Directional Heat Flux (W/m²)



5. Conclusion

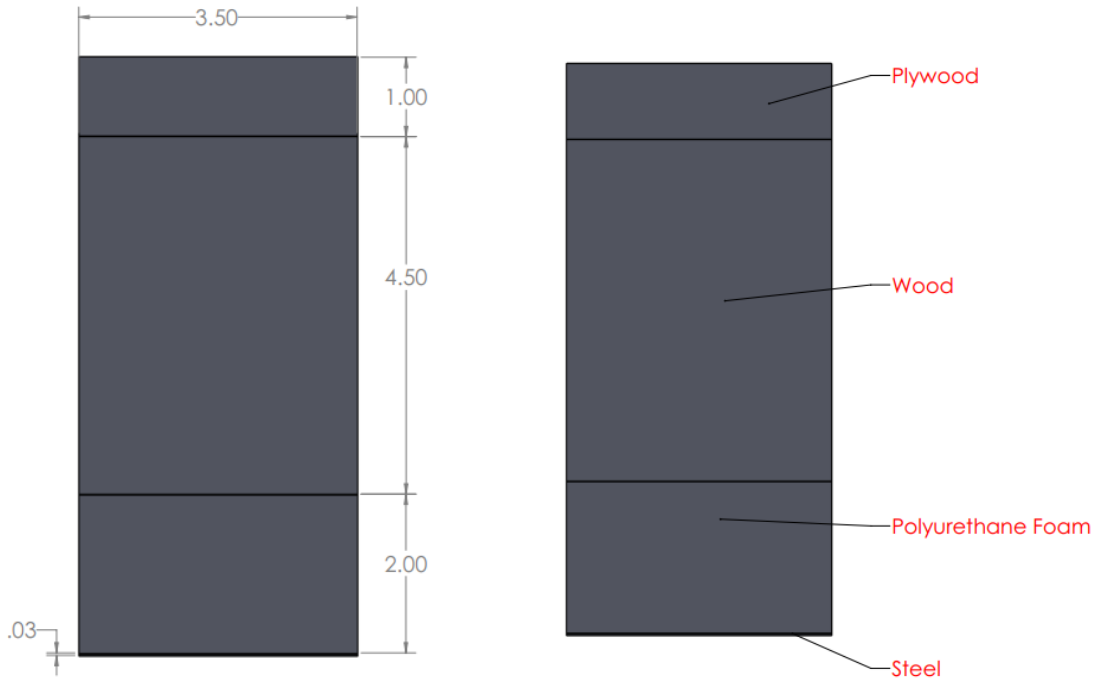
The calculated R-value for this combined wall is 45.44 (hr ft² F/Btu)

DET11.1 Wall R-value Estimate

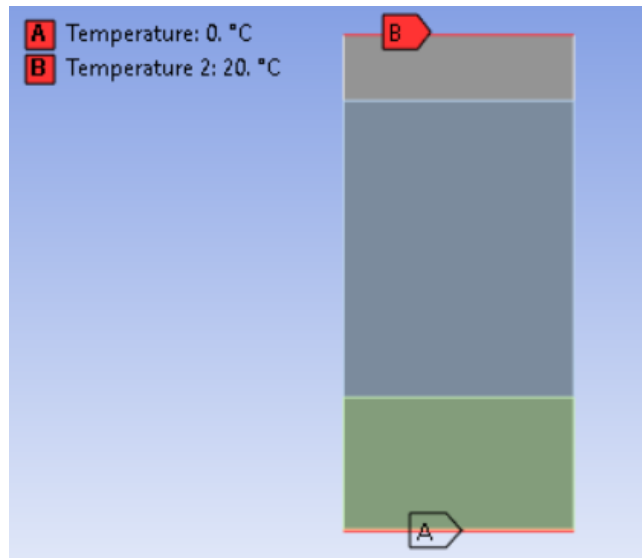
1. Geometry

The 2D geometry was made according to the attached geometry sent.

Dimensions are in inches.



2. Boundary Conditions



3. Materials

Name	Thermal Conductivity(W/m.°C)
Wood	0.23
Plywood	0.125
Polyurethane Foam	0.025
Steel	60

4. Results

4.1 R-value

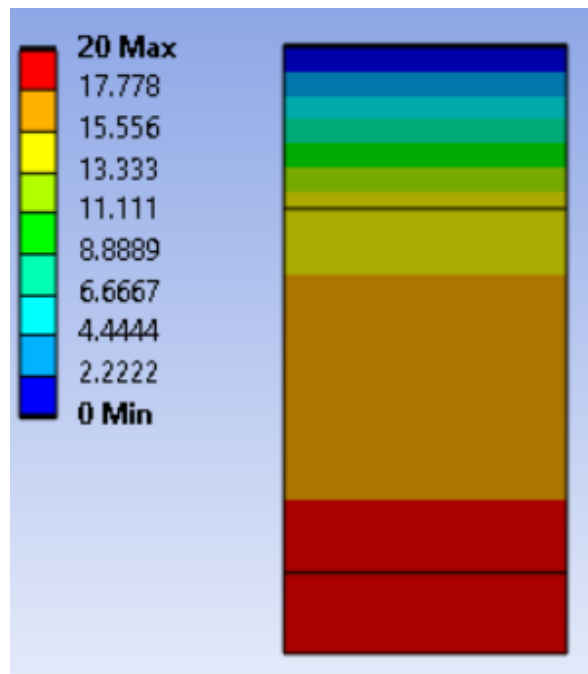
Average 7.3199 W/m²

Average Directional Heat Flux (W/m²) = 7.3199

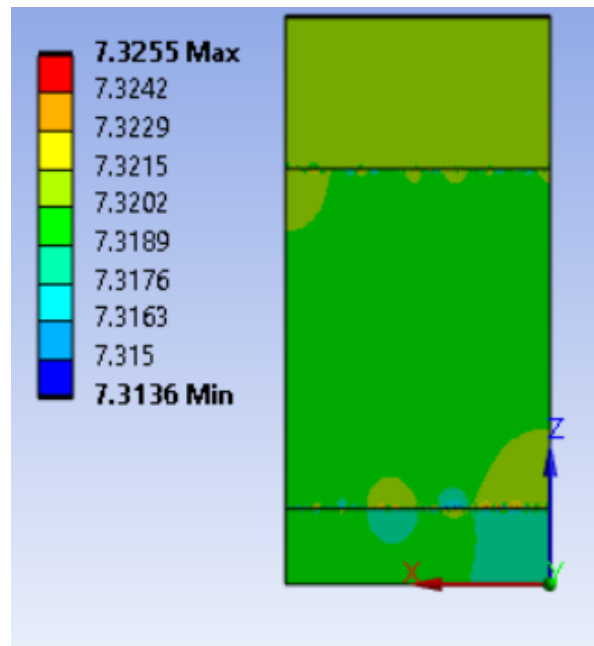
R-value for the combined wall = Temperature Difference / Heat Flux

Heat Flux (W/m ²)	T ₁ -T ₂ (°C)	R-Value (°C.m ² /W)	R-Value (hr ft ² F/Btu)
7.3199	20	2.732277763	15.51387314

4.2 Temperature Distribution (°C)



4.3 Z-Axis Directional Heat Flux (W/m^2)



5. Conclusion

The calculated R-value for this combined wall is 15.513 ($\text{hr ft}^2 \text{ F/Btu}$)