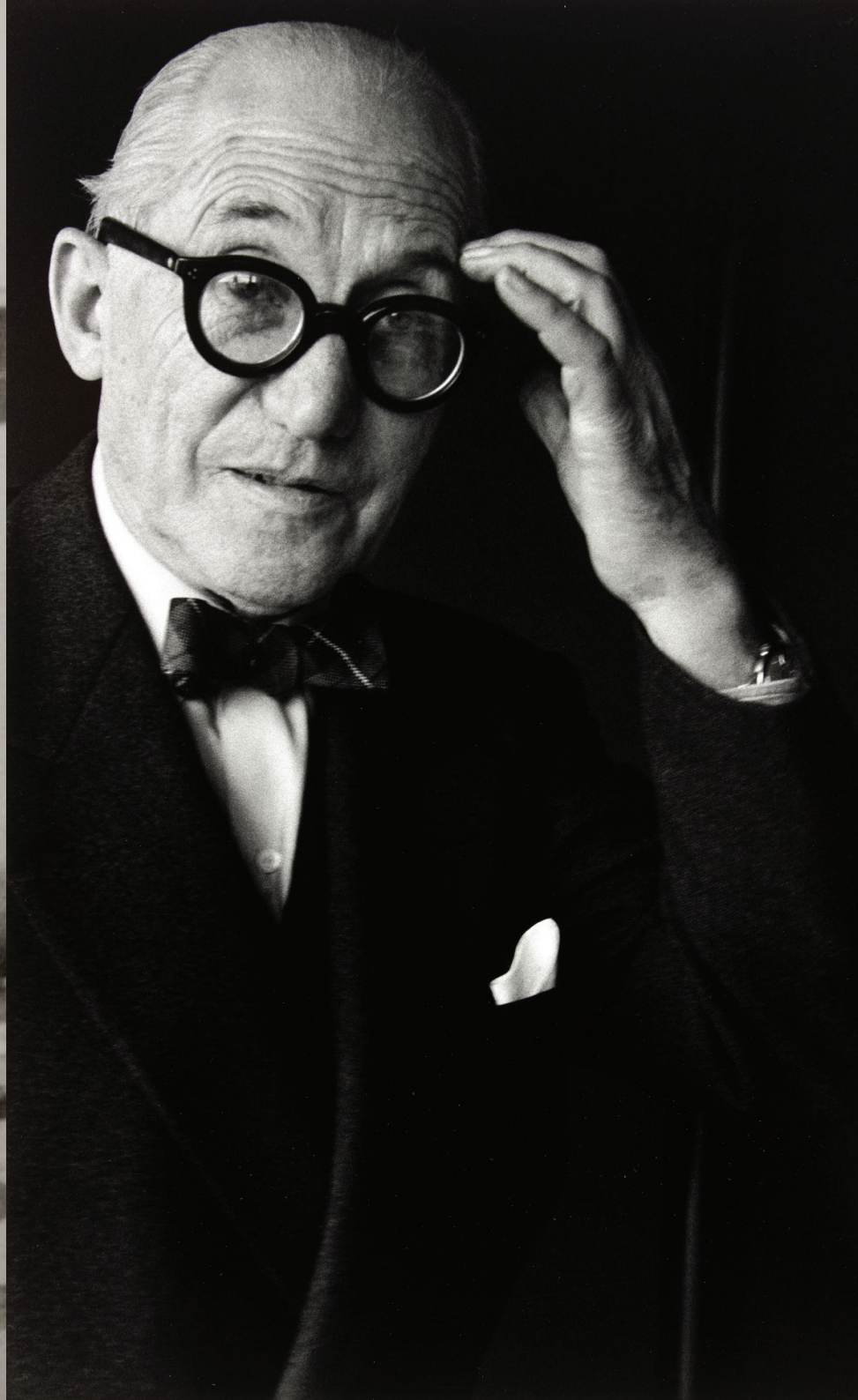
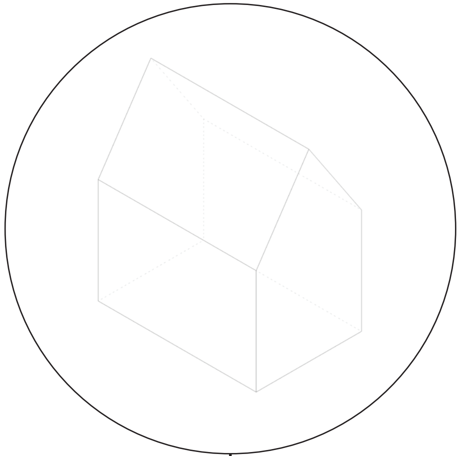
FABFIELD

A new approach to building services design

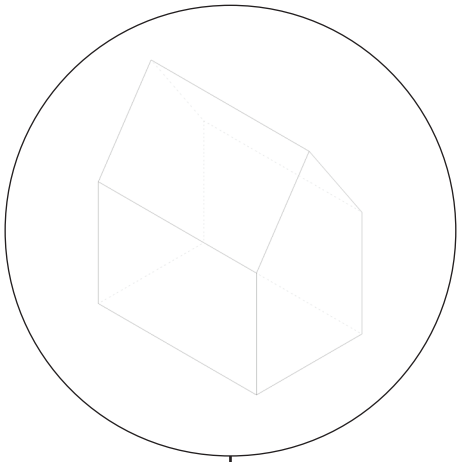


PART 1_ PREFABRICATION

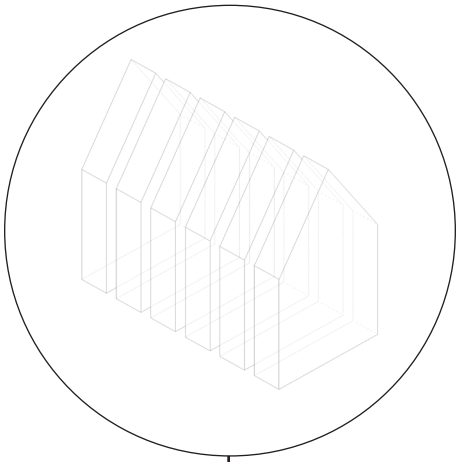
FULLY PREFAB



FULLY PREFAB



PLUG&PLAY MODULES



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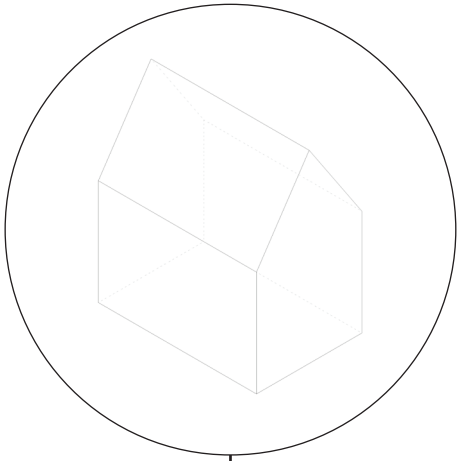

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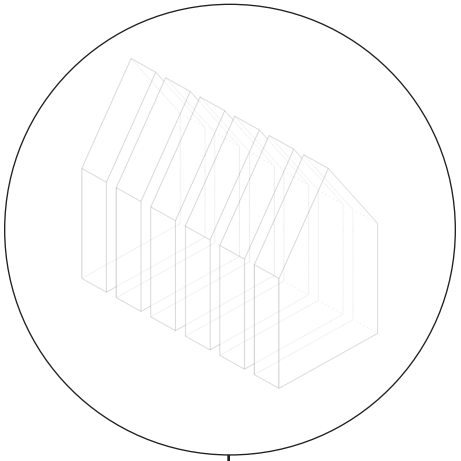
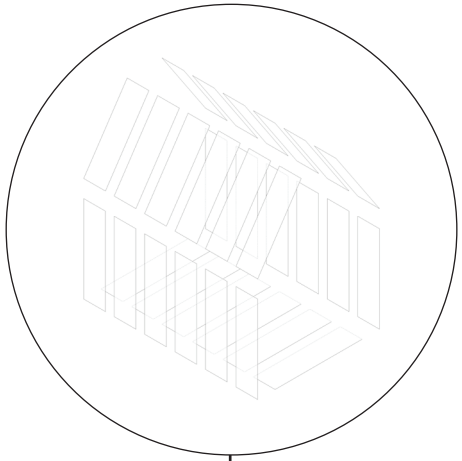
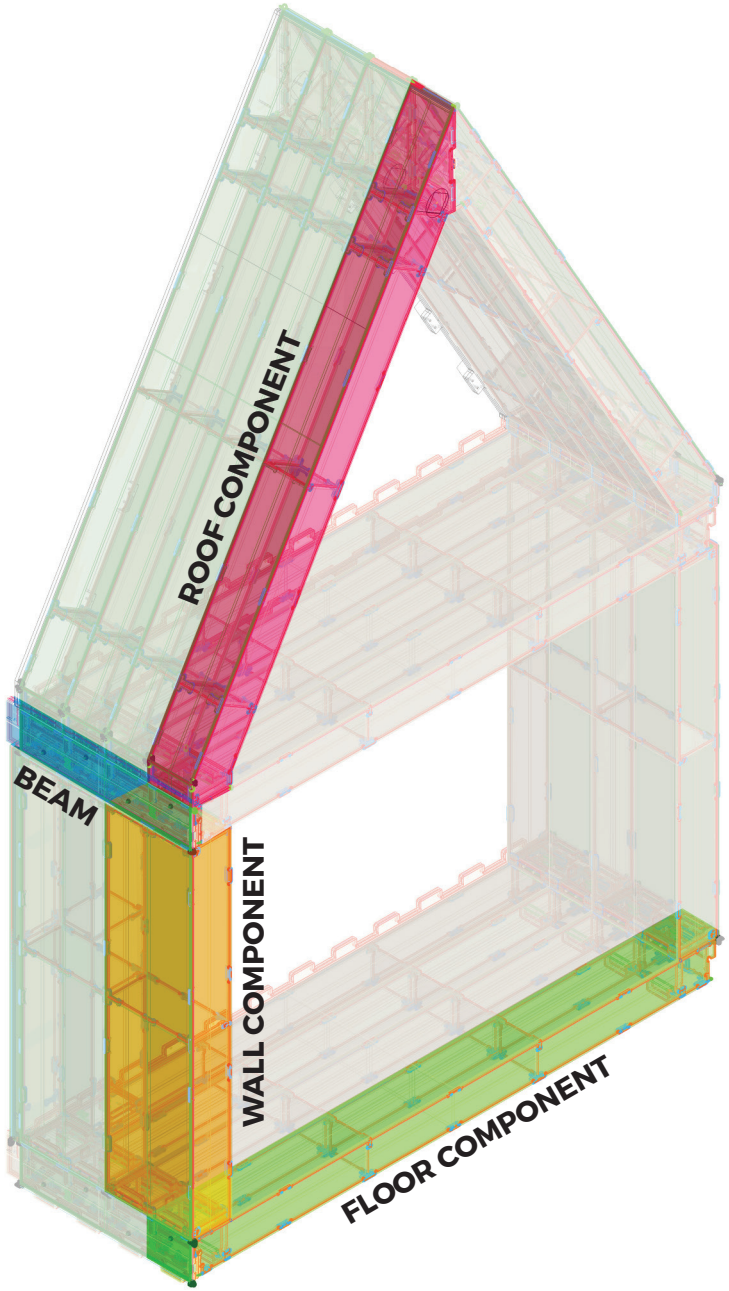


PREFAB COMPONENTS





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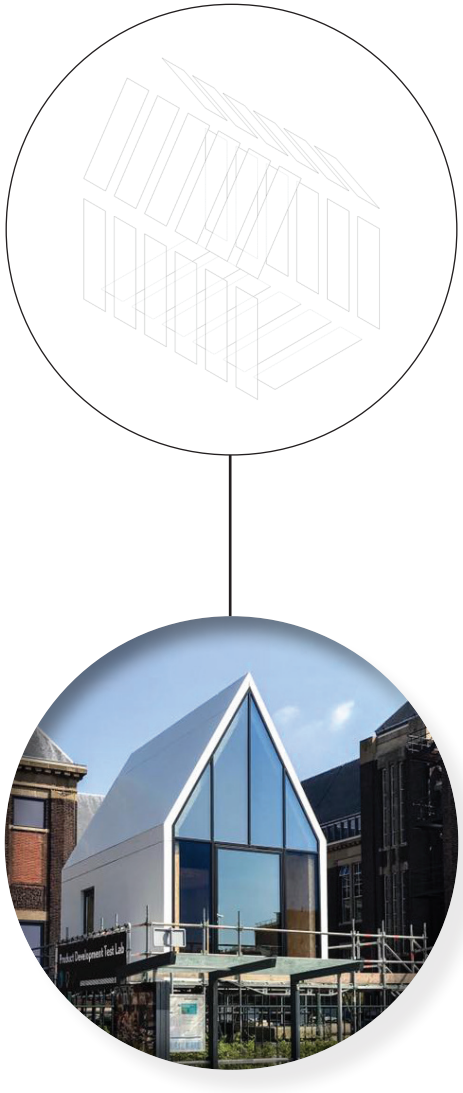


RECORD 220
scm

RESEARCH QUESTION

How can building services be integrated in the FabField building system in such a way that its core values, namely sustainable materials, easy assembly and disassembly, digital fabrication techniques and end of life strategies be perpetuated?

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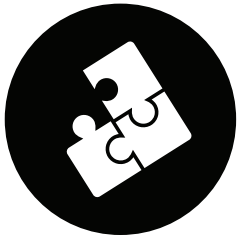

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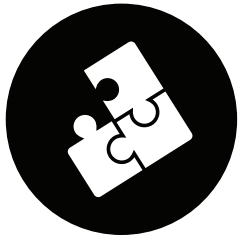

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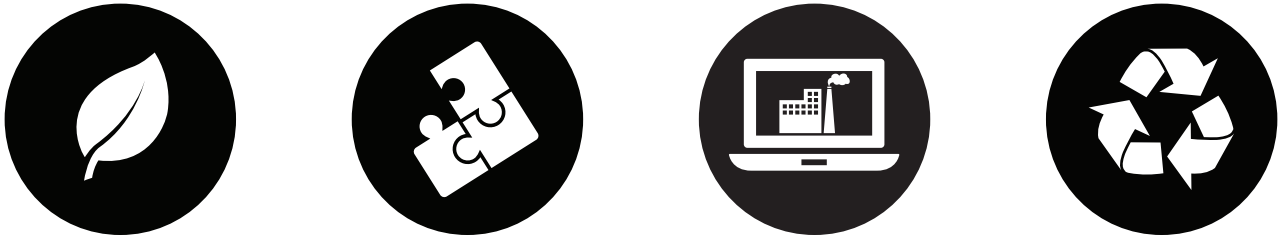
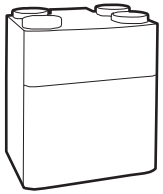
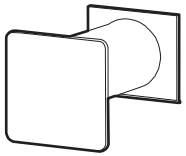
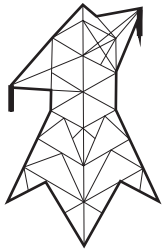
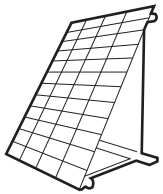
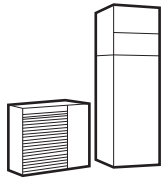
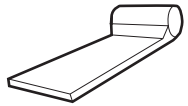
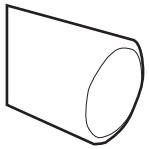
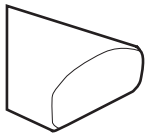
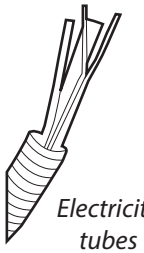
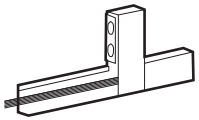
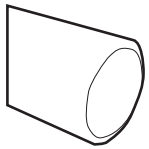
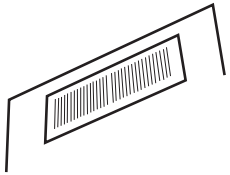
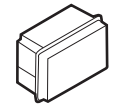
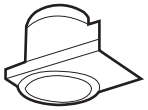
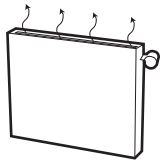
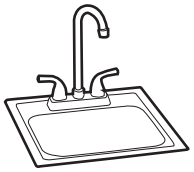
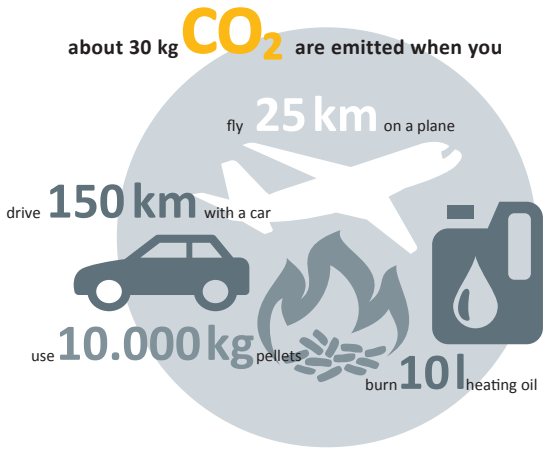
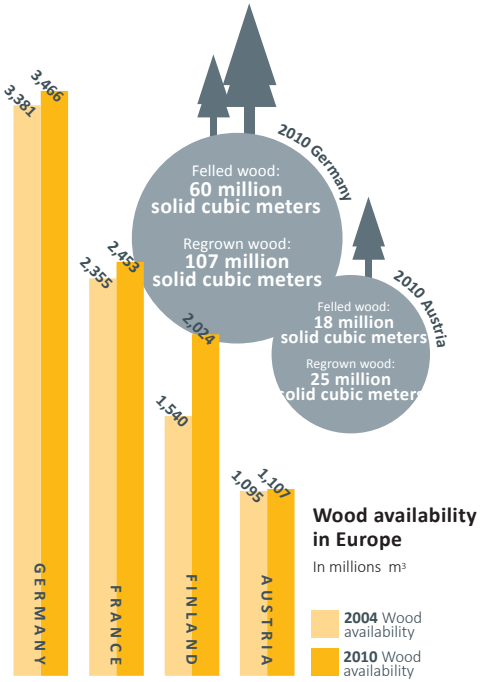


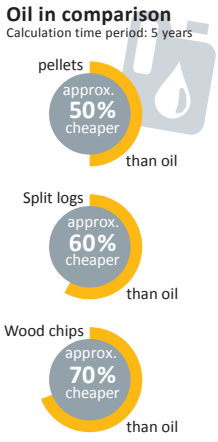
	AIR	POWER	WATER
SOURCE	 *Centralised mechanical ventilation*  *Localised mechanical ventilation*	 *Main grid*  *Photovoltaic*	 *Heat Pump*  *Pellet Boiler*  *Solar Thermal*
DISTRIBUTION	 *Round ducts*  *Flat ducts*	 *Electricity tubes*  *Columns*  *Skirting ducts*	 *Ø15-19 mm copper/plastic pipes*
APPLIANCES	 *Wall-ceiling-floor vents*	  *Lights and flush boxes*   *Recessed lights and flush boxes*	 *Water supplied heating appliances*  *Toilets*  *Sinks*

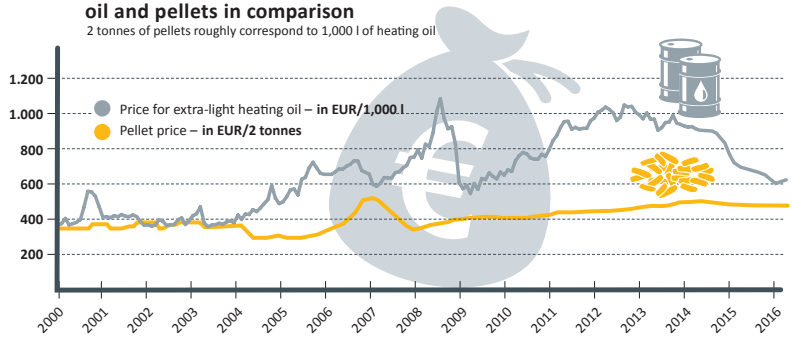
A win-win situation

Save heating costs, strengthen your local economy and look after the environment in the process: heating with pellets is worth it. A dramatic price rise is also not expected in the future, as wood always regrows. Currently, around 7 million cubic metres of additional wood is grown annually in Austria. This trend is similar across Europe, with forested areas increasing every year.

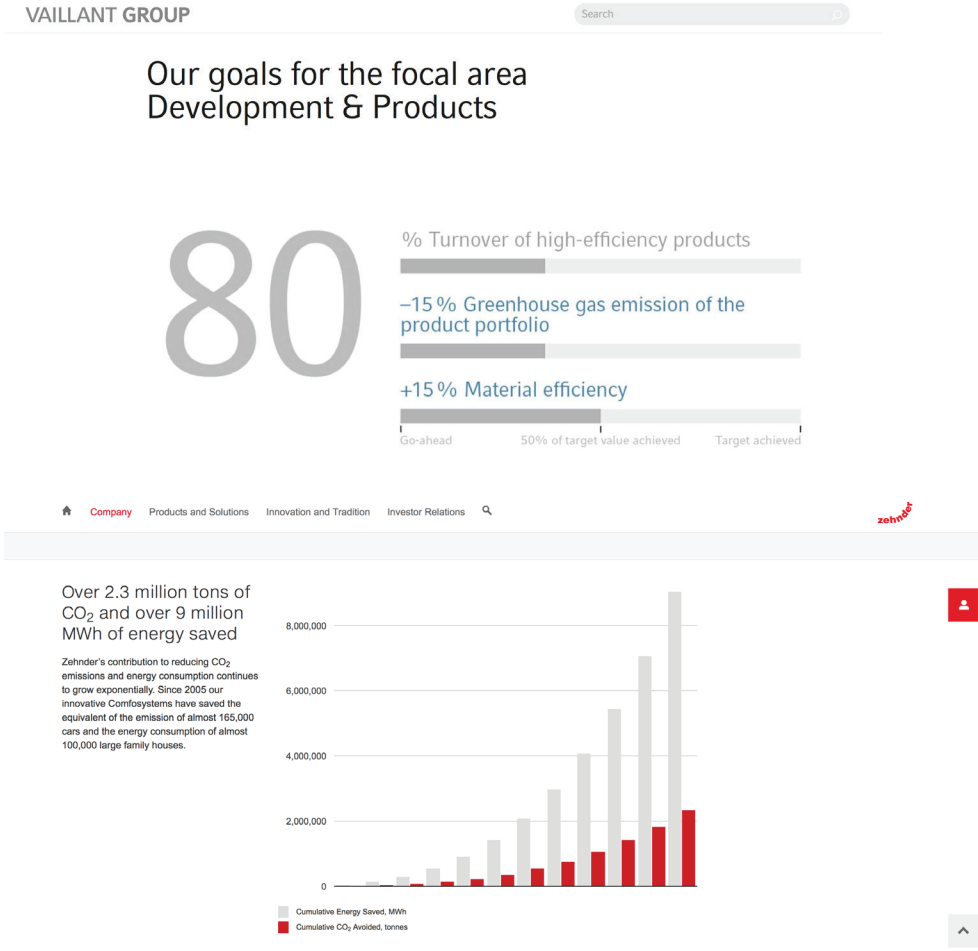


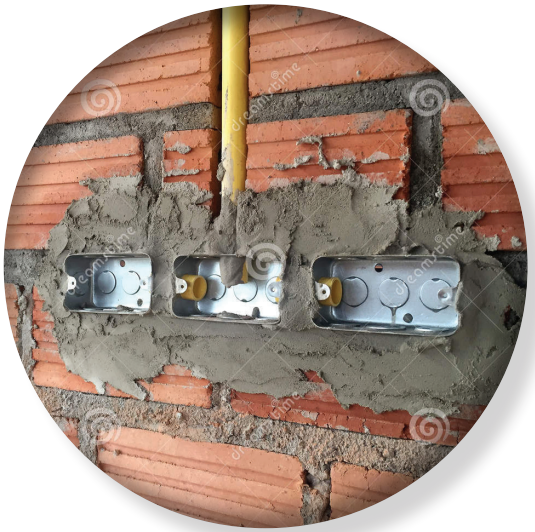






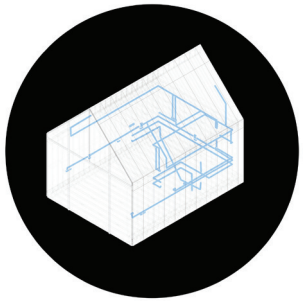
While the prices of fossil fuels such as oil and gas are subject to significant fluctuations in international markets and will certainly rise long-term, the prices of wood and pellets are far more reliable.





PART 4_ METHOD

What is the most suitable distribution system for building services in a modular building system for small family housing?



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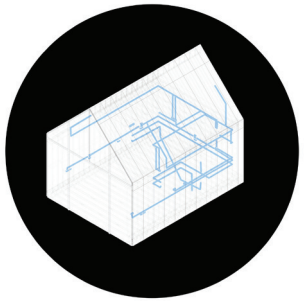
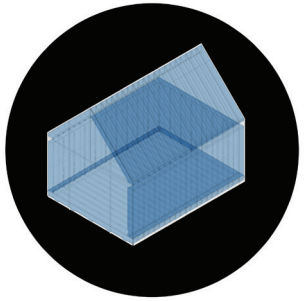


What is the most suitable design for the building components to accommodate such distribution system?



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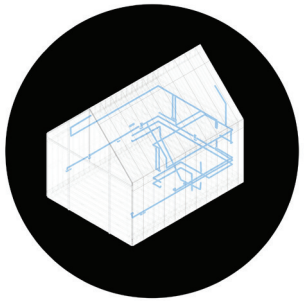

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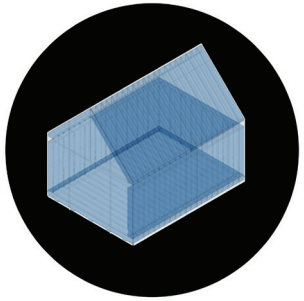
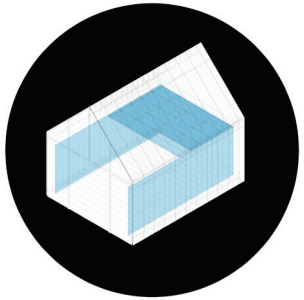
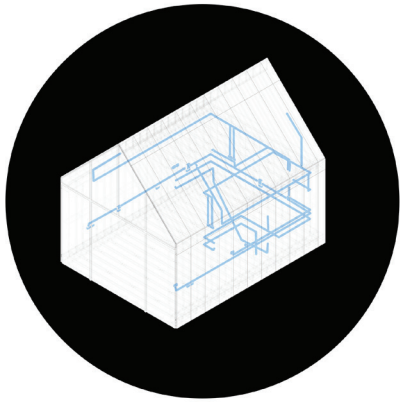


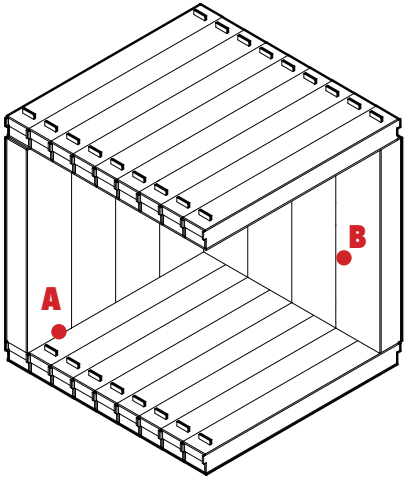
What are the possibilities for the finishings so that final appliances can be integrated within them when required?



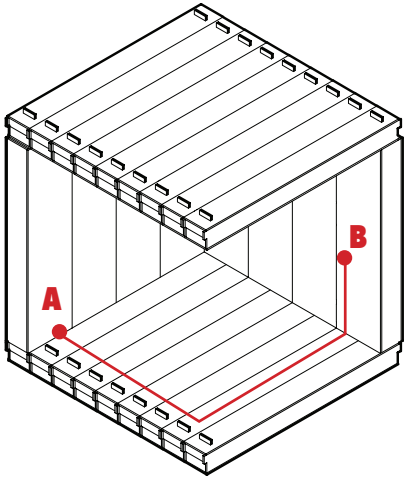


DISTRIBUTION DESIGN

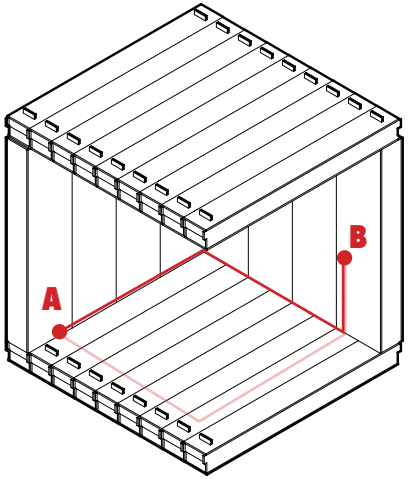
What is the most suitable distribution system for building services in a modular building system for small family housing?



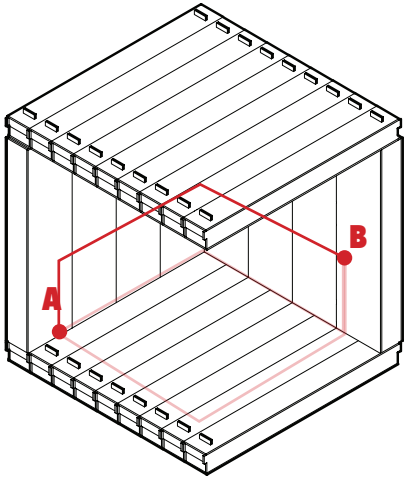
CONNECTION OF 2 GENERIC POINTS A AND B



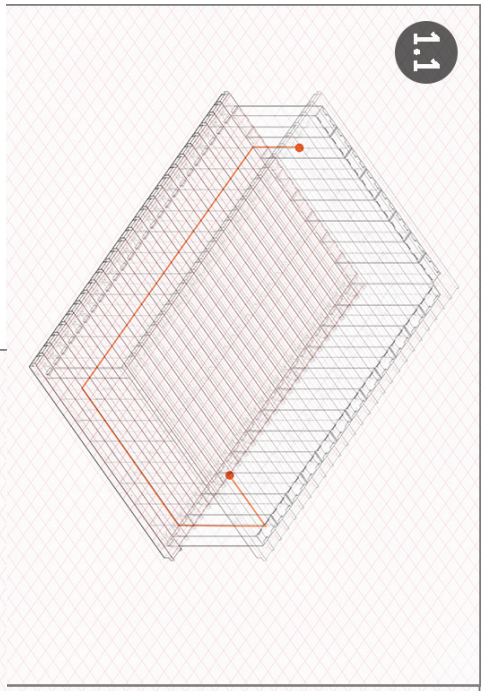
1. PARALLEL+PERPENDICULAR FLOOR MOVEMENT- VERTICAL WALL MOVEMENT



2. SKIRT MOVEMENT- VERTICAL WALL MOVEMENT



3. HORIZONTAL+VERTICAL WALL MOVEMENT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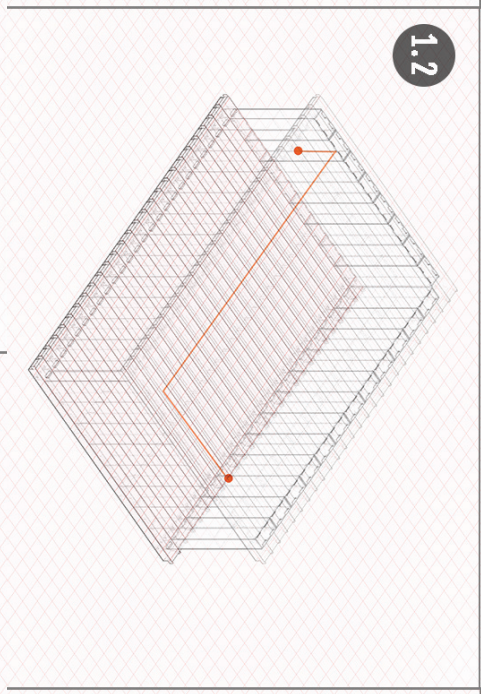
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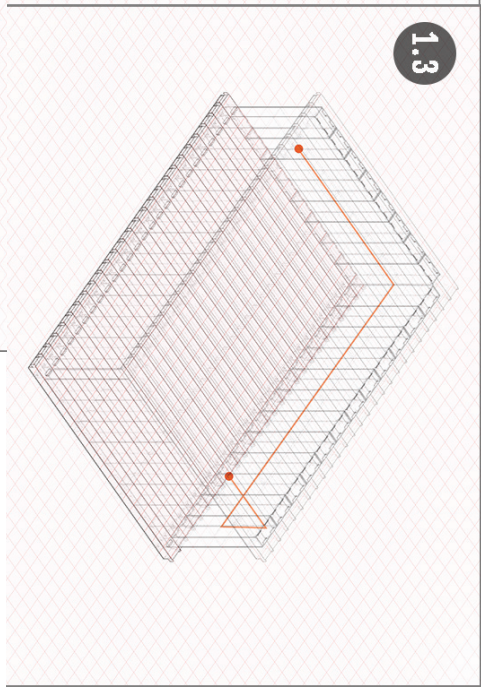
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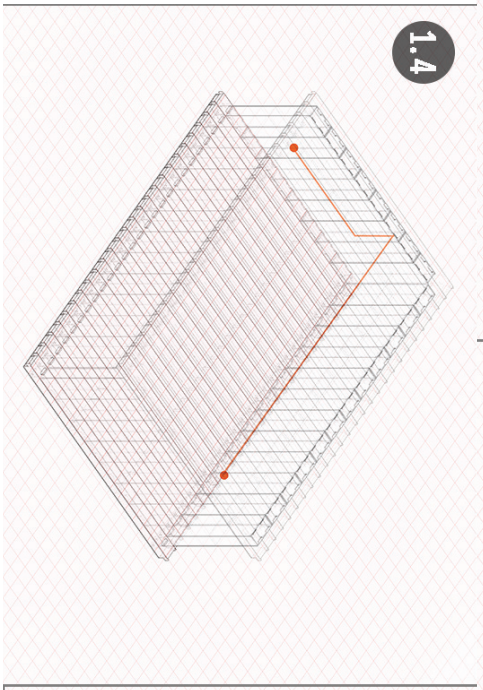
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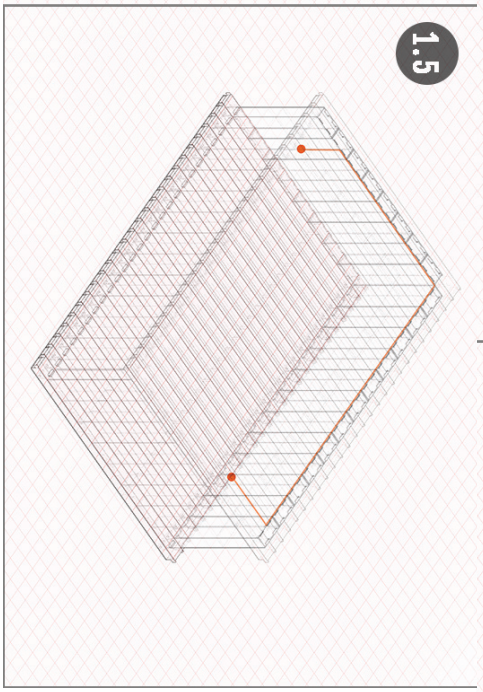
1.5


