Project Documentation #6369

Abstract

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Sendero Verde, Building B-South
Multi-family Residential Building in New York City, USA

Data of building | Gebäudedaten

Year of construction	2022	**Space heating**	**4.1** **kBTU/(ft^{2}yr)**
R-value external wall	41.3 hr-ft^2-°F/BTU		
R-value basement	N/A hr-ft^2-°F/BTU	Primary Energy Renewable (PER)	34.7 kBTU/(ft^{2}yr)
R-value roof	41.3 hr-ft^2-°F/BTU	Generation of renewable Energy	357,207 kBTU/yr
U-value window	Varies BTU/hr-ft^2-°F	Non-renewable Primary Energy (PE)	46.13 kBTU/(ft^{2}yr)
Heat recovery	Varies by location 75% - 86%	Pressurization test n_{50}	0,4 h^{-1}
Special features	Rainwater harvesting, PV panels (not considered in PHPP), electric cooking appliances		

Brief Description

Sendero Verde Building B-South

This 85-unit multi-family residential building is one of two Passive House buildings completed in Phase 1 of the Sendero Verde Residential development. The development will ultimately provide 709, 100% affordable housing units, all certified Passive House, in the East Harlem neighborhood of New York City. This development is the result of an RFP titled SustainNYC, supported by The NYC City Council and the NYC Department of Housing, Preservation, and Development (HPD). Passive House certification was a requirement for this RFP.

Building B-South is comprised of a mix of income levels from 90% Area-Median Income (AMI) to units reserved for those formerly experiencing homelessness. The Passive House design offers tenants improved comfort from a typical apartment in NYC. The high-performance windows and glazing and continuously insulated façade offer improved thermal comfort, as well as, better acoustic performance, protecting tenant's from the noise pollution associated with the neighboring MetroNorth regional rail line.

The residences are located on floors 3-9 with the ground and 2nd floor being reserved for lobby and tenant space leased to one of the oldest settlement houses in NYC, Union Settlement, a benefit to the tenants and the broader community. Tenants have access to amenities including a private roof terrace on the tenth floor, a public outdoor courtyard connecting all buildings in the development, laundry, fitness room, computer room, and party room equipped with warming kitchen.

The building podium is a brick façade in keeping with the neighborhood context and the floors above are clad in EIFS, a cost-effective system for maximizing thermal performance. The windows are high-performance uPVC frames with triple-glazed, low-e coated IGUs. The building is served by a low-energy VRF heating and cooling system, and a centralized ventilation strategy with energy recovery ventilation.

Responsible project participants

Architect	Handel Architects, Louis Koehl, CPHD, AIA Deborah Moelis, CPHD, AIA Ryan Lobello, CPHD, AIA Handel Architects | World-class Architecture
Implementation planning	-
Building systems	Cosentini Associates Cosentini Associates - Home
Structural engineering	Desimone Consulting Engineers DeSimone Consulting Engineers | Bridging Science and Humanity (de-simone.com)
Building physics	-
Passive House project planning	Steven Winter Associates Home - Steven Winter Associates, Inc. (swinter.com)
Construction management	L&M Builders L+M Development Partners LLC. | Real Estate Development | Affordable HousingConstruction - L+M Development Partners LLC. | Real Estate Development | Affordable Housing (lmdevpartners.com)

Certifying body

Passivhaus Institut Darmstadt
www.passiv.de

Certification ID

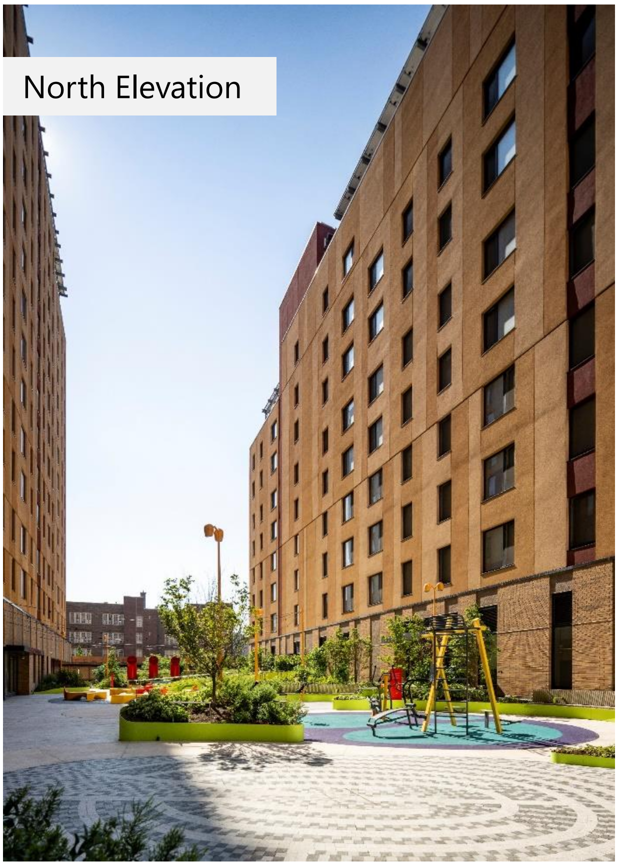
6369	Project-ID (www.passivehouse-database.org) Projekt-ID (www.passivhausprojekte.de)

