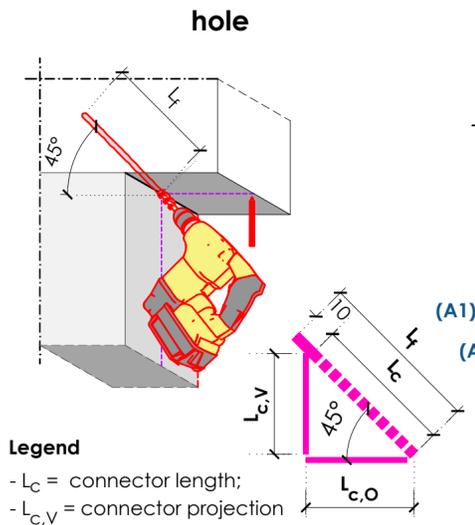
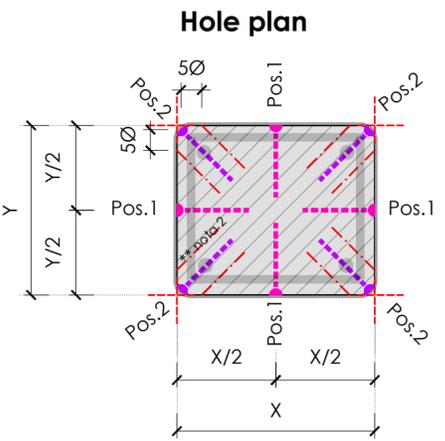
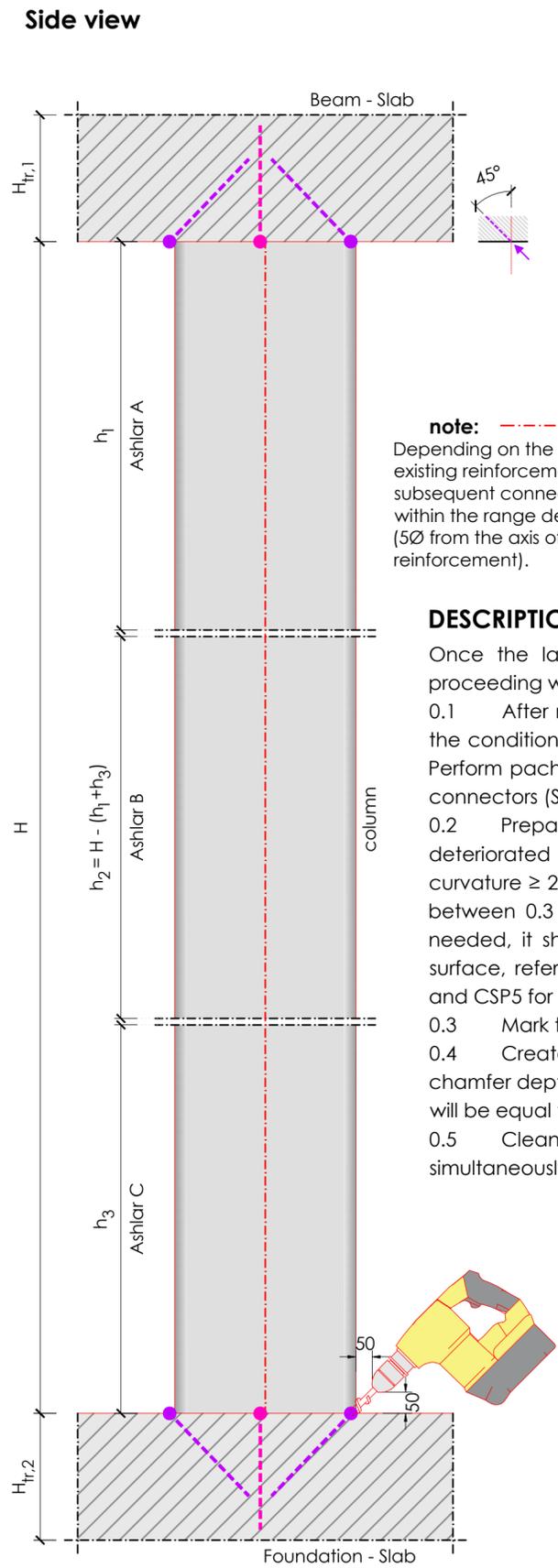




PHASE 0 - Tracing and creation of the holes (scale 1:10)

PHASE 1 - Anchoring of CFRP connectors (scale 1:10)