1.5
1.4
1.3
1.2
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4.1
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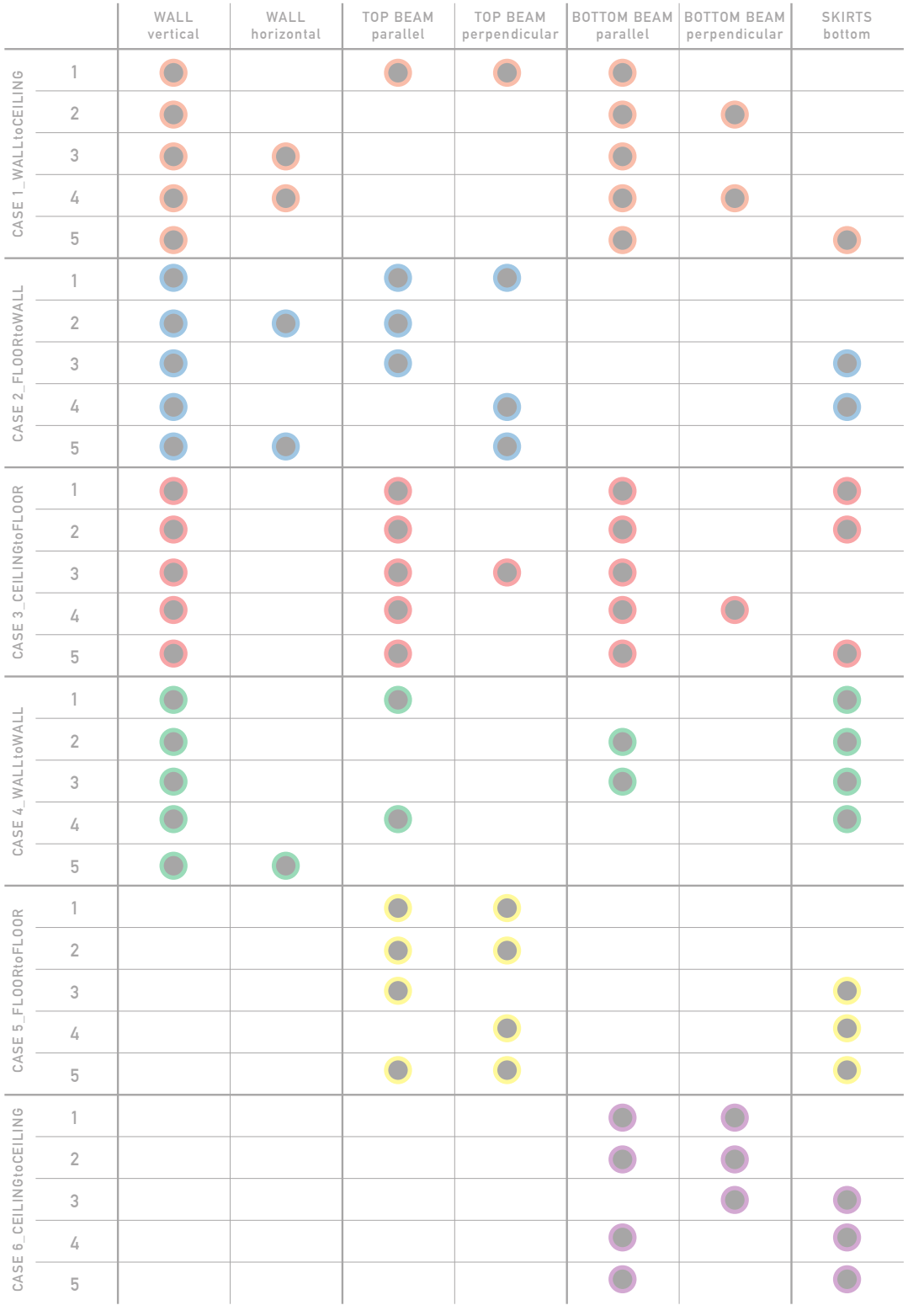
5.4
5.3
5.2
5.1
6.5
6.4
6.3
6.2
6.1

PART 5_ DISTRIBUTION DESIGN

		WALL vertical	WALL horizontal	TOP BEAM parallel	TOP BEAM perpendicular	BOTTOM BEAM parallel	BOTTOM BEAM perpendicular	SKIRTS bottom
CASE 1_WALLtoCEILING	1	●		●	●	●		
	2	●				●	●	
	3	●	●			●		
	4	●	●			●	●	
	5	●				●		●
CASE 2_FLOORtoWALL	1	●		●	●			
	2	●	●	●				
	3	●		●				●
	4	●			●			●
	5	●	●		●			
CASE 3_CEILINGtoFLOOR	1	●		●		●		●
	2	●		●		●		●
	3	●		●	●	●		
	4	●		●		●	●	
	5	●		●		●		●
CASE 4_WALLtoWALL	1	●		●				●
	2	●				●		●
	3	●				●		●
	4	●		●				●
	5	●	●					
CASE 5_FLOORtoFLOOR	1			●	●			
	2			●	●			
	3			●				●
	4				●			●
	5			●	●			●
CASE 6_CEILINGtoCEILING	1					●	●	
	2					●	●	
	3						●	●
	4					●		●
	5					●		●

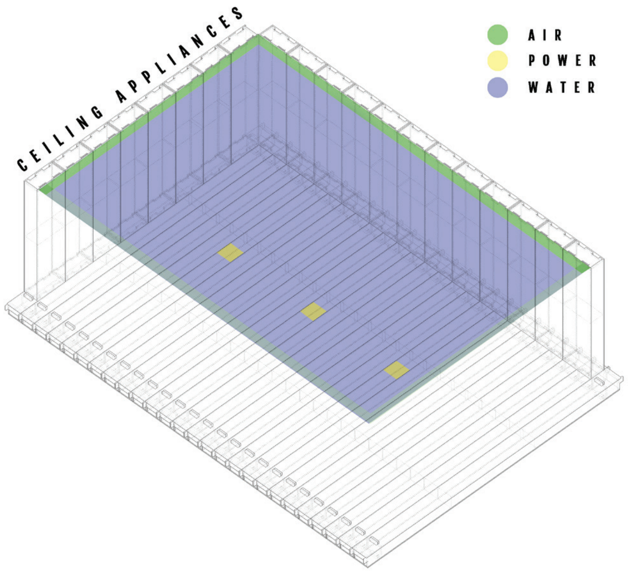
PART 5_ DISTRIBUTION DESIGN

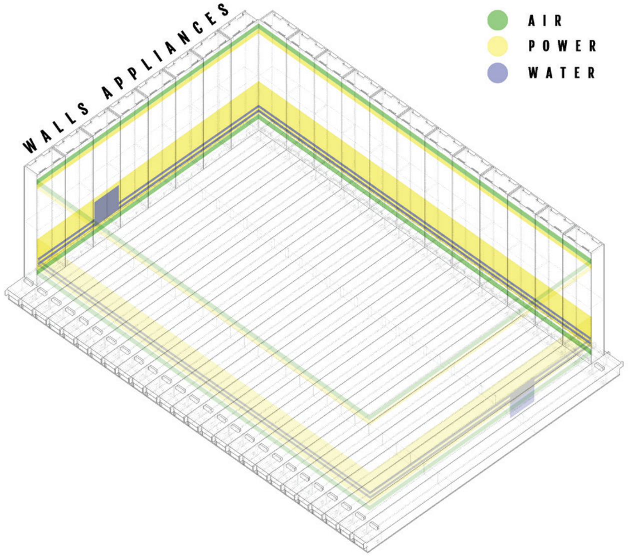


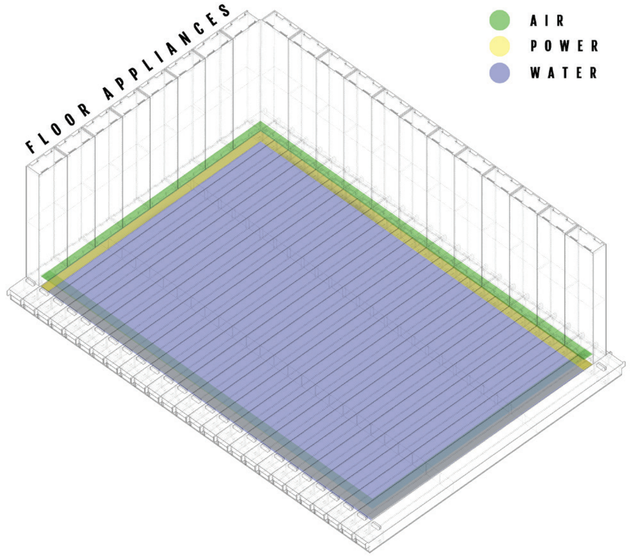
- **WALLS ARE THE MOST AFFECTED COMPONENTS**
- **LESS MOVEMENTS ARE REQUIRED IF A AND B LIE ON THE SAME COMPONENT**
- **HORIZONTAL/PERPENDICULAR MOVEMENTS ALWAYS NEED TO BE ALLOWED AT LEAST ONCE**

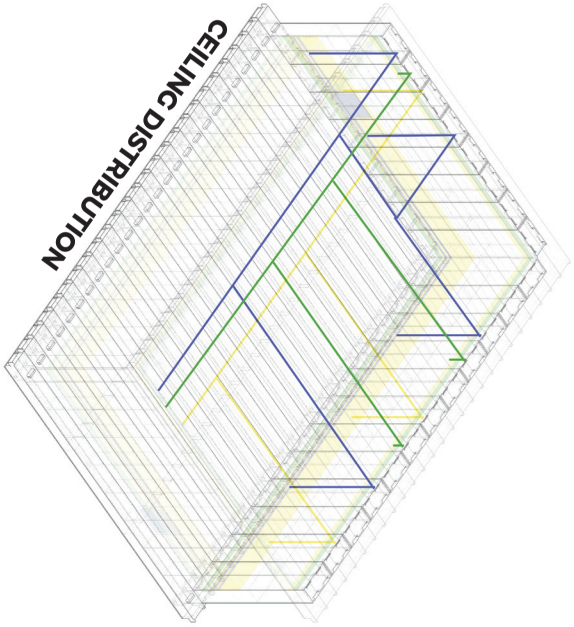
		TYPE OF SERVICE	MINIMUM SPACE REQUIRED	TYPICAL DIRECTION	COMPONENT TYPICALLY AFFECTED	USUAL POSITION
WALL		Flush boxes (switches and plugs)	50/70mm thickness	N/A	Walls	30cm for low plugs; 70 cm for bedside switches; 90cm for light switches; 110 cm for kitchen and WC plugs
		Wires	ø18 mm corrugated tubes	Free flow	Depending on finishing: walls and ceilings for residential buildings	Same height as plugs and switches
		Lights (recessed)	100 to 150mm	N/A	Walls or ceilings, according to preference	Approximately 200cm
		Air grill housing	100 mm to allow flat duct bending	N/A	Floors, ceilings and walls	Depends on finish, preferably right above skirting board and/or below ceiling level
		Air Ducts	H min.50 mm	Vertical	Floors or ceilings	N/A
		Water distribution (Heating+DHW)	ø16 mm	Horizontal+Vertical	Floors and endings in walls	45cm
		Sinks and showers disposal	ø50 mm	Horizontal	Floors	30cm
		Floor heating manifold cabinet	100 mm	N/A	Walls	20cm
FLOOR		Floor channels (wires, plugs, data)	50-100mm thickness (floor channels)	Mainly on edges	Mainly walls, floors for offices with high wiring requirements	Varies for different commercial products
		Air grill housing	100 mm minimum in order to allow flat duct bending	N/A	Floors, ceilings and walls	Varies for different commercial products
		Air Ducts	H min.50 mm	Free flow, mainly on edges	Floor or ceilings	Preferably parallel to floor component, min.200mm from wall edge
		Water distribution (Heating+DHW)	ø16 mm	Free flow	Floors	Preferably parallel to floor component
		Sinks and showers disposal	ø50 mm	Throughout	Floors	Close to tip of floor component
		Main water disposal	ø100 mm	Throughout	Through floor	Close to tip of floor component
CEILING		Wires	ø18mm corrugated tubes	Free flow	Mainly walls, floors for offices with high wiring requirements	Preferably parallel to floor component
		Lights (recessed)	100 to 150mm	N/A	Walls or ceilings	If exceeding 20cm should be parallel to direction of component
		Air grill housing	100mm to allow duct bending	N/A	Floors, ceilings and walls	N/A
		Air Ducts	H min.50mm	Free flow, mainly on edges	Floors or ceilings	Depends on internal partition
		Water distribution (Heating+DHW)	ø16 mm	Free flow (sprinklers)	Floors mainly	N/A

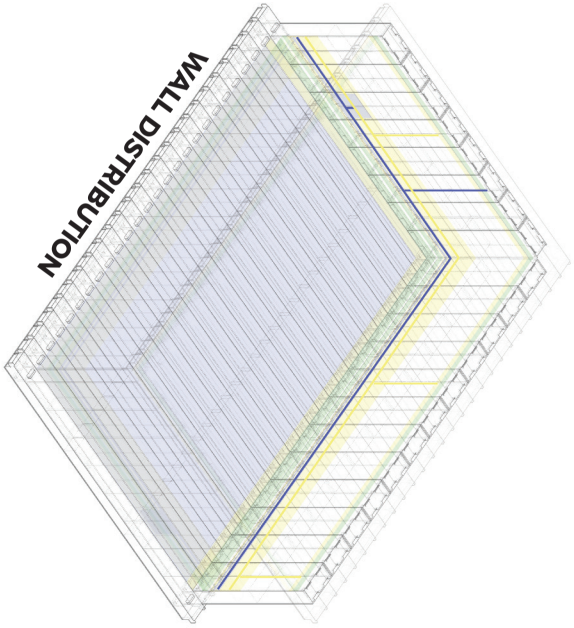
PART 5_ DISTRIBUTION DESIGN

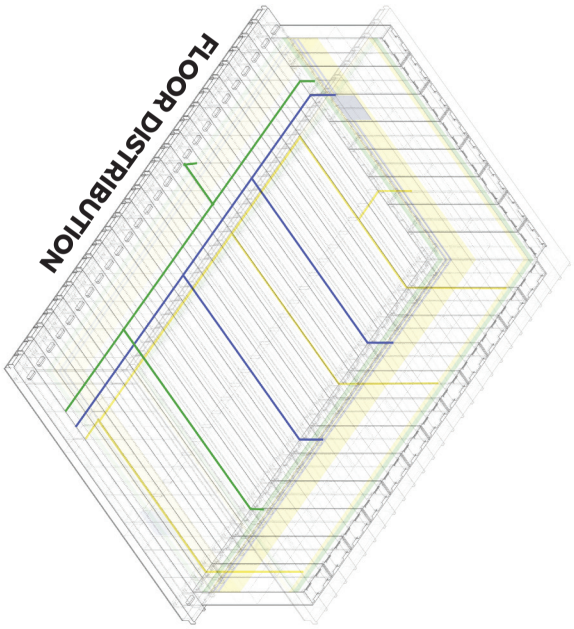







CEILING DISTRIBUTION


WALL DISTRIBUTION


FLOOR DISTRIBUTION

1.*Walls are the most suitable solution since they easily enable the 1% slope required for water disposal; furthermore, most of the water related appliances are usually on walls.*	**1**.*Ceiling, especially if the source is located in the roofspace, this would solve the thickness problem.*	**1**.*Walls are the best component to accommodate wiring since their thickness is contained and most of the related appliances lie on wall components.*
2.*Skirts solve the slope problem and are also very close to the final appliances. The only flaw is limited distribution throughout the building.*	**2**.*Floor, as suitable as ceilings but exhaust mechanical ventilation is always required and best located at high levels.*	**2**.*Ceiling, as suitable as floors in terms of flexibility for future re arrangements, better ranked if we take into account that appliances like ceiling lights and infrared heating panels can be better connected.*
3.*Water floor distribution is not very flexible since underfloor and ceiling heating are not pairable with floor distribution. The 1% slope is also limited in this case.*	**3**.*Skirts, easy maintenance and installation but low position makes it undesirable for intakes of stale air.*	**3**.*Floor, suitable solution but not the best for its distance to ceiling electric appliances.*
4.*Ceiling is the worst choice because of the distance between distribution and final appliances.*	**4**.*Walls, the least suitable due to the big thickness that ducts require.*	**4**.*Skirts, last in the ranking since the reduced thickness of wires does not require a dedicated space like skirting ducts.*

ELECTRICITY DISTRIBUTION THROUGH WALLS
ELECTRICITY APPLIANCES IN WALLS AND CEILING

WATER DISTRIBUTION THROUGH WALLS
WATER APPLIANCES IN WALLS

AIR DISTRIBUTION IN ROOF SPACE
AIR APPLIANCES IN CEILING

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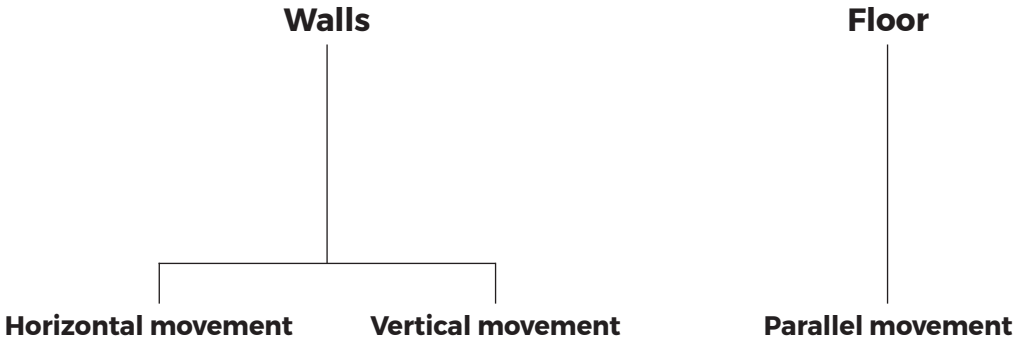
WATER DISTRIBUTION THROUGH WALLS
WATER APPLIANCES IN WALLS

AIR DISTRIBUTION IN ROOF SPACE
AIR APPLIANCES IN CEILING

Final distribution system



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WATER APPLIANCES IN WALLS

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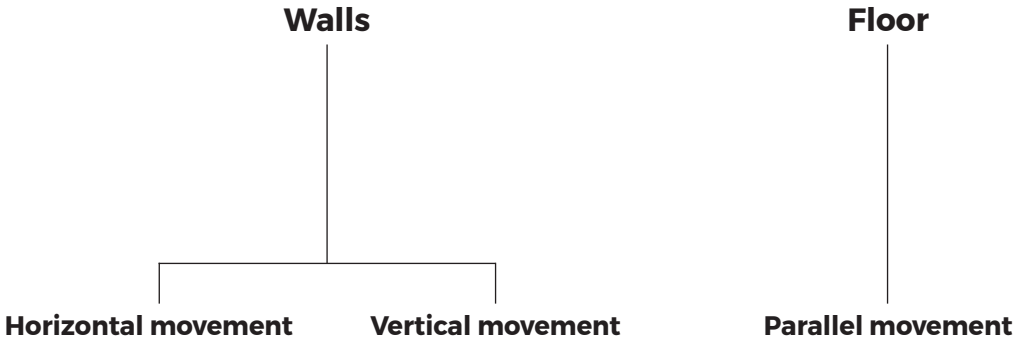

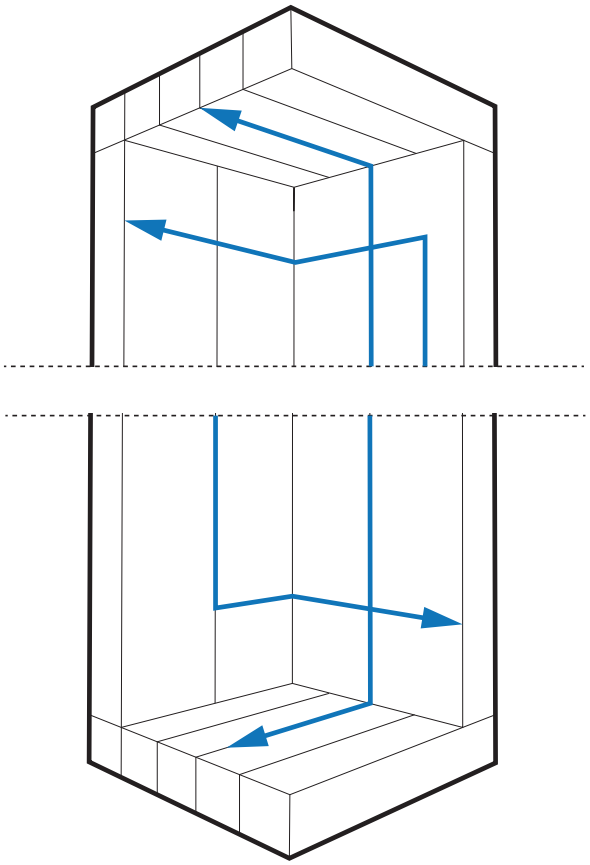

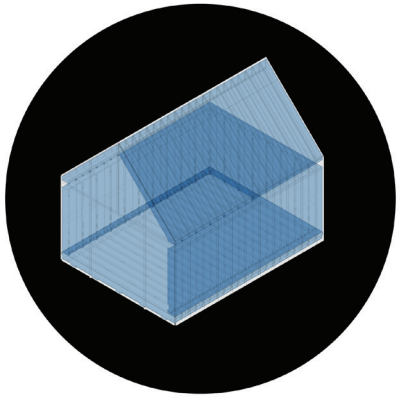

COMPONENTS DESIGN

What is the most suitable design for the building components to accommodate such distribution system?

VISIBLE SERVICES

VISIBLE SERVICES

SUBSTRUCTURE CAVITY

VISIBLE SERVICES

SUBSTRUCTURE CAVITY

EMBEDDED IN STRUCTURE

SUBSTRUCTURE CAVITY

EMBEDDED IN STRUCTURE

SUBSTRUCTURE CAVITY

EMBEDDED IN STRUCTURE

+ Freedom and flexibility

SUBSTRUCTURE CAVITY

EMBEDDED IN STRUCTURE

+ Freedom and flexibility

- Space consuming

SUBSTRUCTURE CAVITY

+ Freedom and flexibility

- Space consuming

EMBEDDED IN STRUCTURE

Space saving +

SUBSTRUCTURE CAVITY

\+ **Freedom and flexibility**

− **Space consuming**

EMBEDDED IN STRUCTURE

Space saving +

Waste of time and materials −

SUBSTRUCTURE CAVITY

\+ **Freedom and flexibility**

\- Space consuming

EMBEDDED IN STRUCTURE

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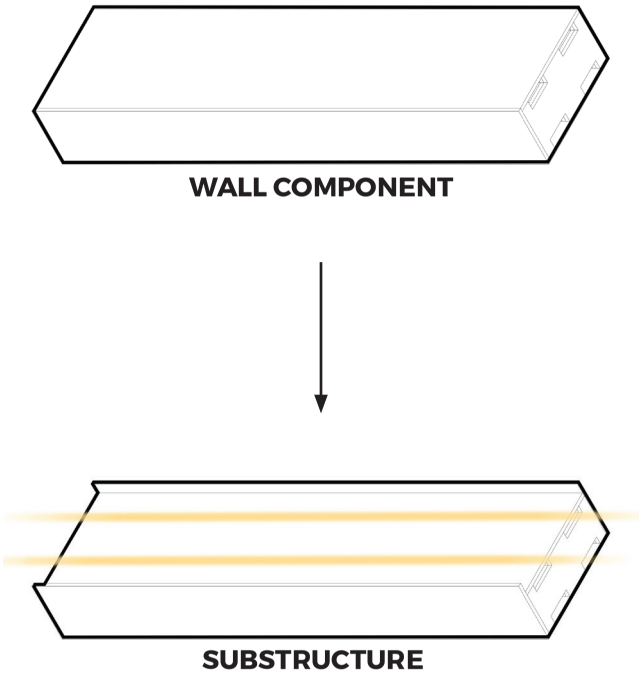
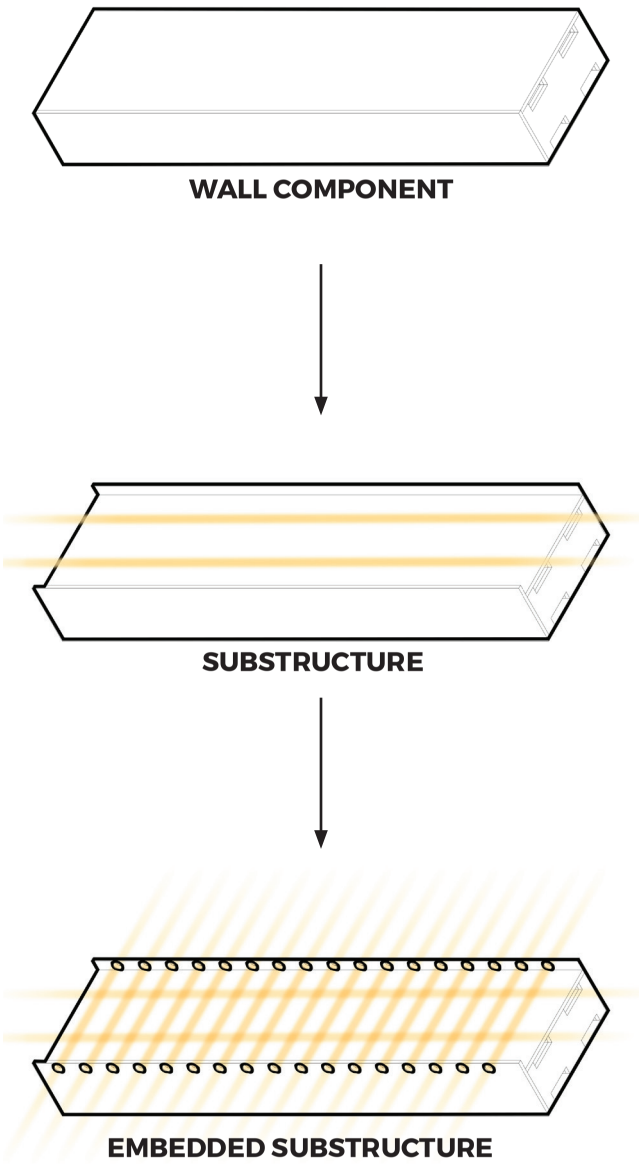
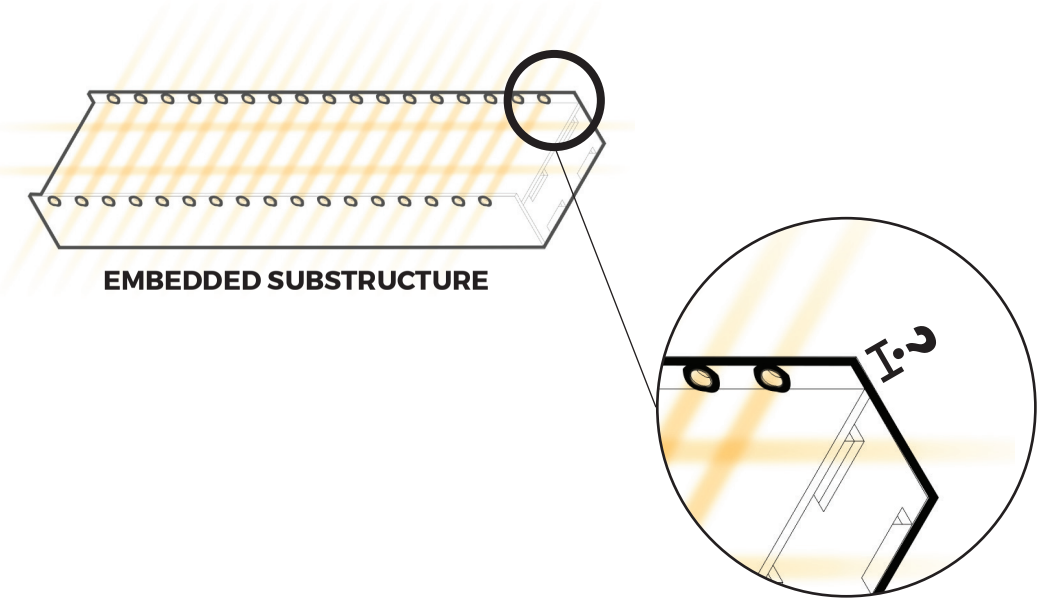
WALL COMPONENT


WALL COMPONENT
SUBSTRUCTURE


WALL COMPONENT
SUBSTRUCTURE
EMBEDDED SUBSTRUCTURE


EMBEDDED SUBSTRUCTURE

PART 6_ COMPONENTS DESIGN

WATER DISTRIBUTION — Ø15-Ø19mm+insulation= Ø25-Ø35mm

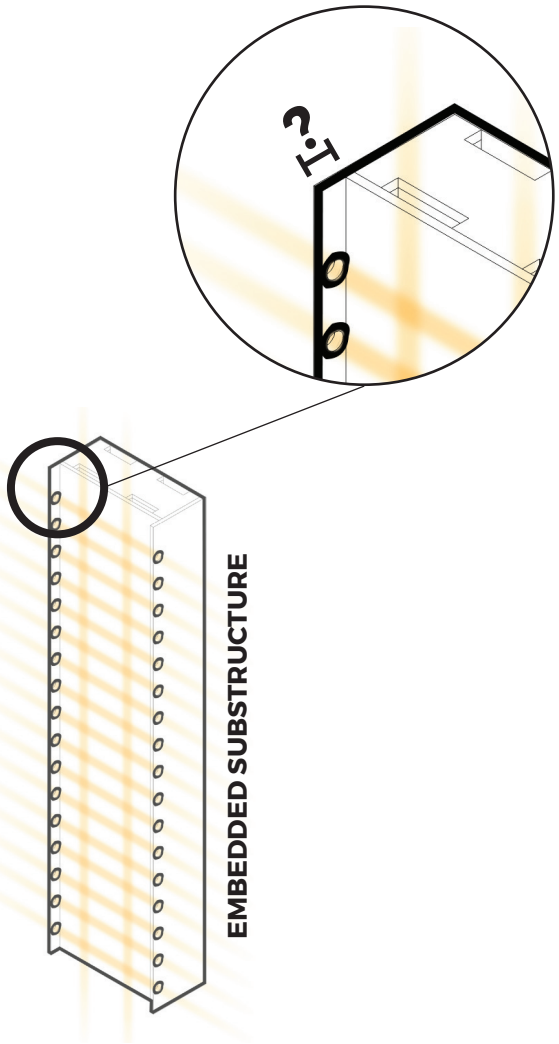
WATER DISPOSAL — Ø100mm main disposal, Ø40-Ø50mm other disposals