Author of project documentation

Passivhaus Institut Darmstadt
www.passiv.de

Date	Signature
20.11.2023	

1. Exterior Photos



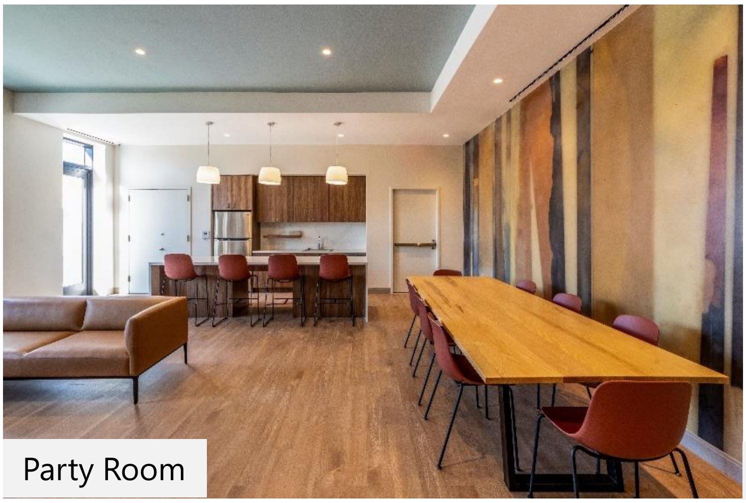
North Elevation

© Handel Architects

West Elevation

© Handel Architects

2. Interior Photos



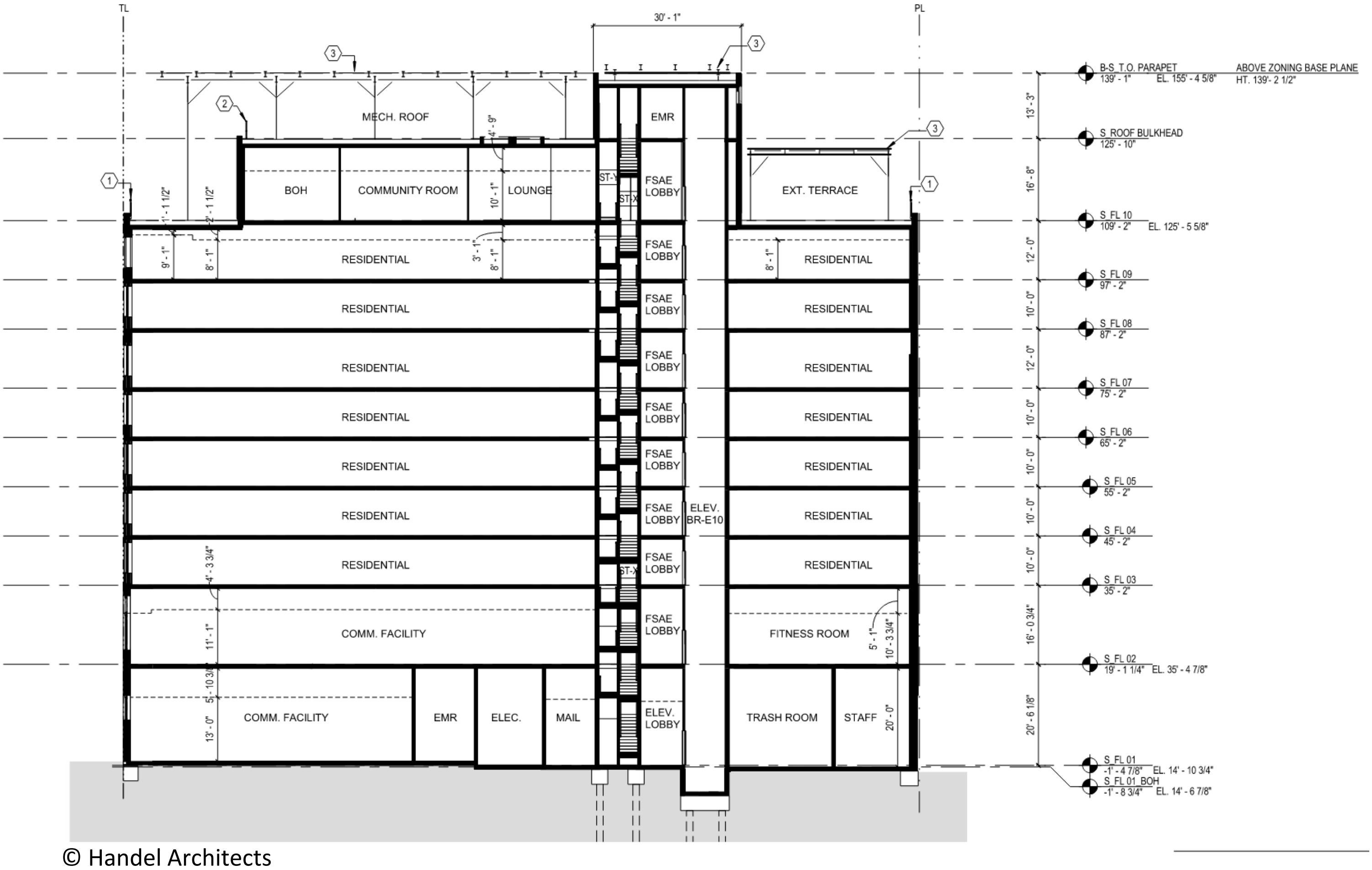
Party Room

© Handel Architects

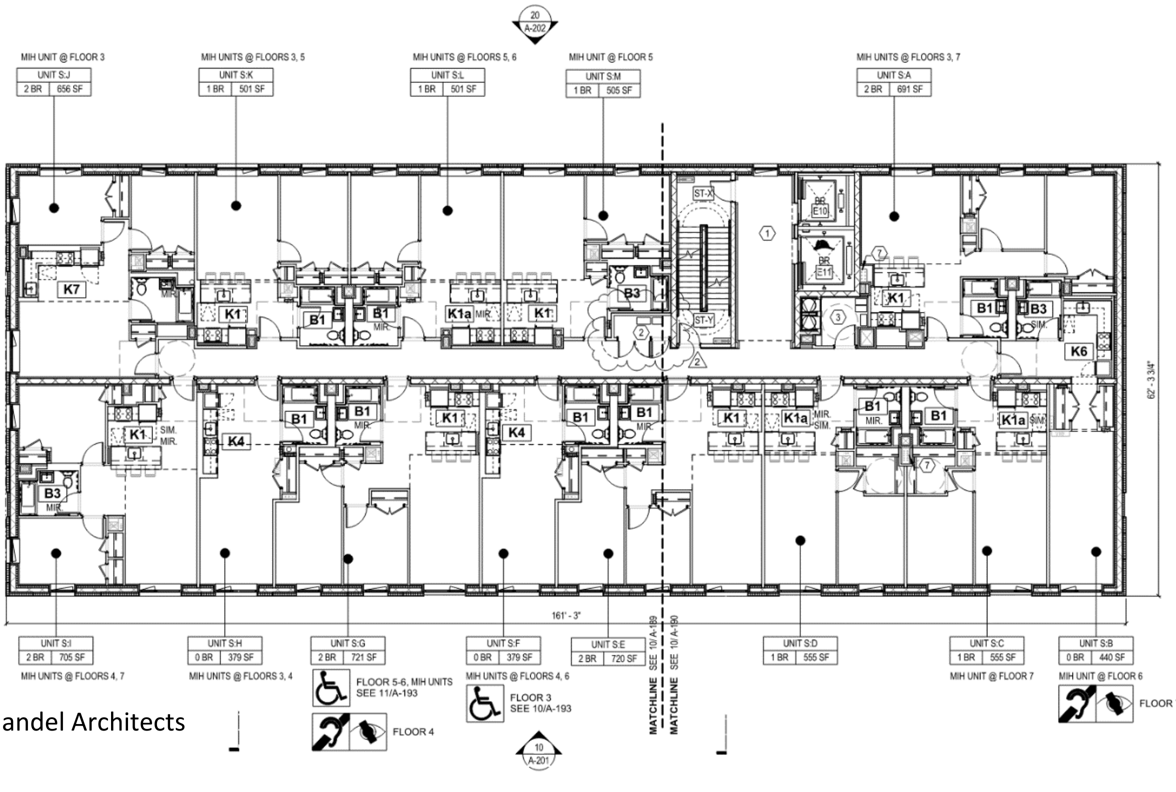
Lobby

© Handel Architects

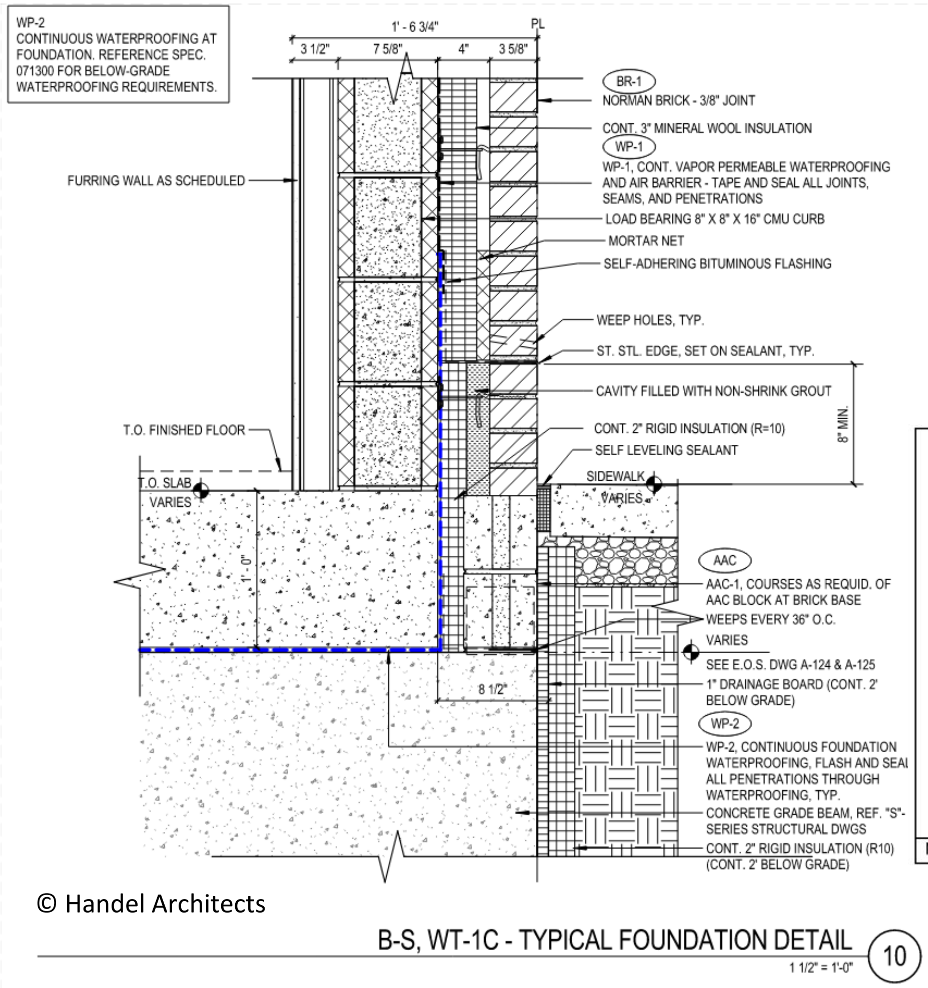
3. Section



4. Floor Plan



5. Floor Slab meeting Exterior Wall

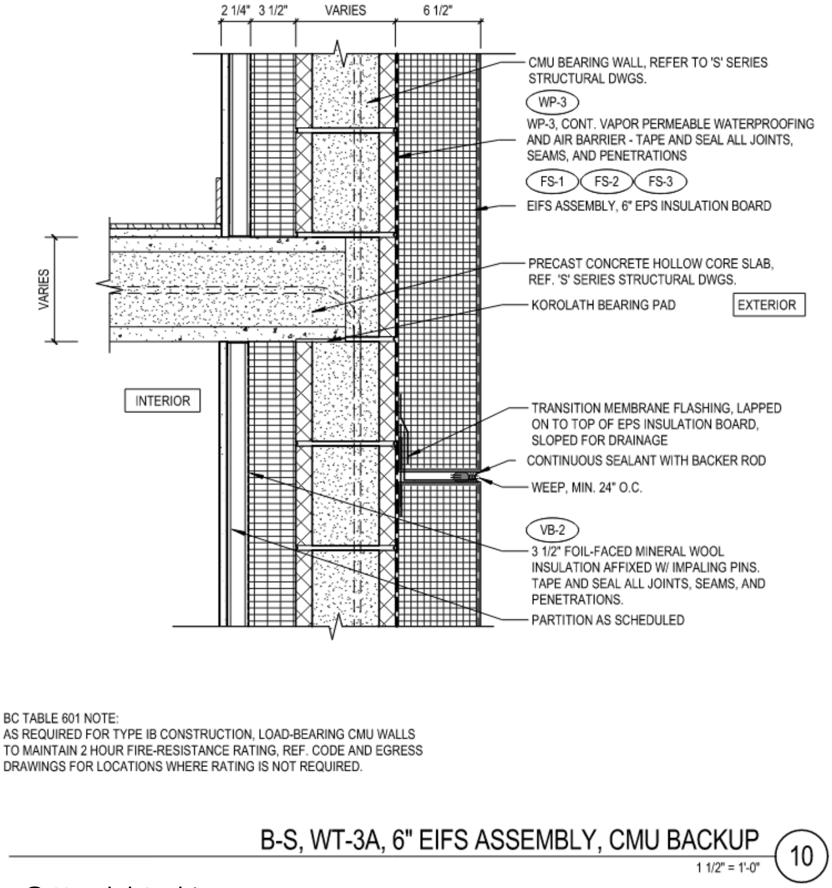


At base of wall, brick is supported on AAC block acting as a thermal break. Face of grade beam is insulated with R-10 insulation, slab on grade has no insulation below.

Notes: Overview AAC Block at transition from below to above grade

	Building data				R-value floor slab/basement ceiling	R_f	1,6	hr.ft².°F/BTU
	Area of ground floor slab / basement ceiling	A	5277	ft²	TBs floor slab / basement ceiling	Ψ_B*l	0,00	BTU/hr.°F
	Perimeter length	P	130,0	ft	R-value floor slab / basement ceiling i	R_f'	1,6	hr.ft².°F/BTU
	Charact. dimension of floor slab	B'	81,2	ft	Equivalent thickness floor	d_t	1,8	ft
	Floor slab type (select only one)							
x	**Slab on grade**							
