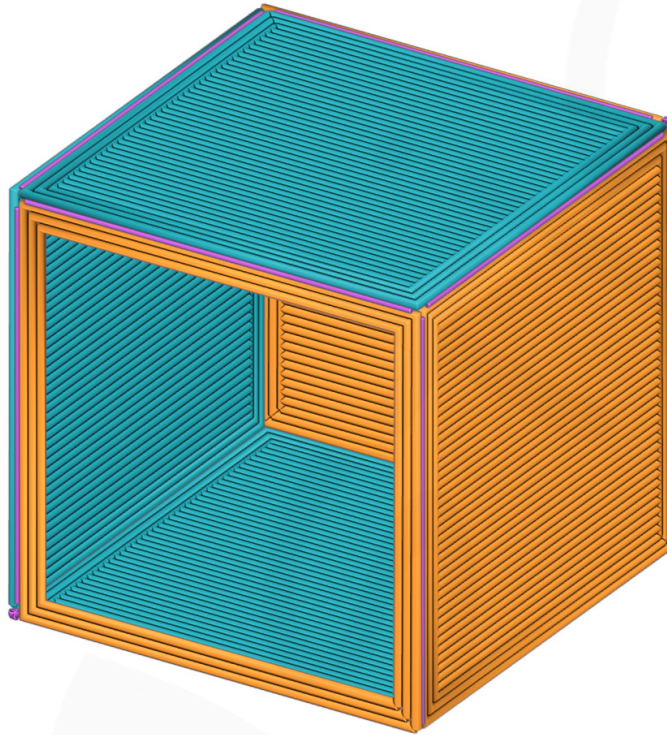


MAKE • DISCOVER • COLLECT

Cube with an open window

Beginners aged 10 and above, young people, and adults; assistance in accordance with the pen instructions. • Approximately 50–80 minutes, with no time limit



Six colorful frames form a hollow $5 \times 5 \times 5$ cm cube. Five filled walls enclose a real interior, visible through the sixth, open window.



Your outcome

Understand how to assemble six planes by making a small object.

Construction illustration. The instructions show the successive stages. Full-size (1:1) templates are supplied on a separate sheet.

What you need

A 3D pen, the selected filament and equipment available in your workspace. See the complete list below.

Equipment

☐	3D pen for PLA	1
☐	Transparent work surface	1; clear area of at least 190 × 130 mm
☐	Templates printed at 1:1 scale	set; print at 100%
☐	Millimeter ruler	1
☐	Pencil	1
☐	Regular paper scissors	1

Filament — amounts include extra

☐	PLA 1.75 mm — turquoise — D, L, T	4.9 m · ≈ 14.7 g
☐	PLA 1.75 mm — orange — B, R, O	3.7 m · ≈ 11.1 g
☐	PLA 1.75 mm — purple — tacks, seams, and corner closures	0.1 m · ≈ 0.3 g

Total filament: 8.7 m · approximately 26.1 g

The quantities include extra filament. Grams indicate estimated net filament mass, excluding packaging.

Before you start

At home or in a workshop

The work surface is equipment. It does not become part of the model. The plain paper serves only as a template beneath it.

- 1 First print the templates at 100% scale, without fitting them to the page. Use a ruler to check the 20 mm segment; if the result differs, correct the print settings before cutting and drawing.
- 2 Use scissors to cut out six 54 × 54 mm paper squares: leave 2,6 mm of paper beyond the outer edge of each frame. Do not cut along the template lines; retain or copy the letters D, B, L, T, R, O in pencil.
- 3 Place all six templates together under the transparent work surface: D, B, L on the top row and T, R, O below. Leave 6 mm between the squares. The 174 × 114 mm paper layout requires a clear area of 190 × 130 mm, with an 8 mm margin all around. Prepare the entire layout before drawing; do not move the templates afterward.
- 4 Place the work surface securely, flat, and fully supported on the tabletop, away from the edge of the table.
- 5 Choose colors for the five filled panels and the window. Use the same PLA for the seams; the colors in the illustration are suggestions.

The 70-minute estimate includes the frames, panels, 24 tacks, 12 seams, two small corner closures, test fitting, cooling, and checking. Approximately 30–50 minutes of pen work; no lesson time limit. Not physically tested.