POWER DISTRIBUTION — Ø15-Ø19mm wire containing tubes

POWER APPLIANCES — 40-60mm deep flush boxes

AIR DISTRIBUTION — 50mm thick flat ducts

AIR APPLIANCES — 80mm for curves for air vents



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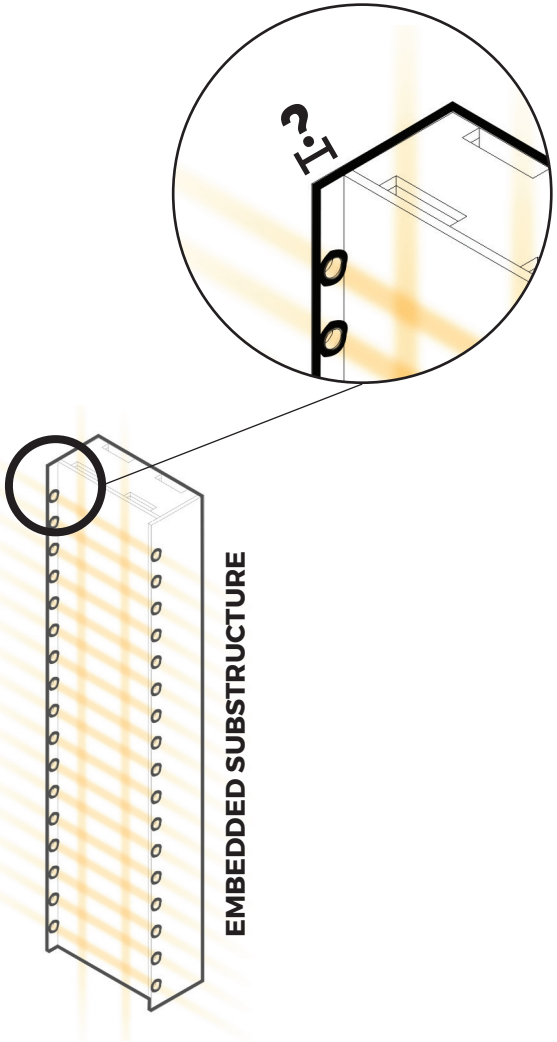
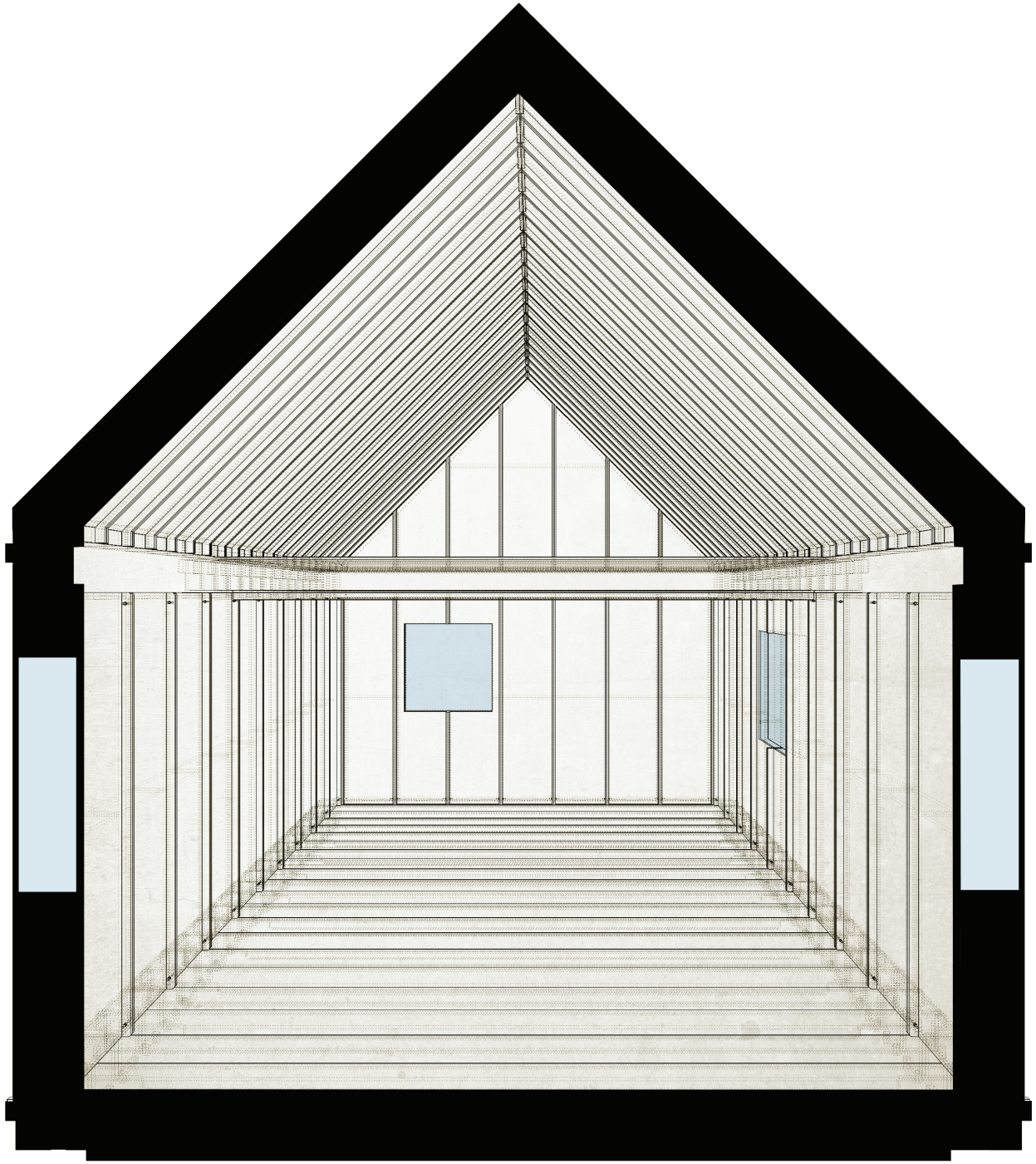
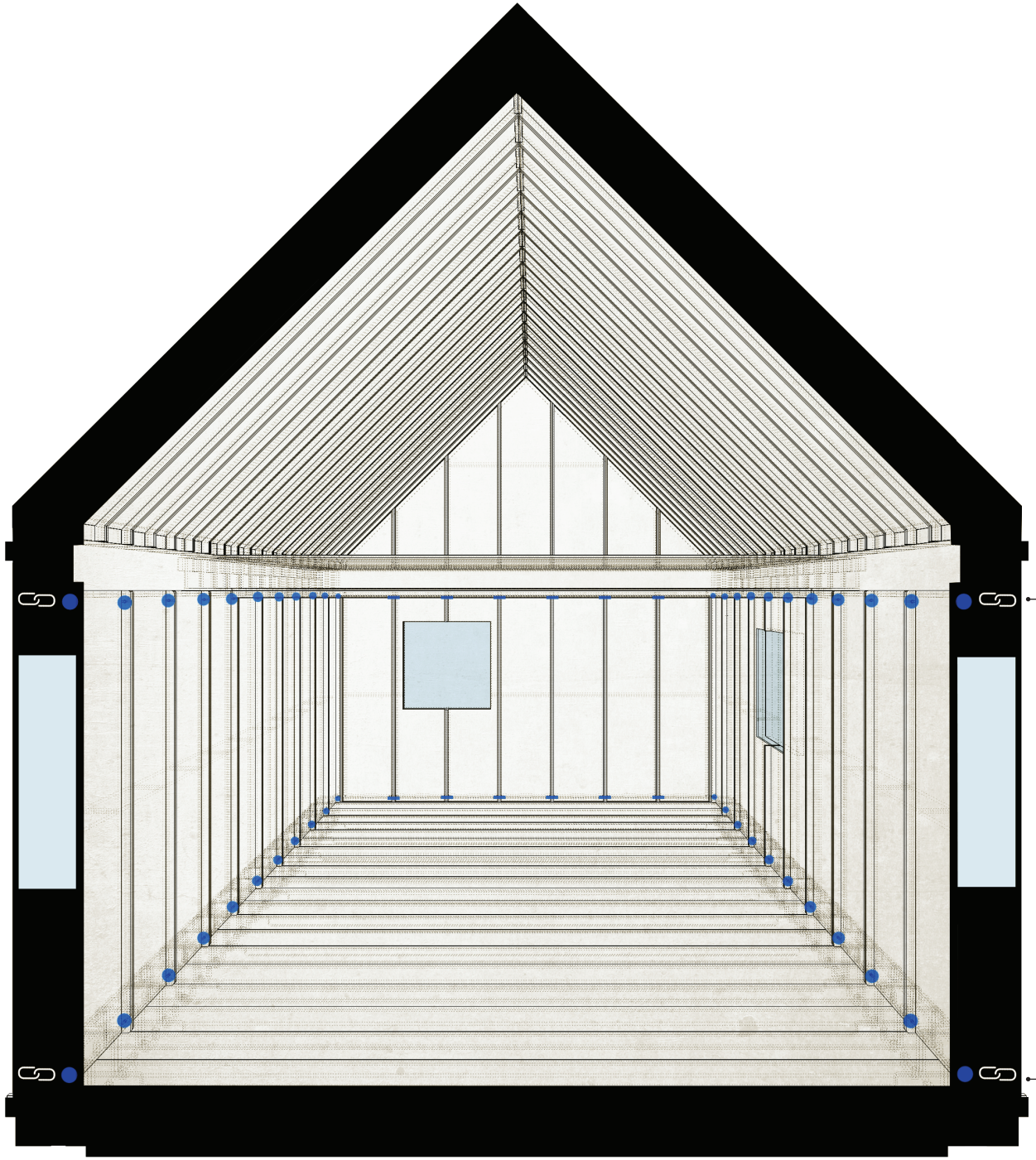


50-60mm



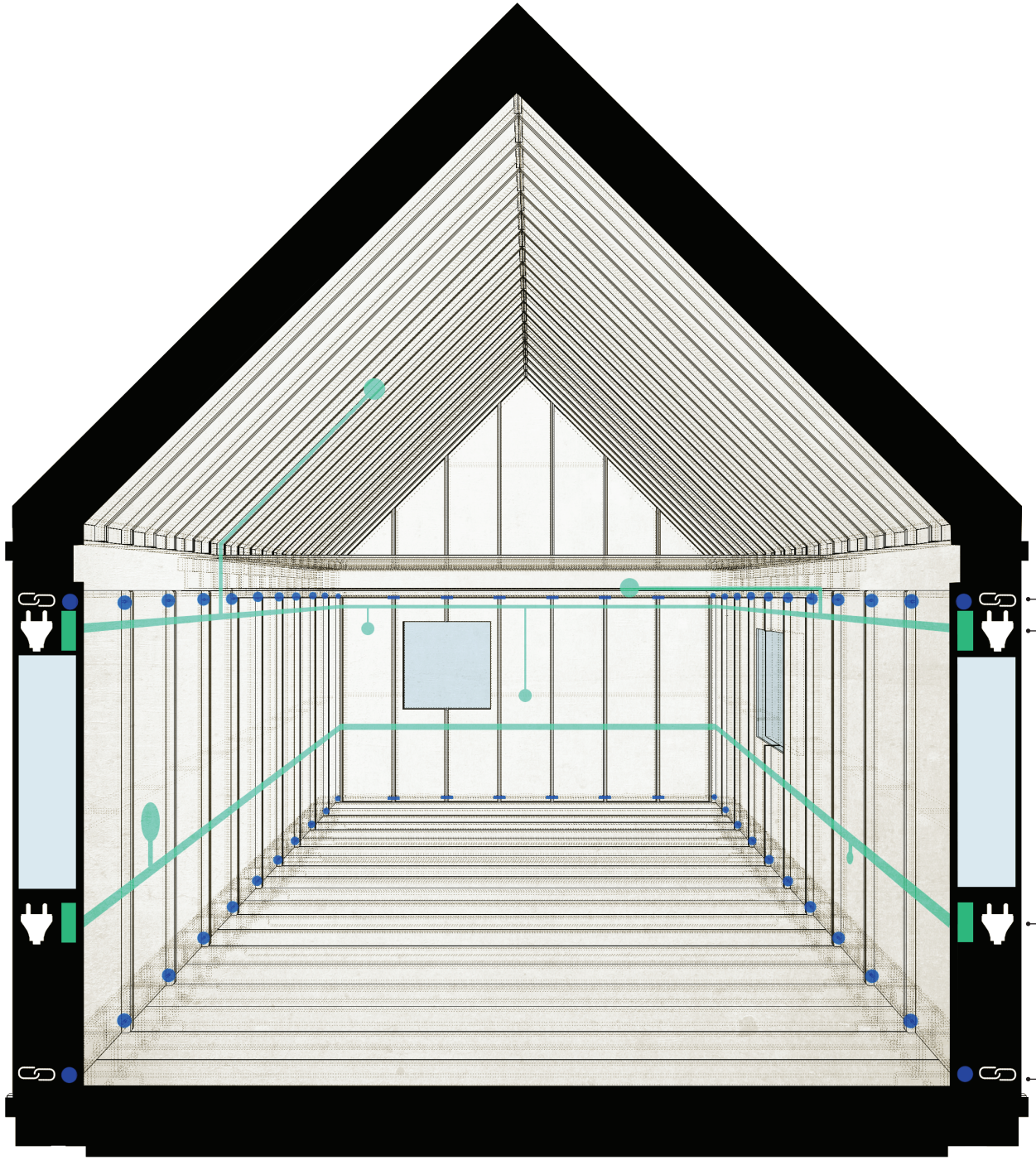
HEIGHT OF HORIZONTAL OPENINGS?



HEIGHT OF HORIZONTAL OPENINGS?

UPPER M10 BOLTS H 235cm
LOWER M10 BOLTS H 6,5cm

The necessity and position of the bolts have been set by previous structural analysis by Kevin Gunawan. They connect neighboring wall components and prevent them from tipping off.



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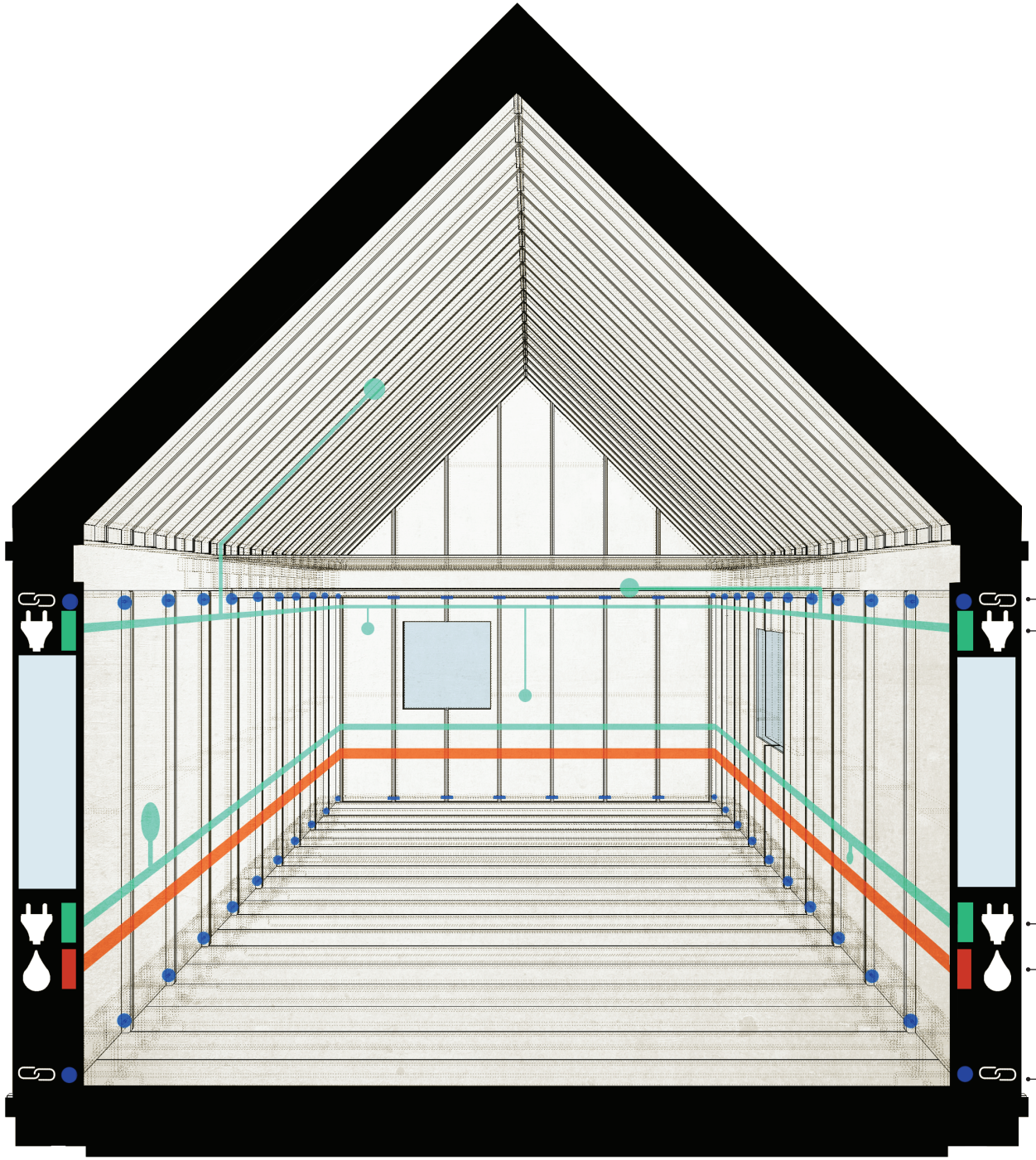
UPPER POWER LINE H 220cm
LOWER POWER LINE H 80cm

Electricity is distributed at two different heights to improve design freedom and decrease the distribution length for ceiling appliances which can be reached easily from the upper line; appliques at 190cm are also reachable from the upper line whereas lower appliances at 110, 90 and 70cm are connected to the lower line.



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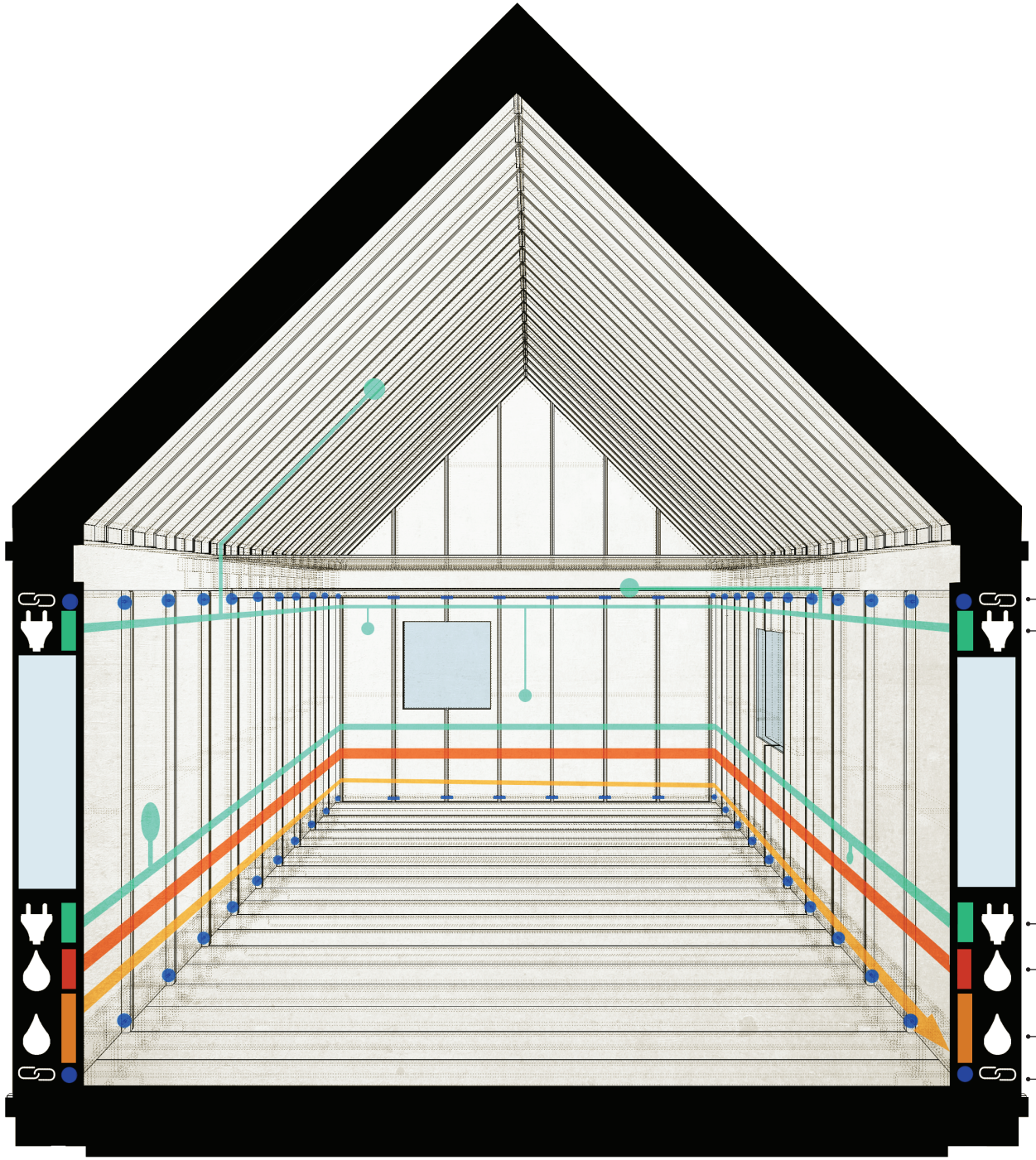
MAIN HOT AND COLD DHW AND SUPPLY AND RETURN HEATING WATER H 50cm
The 4 main lines can run in parallel just below the overlying power distribution and every electric appliance so as to prevent any kind of dangerous leakages on the latter. The height has been determined according to the height of most water appliances which is approx. 40-60cm.



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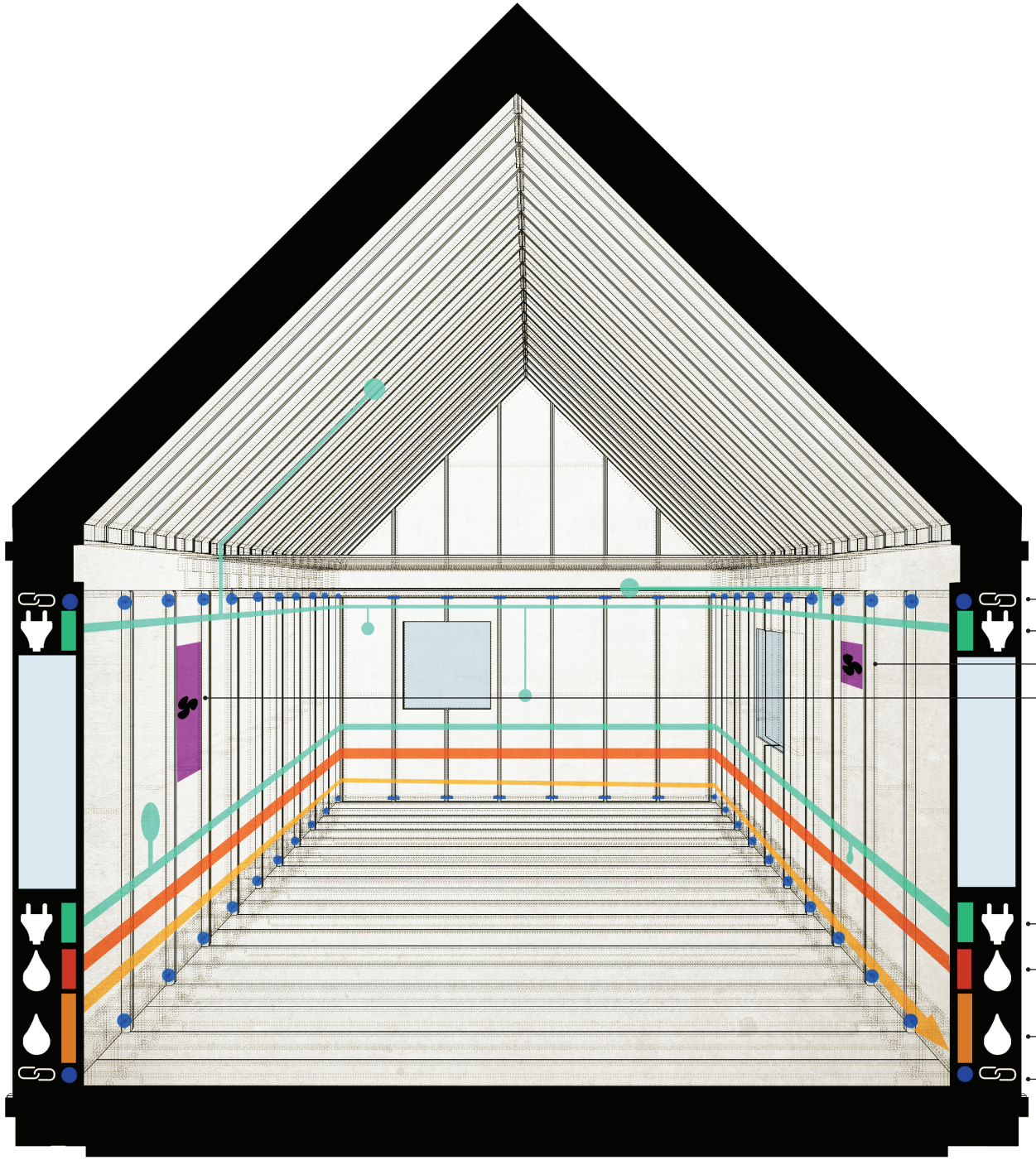
WATER DISPOSAL LINE H 30cm

The waste water from the appliances is connected to the main water pipe with a 1% sloped pipe of 40-50mm diameter which is allowed to sneak by the large space reserved (between H 30 and 10cm). This allows for distances as long as 24 meters, or 40 wall components, before having to reach the 100mm main water disposal vertical pipe.



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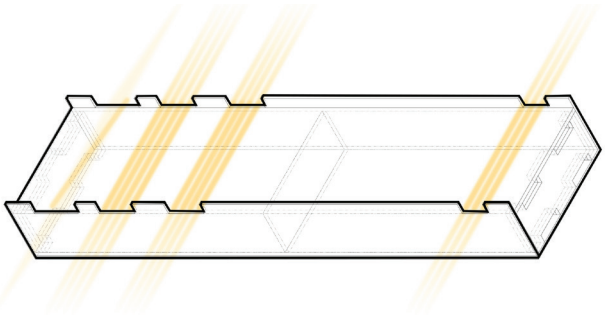
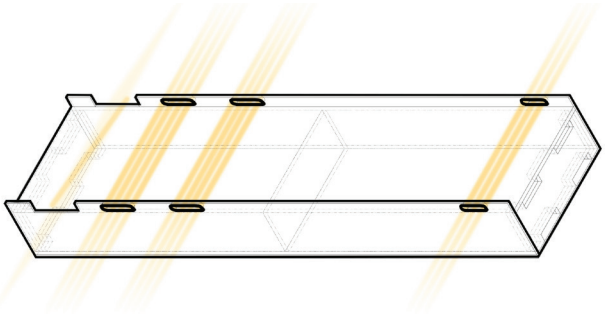
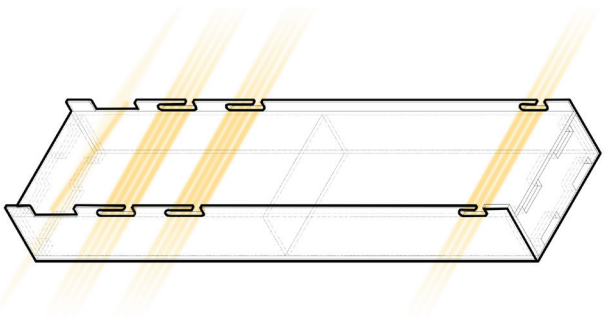
VENTILATION THROUGH LOCALIZED UNITS OR THROUGH FLOOR COMPONENTS

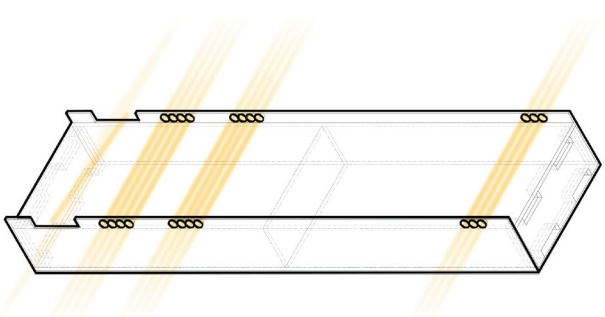
Since the thickness required for the integration of ventilation was too large compared to other appliances, the suggestion is to use localized units when possible. If not, the ducts may run in the roof space's edges and reach the air vents by openings in the floor components.

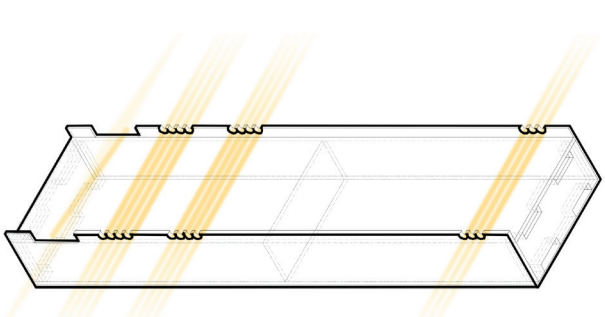
PART 6_ COMPONENTS DESIGN





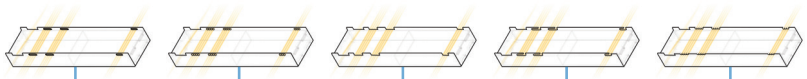






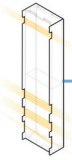
		FREEDOM OF DESIGN	LENGTH OF DISTRIBUTION	NESTING	BATCH SIZE	MILLING TIME	AMOUNT OF ELEMENTS	ASSEMBLY ERGONOMICS (C)	ASSEMBLY TIME	ASSEMBLY COMPLEXITY	VULNERABILITY	PILING EFFICIENCY	LIFTING ERGONOMICS	ASSEMBLY ERGONOMICS (B)	COMPONENTS VARIATION	EASE OF INSTALLATION (BS)	SAFETY	POSSIBLE CLASHES	INSTALLATION TIME	EASE OF INSTALLATION (F)	FINISH QUALITY	ADAPTABILITY	MAINTENANCE	ACCESSIBILITY	DISASSEMBLY	RE-USE	OVERALL SCORE		
DESIGN	FREEDOM OF DESIGN		1	1	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	19	●●●	FREEDOM OF DESIGN
	LENGTH OF DISTRIBUTION	0		1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	1	1	1	0	0	0	0	0	8	●●○	LENGTH OF DISTRIBUTION
MACHINING	NESTING	0	0		1	0	1	0	0	1	0	1	1	0	1	1	0	0	1	1	0	0	0	0	1	0	10	●●○	NESTING
	BATCH SIZE	0	0	0		0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	3	●○○	BATCH SIZE
	MILLING TIME	0	1	1	1		1	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	8	●●○	MILLING TIME
COMPONENTS ASSEMBLY	AMOUNT OF ELEMENTS	0	0	0	0	0		0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	4	●○○	AMOUNT OF ELEMENTS
	ASSEMBLY ERGONOMICS (C)	1	1	1	1	0	1		1	1	0	0	0	0	1	1	0	0	1	1	0	0	1	0	0	0	12	●●○	ASSEMBLY ERGONOMICS (C)
	ASSEMBLY TIME	0	1	1	1	1	1	0		1	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	0	11	●●○	ASSEMBLY TIME
	ASSEMBLY COMPLEXITY	0	1	0	1	1	0	0	0		0	1	1	0	1	0	0	1	0	1	1	1	0	0	0	1	11	●●○	ASSEMBLY COMPLEXITY
COMPONENTS TRANSPORTATION	VULNERABILITY	1	1	1	1	1	1	1	1	1		1	1	1	1	1	0	1	0	1	0	0	1	1	0	0	18	●●●	VULNERABILITY
	PILING EFFICIENCY	0	0	0	1	1	0	1	1	0	0		0	0	1	0	0	1	0	1	1	0	0	0	0	1	9	●●○	PILING EFFICIENCY
	LIFTING ERGONOMICS	0	1	0	1	1	1	1	1	0	0	1		0	1	0	0	1	0	1	1	0	0	0	0	1	12	●●○	LIFTING ERGONOMICS
BUILDING ASSEMBLY	ASSEMBLY ERGONOMICS (B)	0	1	1	1	1	1	1	1	1	0	1	1		1	0	0	1	0	1	1	0	1	0	0	0	15	●●○	ASSEMBLY ERGONOMICS (B)
	COMPONENTS VARIATION	0	0	0	0	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	0	2	●○○	COMPONENTS VARIATION
SERVICES INSTALLATION	EASE OF INSTALLATION (BS)	0	1	0	1	1	1	0	0	1	0	1	1	1	1		0	1	0	1	0	0	0	0	0	0	11	●●○	EASE OF INSTALLATION (BS)
	SAFETY	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	0	1	0	1	1	22	●●●	SAFETY
	POSSIBLE CLASHES	0	1	1	1	0	0	1	1	0	0	0	0	0	1	0	0		0	1	0	0	1	0	0	0	8	●●○	POSSIBLE CLASHES
	INSTALLATION TIME	0	0	0	1	1	0	0	1	1	1	1	1	1	1	1	0	1		0	1	0	0	1	0	0	13	●●○	INSTALLATION TIME
FINISHES INSTALLATION	EASE OF INSTALLATION (F)	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	1		0	0	0	0	0	0	5	●○○	EASE OF INSTALLATION (F)
	FINISH QUALITY	0	0	1	1	0	1	1	0	0	1	0	0	0	1	1	0	1	0	1		0	0	0	0	0	10	●●○	FINISH QUALITY
USE	ADAPTABILITY	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1		1	0	0	1	19	●●●	ADAPTABILITY
	MAINTENANCE	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	0	0	1	1	1	0		1	0	1	17	●●●	MAINTENANCE
	ACCESSIBILITY	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0		1	0	20	●●●	ACCESSIBILITY
END OF LIFE	DISASSEMBLY	0	1	0	1	1	1	1	0	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0		1	18	●●●	DISASSEMBLY
	RE-USE	0	1	1	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	1	1	0	0	1	0		16	●●●	RE-USE

PART 6_ COMPONENTS DESIGN



●	●	●	●	●	STRUCTURAL SOUNDNESS ●●●
●	●	●	●	●	WEIGHT LIMIT ●●●
●	●	●	●	●	ALL FINISHES ALLOWED ●●●
●	●	●	●	●	ALL FUNCTIONS ALLOWED ●●●
2	2	4	3	2	FREEDOM OF DESIGN ●●●
3	3	3	3	3	LENGTH OF DISTRIBUTION ●●○
3	3	4	1	2	NESTING ●●○
3	3	2	2	2	BATCH SIZE ●○○
4	1	4	2	1	MILLING TIME ●●○
2	2	2	2	2	AMOUNT OF ELEMENTS ●○○
1	1	3	3	2	ASSEMBLY ERGONOMICS (C) ●●○
2	2	2	2	2	ASSEMBLY TIME ●●○
2	2	3	3	3	ASSEMBLY COMPLEXITY ●●○
1	2	3	3	2	VULNERABILITY ●●●
3	3	3	2	2	PILING EFFICIENCY ●●○
3	3	2	3	2	LIFTING ERGONOMICS ●●○
1	2	3	3	2	ASSEMBLY ERGONOMICS (B) ●●○
3	3	3	3	3	COMPONENTS VARIATION ●○○
1	1	2	3	4	EASE OF INSTALLATION (BS) ●●○
3	3	2	3	3	SAFETY ●●●
2	2	4	4	2	POSSIBLE CLASHES ●●○
2	2	1	3	4	INSTALLATION TIME ●●○
2	2	3	3	2	EASE OF INSTALLATION (F) ●○○
4	4	3	3	3	FINISH QUALITY ●●○
2	2	4	3	1	ADAPTABILITY ●●●
3	2	3	4	4	MAINTENANCE ●●●
1	1	3	3	2	ACCESSIBILITY ●●●
2	2	2	4	4	DISASSEMBLY ●●●
2	2	4	4	3	RE-USE ●●●
120	116	159	161	136	OVERALL SCORE

PART 6_ COMPONENTS DESIGN

	DESIGN AVG. 2,50/3 ●●◐	MACHINING AVG. 1,66/3 ●●○	COMPONENTS ASSEMBLY AVG. 1,75/3 ●●○	COMPONENTS TRANSPORTATION AVG. 2,33/3 ●●◐	BUILDING ASSEMBLY AVG. 1,50/3 ●◐○	SERVICES INSTALLATION AVG. 2,25/3 ●●◐	FINISHES INSTALLATION AVG. 1,5/3 ●◐○	USE AVG. 3,00/3 ●●●	END OF LIFE AVG. 3,00/3 ●●●
	12	8	16	14	7	29	8	21	21
	15	8	18	19	9	29	9	30	24
	18	18	18	19	9	20	9	30	18
	12	11	12	18	7	19	10	15	12
	12	17	12	15	5	19	10	18	12

- Best for services installation for as the snap fit system is considered very fast and easy to use
- Worst in transportation since it is both very fragile for its sharp edges and not ergonomic
- Worst in finishes installation since the clipping creates an ulterior thickness over the flanges
- The clipping system does not allow much flexibility and it's very fragile since wood is weaker then plastic, therefore it would be the first to brake if sightly forced

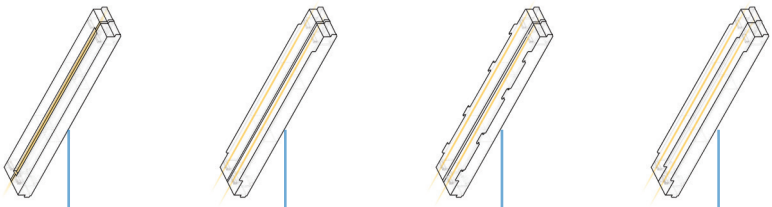
- Worst score in machining since the nesting would be quite a lot in this case
- Scores the best in services installation for its efficiency in the installation and flexibility
- Scores best in use, end of life and 4 other families
- The installation would be very convenient as well as future uses; scores best overall

- Best score for design as the large cutouts enable a great design freedom for every scenario
- Shortest milling time: the bit only has to change direction and keep on cutting the outline
- Scores very well in use for its great flexibility and ease of access for future maintenance
- Second best score; the only issue is that all services would require an external connection since the cutouts do not provide any kind of support for the latter

- Scores best in finishes installation because is the only one (along with the elliptical version) to provide a smooth, straight external section of the flanges
- Worst scores in 5 families mainly due to its fragility and lack of flexibility given by the holes
- Installation of services and disassembly of the latter would be very inconvenient in case the services consisted of rigid, not flexible pipes.