	Perimeter insulation width/depth	D	8,40	in	Orientation of perimeter insulation	horizontal		
	Perimeter insulation thickness	d_n	2,00	in	(check only one field)	vertical	x	
	Perimeter insulation therm. resistance	R per inch	5,000	hr.ft².°F/BTU.in				
	Heated basement or floor slab completely / partially below ground level							
	Basement wall height below ground level	z		ft	R-Value wall below ground	R_{wB}		hr.ft².°F/BTU
	Unheated basement							
	Height aboveground wall	h		ft	R-Value wall above ground	R_W		hr.ft².°F/BTU
	Basement wall height below ground level	z		ft	R-Value wall below ground	R_{WB}		hr.ft².°F/BTU
	Air change unheated basement	n	0,20	1/hr	R-Value basement floor slab	R_{fB}		hr.ft².°F/BTU
	Air flow basement	V		ft³				
	Suspended floor above a ventilated crawl space (at max. 1.6 ft below ground)							
	R-Value crawl space	R_{Crawl}		hr.ft².°F/BTU	Area of ventilation openings	εP		ft²
	Height of crawl space wall	h		ft	Wind velocity at 10 m height	v	8,9	mph
	R-Value crawl space wall	R_W		hr.ft².°F/BTU	Wind shield factor	f_W	0,05	-
	Additional thermal bridge heat losses at perimeter				Steady-state fraction	$\Psi_{P,stat}$*l		BTU/hr.°F
	Phase shift	β		Months	Harmonic fraction	$\Psi_{P,harm}$*l	0,000	BTU/hr.°F