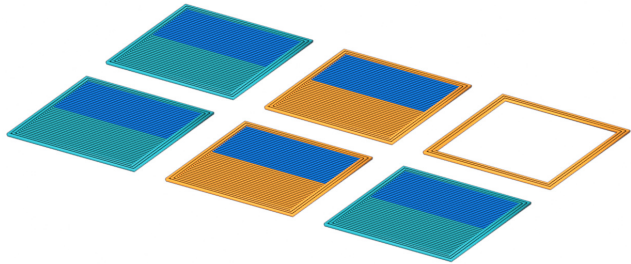
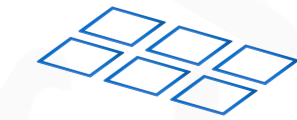


How to read the instructions

The large image shows the completed stage. Small views show the action and current parts. ×N means repeat the whole action N times, cooling and checking each time. Illustrations are not at 1:1 scale.

STAGE 01 / 08 • Session 1

Six panels: five filled and one window



Six frames



Five panels filled halfway

Stage outcome

NOW D — bottom · B — back · L — left wall · T — top · R — right wall · O — window

Blue / dark emphasis: the part used in this action. Arrows: visual guides. Illustration not to scale.

PARTS FOR THIS STAGE

1 × D — bottom; 1 × B — back; 1 × L — left wall; 1 × T — top; 1 × R — right wall; 1 × O — window · PLA | template follow the written method

→ T001 • Techniques — reference appendix

Choose your own PLA colors. Trace three outlines on each of the six templates; do not move the paper. In D, B, L, T, and R, lay connected strands between the inner edges: first to halfway, then until the panels are closed. Do not fill window O. Let the panels cool, mark the letters in pencil on the cool frames, and compare the sides.

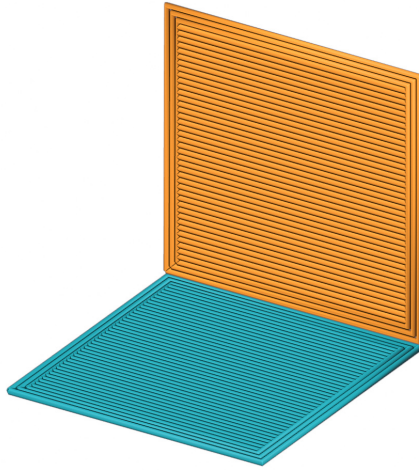
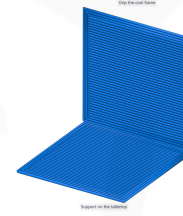
✓ Check

Six separate panels: side length 48,8 mm, thickness approximately 1,2 mm. Five fills join the frames without gaps; window O has a 42,2 mm opening.

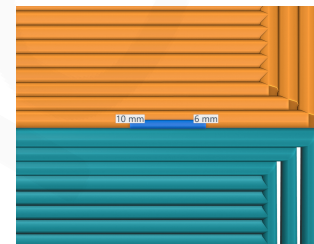
If it does not work

Remake an uneven frame before filling it. Close a gap with a strand supported on the adjacent PLA; allow it to cool and check it.

First corner: bottom D and back B



Test fit before tacking



Two short tacks

Stage outcome

NOW D — bottom · B — back · D-B: set of 2 tacks, 4 mm each; 46.8 mm seam

Blue / dark emphasis: the part used in this action. Arrows: visual guides. Illustration not to scale.

PARTS FOR THIS STAGE

1 × D — bottom; 1 × B — back · PLA | template follow the written method

1 × D-B: set of 2 tacks, 4 mm each; 46.8 mm seam · PLA | template follow the written method

→ T001, T002 • Techniques — reference appendix

Place D on the tabletop. Position B vertically; hold the cool center of the upper frame. Test-fit: the edge of one panel reaches the inner surface of the other, accounting for the 1,2 mm thickness. Mark sections 6–10 mm from both ends of the shared edge. From the outside, make two 4 mm tacks there.

Allow it to cool before changing your grip, then check the right angle. Join the D-B joint with a 46,8 mm seam: from 1 mm after the start to 1 mm before the end of the edge. Keep the nozzle outside and the bottom on the tabletop. Allow it to cool.