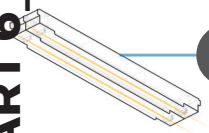
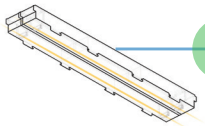
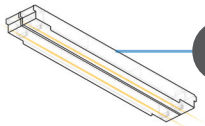
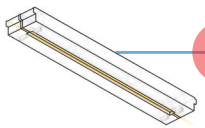
- Scores best in finishes installation because is the only one (along with the round holes version) to provide a smooth, straight external section of the flanges
- Worst scores in 5 families mainly due to its fragility and lack of flexibility given by the holes
- Worst score overall and the only one not to pass the structural soundness: the long and extremely thin section of the flanges are too fragile

PART 6_ COMPONENTS DESIGN



	126	156	160	149
STRUCTURAL SOUNDNESS	●	●	●	●
WEIGHT LIMIT	●	●	●	●
ALL FINISHES ALLOWED	●	●	●	●
ALL FUNCTIONS ALLOWED	●	●	●	●
FREEDOM OF DESIGN	1	3	4	2
LENGTH OF DISTRIBUTION	3	3	4	3
NESTING	2	3	1	3
BATCH SIZE	1	4	3	1
MILLING TIME	1	4	2	3
AMOUNT OF ELEMENTS	1	3	3	4
ASSEMBLY ERGONOMICS (C)	2	3	3	3
ASSEMBLY TIME	1	3	2	3
ASSEMBLY COMPLEXITY	1	2	2	3
VULNERABILITY	4	2	1	2
PILING EFFICIENCY	4	3	3	1
LIFTING ERGONOMICS	2	2	2	3
ASSEMBLY ERGONOMICS (B)	2	3	3	2
COMPONENTS VARIATION	2	2	2	4
EASE OF INSTALLATION (BS)	3	3	4	3
SAFETY	3	3	3	3
POSSIBLE CLASHES	2	3	4	3
INSTALLATION TIME	2	4	4	4
EASE OF INSTALLATION (F)	4	3	3	3
FINISH QUALITY	4	3	3	3
ADAPTABILITY	2	3	4	3
MAINTENANCE	3	3	4	3
ACCESSIBILITY	2	2	2	2
DISASSEMBLY	3	3	3	3
RE-USE	2	3	4	3
OVERALL SCORE	126	156	160	149

PART 6_ COMPONENTS DESIGN

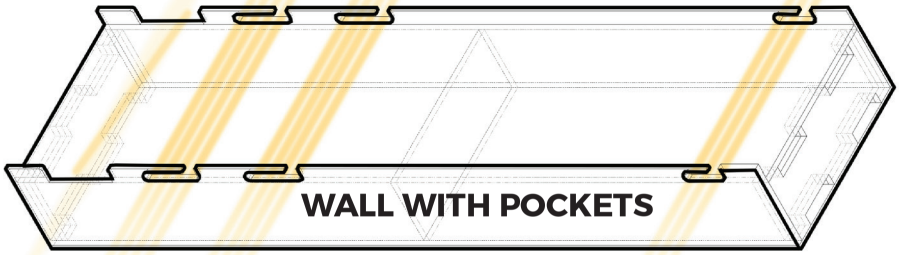
	DESIGN AVG. 2,50/3 ●●◐	MACHINING AVG. 1,66/3 ●●○	COMPONENTS ASSEMBLY AVG. 1,75/3 ●●○	COMPONENTS TRANSPORTATION AVG. 2,33/3 ●●◐	BUILDING ASSEMBLY AVG. 1,50/3 ●◐○	SERVICES INSTALLATION AVG. 2,25/3 ●●◐	FINISHES INSTALLATION AVG. 1,5/3 ●◐○	USE AVG. 3,00/3 ●●●	END OF LIFE AVG. 3,00/3 ●●●
	12	13	22	14	8	29	9	24	18
	20	9	17	13	8	33	9	30	21
	15	18	19	16	8	29	9	24	18
	9	7	9	24	6	23	12	21	15

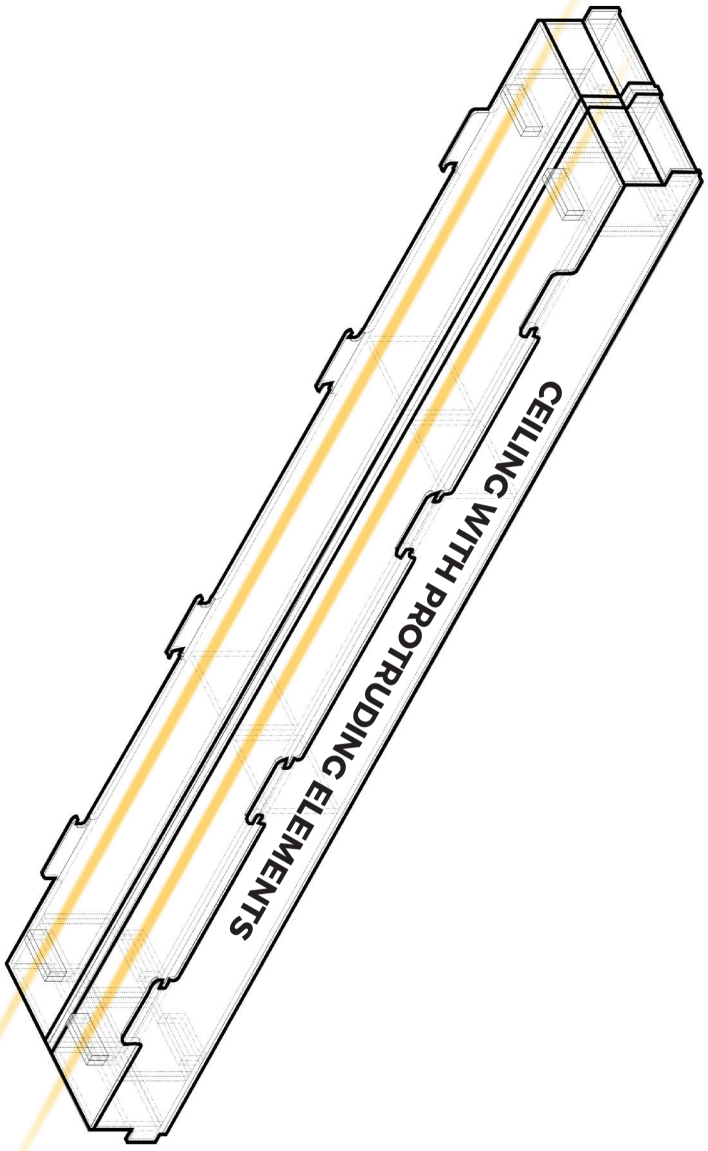
- Best in components assembly as the two symmetric flanges keep the variation of elements very low, also building assembly scores high for the same reason: the component has a centric CG and there is no variation of components
- Low grade in finishes installation is shared with other alternatives, therefore not significant
- Good alternative but the main issue is the weight since two big flanges are added

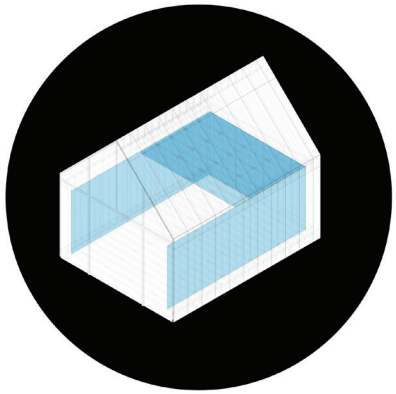
- Best score in use and end of life is related to its much higher flexibility given by the possibility to allow services to flow in parallel but also perpendicularly between floor components
- Lowest score in transportation is given by the fragility of the notches and the asymmetric CG
- Lowest score in finishes installation is shared with other alternatives, therefore not significant

- Best score in machining is given byt the fact that the only difference between this alternative and the original component is the presence of one flange
- The high score on assembly and low on finishes installation are marked as not significant due to the shared score with 2 other alternatives
- Second best overall score

- Worst scoring design overall
- Recess makes the batch size larger as well as the nesting and the difficulties in the components assembly, the asymmetric CG also creates difficulties in ergonomics and B. assembly
- Main perk of this design is the lack of protrusions which gives a great stackability and sturdiness of the component as well as the best score in finishes installation


WALL WITH POCKETS

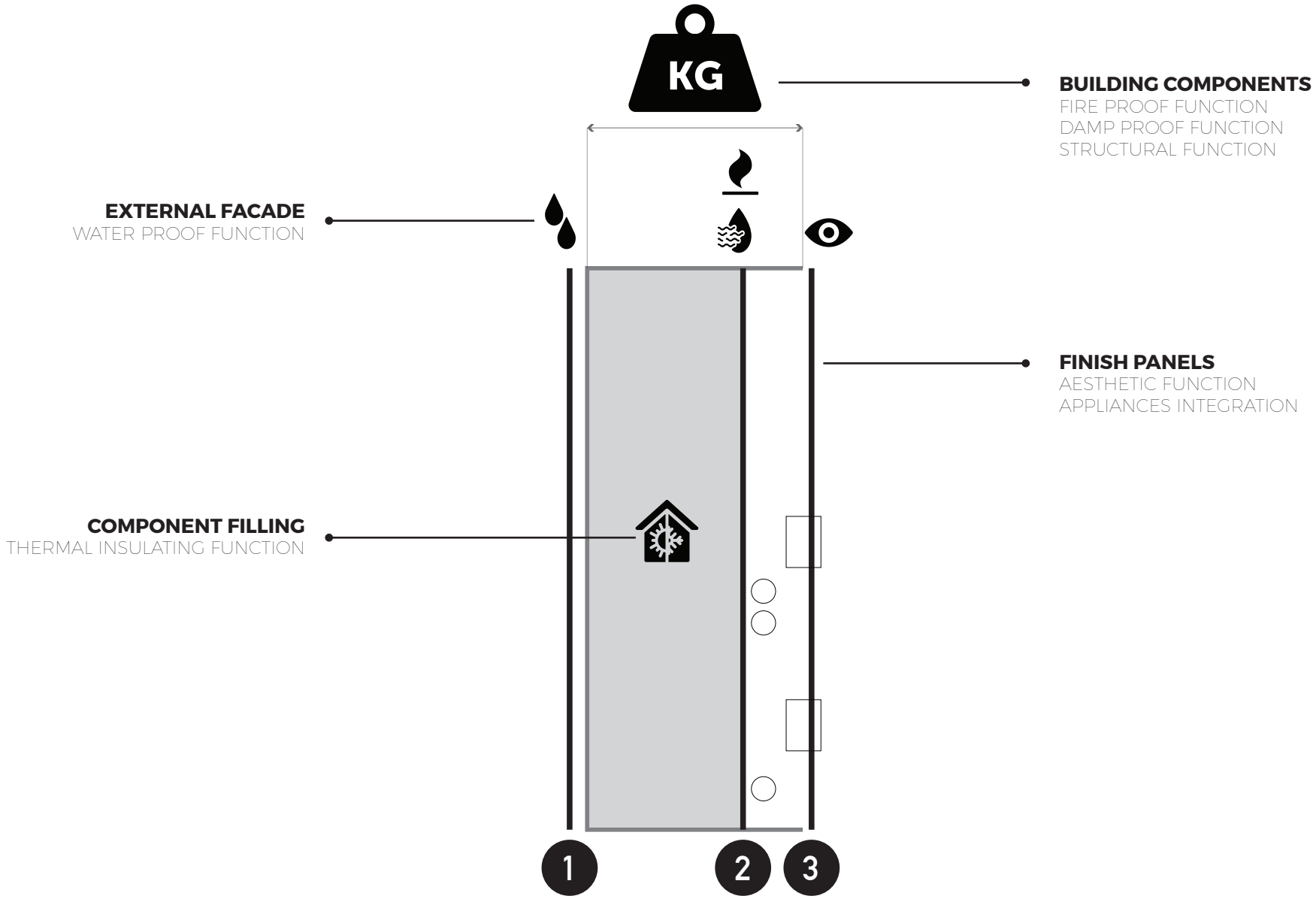

CEILING WITH PROTRUDING ELEMENTS



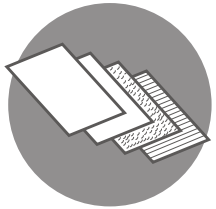
FINISHES DESIGN

What are the possibilities for the finishings so that final appliances can be integrated within them when required?

FINISHINGS REQUIREMENTS

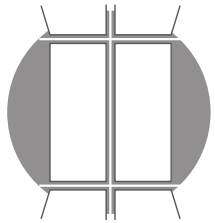


PART 7_ FINISHES DESIGN

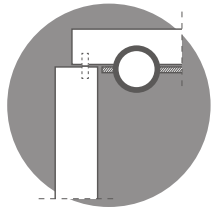


MATERIALS

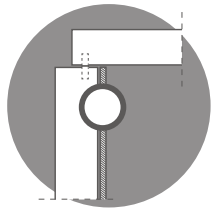
ASSEMBLY



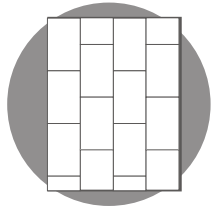
JOINTS



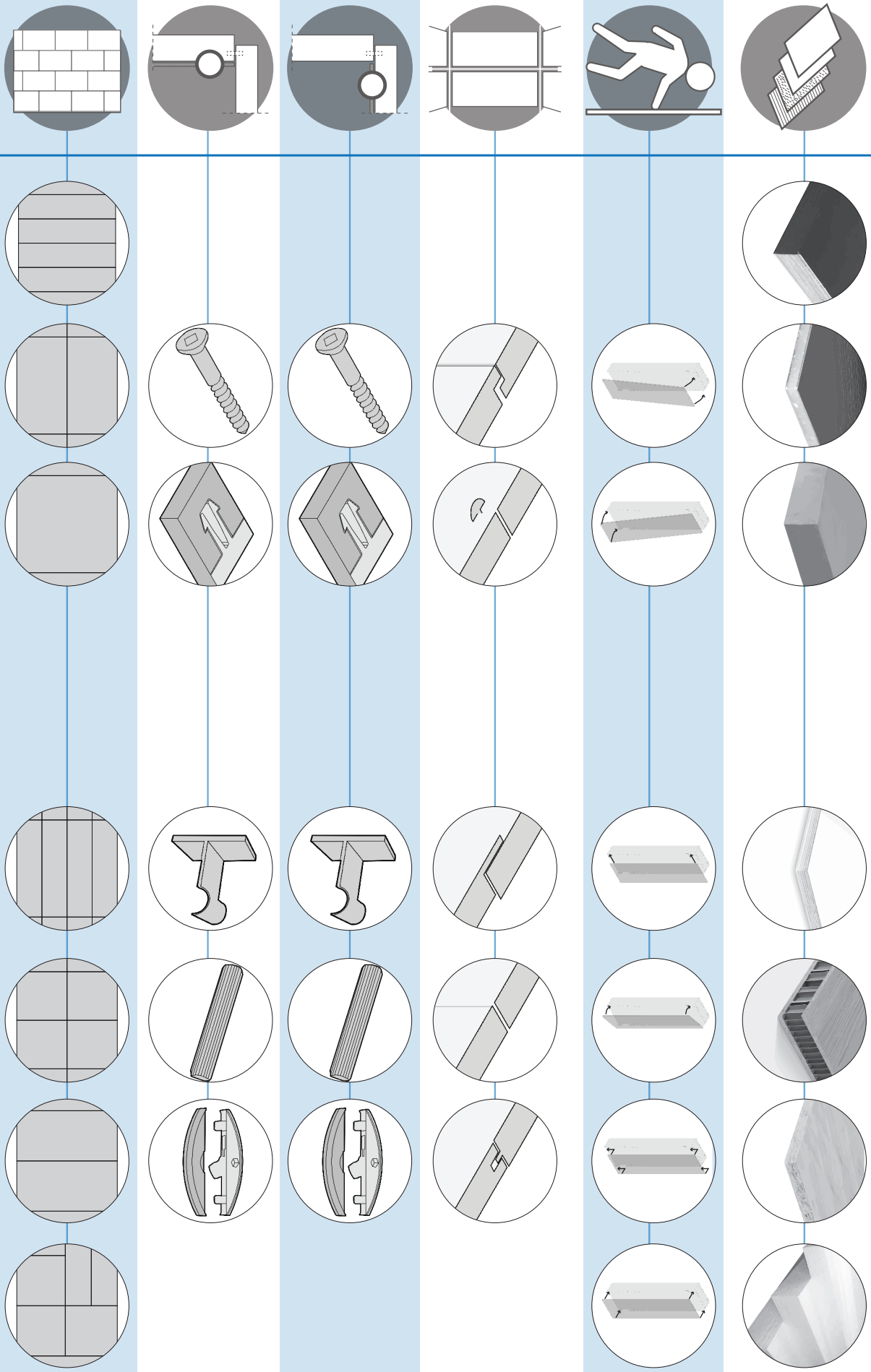
CEILING CONNECTIONS



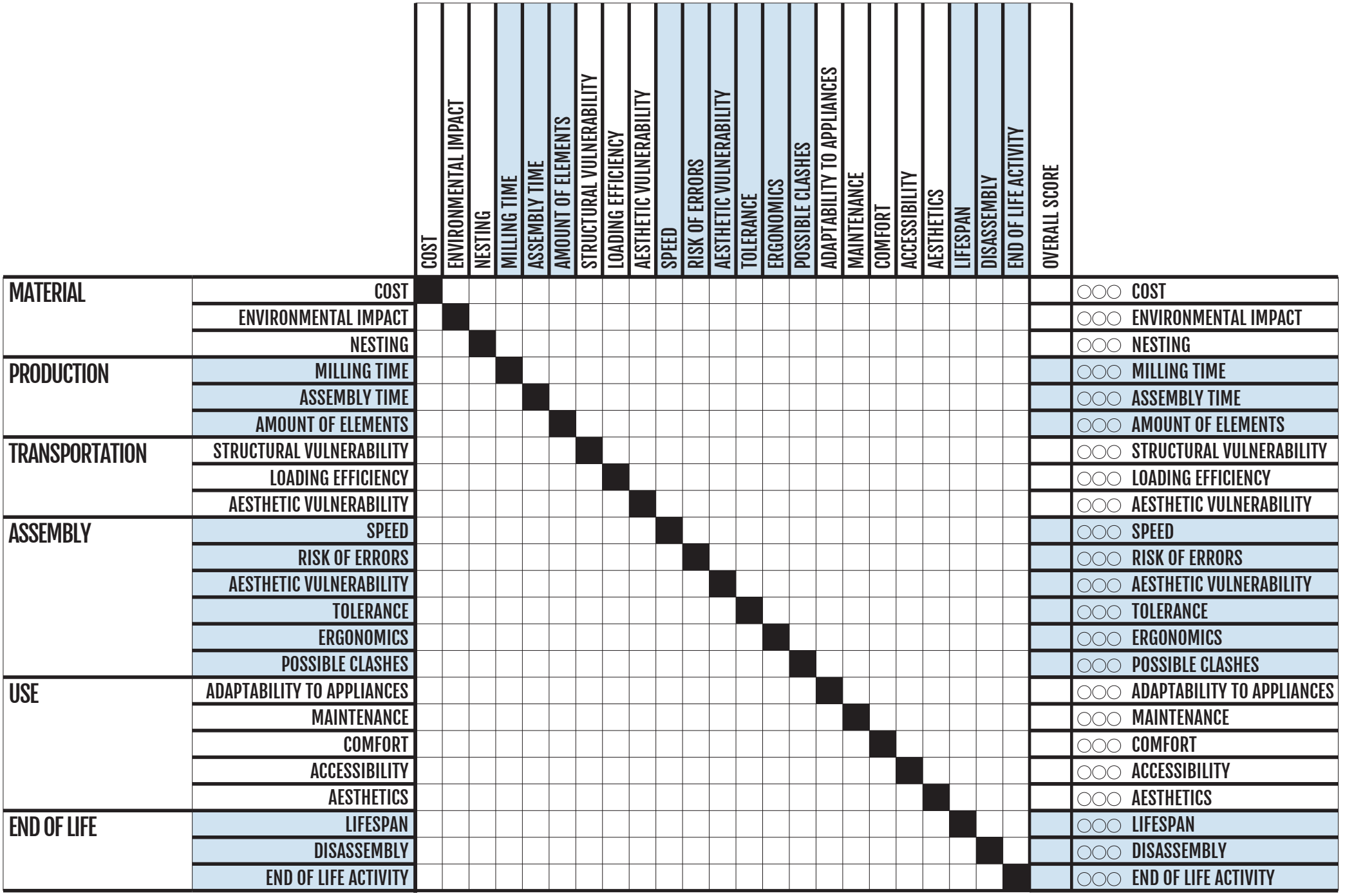
WALL CONNECTIONS

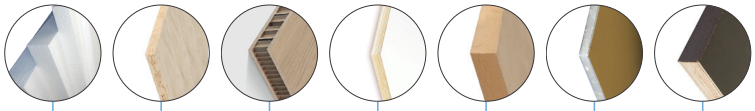


CONFIGURATION

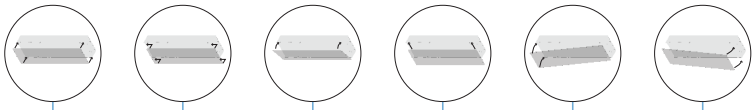


PART 7_ FINISHES DESIGN

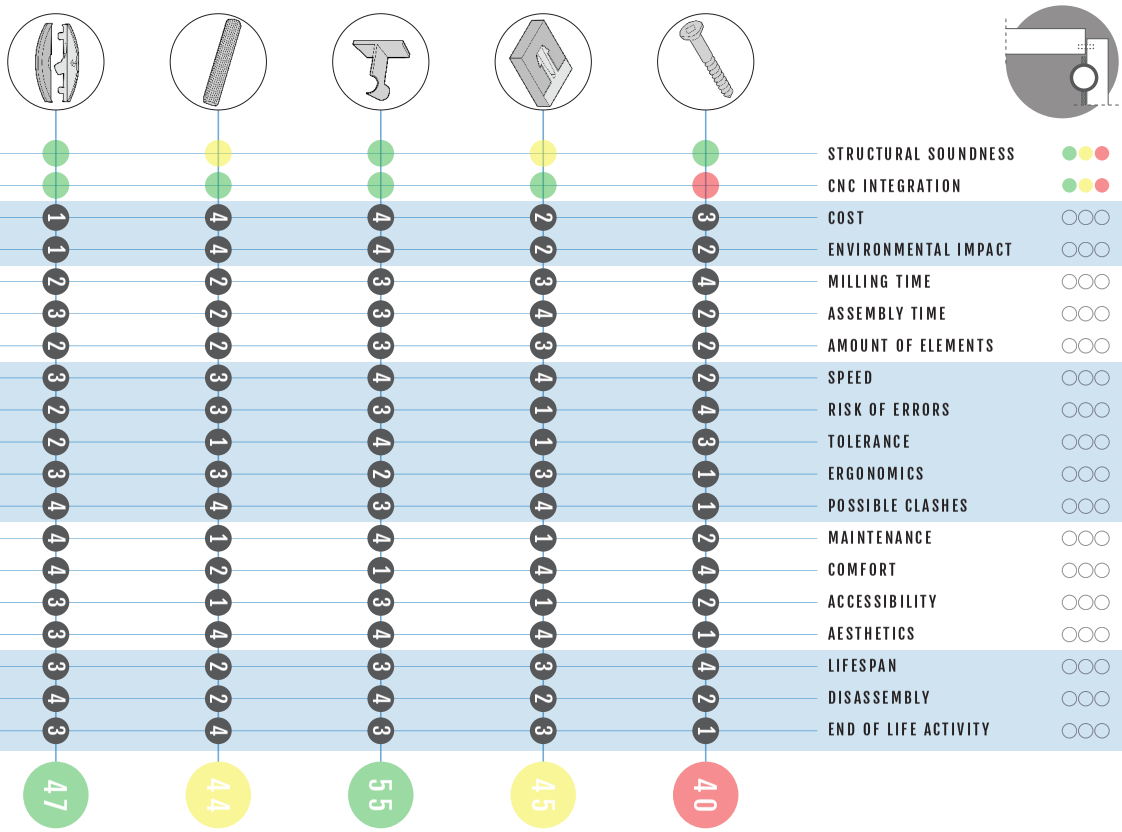


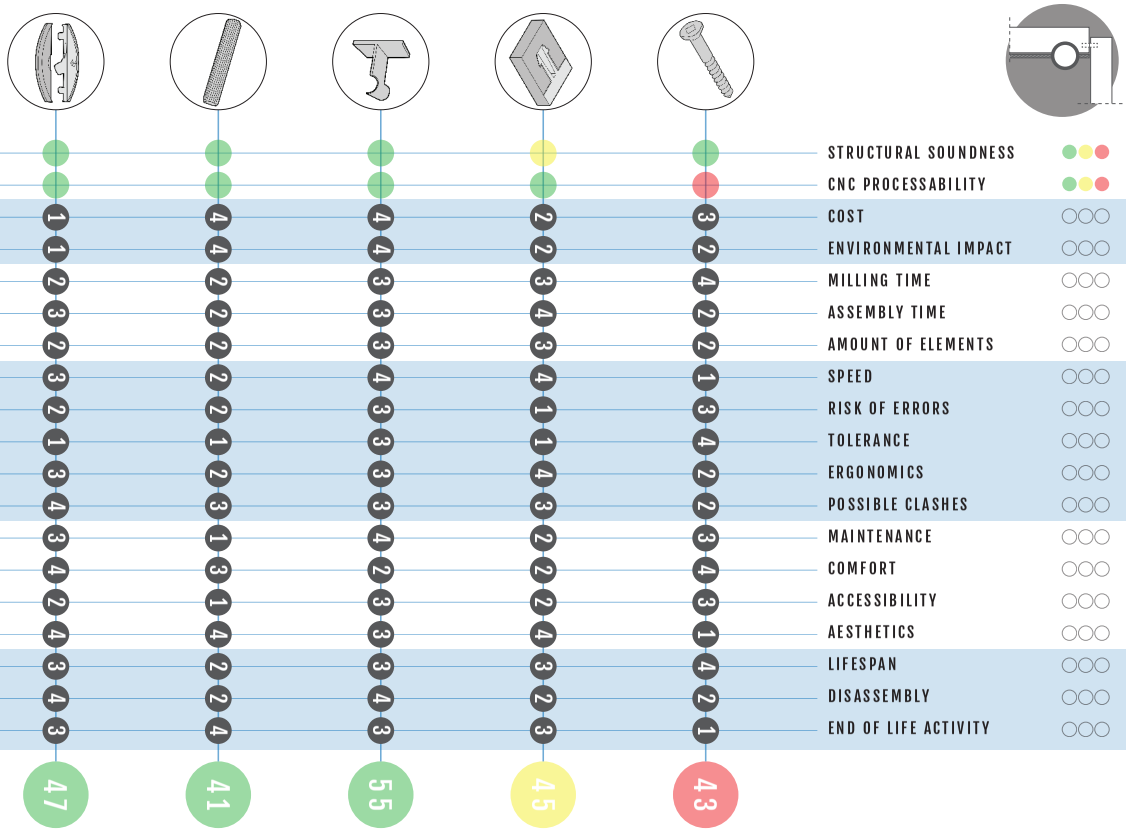


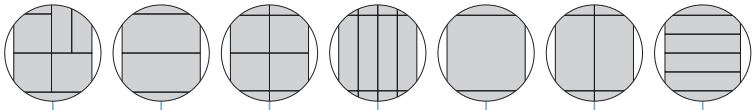
STRUCTURAL SOUNDNESS	●	●	●	●	●	●	●
CNC PROCESSABILITY	●	●	●	●	●	●	●
WEIGHT	●	●	●	●	●	●	●
COST	4	4	2	3	4	1	2
ENVIRONMENTAL IMPACT	1	4	3	3	4	2	2
NESTING	2	4	3	3	3	2	3
MILLING TIME	4	3	2	4	2	3	3
AESTHETIC VULNERABILITY	1	3	4	3	3	2	2
MAINTENANCE	1	3	3	4	3	4	4
COMFORT	4	3	3	3	3	2	3
AESTHETICS	2	3	4	4	3	2	3
LIFESPAN	1	2	3	3	2	4	4
DISASSEMBLY	1	3	3	3	3	4	3
END OF LIFE ACTIVITY	1	4	3	3	4	2	2
	22	36	33	36	34	28	31

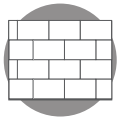


STRUCTURAL SOUNDNESS	●	●	●	●	●	●
SPEED	3	4	3	4	4	3
RISK OF ERRORS	3	3	3	2	3	3
AESTHETIC VULNERABILITY	2	4	4	3	3	3
TOLERANCE	1	3	4	4	2	2
ERGONOMICS	2	3	2	2	3	4
POSSIBLE CLASEHS	3	2	2	1	4	4
ADAPTABILITY TO APPLIANCES	4	2	4	2	2	2
ACCESSIBILITY	3	2	4	2	3	3
AESTHETICS	2	3	2	3	3	3
DISASSEMBLY	4	2	4	1	3	3
	27	27	32	24	30	30

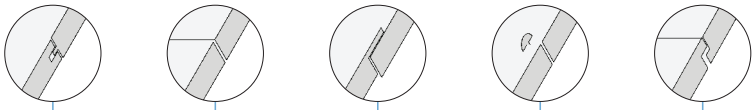

STRUCTURAL SOUNDNESS
CNC INTEGRATION
COST
ENVIRONMENTAL IMPACT
MILLING TIME
ASSEMBLY TIME
AMOUNT OF ELEMENTS
SPEED
RISK OF ERRORS
TOLERANCE
ERGONOMICS
POSSIBLE CLASHES
MAINTENANCE
COMFORT
ACCESSIBILITY
AESTHETICS
LIFESPAN
DISASSEMBLY
END OF LIFE ACTIVITY
47
44
55
45
40

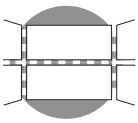

STRUCTURAL SOUNDNESS
CNC PROCESSABILITY
COST
ENVIRONMENTAL IMPACT
MILLING TIME
ASSEMBLY TIME
AMOUNT OF ELEMENTS
SPEED
RISK OF ERRORS
TOLERANCE
ERGONOMICS
POSSIBLE CLASHES
MAINTENANCE
COMFORT
ACCESSIBILITY
AESTHETICS
LIFESPAN
DISASSEMBLY
END OF LIFE ACTIVITY
47
41
55
45
43



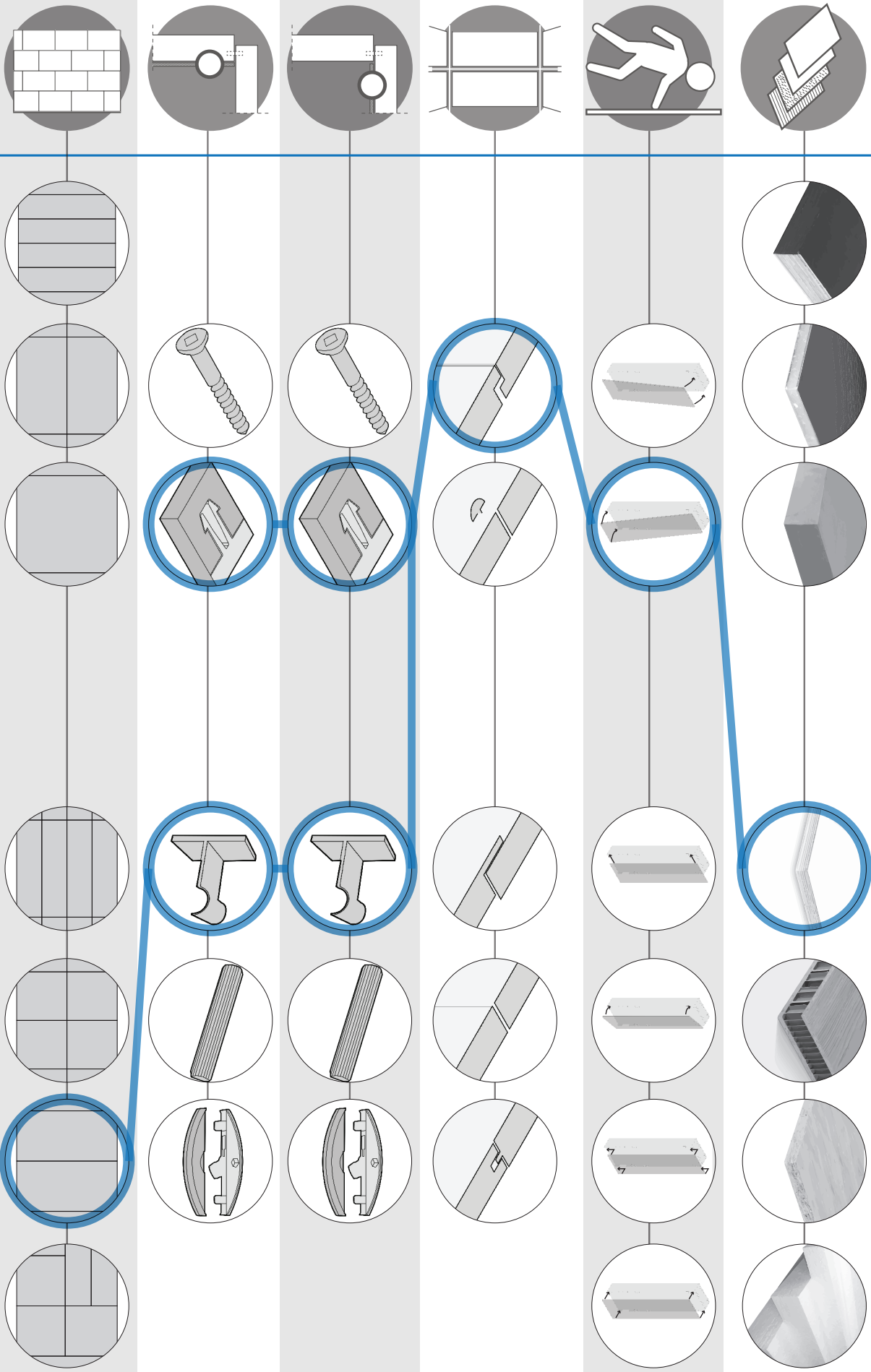


WEIGHT	●	●	●	●	●	●	●
MAXIMUM SIZE	●	●	●	●	●	●	●
MILLING TIME	1	3	3	2	4	3	2
ASSEMBLY TIME	1	3	3	2	4	3	2
AMOUNT OF ELEMENTS	1	3	3	2	4	3	2
STRUCTURAL VULNERABILITY	3	3	3	2	2	3	2
LOADING EFFICIENCY	1	3	4	2	4	3	2
SPEED	1	3	3	3	4	3	3
RISK OF ERRORS	1	3	3	3	4	2	3
TOLERANCE	2	3	1	2	4	3	2
ERGONOMICS	2	3	2	1	2	3	2
ACCESSIBILITY	1	4	2	3	1	2	4
AESTHETICS	4	3	1	1	2	2	3
DISASSEMBLY	3	4	2	4	2	3	4
	21	38	30	27	37	33	31