6. Wall Construction

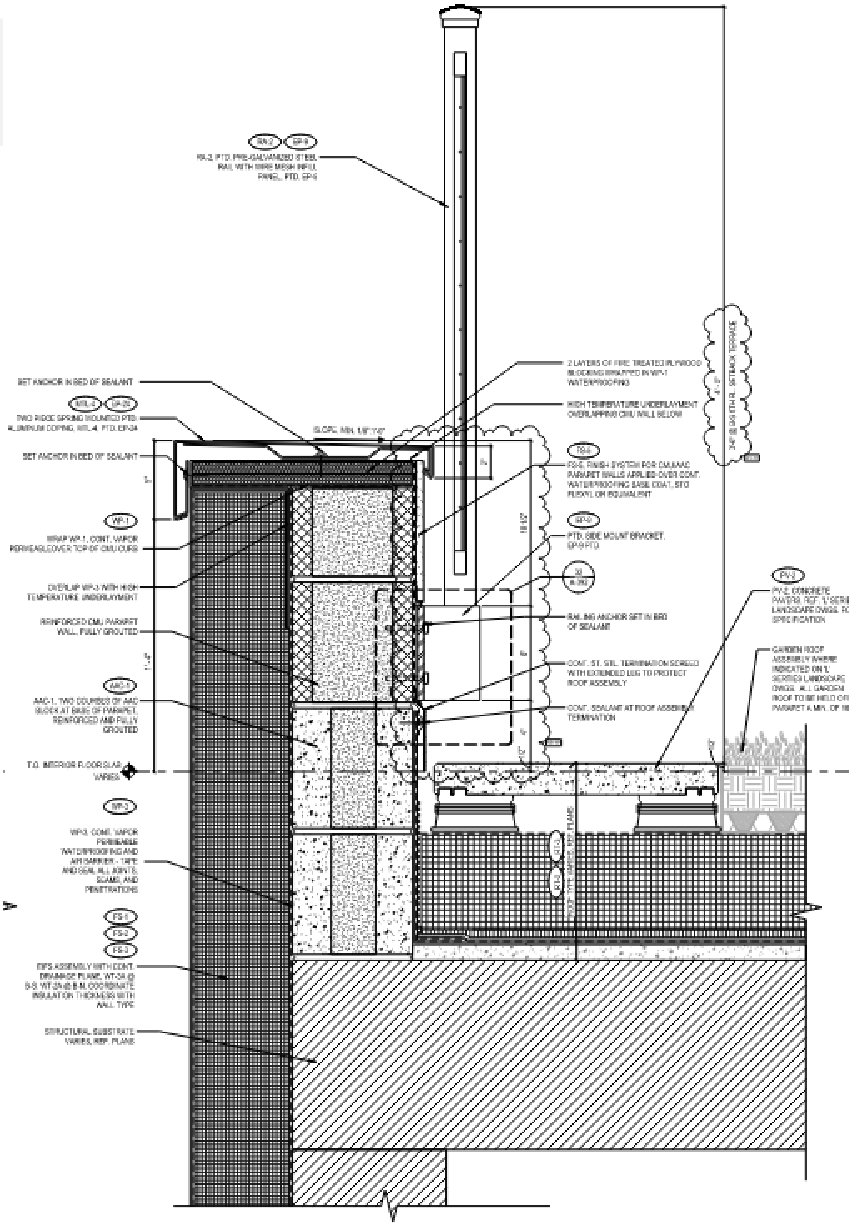


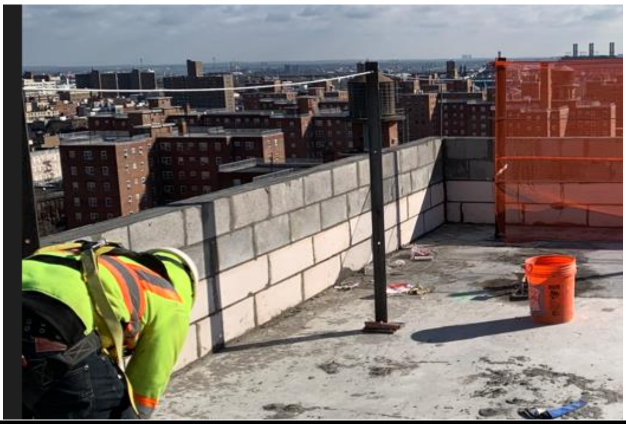
Exterior wall includes 6" EPS insulation on exterior side with 3.5" mineral wool insulation on interior side. Air barrier is the waterproofing membrane behind the EIFS system. There is an additional vapor control layer on the interior side of mineral wool, in the form of foil-facing.

Assembly no.		Building assembly description						Interior insulation?
04ud		WT-3A EIFS						
		Heat transmission resistance [hr.ft².F/BTU]						
Orientation of building element	0,738174337	interior R_{si}	0,74					
Adjacent to	0,227130565	exterior R_{se}:	0,23					
Area section 1	**R per inch**	**Area section 2 (optional)**	**R per inch**	**Area section 3 (optional)**	**R per inch**			**Thickness [in]**
EPS	3,85							6,00
CMU	0,14							7,64
Mineral Wool (continuous)	4,20							3,50
Air Gap	0,57							1,63
Interior Gyp	0,90							0,63
Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3				Total 19,39 in
U-value supplement		BTU/hr.ft².°F		R-value:	41,3	hr.ft².°F/BTU		

6. Wall Construction (cont.)

The parapet conditions are the largest linear thermal breaks on the project. To isolate these conditions the team has come up with an innovative detail that uses two courses of Autoclaved Aerated Concrete (AAC) masonry units at the base of the parapet wall. This lower density block has a significantly higher R-value than traditional CMU. On top of that block, traditional CMU was installed. The traditional CMU has a higher pull-out strength and was better for mouting the steel guard rails. By mounting the guard rails direclty to the face of rthe CMU wall we also avoided any thermal bridging from the steel rail to the roof slab.