Check

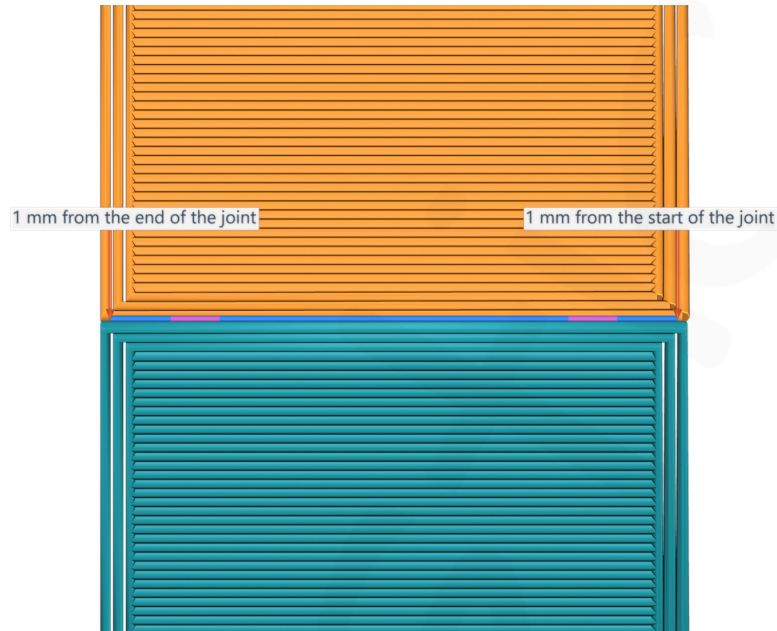
D and B form an even right angle; the seam joins both panels.

If it does not work

Allow it to cool, check the alignment, and correct the local joint. Do not bend rigid PLA.

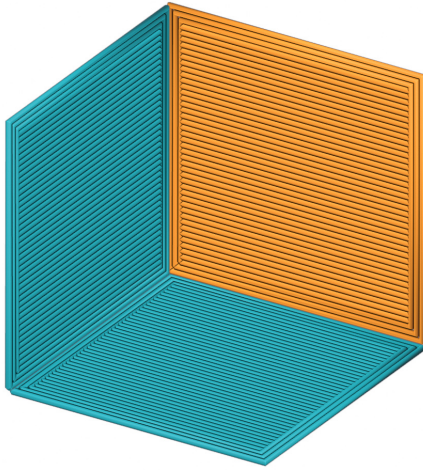
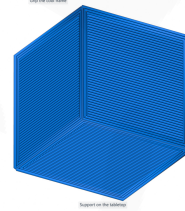
First corner: bottom D and back B — construction details

Full seam

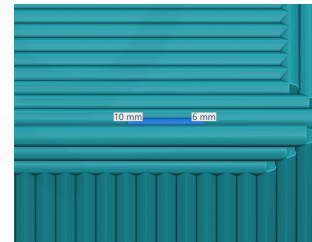


STAGE 03 / 08 • Session 1

Add left wall L



L before joining



Tacks on two joints

Stage outcome

NOW B — back · D-B: set of 2 tacks, 4 mm each; 46.8 mm seam · D — bottom · L — left wall · D-L: set of 2 tacks, 4 mm each; 45.6 mm seam · B-L: set of 2 tacks, 4 mm each; 46.8 mm seam

Blue / dark emphasis: the part used in this action. Arrows: visual guides. Illustration not to scale.

PARTS FOR THIS STAGE

1 × D — bottom; 1 × L — left wall · PLA | template follow the written method

1 × D-L: set of 2 tacks, 4 mm each; 45.6 mm seam; 1 × B-L: set of 2 tacks, 4 mm each; 46.8 mm seam · PLA | template follow the written method

→ T001, T002 • Techniques — reference appendix

D remains on the tabletop. Test-fit L against D and B, holding the cool center of the upper frame. Account for the 1,2 mm thickness: the edge reaches the inner surface of the adjacent panel. On each D-L and B-L joint, mark sections 6–10 mm from both ends. From the outside, make two 4 mm tacks on each.

Allow it to cool before changing your grip; check the right angles. Reinforce the joints: D-L 45,6 mm, B-L 46,8 mm. Each seam begins and ends 1 mm from the ends of the shared edge. Hold the cool frame, work from the outside, and allow it to cool.