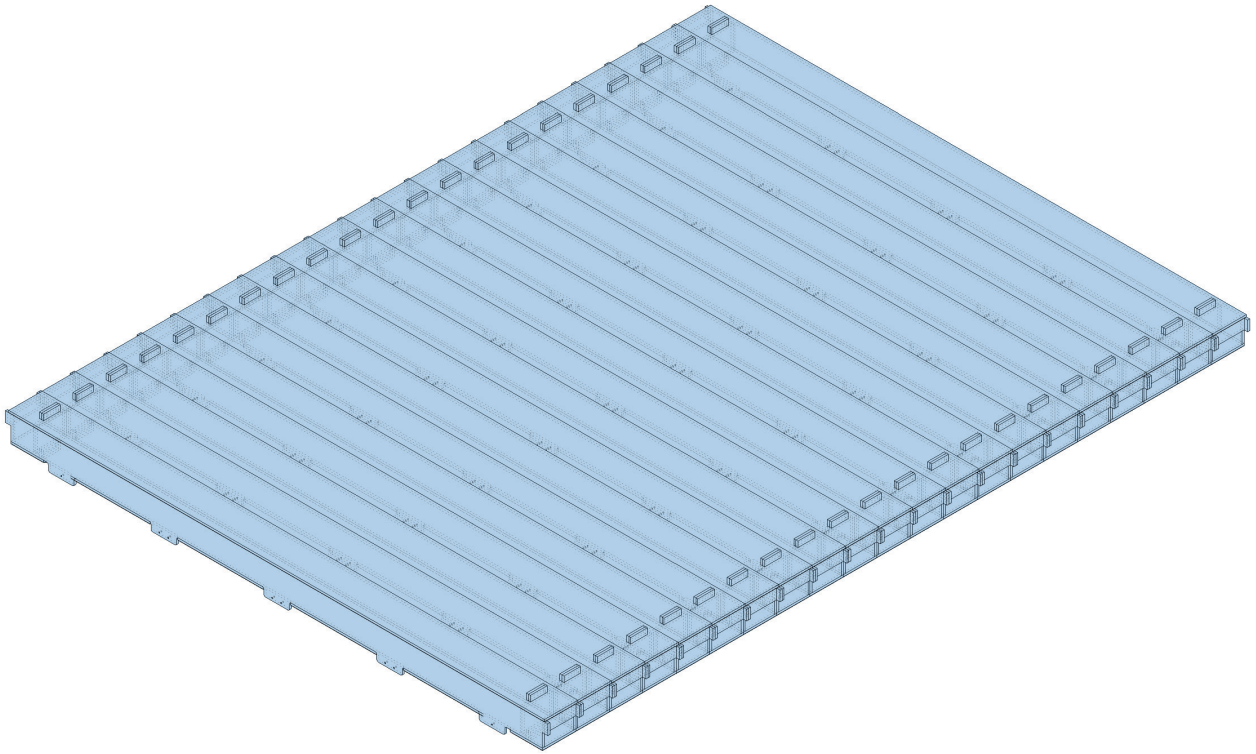




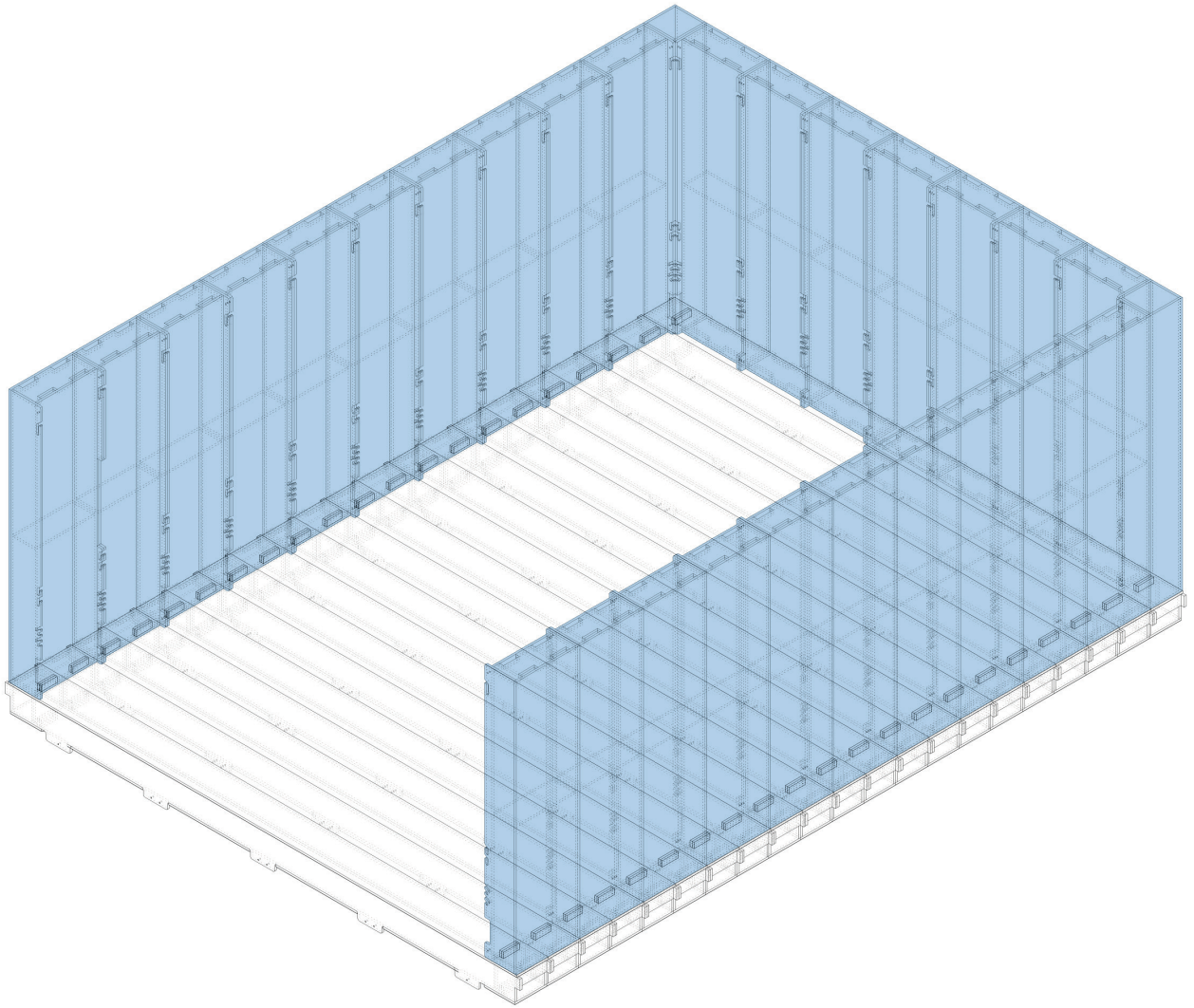
STRUCTURAL SOUNDNESS	●	●	●	●	●
NESTING	2	4	2	4	3
MILLING TIME	2	4	3	4	3
AMOUNT OF ELEMENTS	3	4	3	4	3
STRUCTURAL VULNERABILITY	2	4	1	4	2
LOADING EFFICIENCY	2	4	2	4	3
RISK OF ERRORS	2	3	2	2	2
AESTHETIC VULNERABILITY	2	3	1	3	2
TOLERANCE	3	1	3	1	3
ERGONOMICS	3	3	3	2	3
MAINTENANCE	3	4	3	1	3
ACCESSIBILITY	2	4	3	1	3
AESTHETICS	4	1	2	2	4
DISASSEMBLY	3	4	3	1	3
	33	43	31	33	37