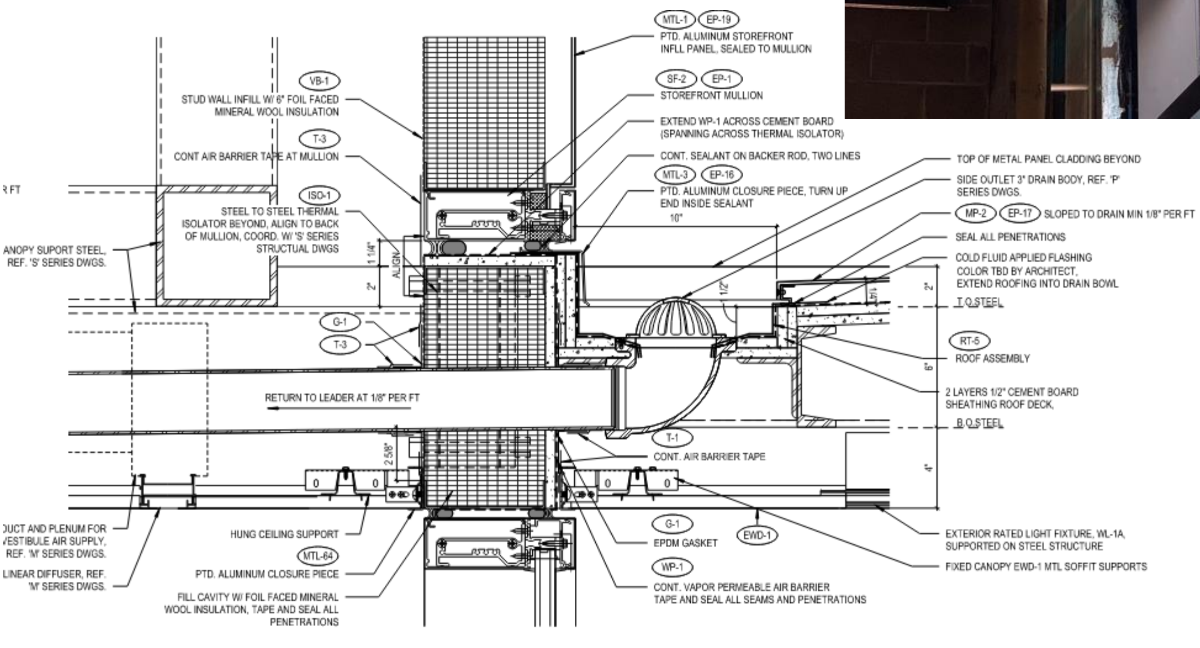


Thermal bridge inputs

No.	Thermal bridge - denomination	Group No.	Assigned to group	Quantity	x (	Length [ft]	-	Subtraction length [ft]	)=	Length ℓ [ft]	User determined psi value [BTU/hr.ft.F]	User determined $f_{Rsi=0,25}$ (optional)	or	Ψ-Value [BTU/hr.ft.F]
1	-				x (		-		) =				or	
2	Roof TB				x (		-		) =				or	
3	TB1 - Parapet	15	Thermal bridges Ambient	1	x (	485	-		) =	485	0,024	0,85	or	0,024
4	TB2 - Parapet	15	Thermal bridges Ambient	1	x (	7	-		) =	7	0,034	0,83	or	0,034
5	TB3 - Parapet	15	Thermal bridges Ambient	1	x (	121	-		) =	121	0,086	0,79	or	0,086
6	TB4 - Roof upturn to wall	15	Thermal bridges Ambient	1	x (	155	-		) =	155	0,101	0,94	or	0,101
7	TB5 - Roof upturn to wall	15	Thermal bridges Ambient	1	x (	41	-		) =	41	0,148	0,85	or	0,148
8	TB6 - Roof upturn to wall	15	Thermal bridges Ambient	1	x (	162	-		) =	162	0,134	0,93	or	0,134
9	TB7 - Roof upturn to wall	15	Thermal bridges Ambient	1	x (	166	-		) =	166	0,023	0,84	or	0,023
10	TB15 - Roof PV supports & dunnages	15	Thermal bridges Ambient	25	x (	2	-		) =	43	0,151	0,92	or	0,151
11	TB17 - Roof ERV curbs	15	Thermal bridges Ambient	1	x (	81	-		) =	81	0,048	0,94	or	0,048
12					x (		-		) =				or	
13	AG Wall TB				x (		-		) =				or	
14	TB9 - Slab edge	15	Thermal bridges Ambient	1	x (	2.390	-		) =	2.390	0,039	0,91	or	0,039
15	TB10 - Slab edge	15	Thermal bridges Ambient	1	x (	164	-		) =	164	0,065	0,88	or	0,065
16	TB11 - EIFS to brick transition	15	Thermal bridges Ambient	1	x (	66	-		) =	66	-0,005	0,89	or	-0,005
17	TB12 - EIFS joint (typ)	15	Thermal bridges Ambient	1	x (	1.145	-		) =	1.145	0,004	0,96	or	0,004
18	TB13 - EIFS joint (step down / vert)	15	Thermal bridges Ambient	1	x (	488	-		) =	488	0,005	0,96	or	0,005
19	TB16 - Corridor wall connection	15	Thermal bridges Ambient	1	x (	148	-		) =	148	0,037	0,94	or	0,037
20					x (		-		) =				or	
21					x (		-		) =				or	
22					x (		-		) =				or	
23					x (		-		) =				or	
24					x (		-		) =				or	
25					x (		-		) =				or	
26					x (		-		) =				or	
27	Other TB				x (		-		) =				or	
28	Trash Chute	15	Thermal bridges Ambient	1	x (	10	-		) =	10	0,891		or	0,891
29	Sanitary Pipe Vents	15	Thermal bridges Ambient	4	x (	0,09	-		) =	0	9,158		or	9,158
30	-				x (		-		) =				or	

6. Wall Construction (cont.)

Steel canopies were thermally broken with Schock brand steel-to-steel thermal isolators. These connections penetrated the curtain wall and were wrapped on all sides in mineral wool insulation.



B-N, RESIDENTIAL CANOPY SECTION @ DRAIN (10)
3" = 1'-0"

Thermal bridge inputs

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12					x (		-		) =				or	
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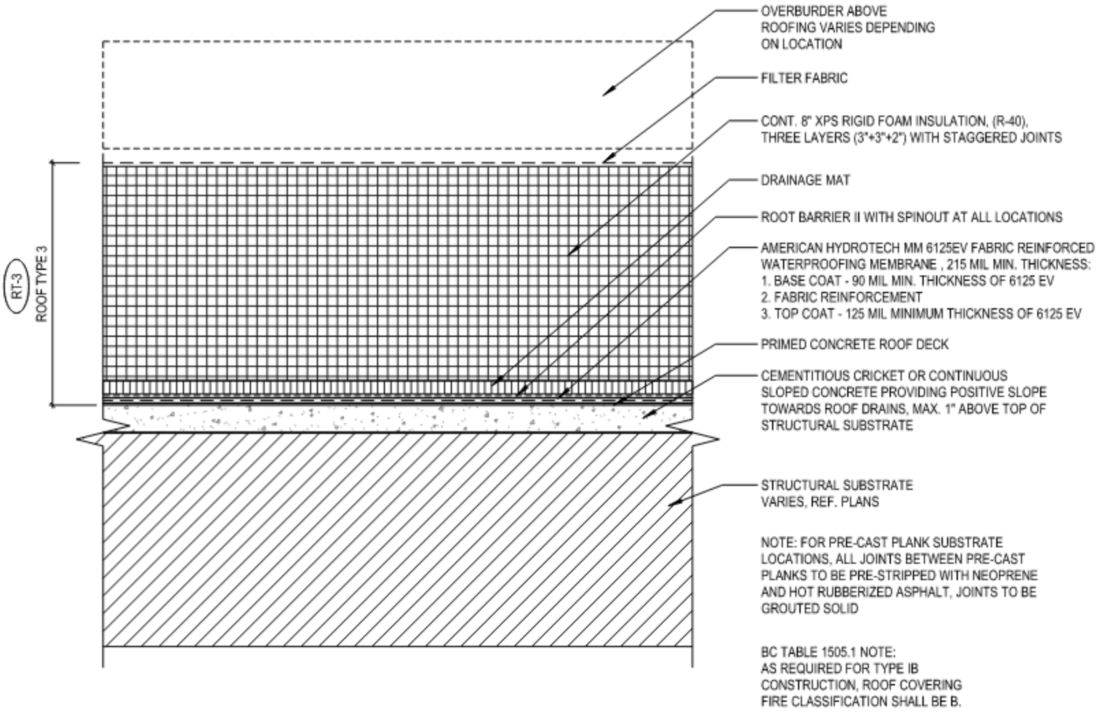
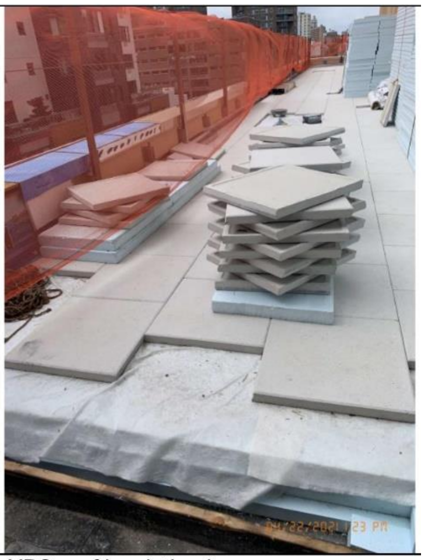
7. Roof Construction



RT-3 - IRMA ROOF ASSEMBLY, REF. SPEC SE

Roof assembly is comprised of 8" XPS insulation with various overburdens (green roof, pedestal pavers, interlocking pavers).