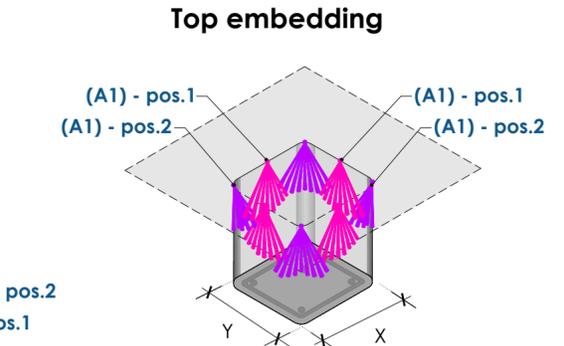
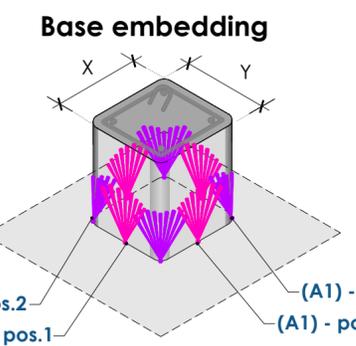
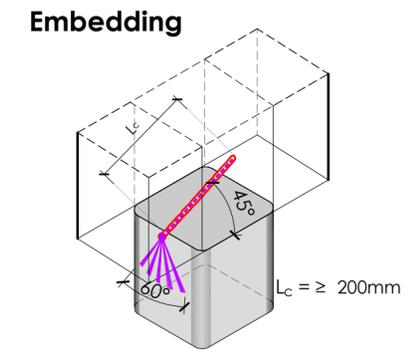
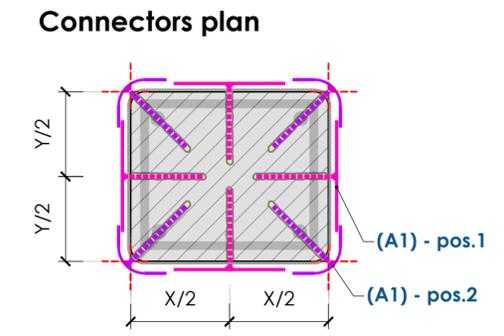
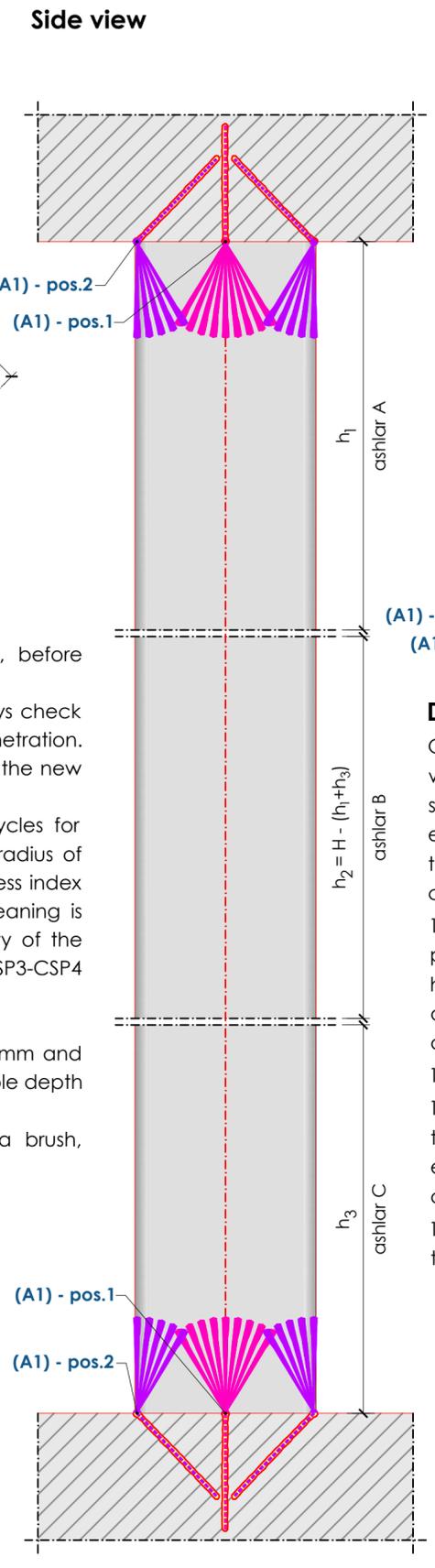


**note:**  
Depending on the actual position of the existing reinforcement, the hole and the subsequent connector can be shifted within the range defined by the red lines ( $5\phi$  from the axis of the existing reinforcement).

DESCRIPTION OF WORKS - PHASE 0

- Once the layout, type, and quantity of reinforcement to be applied have been defined, before proceeding with the installation, follow these preliminary operational steps:
- 0.1 After removing any existing plaster, perform mechanical cleaning of the substrate. Always check the condition of potential concrete degradation by testing carbonation depth and chloride penetration. Perform pachometric investigations to limit interference between the existing reinforcement and the new connectors (See Phase 1).
  - 0.2 Prepare the reinforced concrete substrate with any necessary concrete restoration cycles for deteriorated concrete. For details, refer to the reference drawings. Round the corners with a radius of curvature  $\geq 20$  mm. The application surface should not be "smooth" but "rough," with a roughness index between 0.3 - 0.5 mm. It must be free of oils, fats, and/or form release agents. If surface cleaning is needed, it should be done mechanically, preferably with sandblasting. To check the suitability of the surface, refer to the ICRI - International Concrete Repair Institute guidelines for classes CSP2-CSP3-CSP4 and CSP5 for in-situ laminates, and CSP6 for preformed reinforcements.
  - 0.3 Mark the holes to be made according to the graphic layout presented in this document.
  - 0.4 Create holes  $\phi$  12/14 mm for connector embedding, with a chamfer of the hole  $\phi$  16 mm and chamfer depth  $>10$  mm. Use a rotary hammer (no percussion). For non-through connectors, the hole depth will be equal to the length of the connector plus 10 mm.
  - 0.5 Clean the holes from any debris by blowing with a compressor or brushing with a brush, simultaneously vacuuming the dust with a suitable vacuum cleaner.

HOLE TABLE						
Identification		Characteristics				
Pos.	Ashlar	N. holes	$\phi$ holes	Chamfer	Inclination	Hole length $L_f$
Pos .1	A head	4	12/14 mm	$> 16$ mm	45°	$L_{c,v} \leq 3/4 H_{tr,1} + 10$ mm
						$L_{c,v} \geq 200 + 10$ mm
Pos .1	C Base					$L_{c,v} \leq 3/4 H_{tr,2} + 10$ mm
						$L_{c,v} \geq 200 + 10$ mm
Pos .2	A head					$L_{c,v} \leq 3/4 H_{tr,1} + 10$ mm
						$L_{c,v} \geq 200 + 10$ mm
Pos .2	C Base					$L_{c,v} \leq 3/4 H_{tr,2} + 10$ mm
						$L_{c,v} \geq 200 + 10$ mm