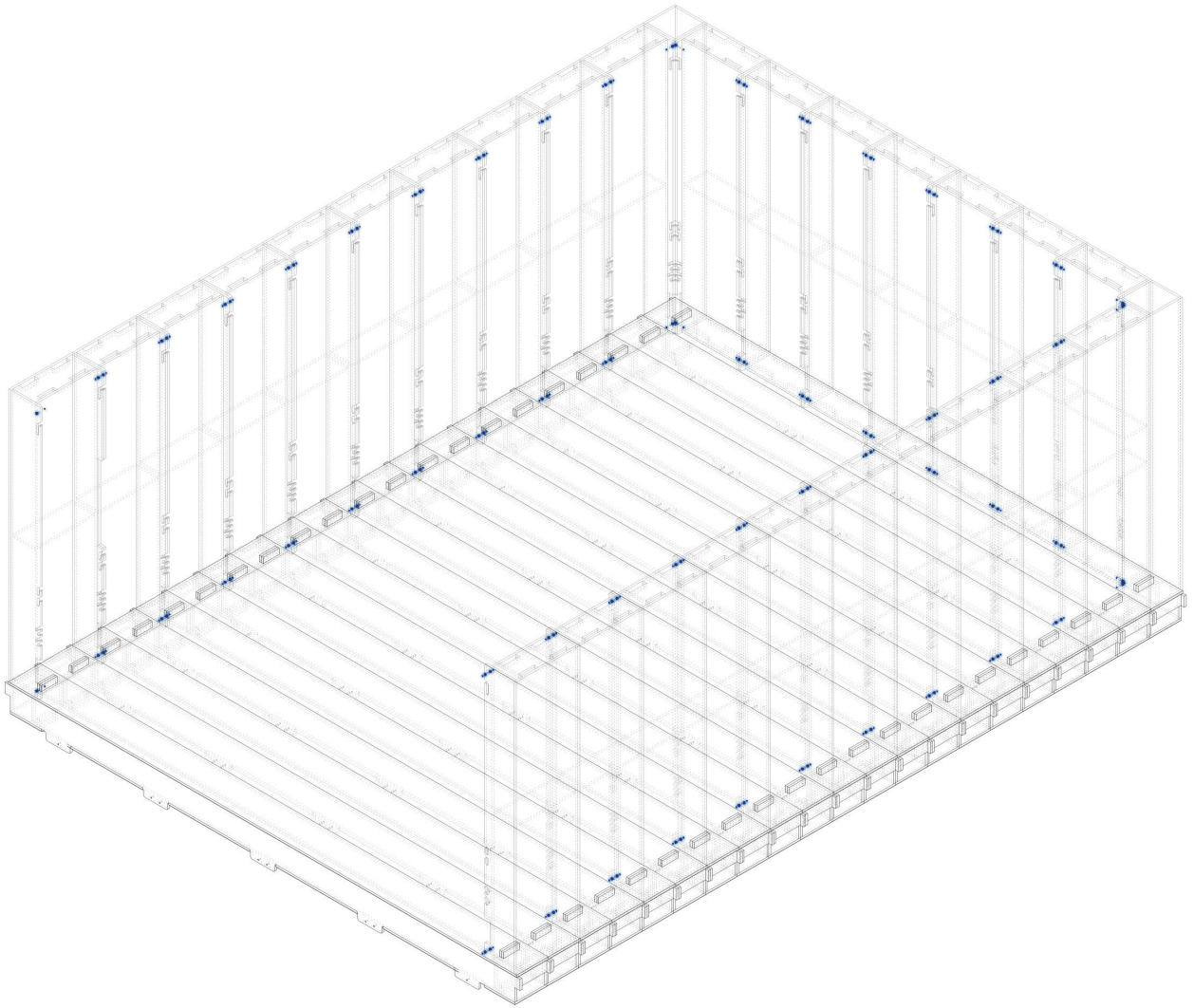
FLOOR COMPONENTS



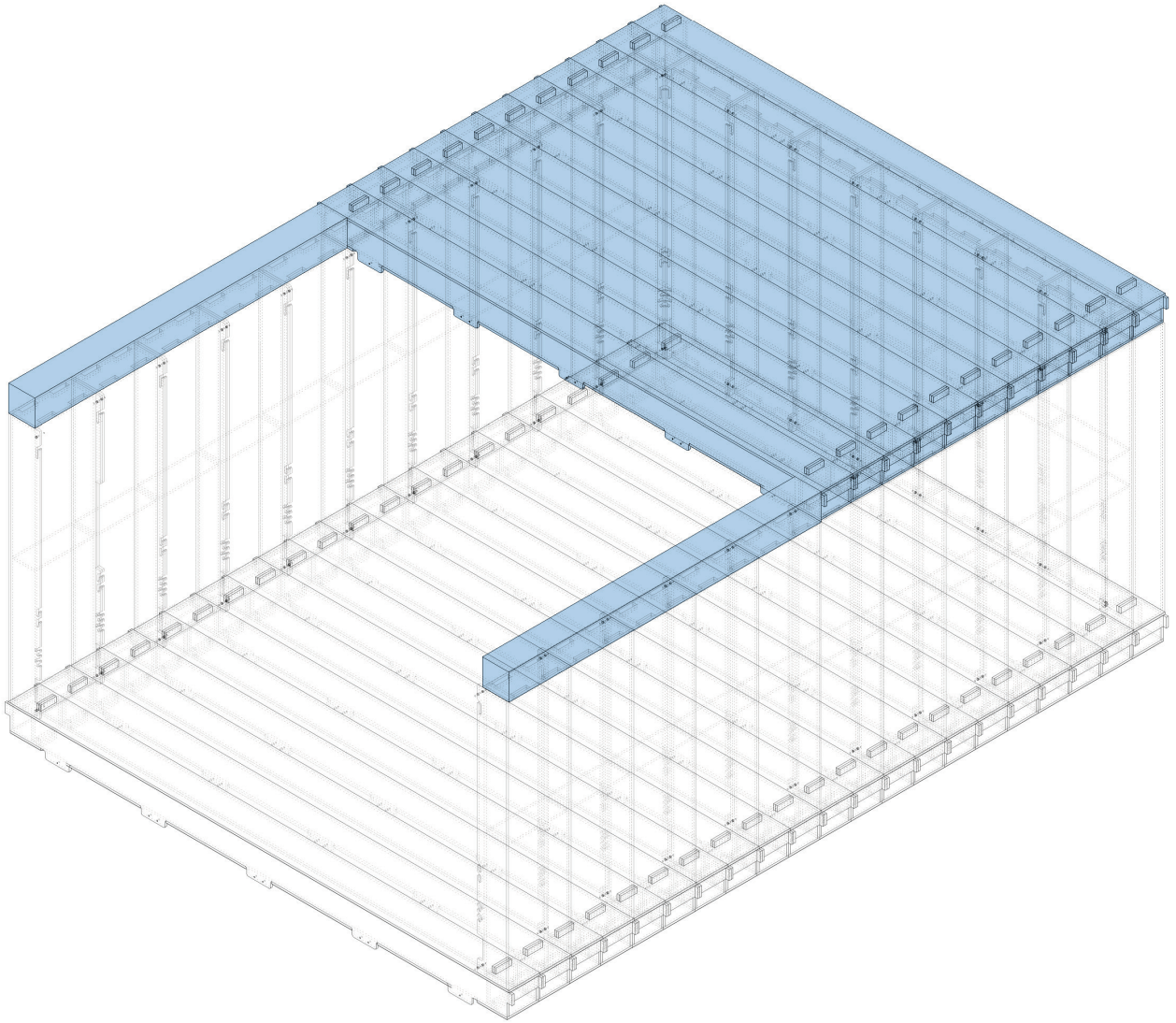
WALL COMPONENTS



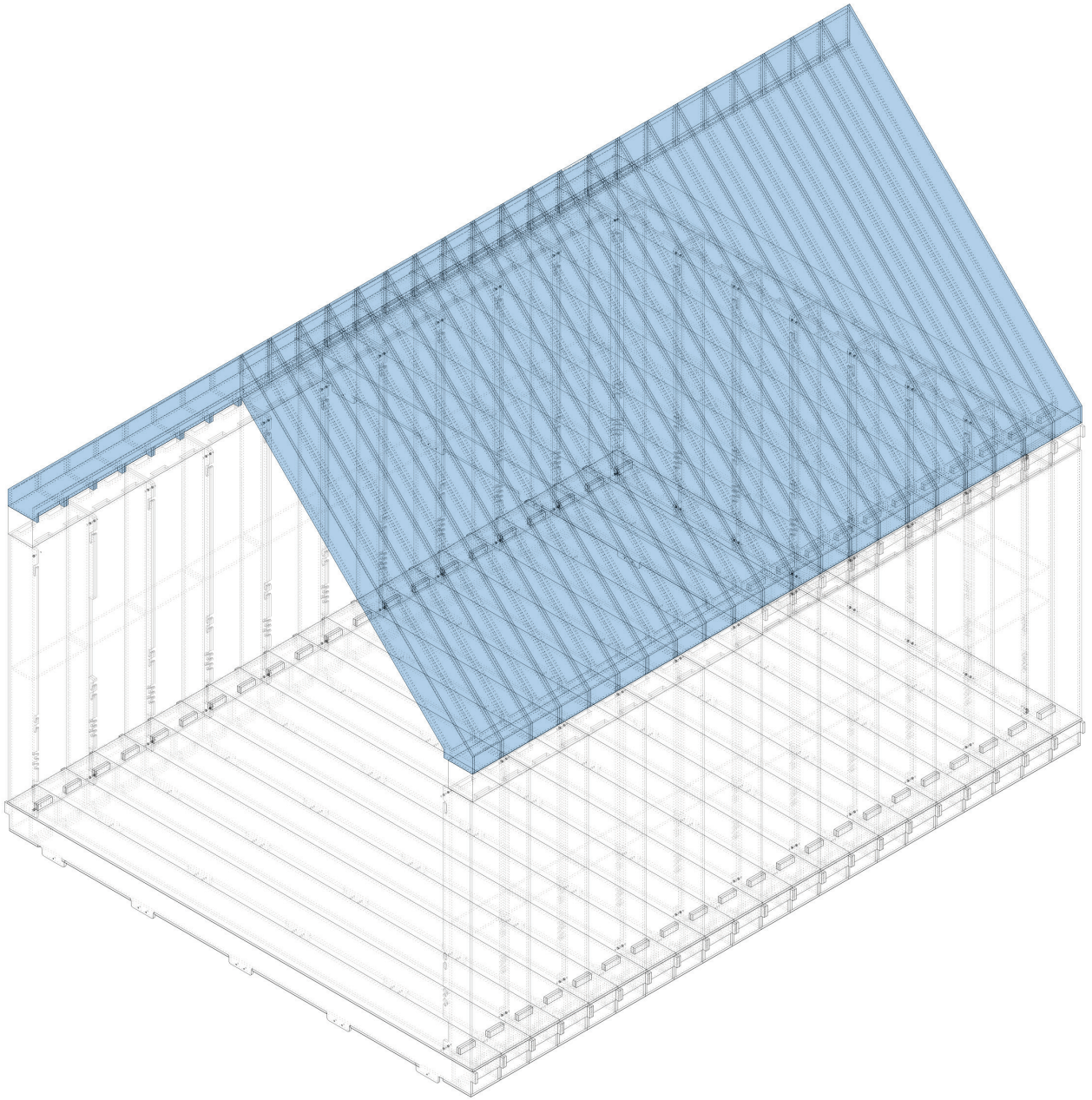
BOLTS



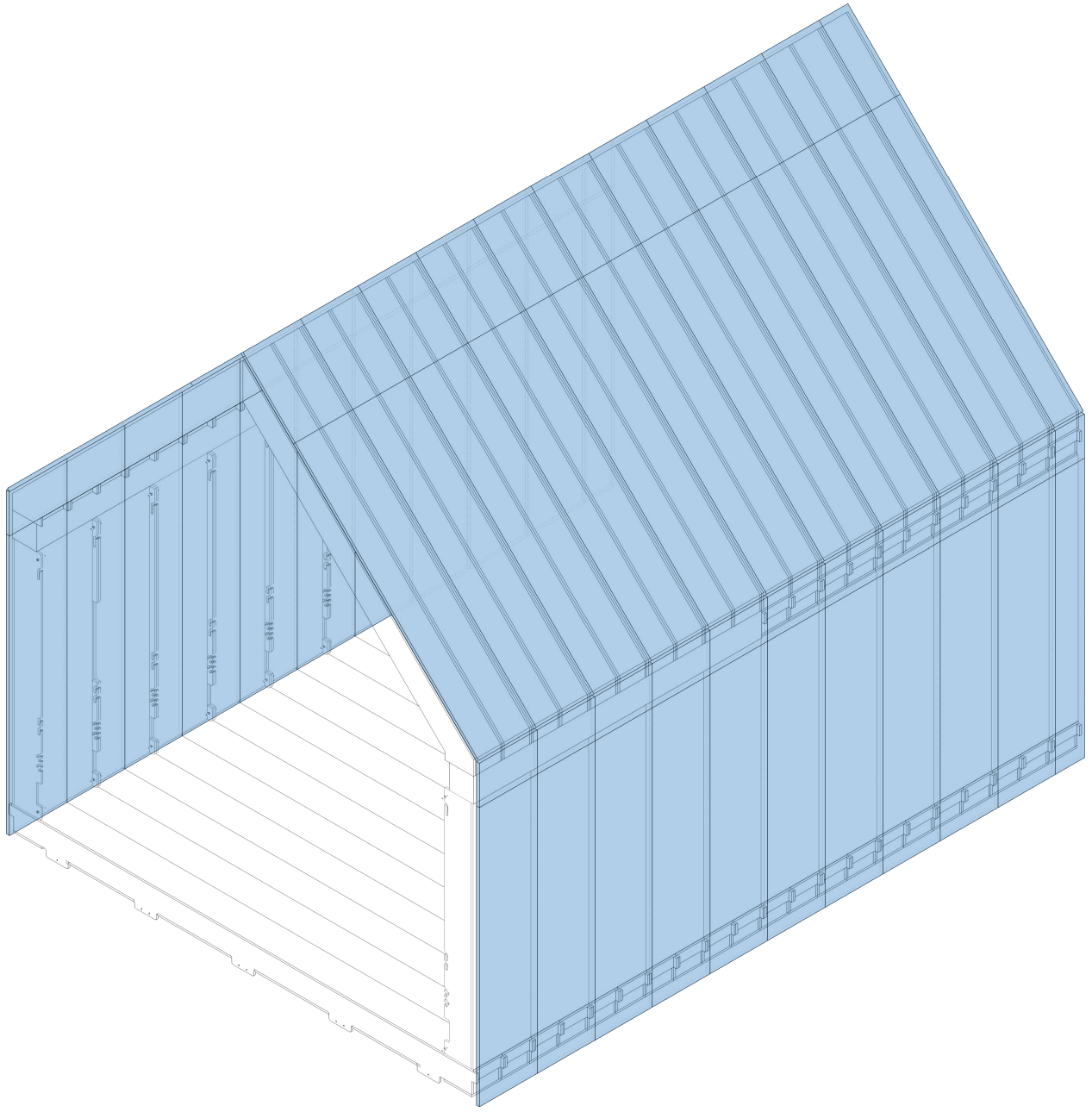
FLOOR COMPONENTS SECOND LEVEL



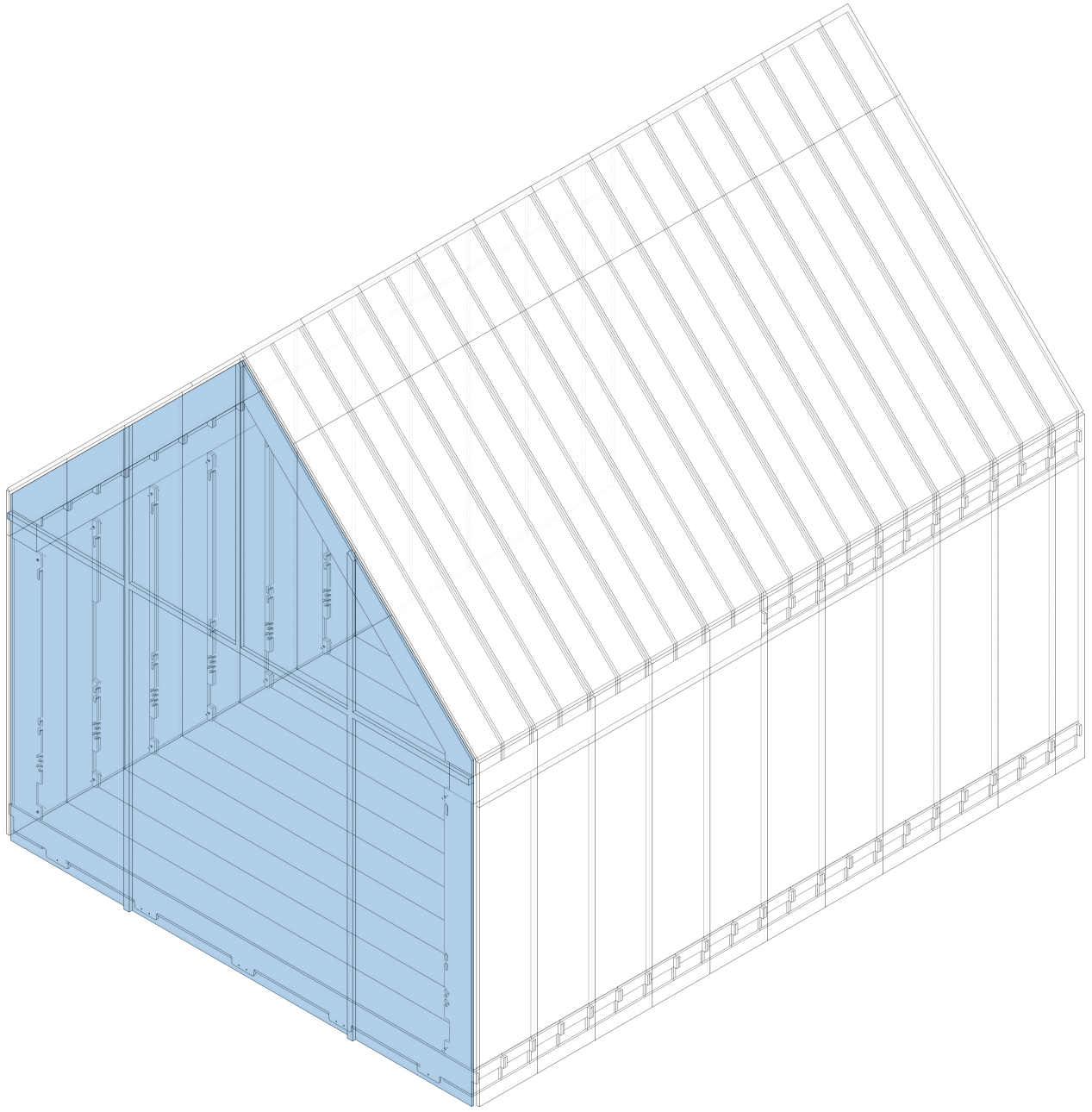
ROOF COMPONENTS



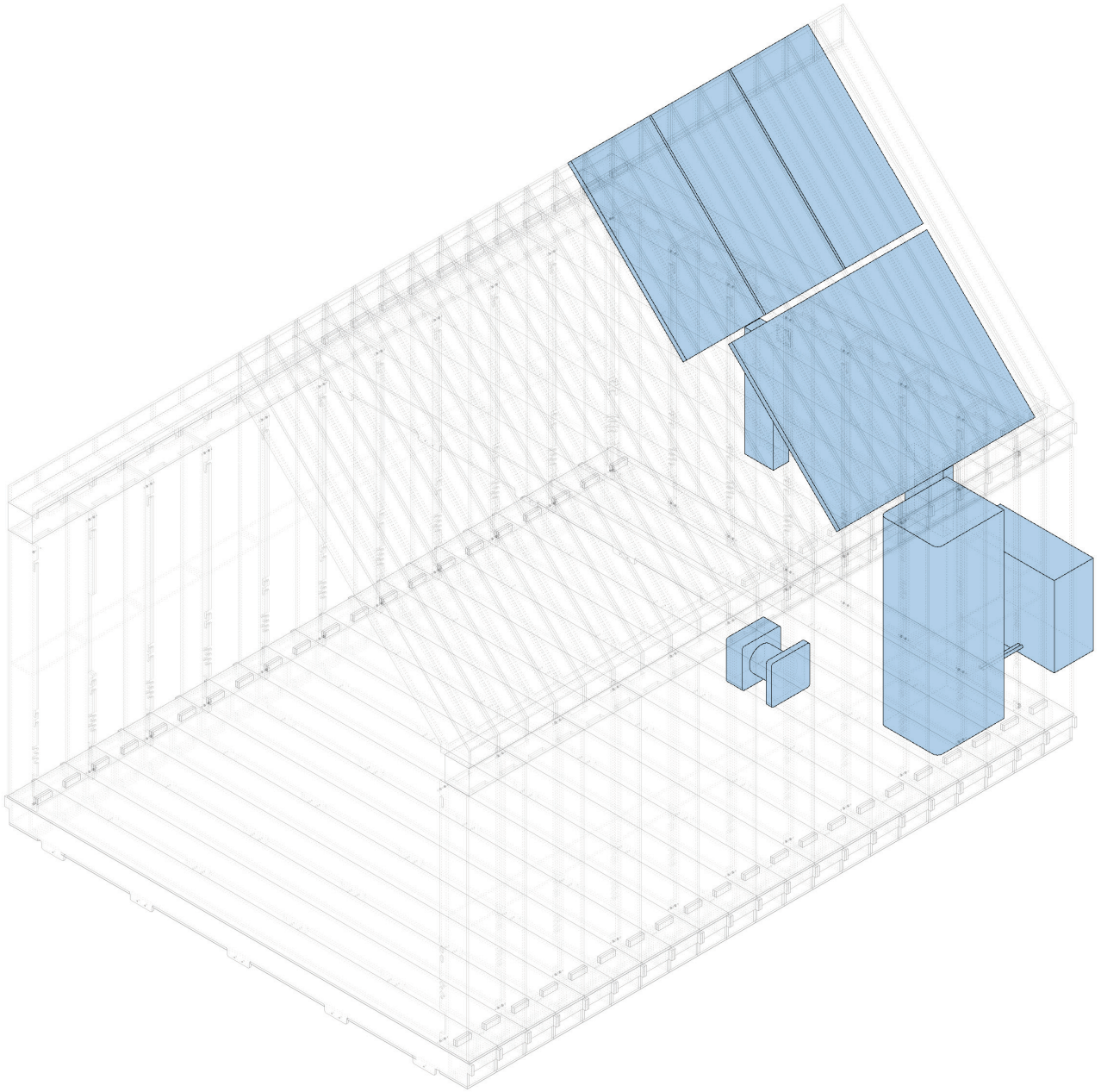
MODULAR FACADE PANELS



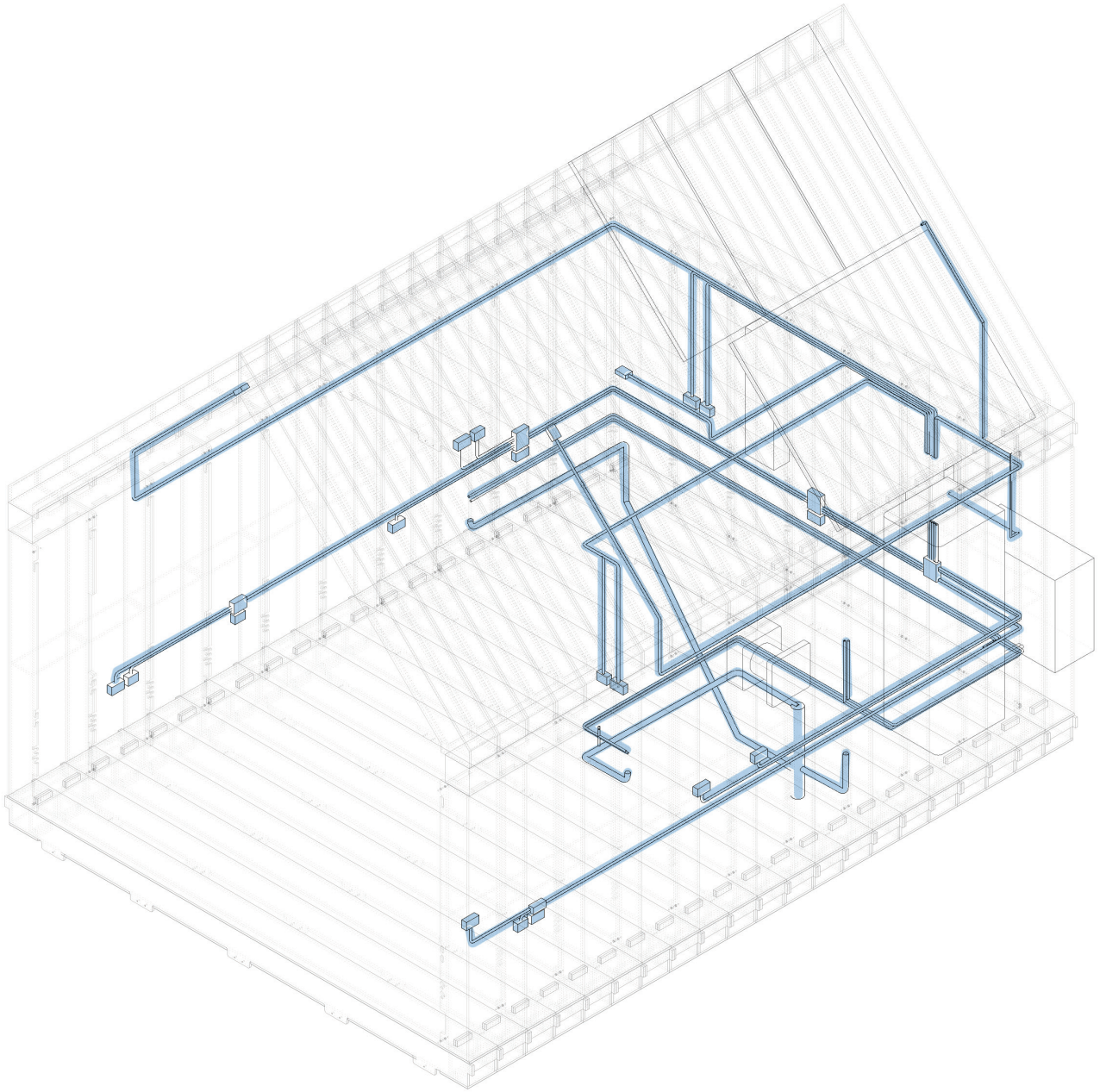
FRONT AND BACK FACADES



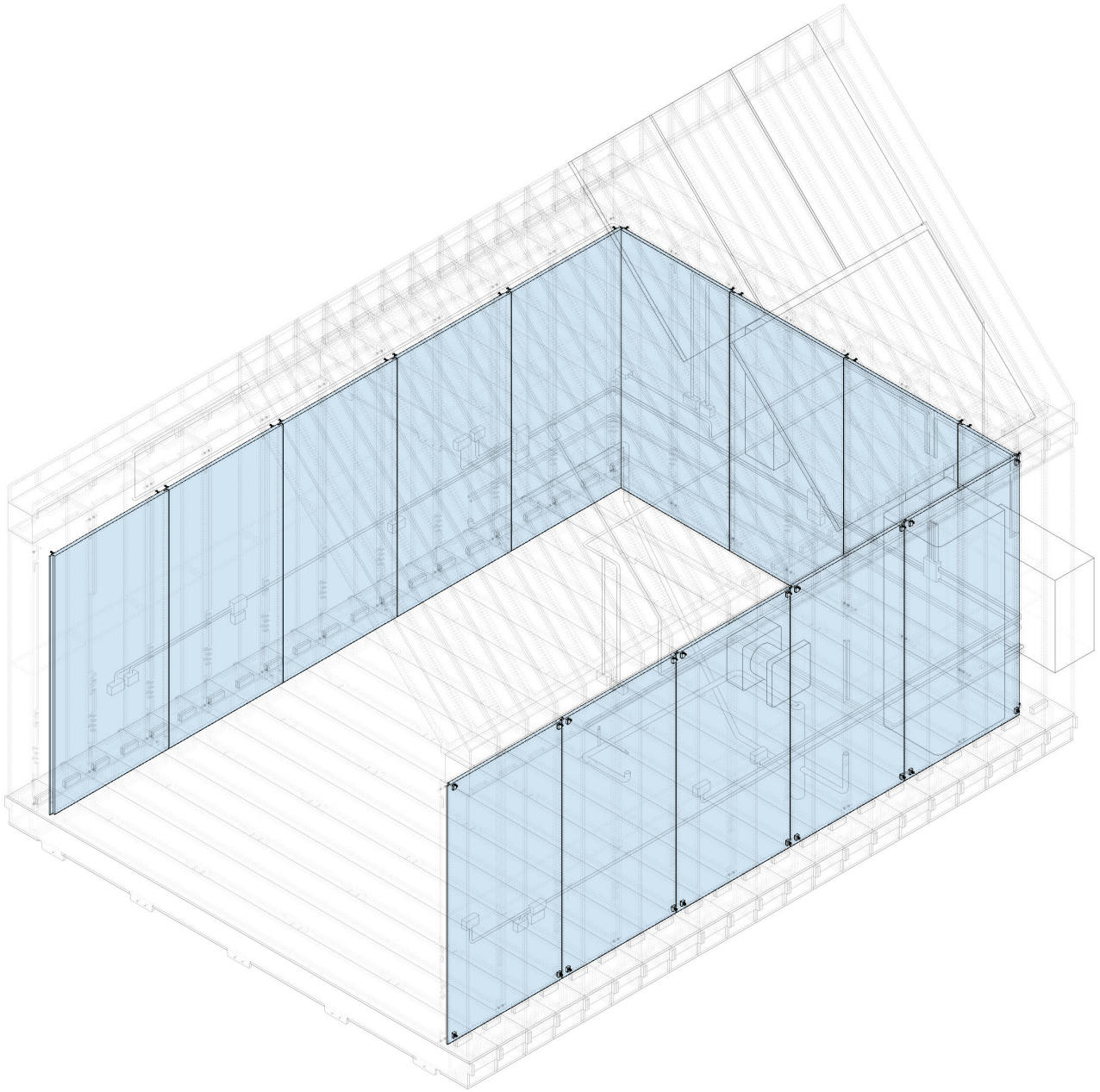
SOURCES



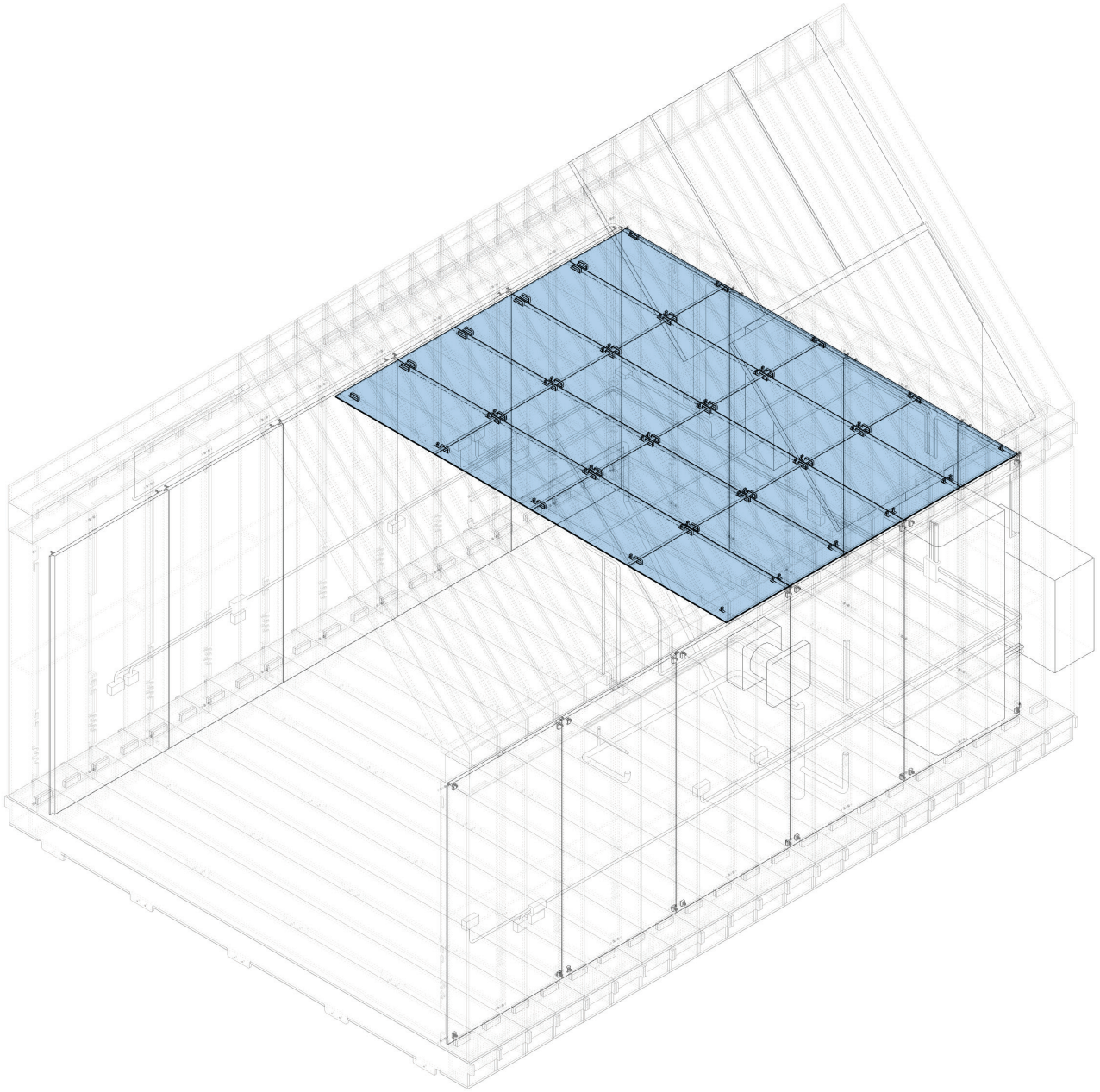
DISTRIBUTION



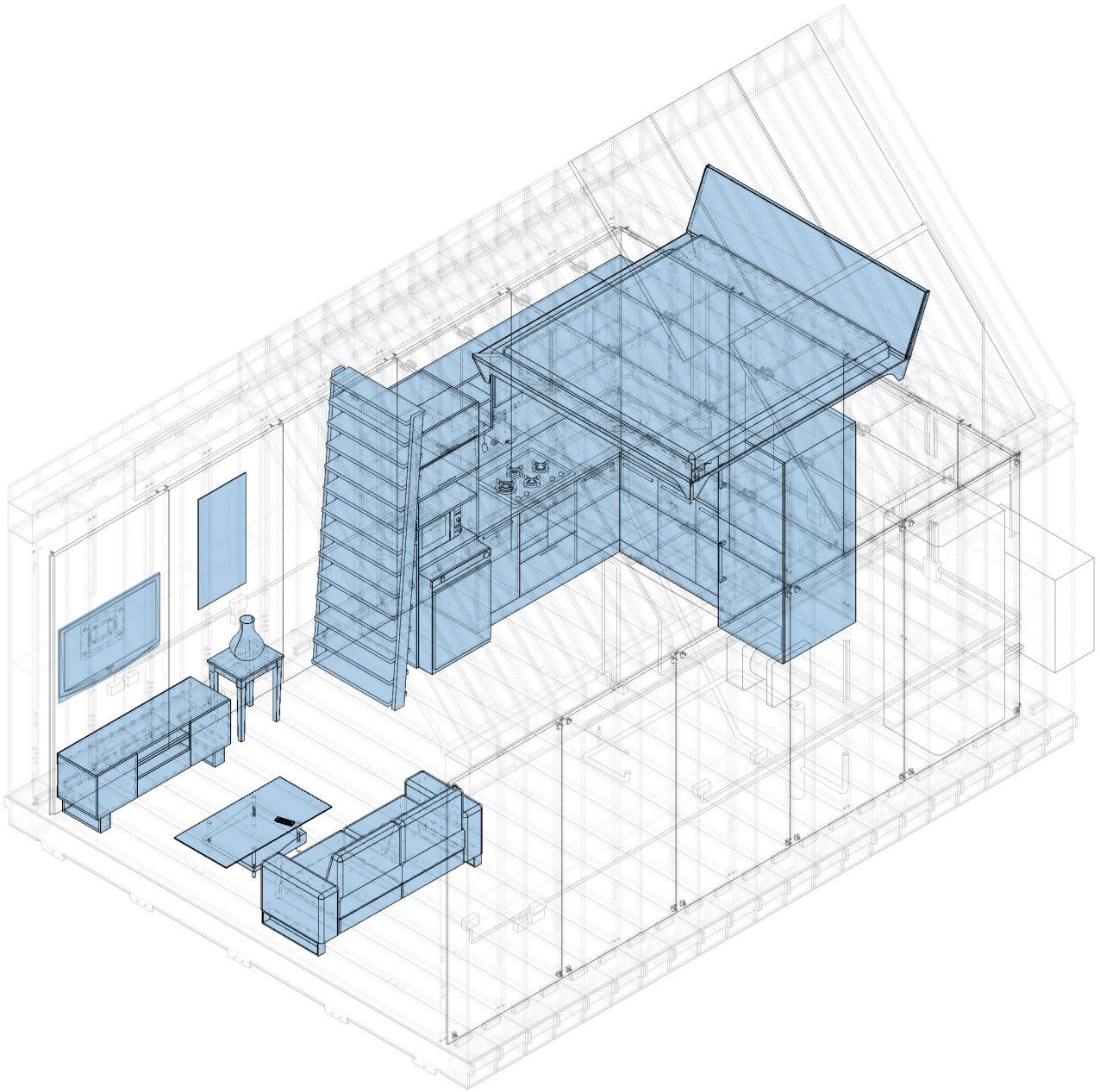
WALL FINISH PANELS

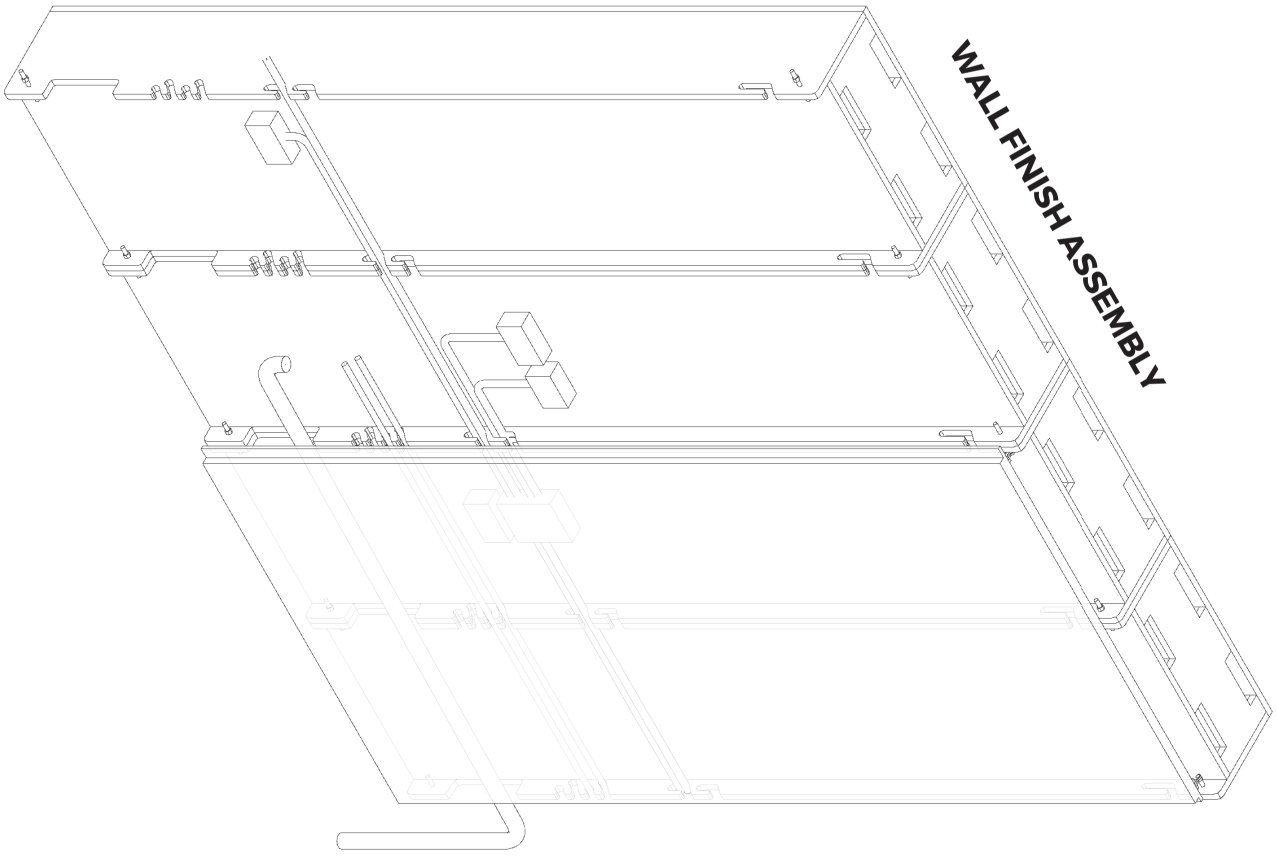


CEILING FINISH PANELS

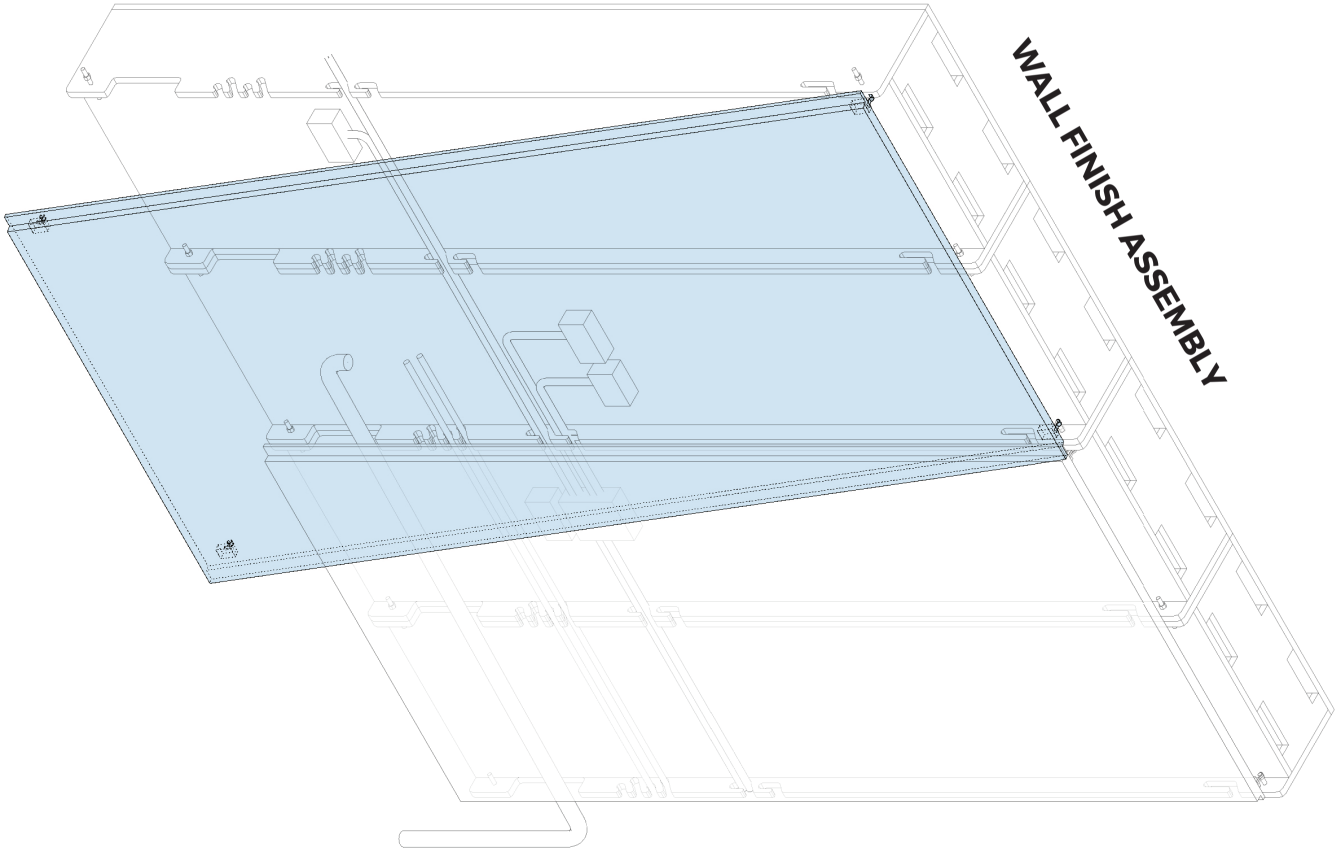


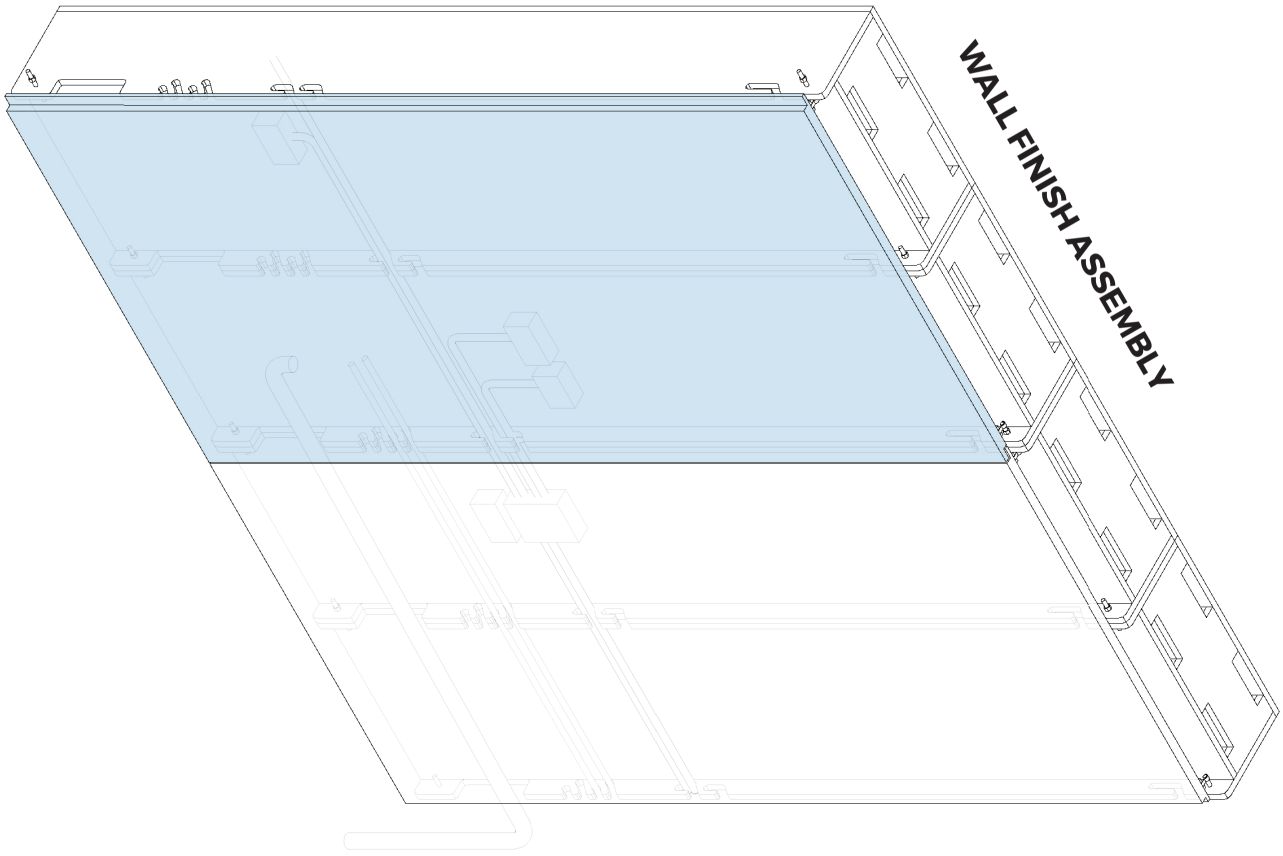
APPLIANCES AND FURNITURE



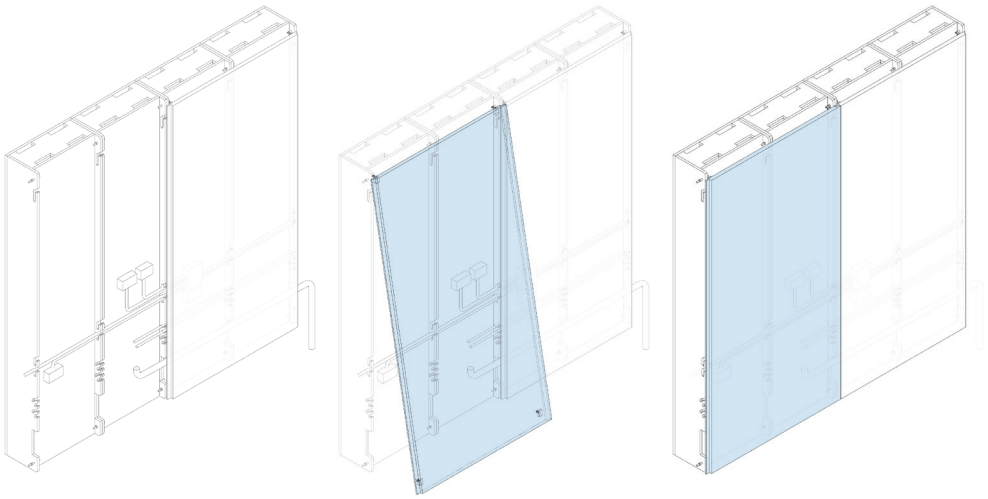


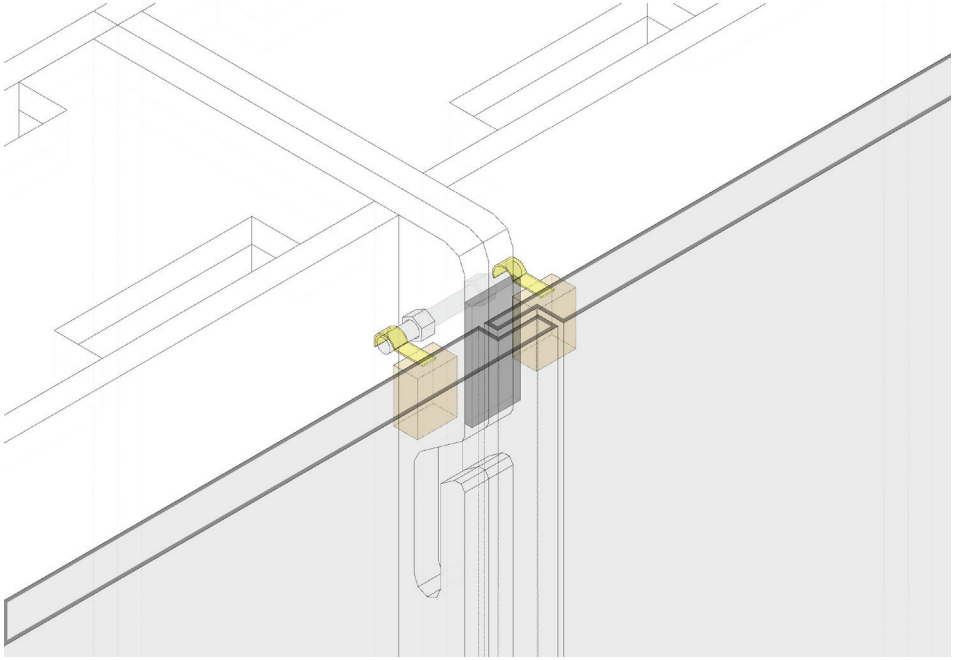
WALL FINISH ASSEMBLY


WALL FINISH ASSEMBLY

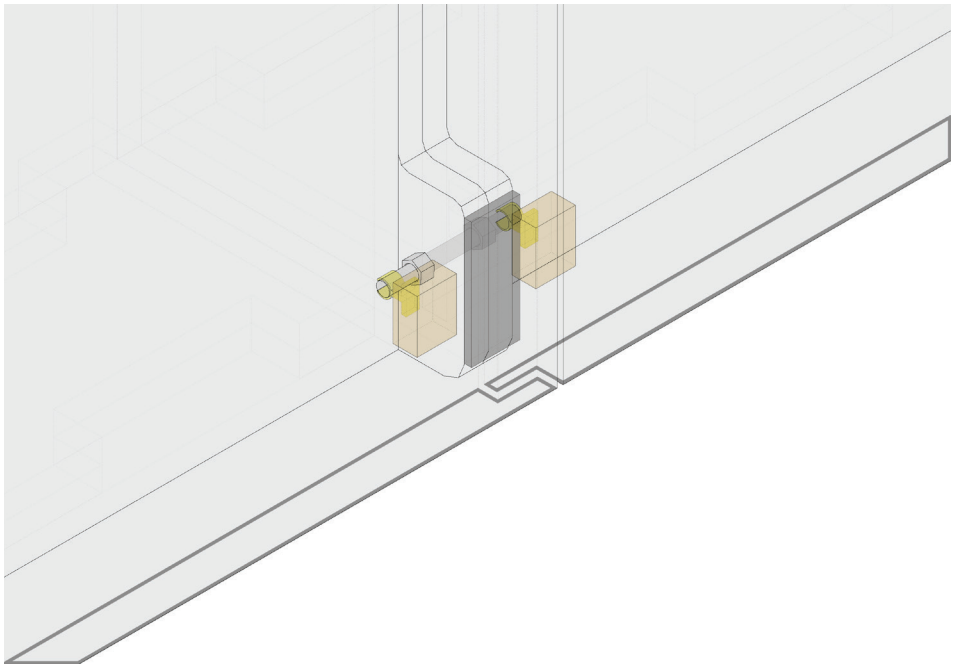

WALL FINISH ASSEMBLY