Notes: Overview XPS roof insulation in progress

Assembly no.	Building assembly description	Interior insulation?
09ud	RT-03 IRMA Roof R-40	

Heat transmission resistance [hr.ft².F/BTU]

Orientation of building element	0,681391696	interior R_{si}	0,68
Adjacent to	0,227130565	exterior R_{se}:	0,23

Area section 1	R per inch	Area section 2 (optional)	R per inch	Area section 3 (optional)	R per inch	Thickness [in]
XPS	5,00					8,00
Concrete Slab	0,06					10,00

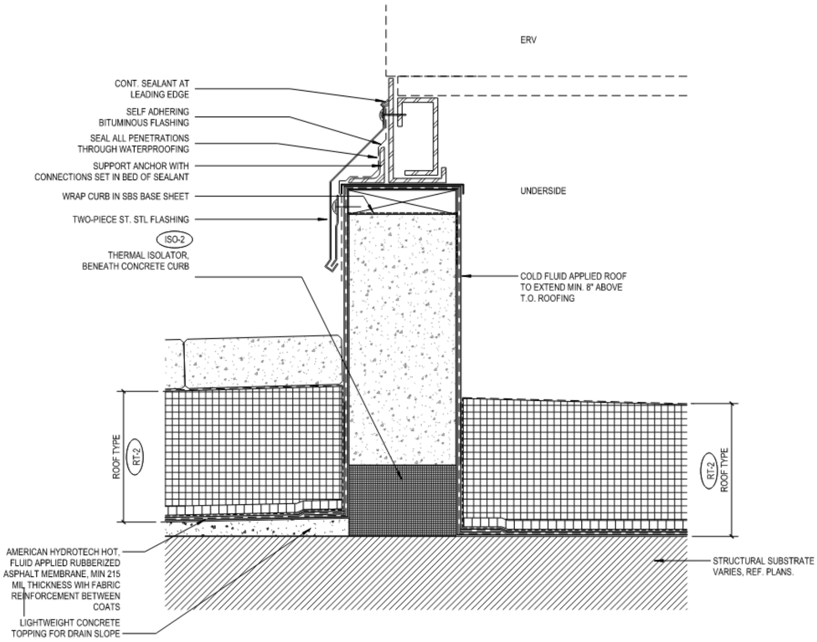
Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
100%			18,00 in

U-value supplement ____ BTU/hr.ft².°F

R-value: 41,5 hr.ft².°F/BTU

7. Roof Construction (cont.)

Below large equipment like the generators and ERUs the team specificed the use of thermally broken curbs. This detail was achieveed using a structural plastic thermal isolator in between a cast in place concrete curb and the precast roof desk with topping slab. This detail allows for simple roofing terminations and waterproofing continuity.



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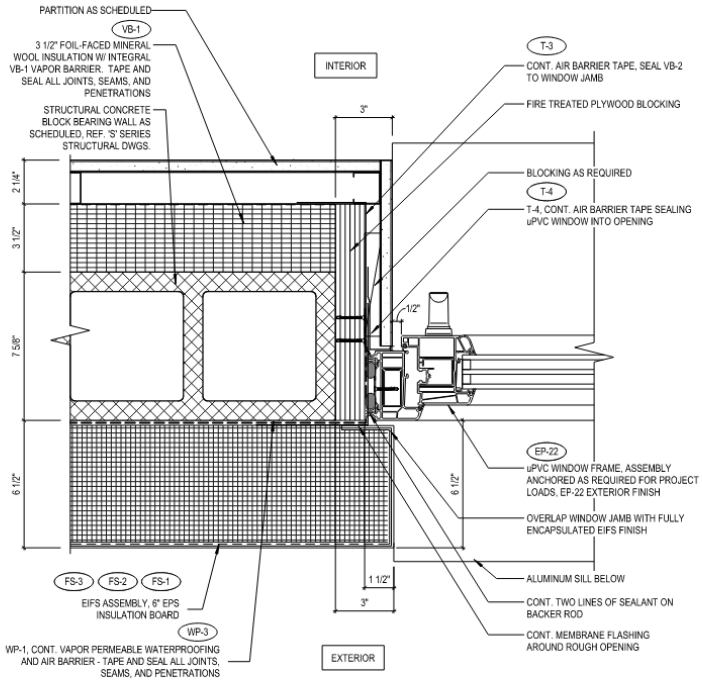
30	-				x (		-		) =				or	

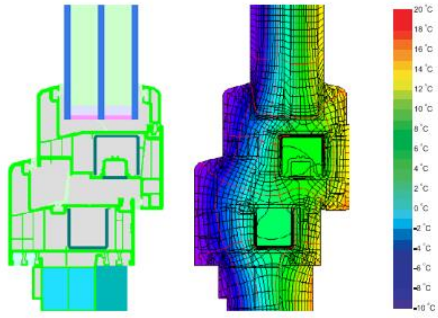
8. Fenestration

SUPERA 83 PASSIVE PROFILE

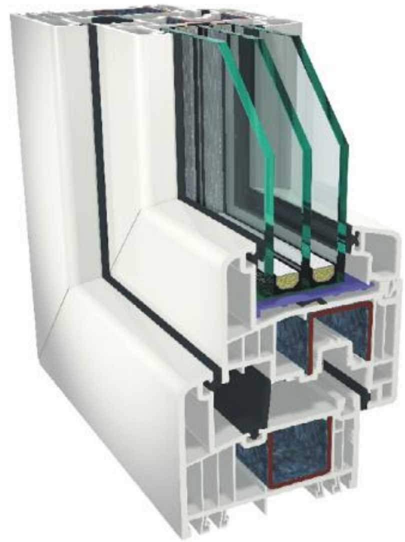
INTUS achieves Passive House Institute (PHI) Certification through our thermally efficient Supera 83 Passive profile and high performance triple glazing. By using this method versus expensive super insulated profiles, INTUS is able to affordably achieve PHI Certification for any climate zone in the U.S., Central America, and areas of Canada. With its steel reinforced profile, Supera 83 Passive is stronger structurally and can achieve certification at greater heights.