DESCRIPTION OF WORKS - PHASE 1

- Once the layout, type, and quantity of reinforcement to be applied have been defined, wait for the curing of the restoration mortar according to the product technical data sheets. In any case, verify the moisture content of the substrate, which must be  $< 10\%$ , even by making a hole to the depth of the restoration mortar thickness. The installation of the connectors must be carried out after the preliminary surface preparation and hole creation phases (See Phase 0), proceeding with the following operational steps:
- 1.1 After thoroughly cleaning the holes (See Phase 0.5) and surfaces, apply the epoxy primer type **FB-RC01** according to the instructions in the technical data sheet. Wait for 1 hour but do not exceed 3 hours. During this waiting period, proceed with the installation of the connectors according to the instructions in the subsequent phases, after applying a layer of impregnation resin **FB-RC.02** only at the bowed points.
  - 1.2 Inject resin for bar embedding (connectors) type **FB-RC30/3.;**
  - 1.3 Embed the bowed bars on one side (non-through connectors) positions 1 and 2 type **FB-TUP10-CHT1A  $\phi$ 10**, inclined at 45°, without performing the bowing. The embedding operation must be performed by rotating the bar to ensure perfect adhesion of the resin both to the bar and to the lateral surface of the hole.
  - 1.4 Bow at a 60° angle on the bars in position 1 placed in phase 1.3, and impregnate them with resin type **FB-RC02**. Perform the same procedure for the bars in position 2.;

Legend

- X/ Y = sides of the column;
- $\phi$  = hole diameter (12 -14 mm);
- $L_c$  =connector length;
- H=height of the column;
- $h_1/h_2/h_3$ = height of the column units;
- $b_f$  = reinforcement width.

MATERIAL IDENTIFICATION

- (A1) **FB-TUP10-CHT1A** (Bowed rods in C.F.R.P.)
- (B-C) **FB-GV.....-.....** (Unidirectional fabric in C.F.R.P.)
- (P1) **FB-RC01** (Epoxy resin – Primer)
- (P2) **FB-RC02** (Epoxy resin – Impregnating agent)
- (P3) **FB-RC30/3** (Epoxy resin – Grouting/Anchoring)

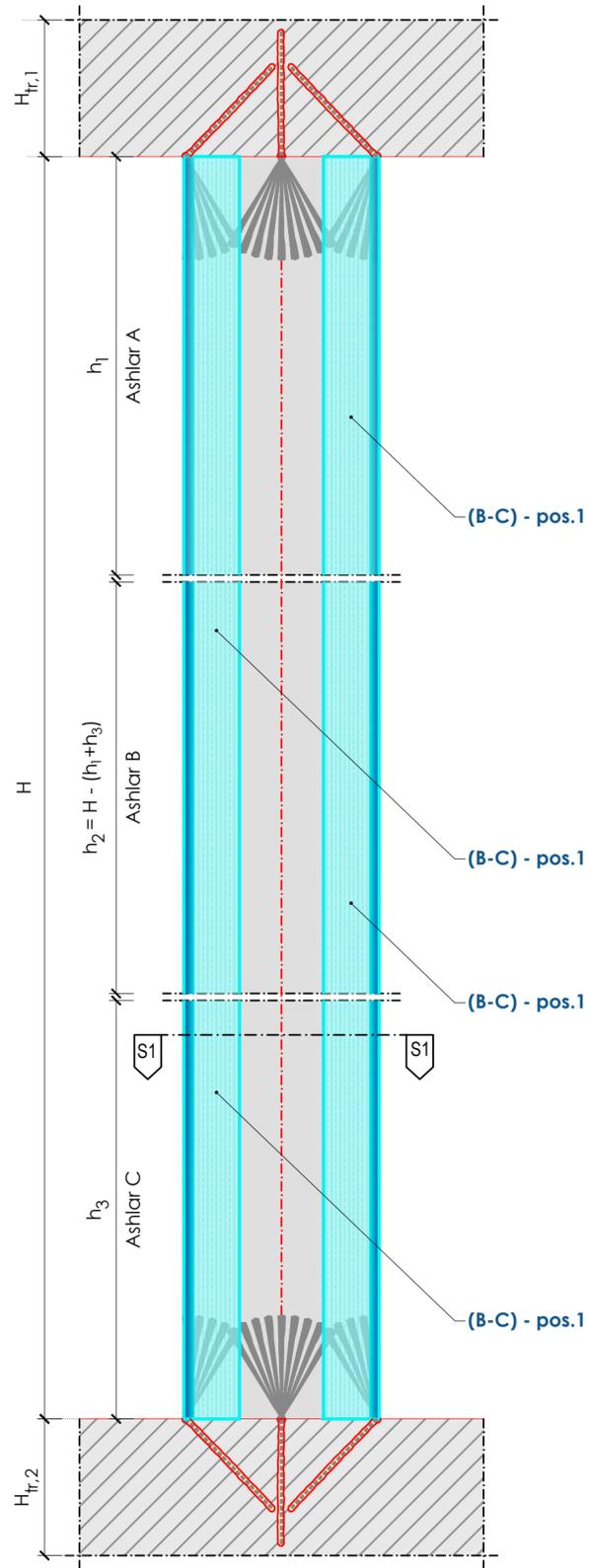
Dimensions are given in mm unless otherwise specified  
For the materials table, refer to drawing FRP22.