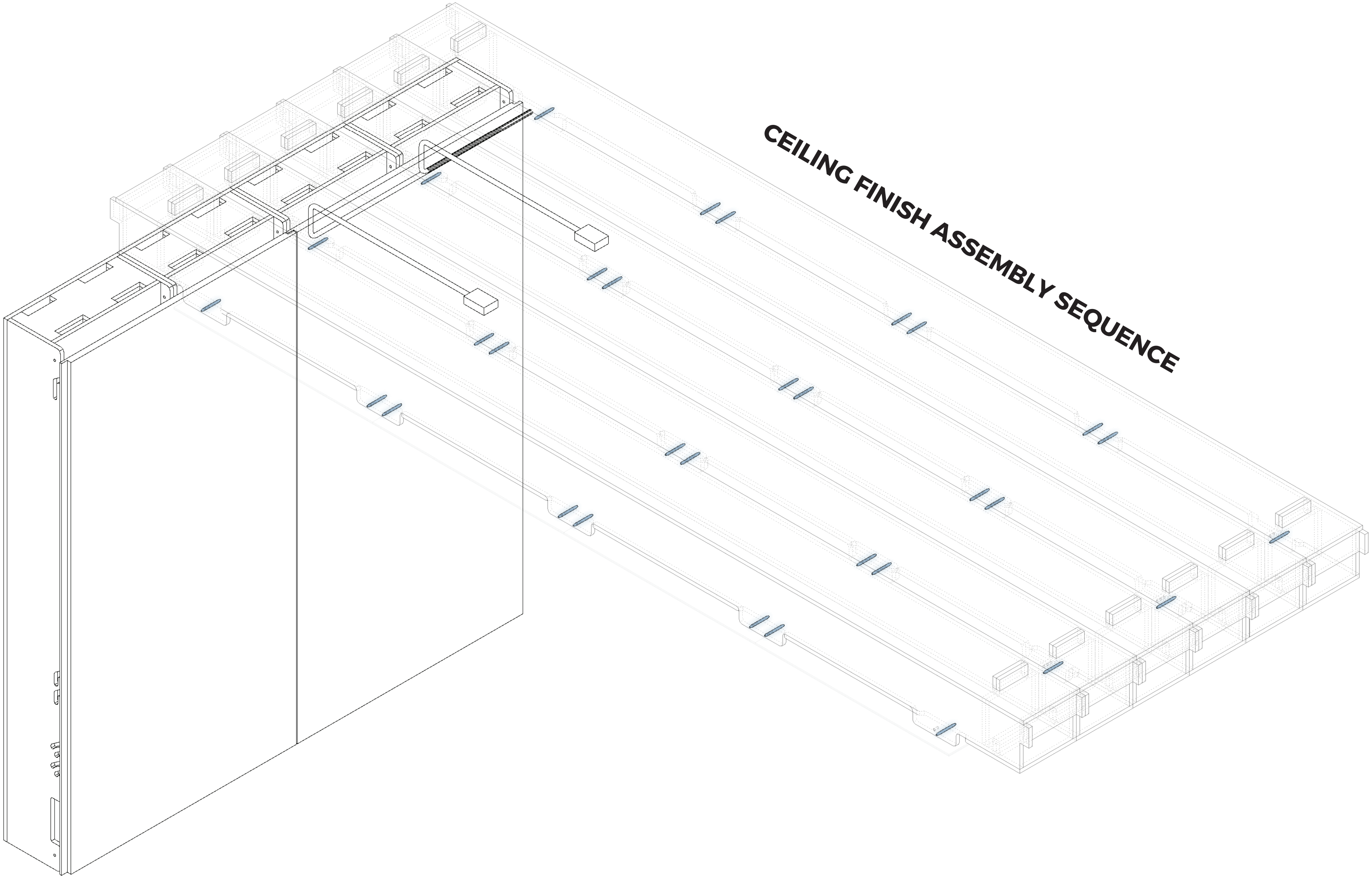
WALL FINISH ASSEMBLY SEQUENCE



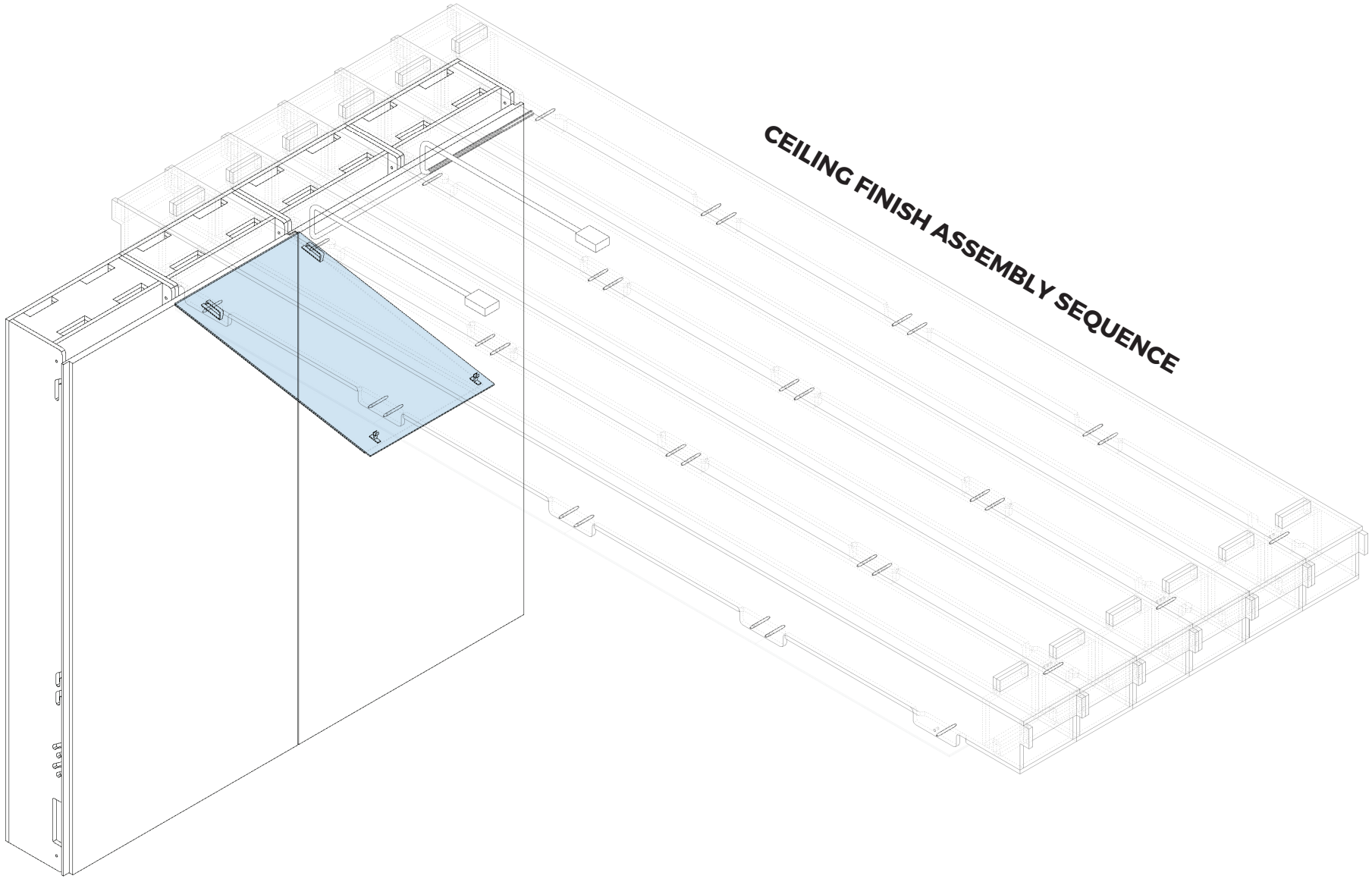


TOP AND BOTTOM CONNECTIONS




CEILING FINISH ASSEMBLY SEQUENCE

CEILING FINISH ASSEMBLY SEQUENCE



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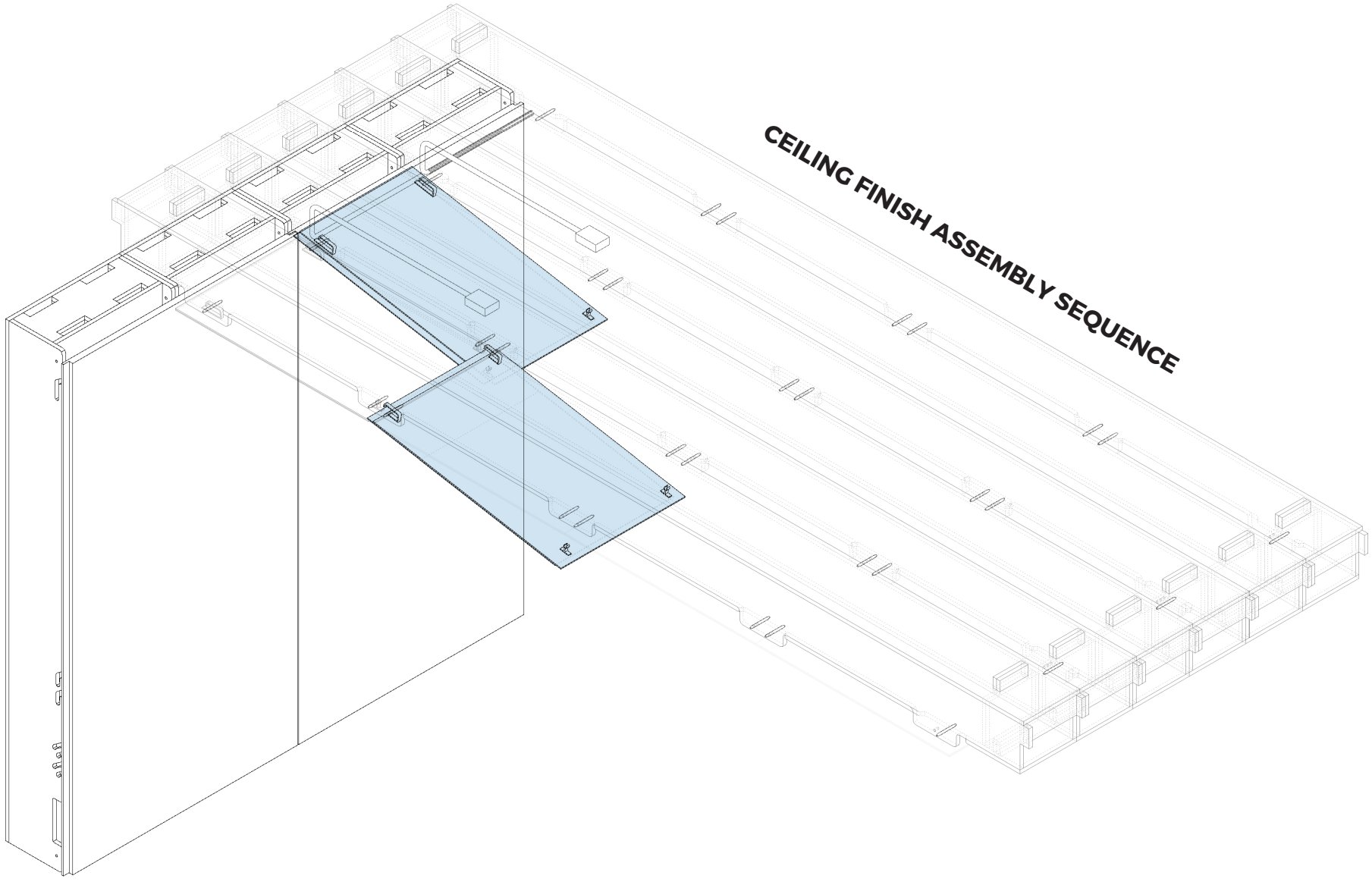
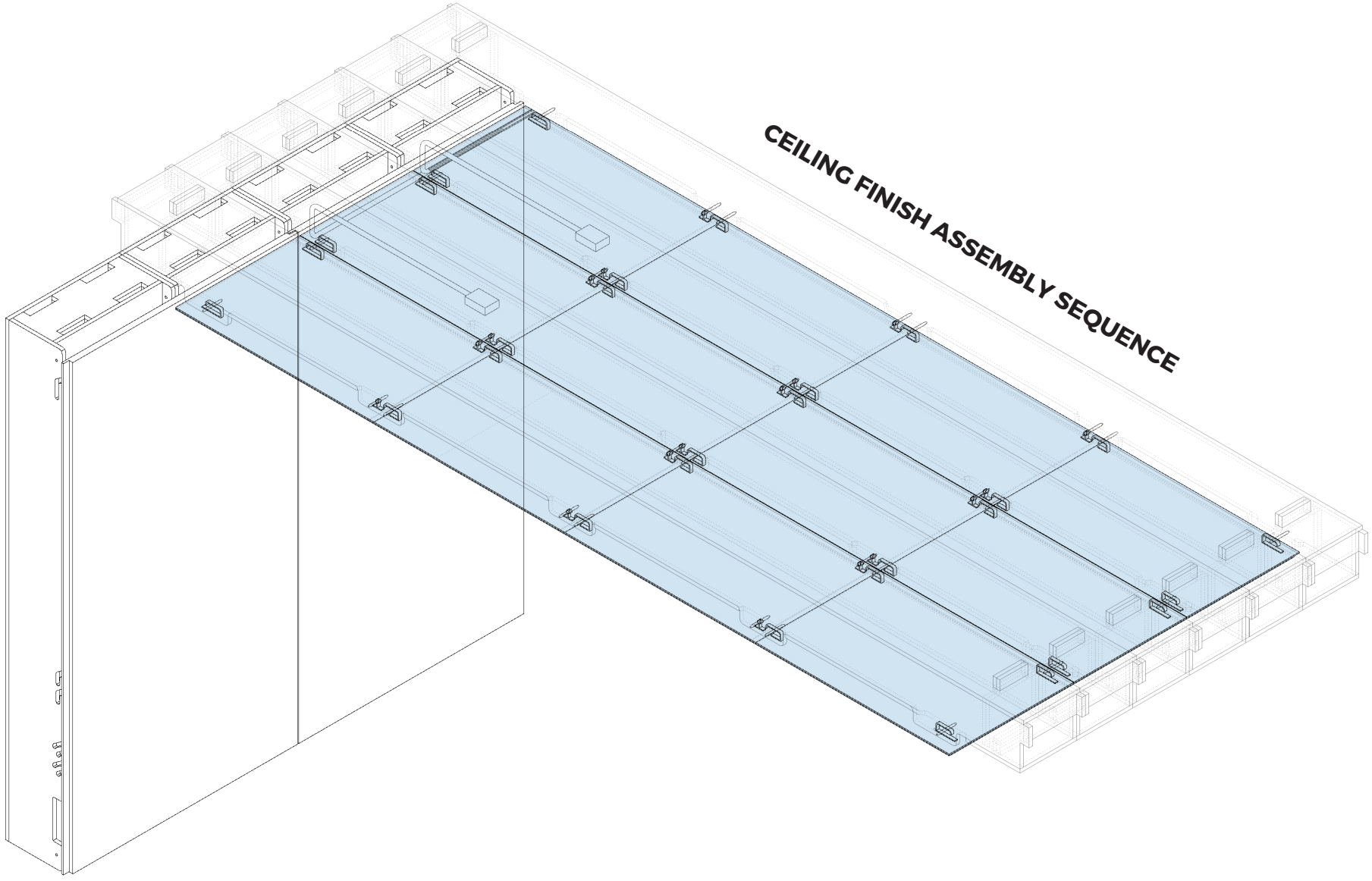
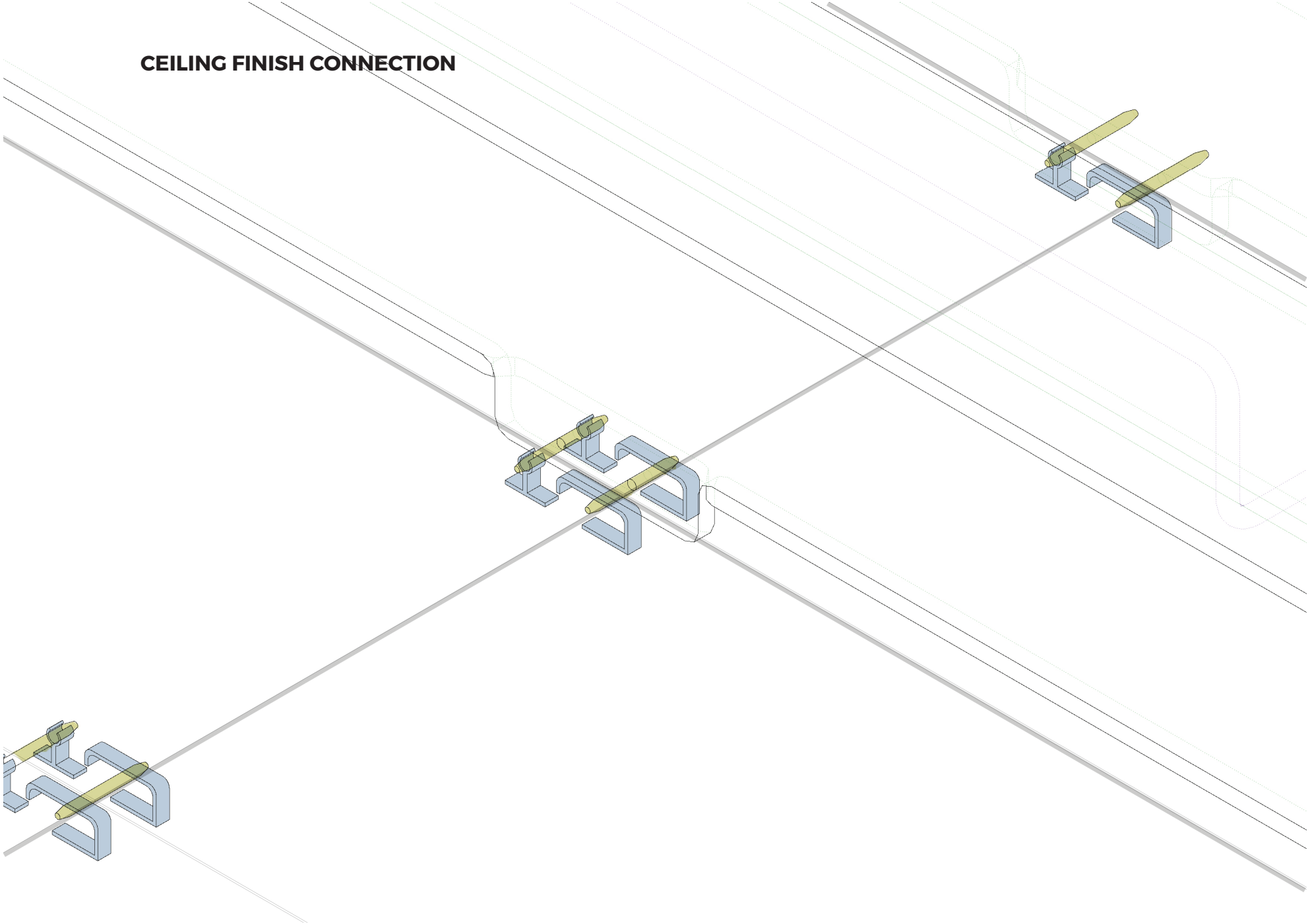
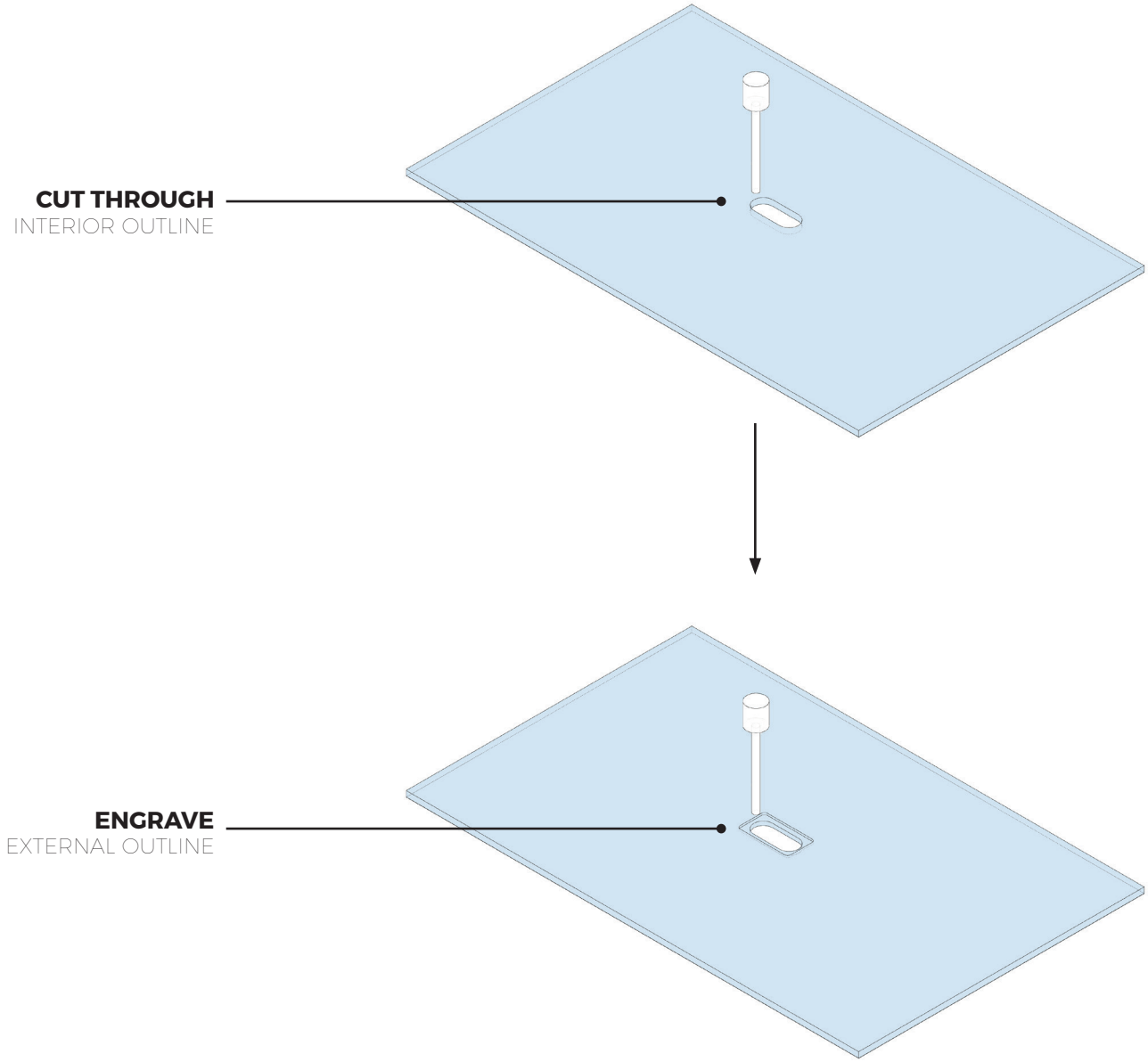


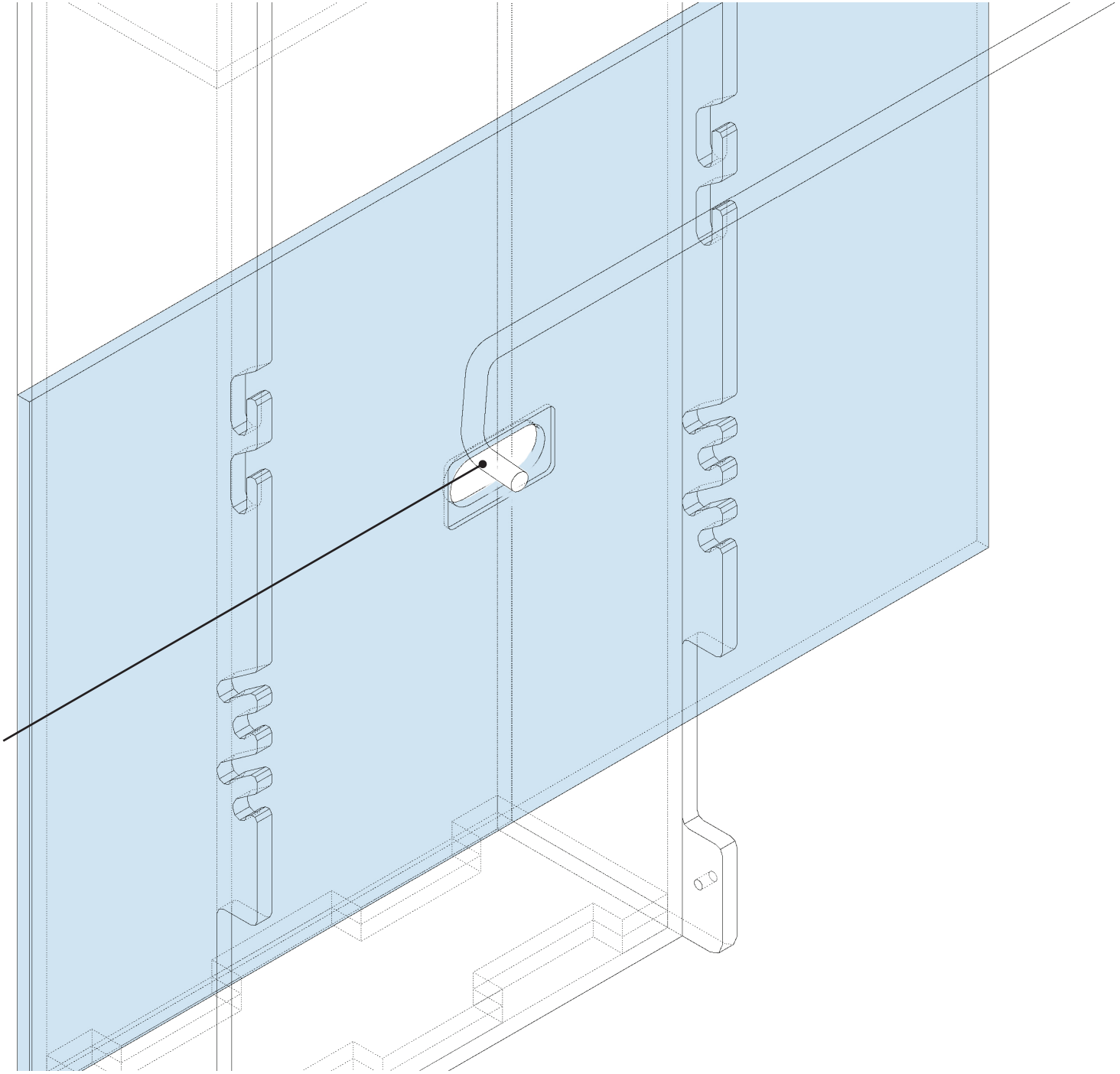
CEILING FINISH ASSEMBLY SEQUENCE



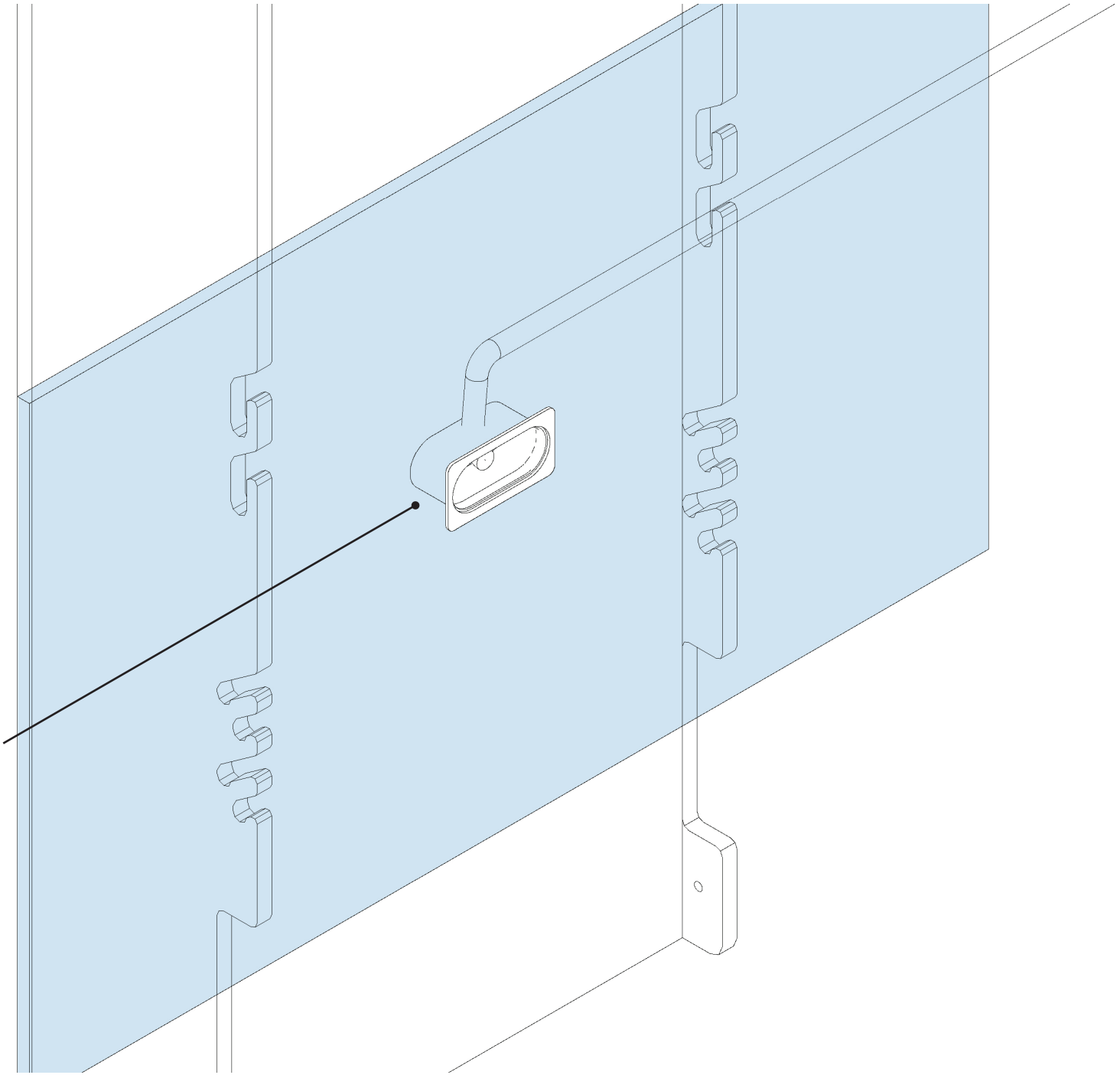
CEILING FINISH CONNECTION




CUT THROUGH
INTERIOR OUTLINE
ENGRAVE
EXTERNAL OUTLINE

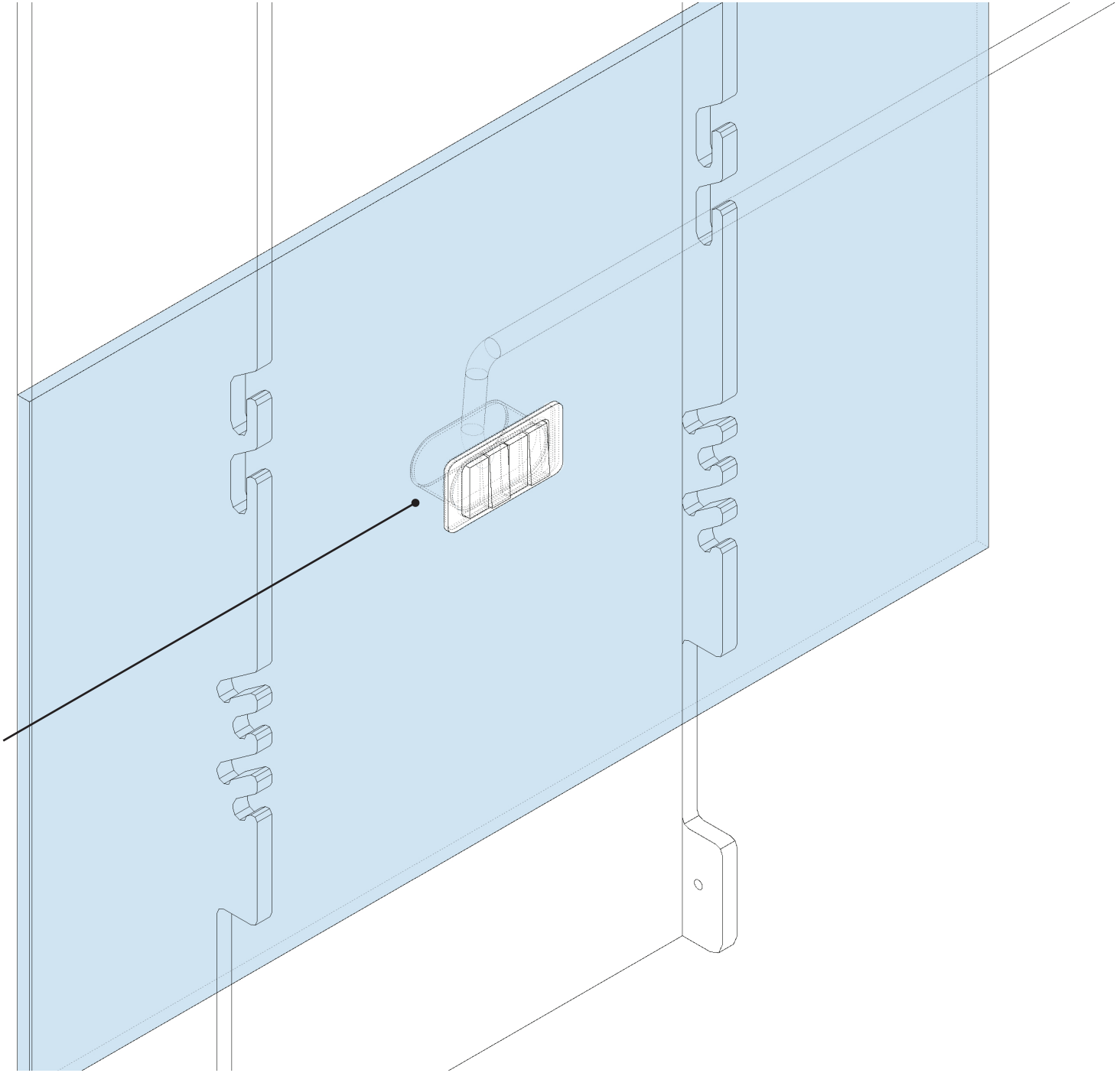


WALL PANEL FIXED
THE CABLE CAN BE PULLED OUT
FROM THE HOLE ON THE PANEL



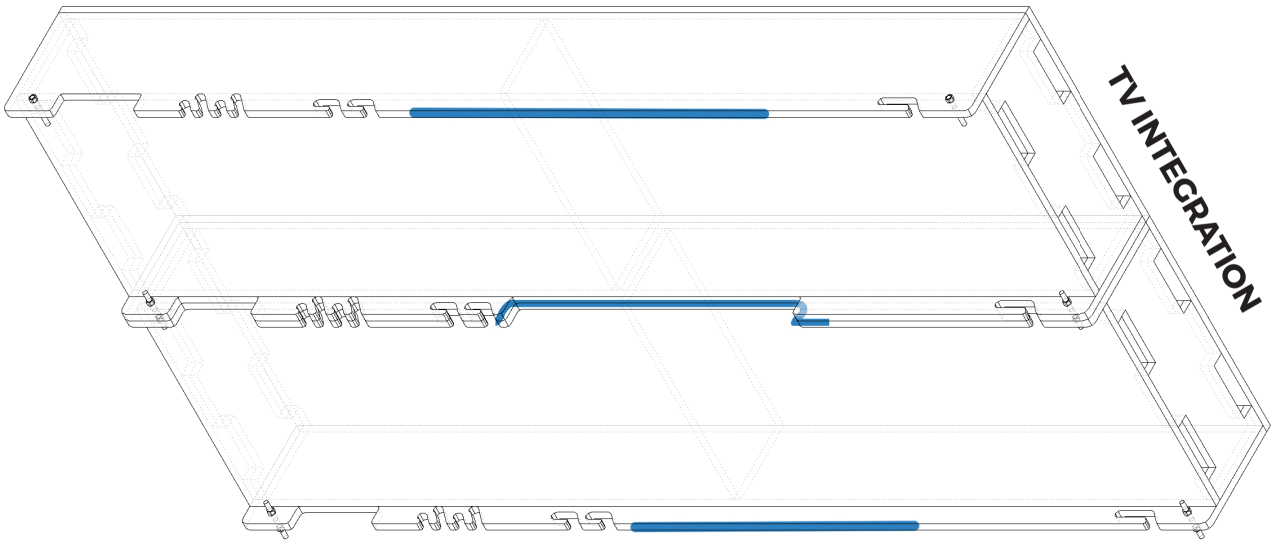
FLUSH BOX FIXED

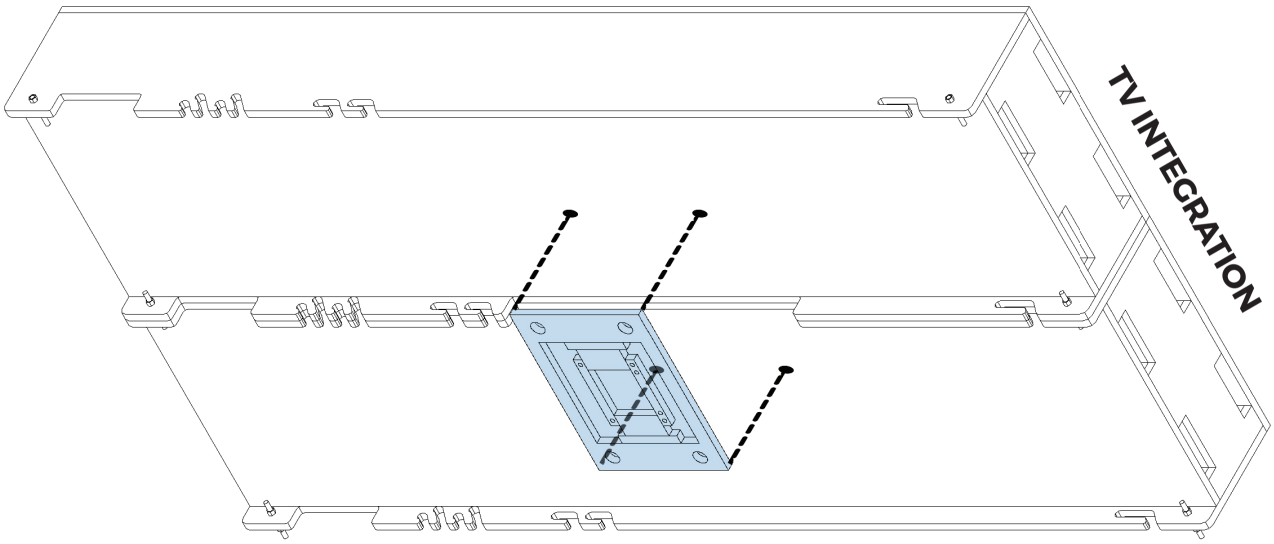
THE BOX CAN BE FIT INSIDE THE HOLE AND REST ON THE EXTERNAL ENGRAVING. IT IS THEN CLAMPED TO THE WALL PANEL FROM THE OUTSIDE