B-S, WT-3, uPVC WINDOW JAMB, OPERABLE 12



Calculation Model   Isothermal Model



https://database.passivehouse.com/en/components/details/window/intus-windows-supera-83-passive-1495ws84

Window frames

ID	Description	U_f-Value left	right	bottom	above
		BTU/hr.ft²°F	BTU/hr.ft²°F	BTU/hr.ft²°F	BTU/hr.ft²°F
01ud	Fixed (L/R) uPVC D	0,174	0,174	0,185	0,174
02ud	Operable (L/R) uPVC D	0,206	0,206	0,209	0,206
03ud	SF window - Kawneer 1600 UT fiberglass PP	0,910	0,910	0,850	0,850
04ud	SF door - Kawneer 350T Insulpour Thermal Medium Stile	1,250	1,250	1,250	1,250
05ud	Fixed (single) Aluminum C	0,546	0,546	0,544	0,544
06ud	Operable (single) Aluminum C	0,546	0,546	0,544	0,544
07ud	Operable (single) uPVC D	0,206	0,206	0,209	0,206
08ud	Fixed (single) uPVC D	0,174	0,174	0,185	0,174
09ud	Terrace door - Kawneer 2000T	0,850	0,850	0,850	0,850
10ud					

Make-up Name	Glass 1 & Coating	Glass 2 & Coating	Visible Light Transmittance	Visible Light Reflectance		Solar Energy Transmittance	Solar Energy Reflectance	Solar Factor (g%)	Secondary Heat Transfer (qi)	Thermal Properties U-Value
			Visible (τ_v %)	ρ_v % out	ρ_v % in	Solar (τ_e %)	ρ_e % out			U_g W/m²·K [3 decimals]
CG 44.2 x 18 x 4 x 16 x 6 CG	Guardian ExtraClear (CE)	ClimaGuard® 1.0+ (CE) on Guardian ExtraClear (CE)	62.5	24.1	24.3	31.3	36.2	36.9	5.7	0.496

Calculation Standard: EN 410:2011 / EN 673:2011

CG 44.2 x 18 x 4 x 16 x 6 CG

Outdoors

GLASS 1	Guardian ExtraClear (CE) Thickness = 5/32" (4mm)	#1 ----- #2 -----
INTERLAYER 1	PVB Clear 0.76mm (CE)	
GLASS 2	Guardian ExtraClear (CE) Thickness = 5/32" (4mm)	#3 ----- #4 ClimaGuard® 1.0+ (CE)
GAP 1	10% Air, 90% Argon, 18mm	
GLASS 3	Guardian ExtraClear (CE) Thickness = 5/32" (4mm)	#5 ----- #6 -----
GAP 2	10% Air, 90% Argon, 16mm	
GLASS 4	Guardian ExtraClear (CE) Thickness = 1/4" (6mm)	#7 ClimaGuard® 1.0+ (CE) #8 -----

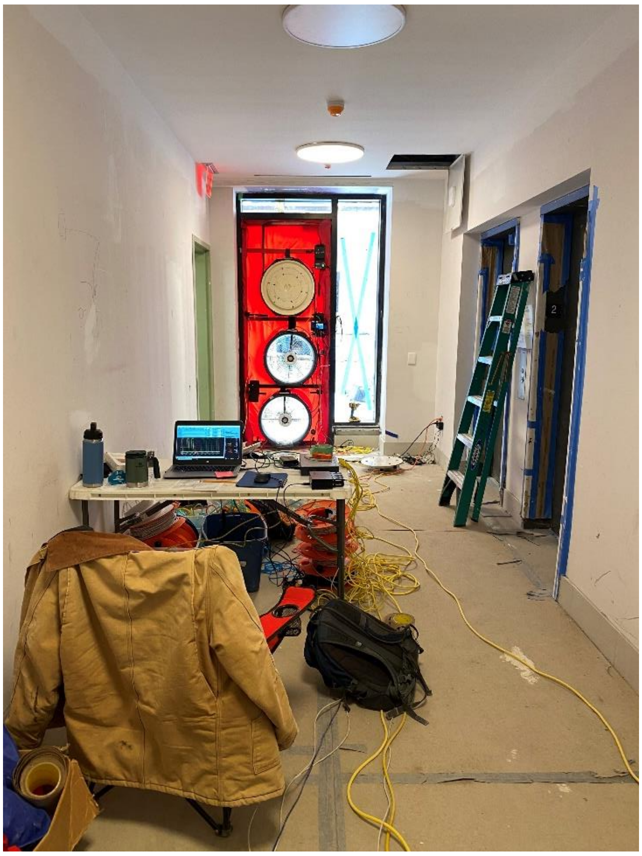
Total Unit (Nominal) = 52.762 mm   Slope = 90°

Estimated Nominal Glazing Weight: 43.6 kg/m²

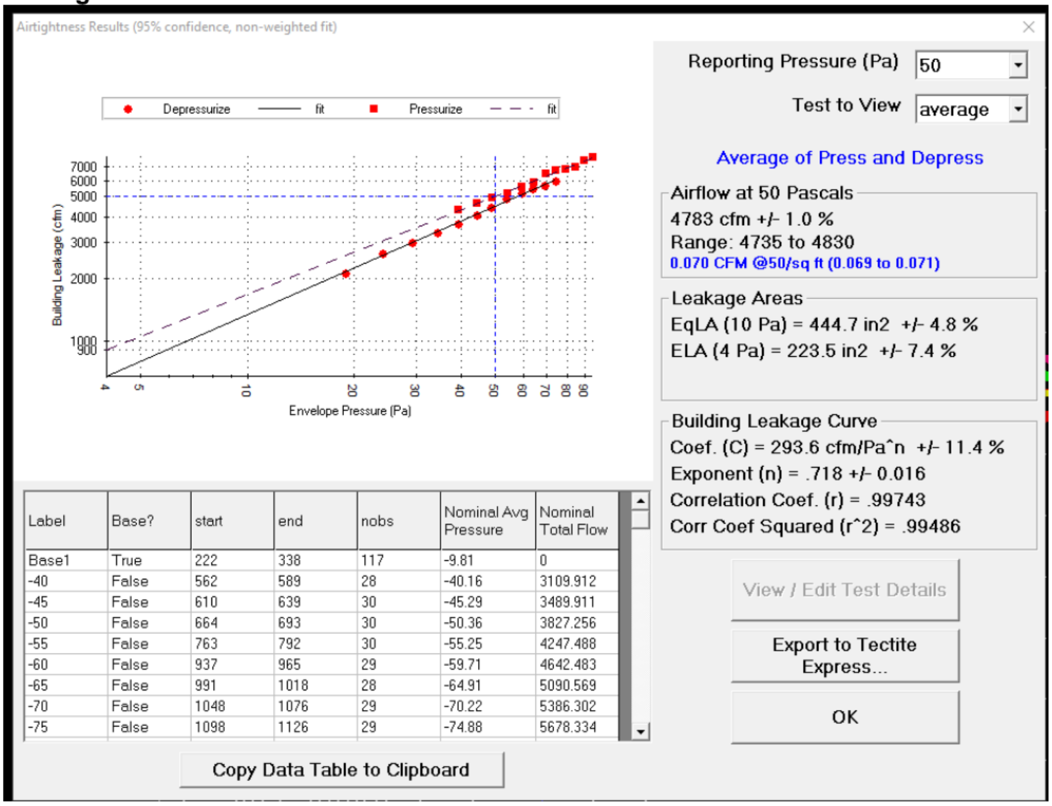
Indoors

9. Airtightness

Guarded blower door tests were performed by Steven Winter Associates (SWA) after the first residential floor was fully sealed. SWA performed a final blower door test upon substantial completion of the building.