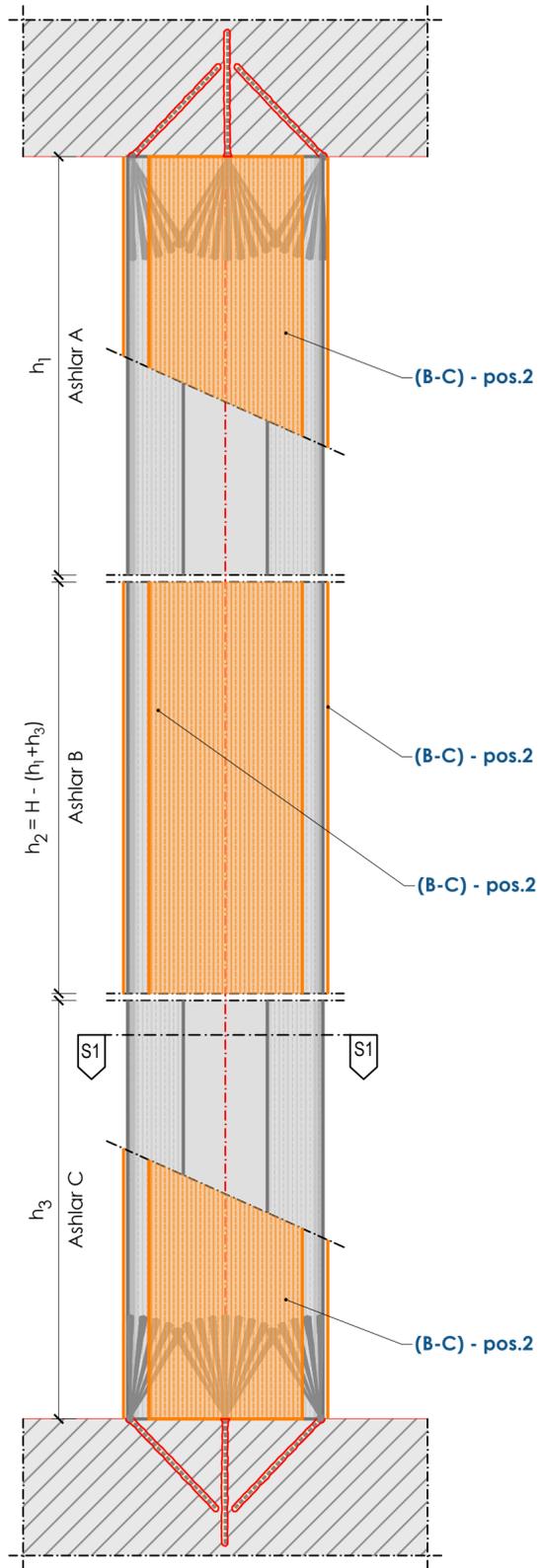


PHASE 2 - Flexural reinforcement (scale 1:10)

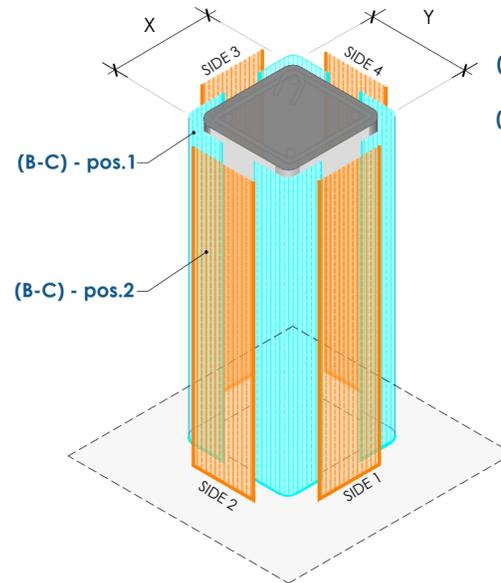
PHASE 2 – Flexural reinforcement  
Side view



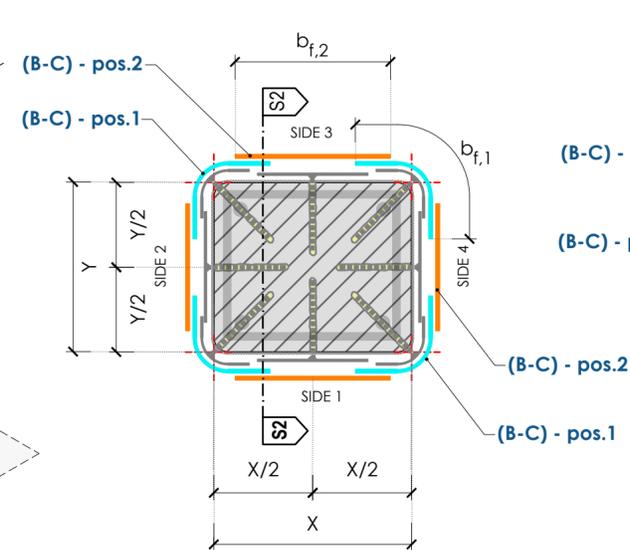
PHASE 2 – Flexural reinforcement  
Side view



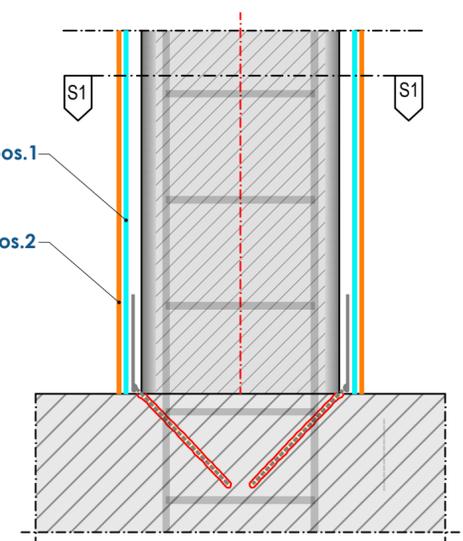
Flexural reinforcement



Section S1-S1



Section S2-S2



DESCRIPTION OF WORKS - PHASE 2

Once the arrangement, type, and quantity of reinforcement to be applied are defined, the installation must be carried out according to the following operational phases:

2.1 After applying a layer of epoxy impregnation resin FB-RC02, install the C.F.R.P. reinforcements of type **FB-GV.....-....** vertically to "wrap" the four corners of the pillar (position 1), avoiding the formation of wrinkles, folds, or air pockets. Use a bubble-breaking roller to facilitate this operation. After placing the fabrics, apply a second layer of impregnation resin **FB-RC02** and continue rolling with the bubble-breaking roller until complete impregnation of the fibers is achieved.

2.2 The same installation procedure applies for C.F.R.P. reinforcements of type **FB-GV.....-....** positioned vertically along the axes of the four walls of the pillar (position 2). Any repetition of phases 2.1 and 2.2 for all additional design layers should be applied alternately (position 1, position 2, position 1, position 2, ...).

FABRIC TABLE - FLEXURAL REINFORCEMENT

Identification		characteristics				
material	Pos.	ashlar	N. sides	N. layers	Width of the strips $b_f$	Length of the strips
<b>(C)</b>	Pos .1	A	4	to be defined	$b_{f,1}$	$H=h_1+h_2+h_3$
		B				
		C				
	Pos .2	A	4	to be defined	$b_{f,2}$	$H=h_1+h_2+h_3$
		B				
		C				

Legend

X / Y = sides of the pillar;  $0,8 X \leq Y \leq 1,5 X$ ;  
 $\Phi$  = hole diameter (12 -14 mm);  
 Lc = connector length;  
 H= pillar height;  
 $h_1/h_2/h_3$ = height of pillar segments;  $h_1=h_3$ ;  $h_1/h_3 \geq 1/6 H$   
 $b_{f,1}/b_{f,2}$  = width of reinforcement.