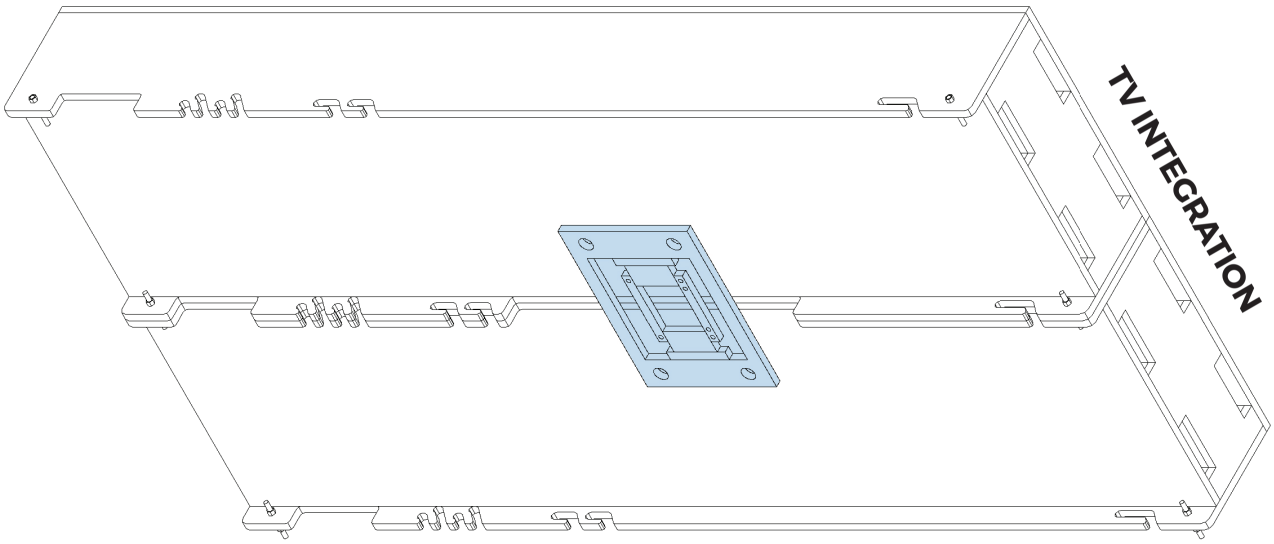


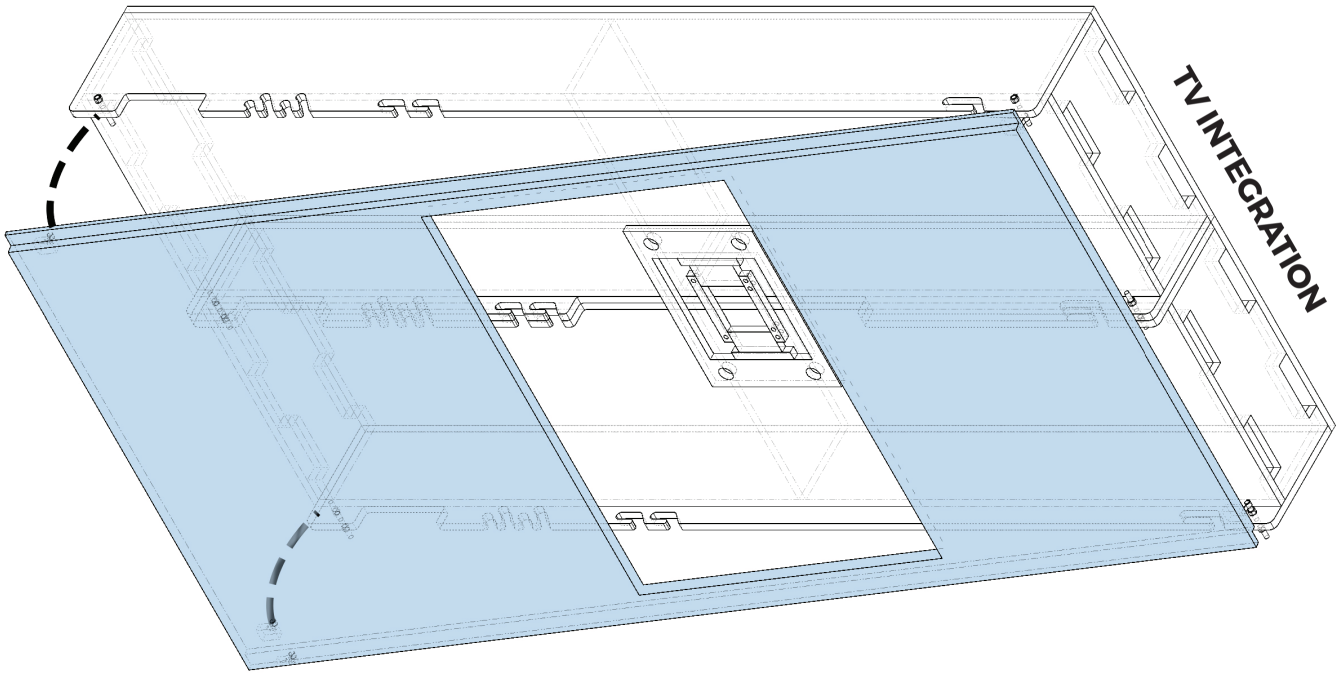
PLUGS/SWITCHES CLICKED

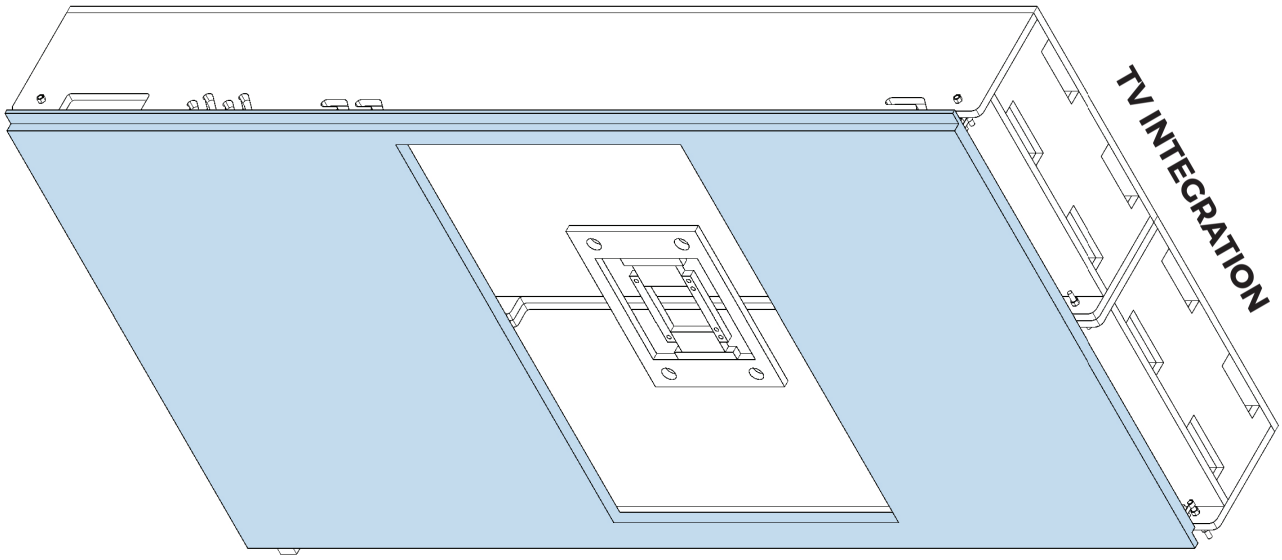
THE FINISHING ELECTRIC FRAME CAN BE SIMPLY CLICKED TO THE FLUSH BOX LEAVING A SEAMLESS CONNECTION


TV INTEGRATION


TV INTEGRATION


TV INTEGRATION


TV INTEGRATION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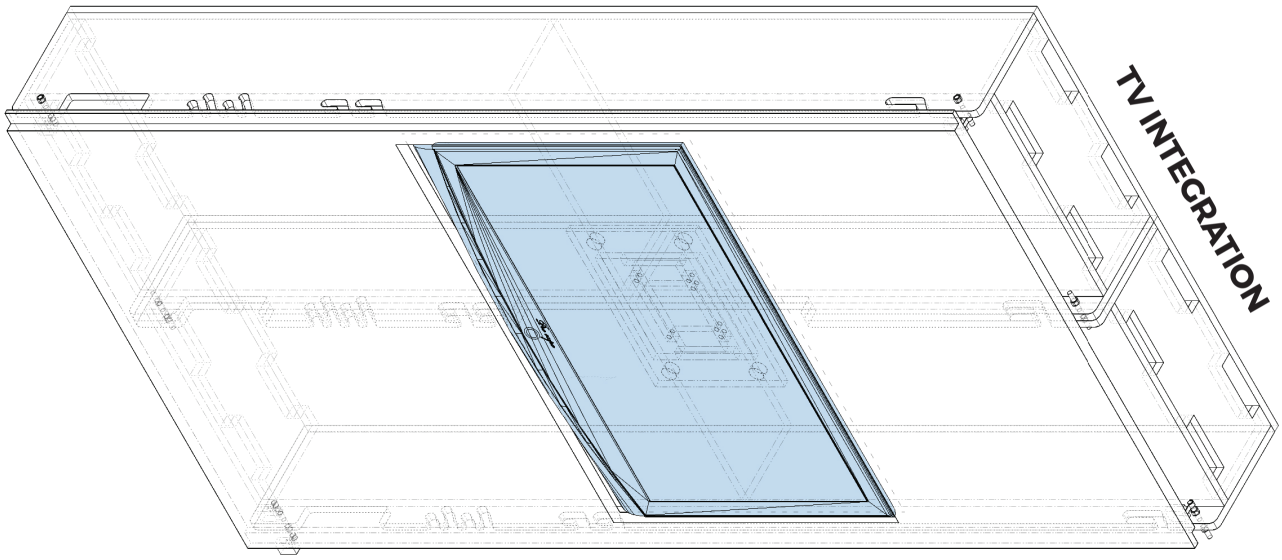
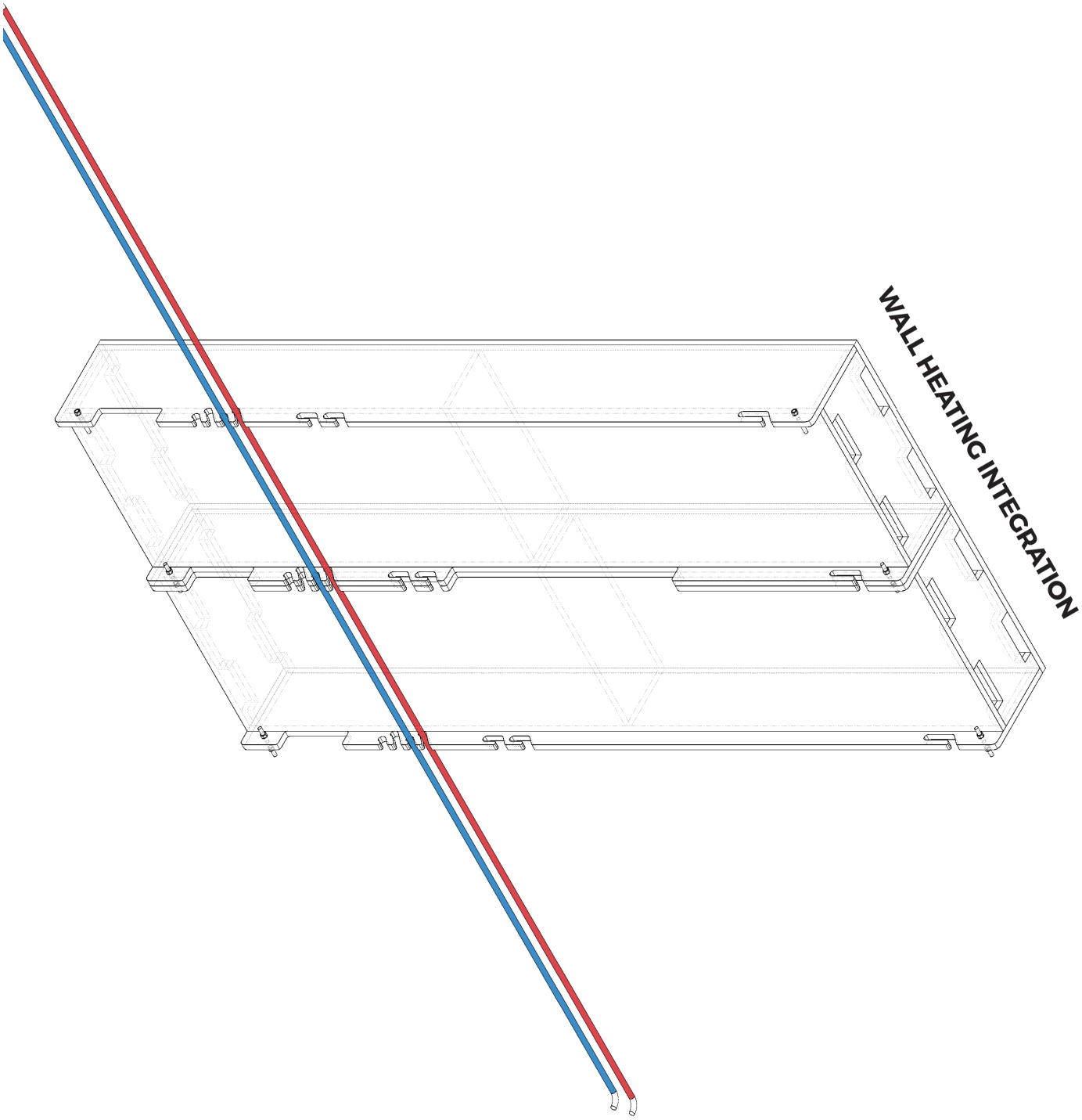
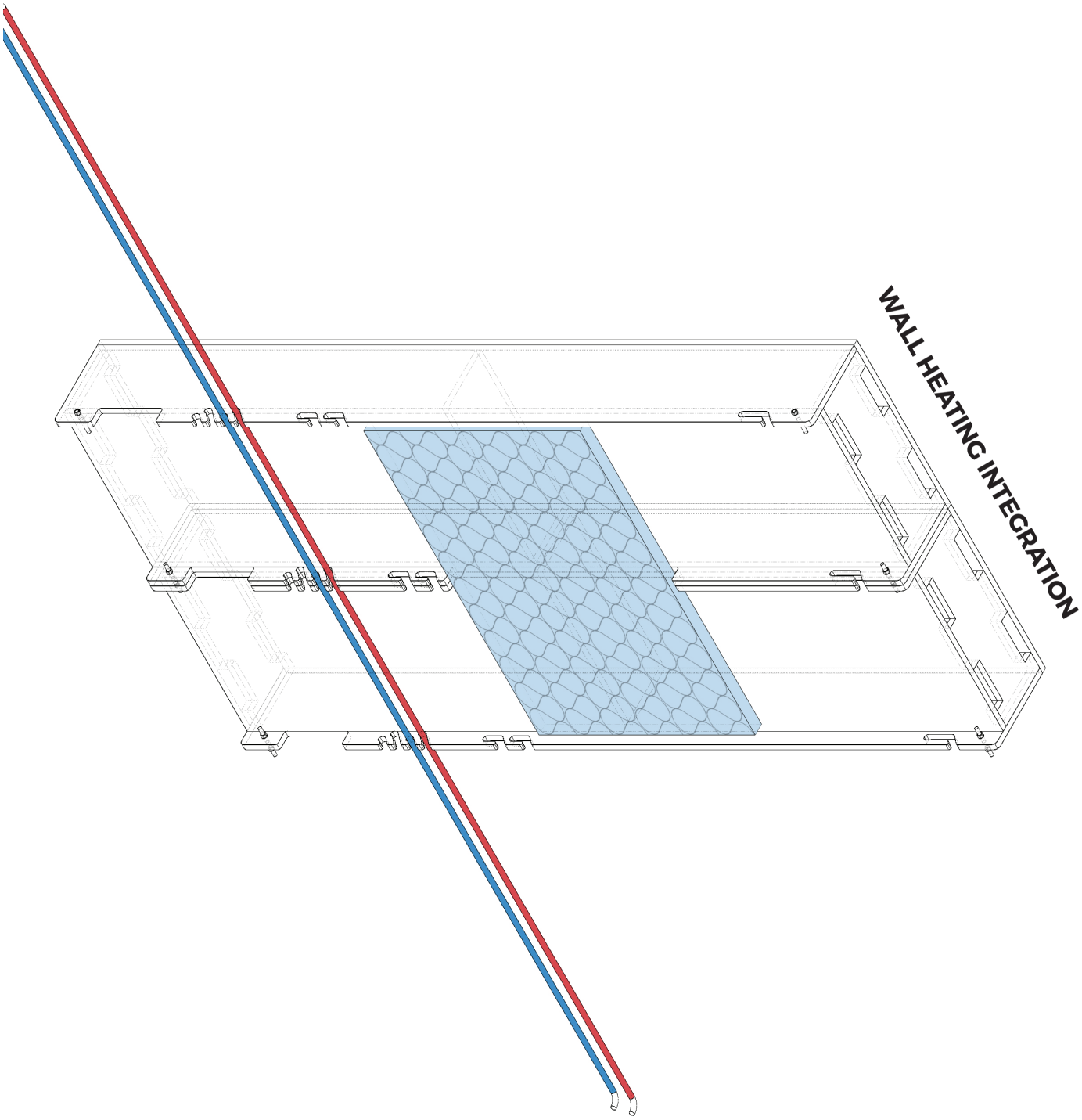


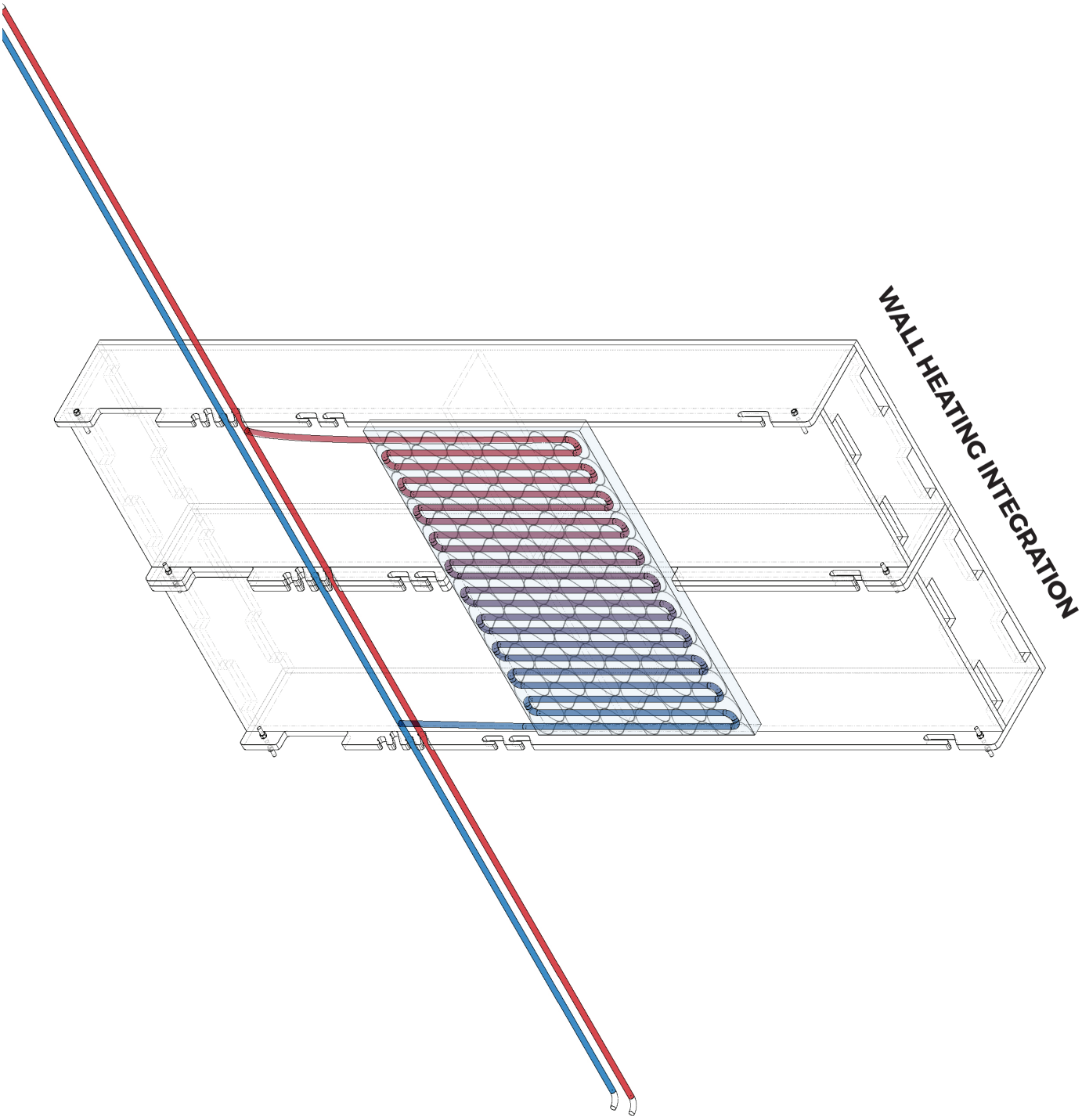
TV INTEGRATION



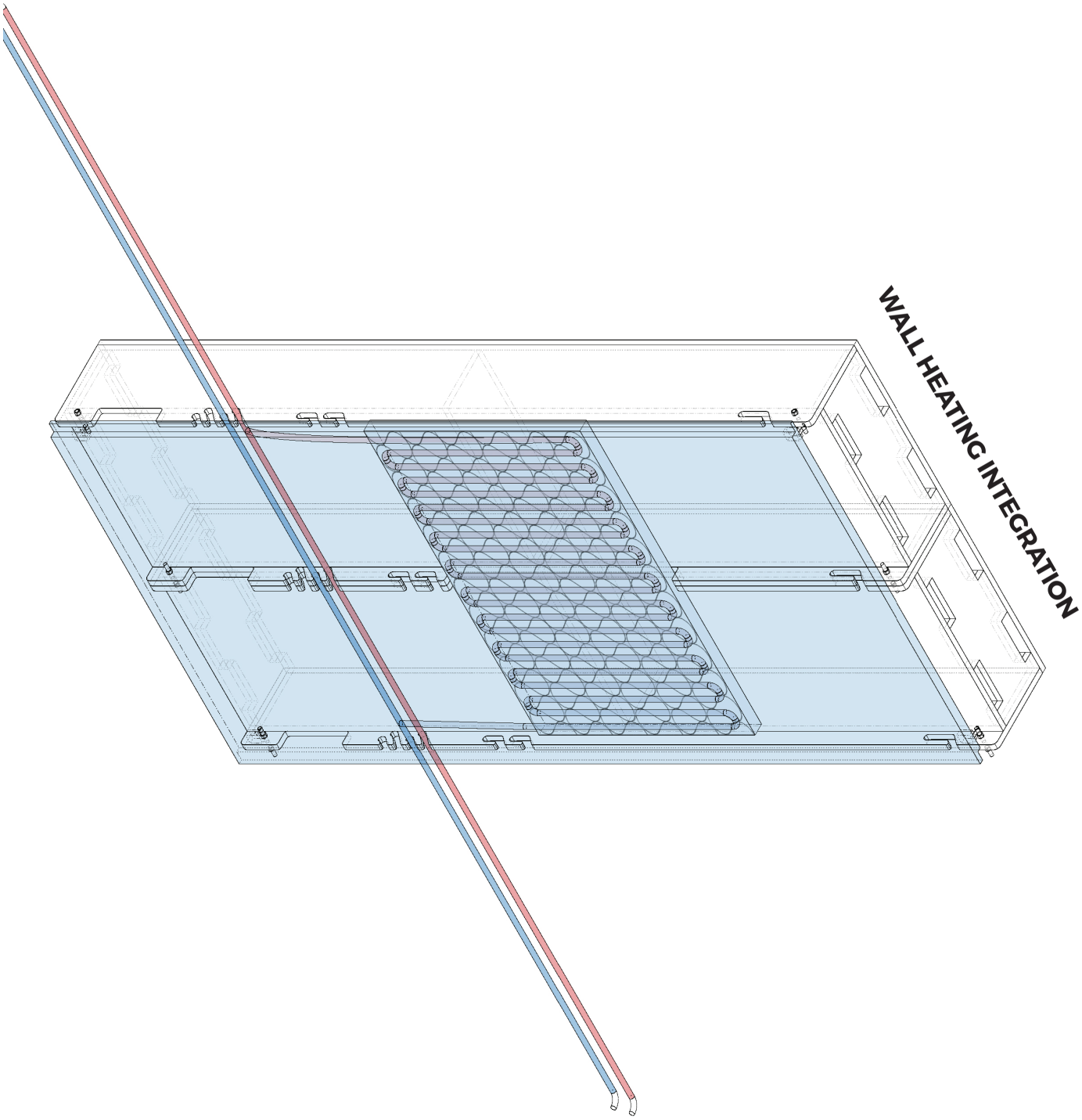
WALL HEATING INTEGRATION



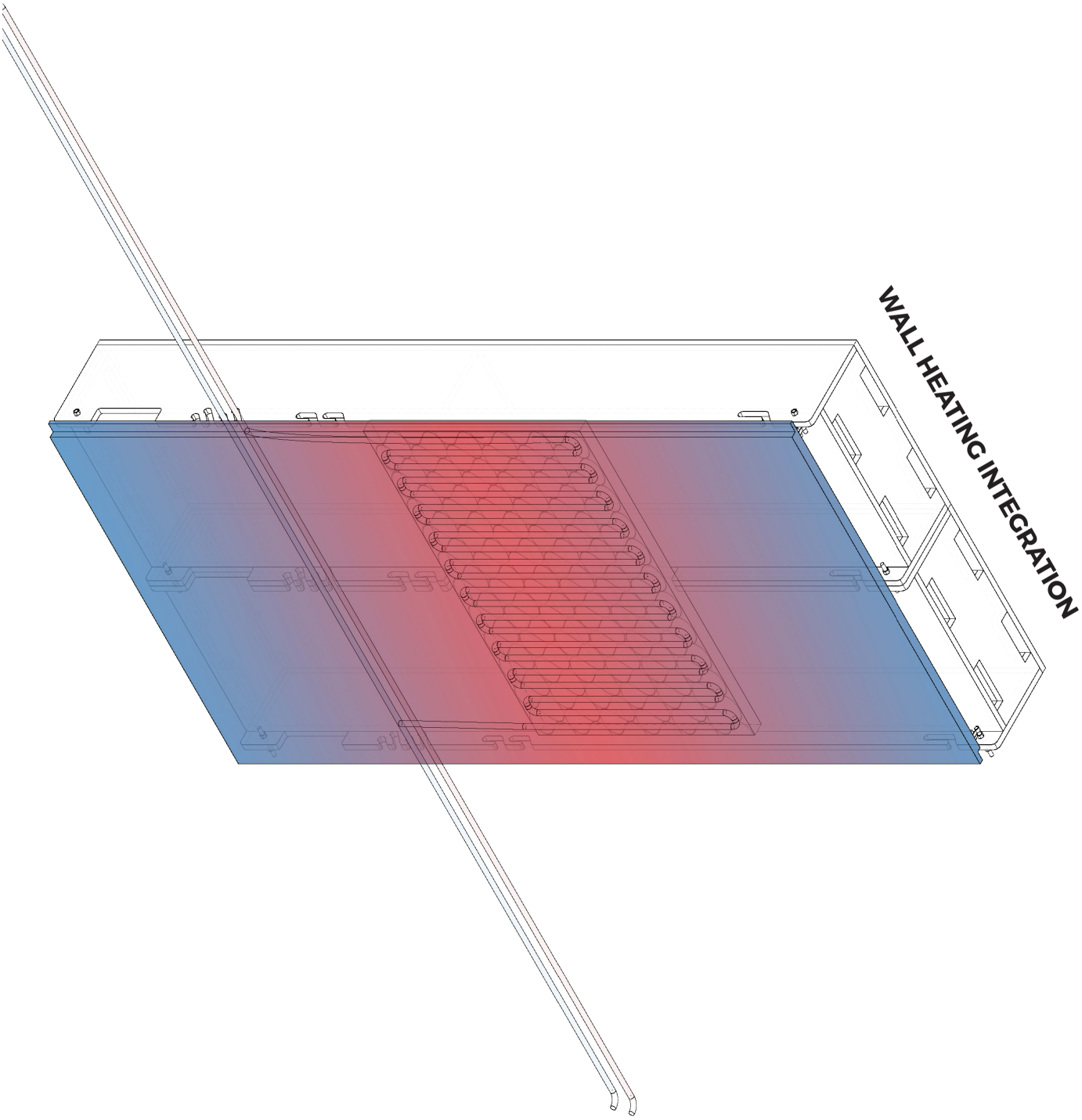
WALL HEATING INTEGRATION



WALL HEATING INTEGRATION

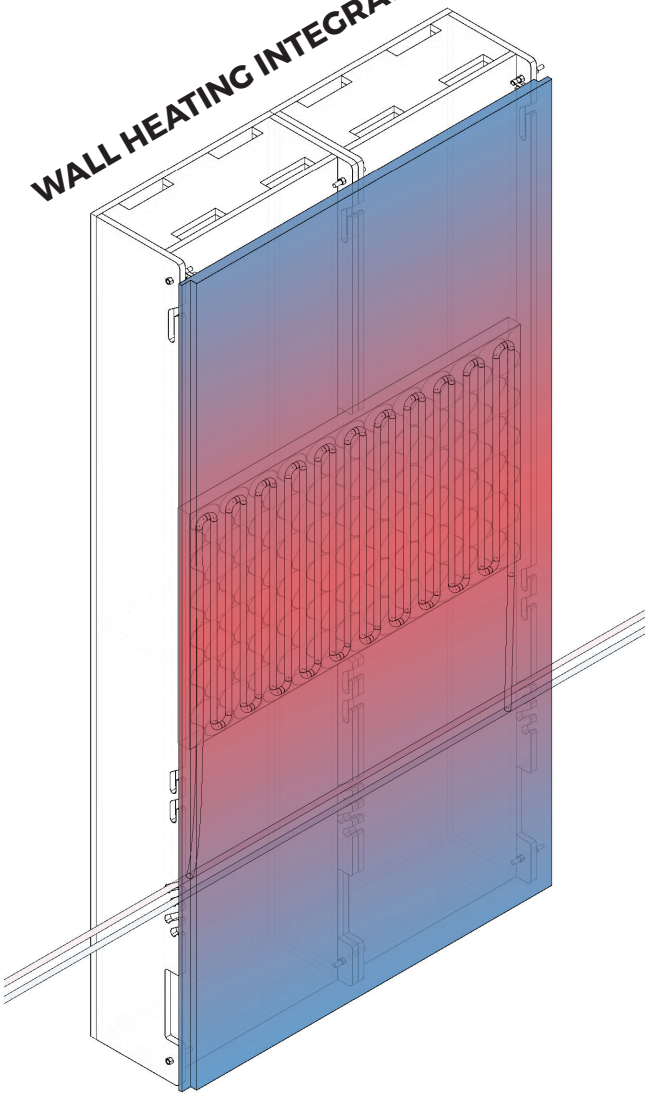


WALL HEATING INTEGRATION

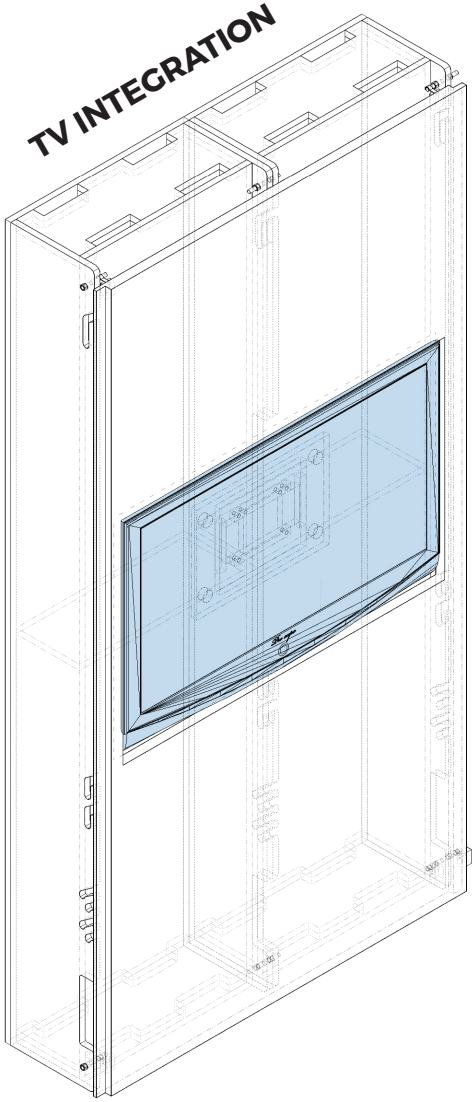


WALL HEATING INTEGRATION

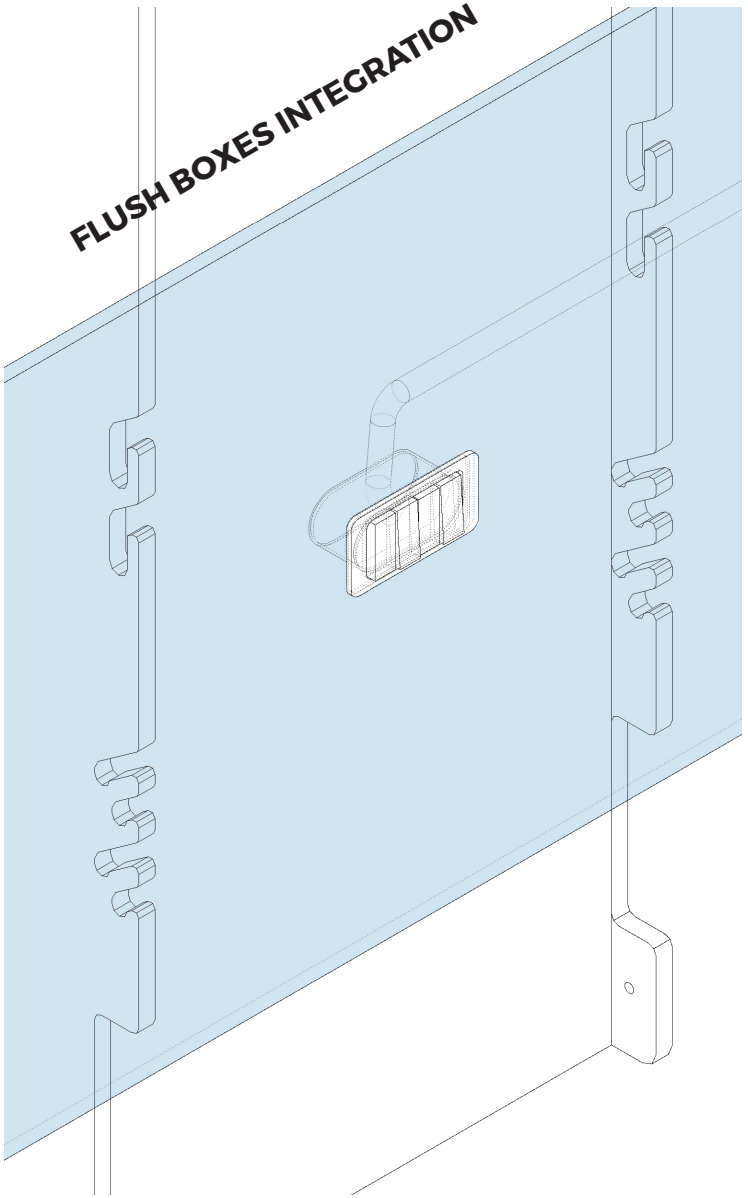
WALL HEATING INTEGRATION



TV INTEGRATION



FLUSH BOXES INTEGRATION



Thank you for the attention