Average Results Photo 1:



Label	Base?	start	end	nobs	Nominal Avg Pressure	Nominal Total Flow
Base1	True	222	338	117	-9.81	0
-40	False	562	589	28	-40.16	3109.912
-45	False	610	639	30	-45.29	3489.911
-50	False	664	693	30	-50.36	3827.256
-55	False	763	792	30	-55.25	4247.488
-60	False	937	965	29	-59.71	4642.483
-65	False	991	1018	28	-64.91	5090.569
-70	False	1048	1076	29	-70.22	5386.302
-75	False	1098	1126	29	-74.88	5678.334

Airtightness is provided by continuous vapor-permeable air barrier at drainage plane of all exterior wall assemblies (brick and EIFS). These tie into the roofing membrane at all roofs and into the concrete floor slab which acts as the c

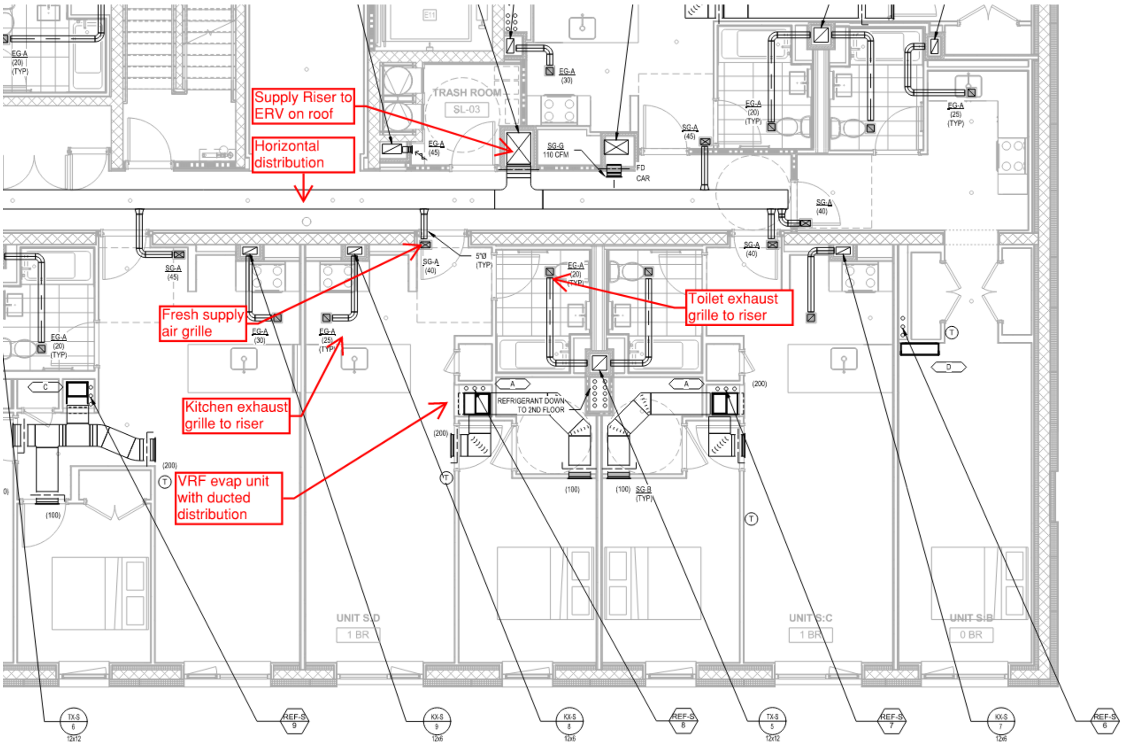
10. Ventilation Unit

There are multiple energy recovery ventilation units on the project. All provided by Swegon and equipped with MErV 13 filtration.

Ventilation units with heat recovery

	Recommended specifications to start planning: Frost protection: Yes; Humidity recovery: Yes	75 %		0,76
ID	Description	Effective heat recovery efficiency	Humidity recovery efficiency	Electric efficiency
	User defined area	%	%	W/cfm
01ud	SWEGON GOLD RX 35	86,0%	69,5%	0,75
02ud	SWEGON GOLD RX 11	75,0%	56,0%	0,35
03ud	Exhaust only	0,0%	0,0%	0,72
04ud	Trash room ERV - Swegon GOLD ARX 05	86,5%	67,5%	0,54

11. Ventilation Distribution



Air supply is delivered to each apartment near the entrance. From here it is pulled into the VRF evaporator return and blown via ductwork to the living spaces (living rooms and bedrooms). Return air is extracted from kitchens and bathrooms.

Ventilation units are centrally located on the roof and delover air to the apartments via large vertical ducts connecting to horizontal ducts running in each corridor. These ducts branch into indivudal aprtments.

12. Heating and Cooling

Heating and cooling is provided by a low-energy Daikin VRF system. Condensers are located on the roof and evaporator units are located inside the apartments in closets. These indoor units duct air from a central location to all habitable rooms. Refrigerant is run in vertical risers from condensers to evaporators.

	
Notes: Overview outdoor units on 10th floor east side roof	Notes: Apartment equipment nameplate (HP-A)

13. Building Costs

It is estimated that pursuing Passive Hosue certification for this project resulted ina 6.5% premium over the cost of a comparable building designed to meet local energy and building codes.

14. Literature

15. PHPP Summary

Passive House Verification

Building:	Sendero Verde - Building B South
Street:	E 112th Street & Park Ave
Postcode/City:	10029 / New York City
Province/Country:	Unites States / US-United States of America
Building type:	Residential
Climate data set:	US0055b-New York
Climate zone:	4: Warm-temperate; Altitude of location: 16 ft
Home owner / Client:	L+M Development
Street:	1865 Palmer Ave #203
Postcode/City:	10538 / Larchmont
Province/Country:	New York / US-United States of America

Architecture:	Handel Architects	**Mechanical engineer:**	Cosentini Consulting Engineers
Street:	120 Broadway, 6th Floor	Street:	2 Pennsylvania Plaza
Postcode/City:	10271 / New York City	Postcode/City:	10121 / New York City
Province/Country:	NY / US-United States of America	Province/Country:	NY / US-United States of America
Energy consultancy:	Steven Winter Associates	**Certification:**	Passive House Institute
Street:	307 7th Avenue, Suite 1701	Street:	Rheinstr. 44/46
Postcode/City:	10001 / New York City	Postcode/City:	64283
Province/Country:	NY / US-United States of America	Province/Country:	Darmstadt, Germany / DE-Germany

Year of construction:	2020	Interior temperature winter [°F]:	68,0	Interior temp. summer [°F]:	77,0
No. of dwelling units:	85	Internal heat gains (IHG) heating case [BTU/(hr.ft²)]:	0,93	IHG cooling case [BTU/(hr.ft²)]:	1,24
No. of occupants:	197,0	Specific capacity [BTU/F per ft² TFA]:	23,2	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

		Value		Criteria	Alternative criteria	Fulfilled?[2]
	Treated floor area ft²	54900				
Space heating	Heating demand kBTU/(ft²yr)	4,10	≤	4,75	-	yes
Space cooling	Cooling & dehum. demand kBTU/(ft²yr)	4,43	≤	6,66	6,66	yes
	Frequency of excessively high humidity (> 0.012 lb/lb) %	0,0	≤	10		yes
Airtightness	Pressurization test result n_{50} 1/hr	0,4	≤	0,6		yes
Moisture protection				yes		
	Smallest temperature factor $f_{Rsi=1.42\ hr.ft^2.F/BTU}$ -	0,79	≥	0,65		yes
Thermal Comfort	All requirements fulfilled? -			yes		yes
Non-renewable Primary Energy (PE)	PE demand kBTU/(ft²yr)	46,13	≤	58,50		yes

[2] Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive House Classic? yes

Task:	First name:	Surname:	Signature:
2-Certifier	Dragos	Arnautu	
Certificate ID	**Issued on:**	**City:**	
35884-35968_PHI_PH_20220825_DA	25.08.22	Darmstadt