MATERIAL IDENTIFICATION

- (A1) FB-TUP10-CHT1A (Bowed rods in C.F.R.P.)
- (B-C) FB-GV.....-.... (unidirectional fabric in C.F.R.P.)
- (P1) FB-RC01 (Epoxy resin - Primer)
- (P2) FB-RC02 (Epoxy resin - Impregnating agent)
- (P3) FB-RC30/3 (Epoxy resin - Grouting)

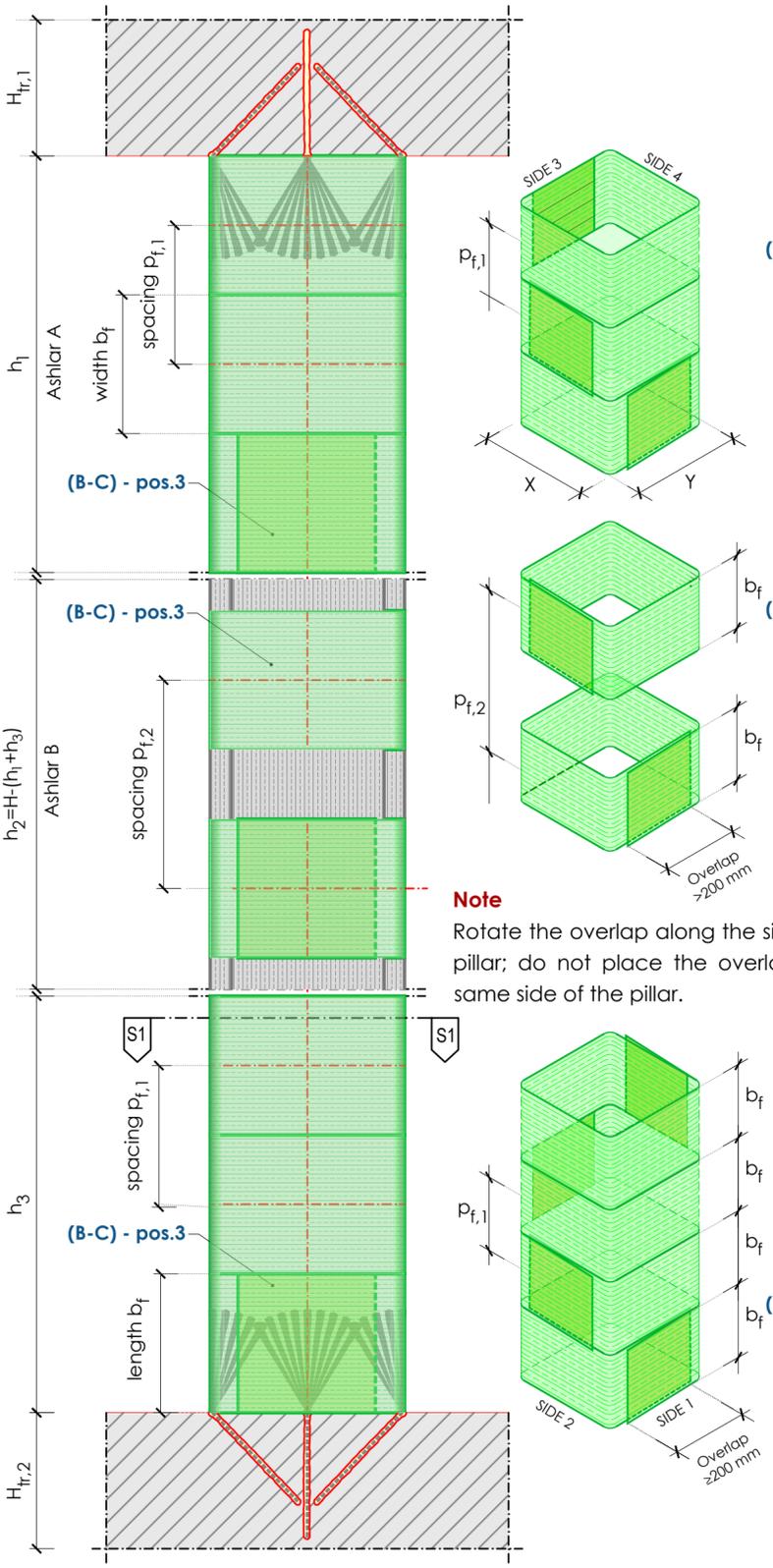
Dimensions are expressed in mm unless otherwise specified  
 For the materials table, refer to drawing FRP22.



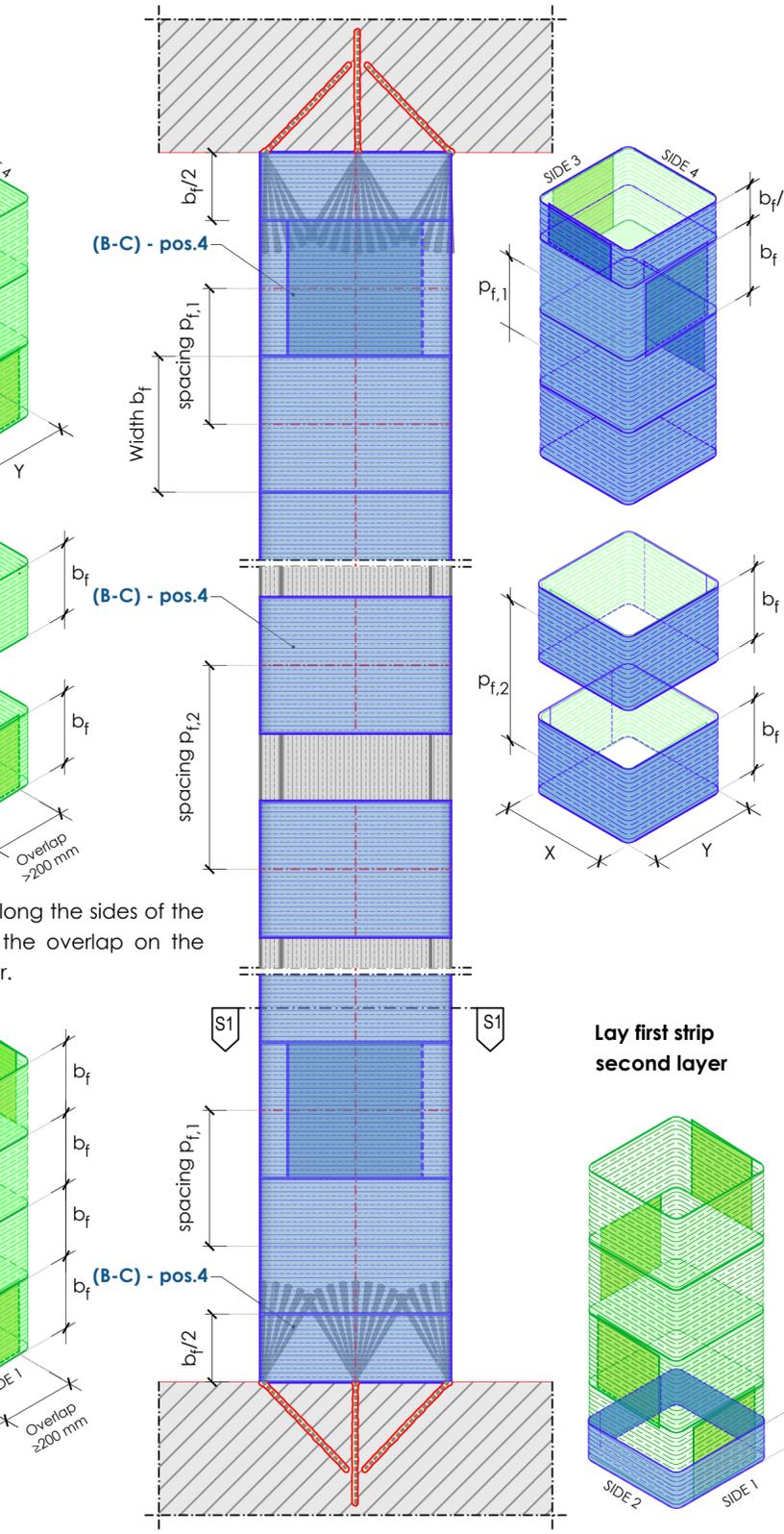


PHASE 3 - Confinement / Shear reinforcement (scale 1:10)

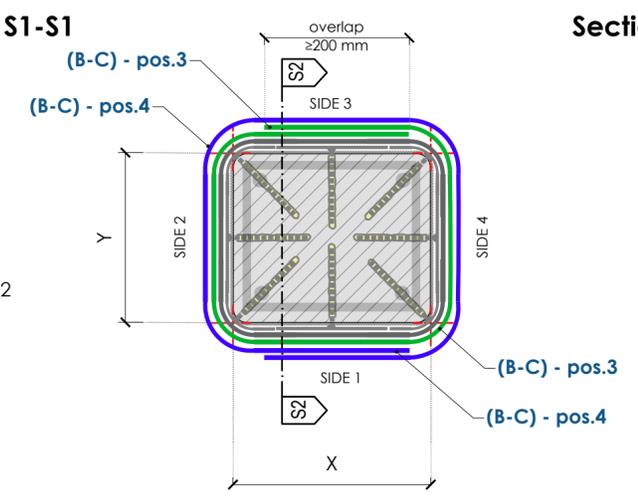
PHASE 3.1 - Confinement - pos.3  
Side view



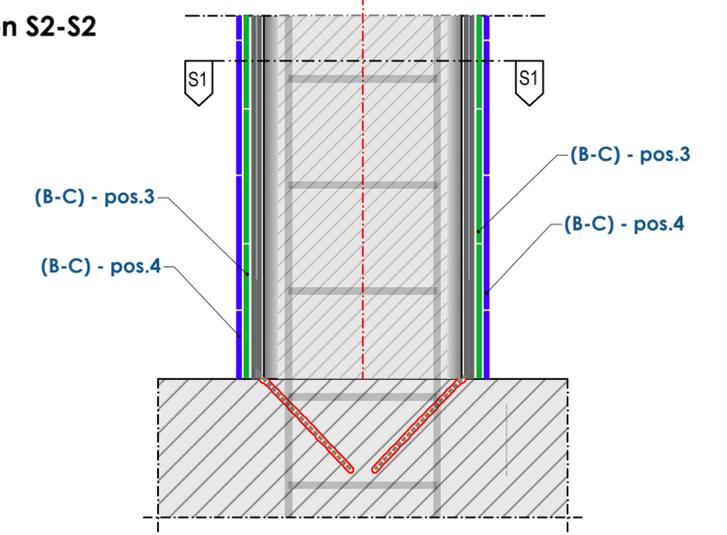
PHASE 3.2 - Confinement - pos.4  
Side view



Section S1-S1



Section S2-S2



DESCRIPTION OF WORKS - PHASE 3

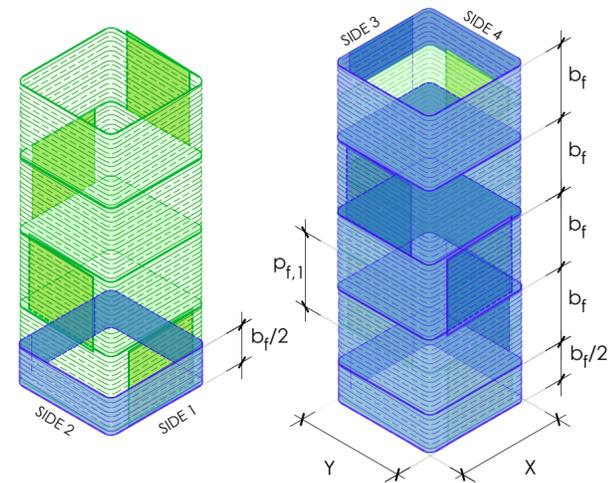
Once the arrangement, type, and quantity of fabric to be applied have been defined, and after the flexural reinforcement is completed, the confinement in F.R.P. must be carried out according to the following operational steps:

- 3.1 After applying a layer of epoxy impregnation resin **FB-RC02**, install the C.F.R.P. reinforcements of type **FB-GV.....-....** horizontally (pos.3) in a complete wrap along the entire height of the pillar, following the specifications in the table and avoiding the formation of wrinkles, folds, or air pockets. Use a bubble-breaking roller to assist with this operation. After placing the fabric, apply a second layer of epoxy impregnation resin **FB-RC02** and continue rolling with the bubble-breaking roller until full fiber impregnation is achieved.
- 3.2 If an additional layer is required, apply a further coat of epoxy impregnation resin **FB-RC02**, then install the second layer of C.F.R.P. reinforcement of type **FB-GV.....-....** with staggered horizontal joints (pos.4) relative to the first. Apply another coat of **FB-RC02** resin and continue rolling with the bubble-breaking roller until complete fiber impregnation is achieved.
- 3.3 Repeat steps 3.1 and 3.2 as needed for all additional design layers, alternating the joints horizontally (pos.3, pos.4, pos.3, pos.4,...) with a spacing equal to  $b_f/2$  ;
- 3.4 spread quartz sand over the surface of the fresh resin composite to ensure adhesion of the finishing plaster.

**Note**  
Rotate the overlap along the sides of the pillar; do not place the overlap on the same side of the pillar.

Lay first strip  
second layer

Lay subsequent strips  
second layer



FABRIC TABLE - CONFINEMENT						
Identification		Characteristics				
Material	Pos.	Ashlar	N. sides	N. layers	width $b_f$	Length of the strips
<b>(C)</b>	Pos .3	A (**)	$N_A = h_1/200$	to be defined	200	$2(X+Y)+200$
		B (**)	$N_B = (h_2/200) - 1$			
		C (**)	$N_C = h_3/200$			
	Pos .4	A (**)	$N_A = h_1/200$ + 1 fascia larghezza $b_f/2$	to be defined	200	$2(X+Y)+200$
		B (**)	$N_B = (h_2/200) - 1$			
		C (**)	$N_C = h_1/200$ + 1 fascia larghezza $b_f/2$			

(\*) If a second layer is required (\*\*N<sub>x</sub> = Whole number)

Legend

- X / Y = sides of the pillar;
- Φ = hole diameter (12 - 14 mm);
- H = pillar height;
- $h_1/h_2/h_3$  = height of pillar segments;
- $p_{f,1}/p_{f,2}$  = center-to-center distance of reinforcement;
- $b_f$  = width of reinforcement.

MATERIAL IDENTIFICATION

- (A1) FB-TUP10-CHT1A** (Bowed rods in C.F.R.P.)
- (B-C) FB-GV.....-....** (Unidirectional fabric in C.F.R.P.)
- (P1) FB-RC01** (Epoxy resin - Primer)
- (P2) FB-RC02** (Epoxy resin - Impregnating agent)
- (P3) FB-RC30/3** (Epoxy resin - Grouting)

Dimensions are expressed in mm unless otherwise specified  
For the materials table, refer to drawing FRP22

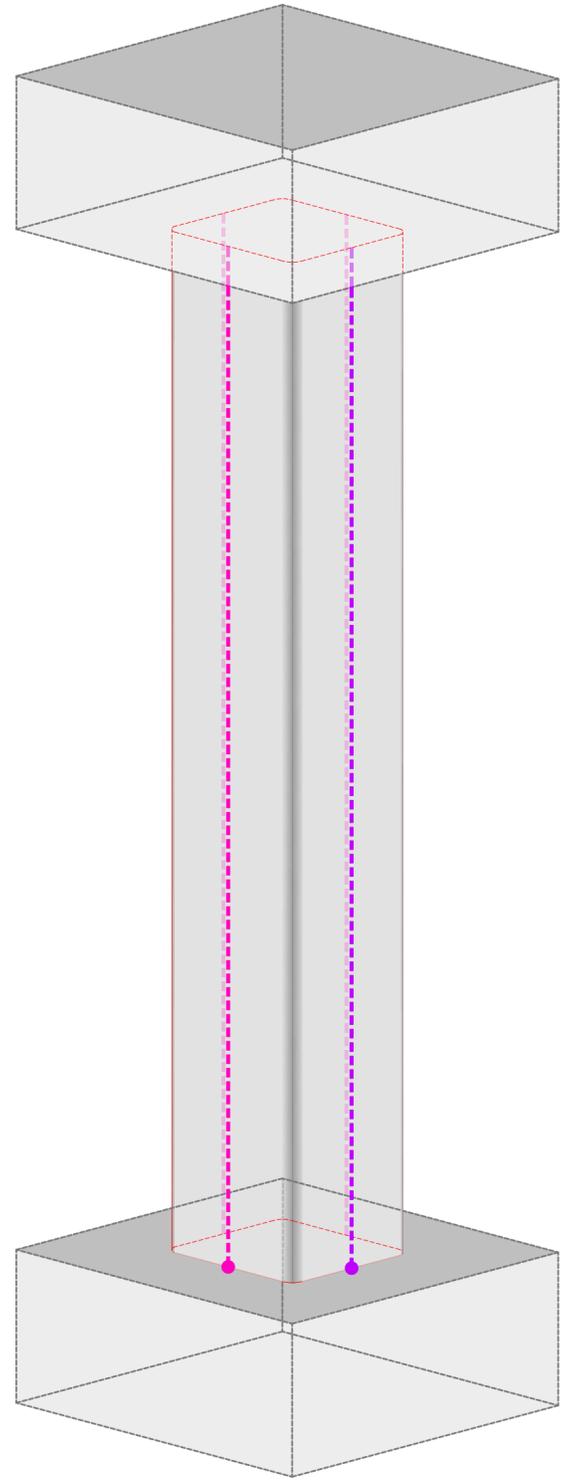




**PHASE 0 -** Layout Phase

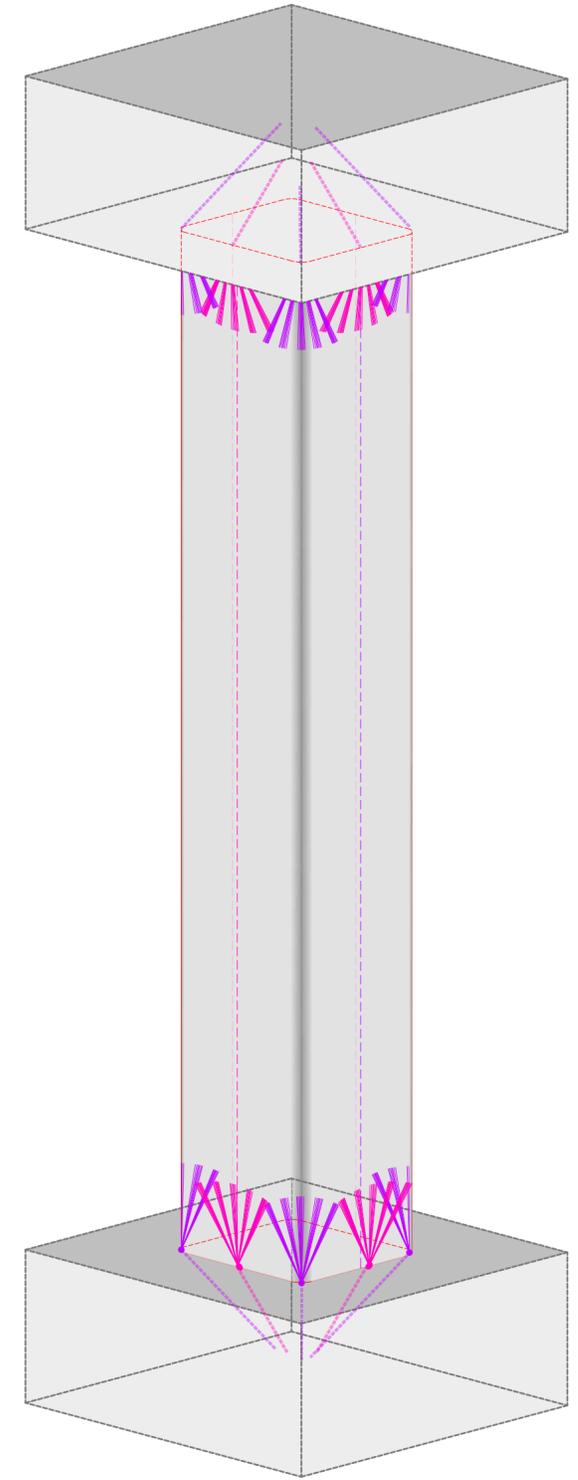
**Axonometric view**

(Drawing FRP 03.a)



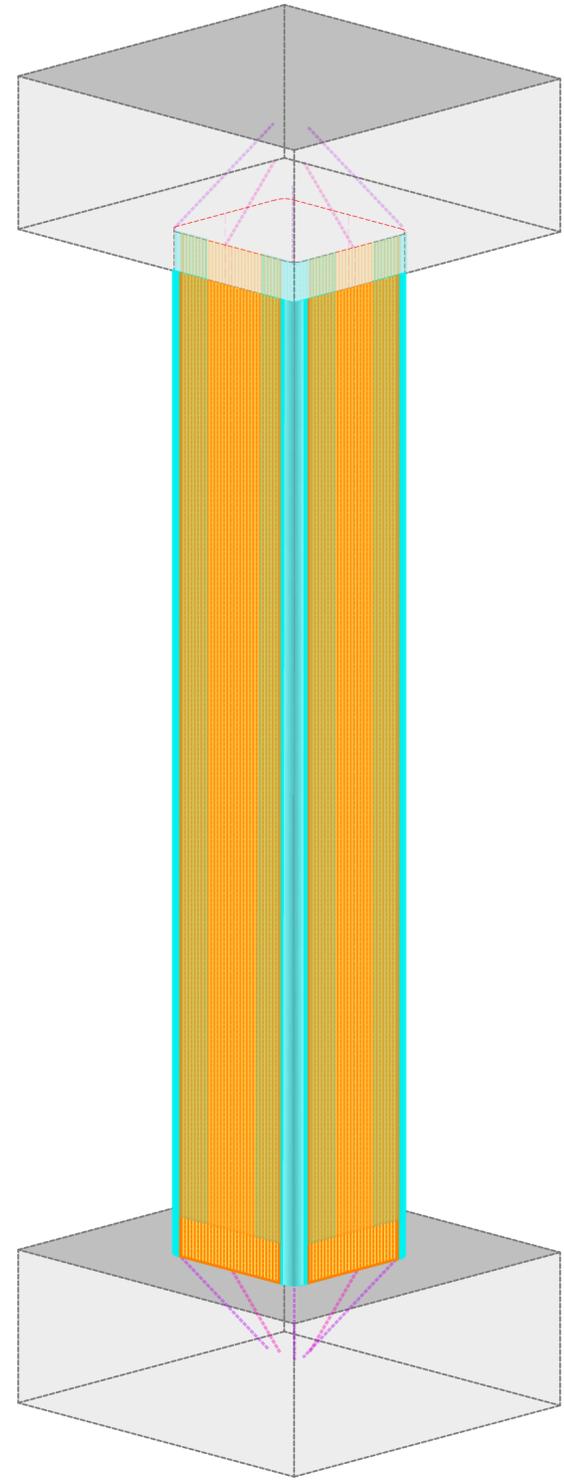
**PHASE 1 -** Installation of connection system

(Drawing FRP 03.a)



**PHASE 2 -** Installation of reinforcement

(Drawing FRP 03.b)



**PHASE 3 -** Installation of reinforcement

(Drawing FRP 03.b)