Check

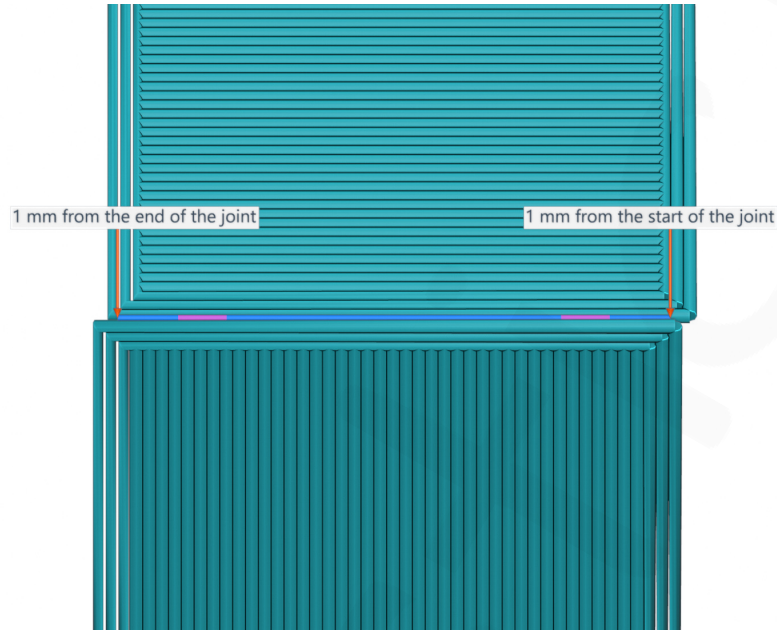
A rigid D-B-L corner has been formed from three filled panels set at right angles.

If it does not work

Allow it to cool and check the fit. Correct the local joint without bending the walls.

Add left wall L — construction details

Reinforced joints



B–L: first 4 mm tack; second placed symmetrically

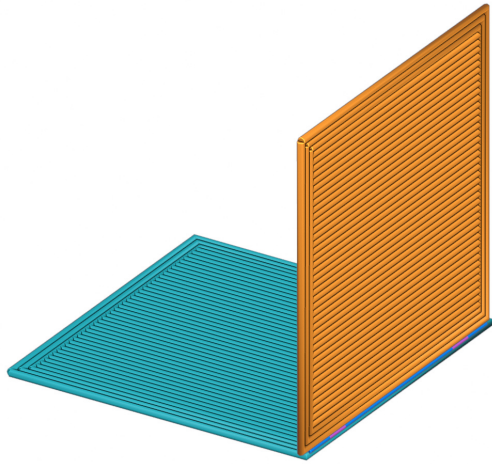
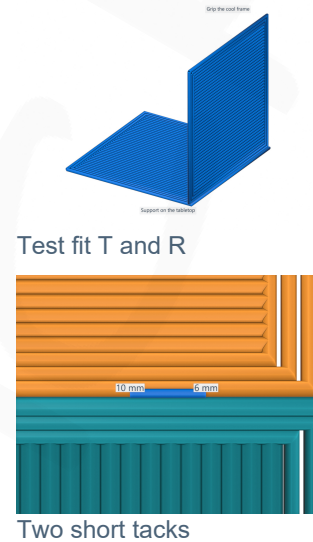


Add left wall L — construction details

B–L: 46.8 mm seam between the markers



Second corner: top T and right wall R



Stage outcome

NOW T — top · R — right wall · T–R: set of 2 tacks, 4 mm each; 45.6 mm seam

Blue / dark emphasis: the part used in this action. Arrows: visual guides. Illustration not to scale.

PARTS FOR THIS STAGE

1 × T — top; 1 × R — right wall · PLA | template follow the written method

1 × T–R: set of 2 tacks, 4 mm each; 45.6 mm seam · PLA | template follow the written method

→ T001, T002 • Techniques — reference appendix

Place T on the tabletop. Position R vertically; hold the cool center of the upper frame. Test-fit: the edge reaches the inner surface of the other panel, accounting for the 1,2 mm thickness. Mark sections 6–10 mm from both ends of the T–R joint. From the outside, make two 4 mm tacks.

Allow it to cool before changing your grip and check the right angle. Lay a 45,6 mm T–R seam, from 1 mm after the start to 1 mm before the end of the shared edge. T remains on the tabletop and the nozzle stays outside. Allow it to cool.

✓ Check

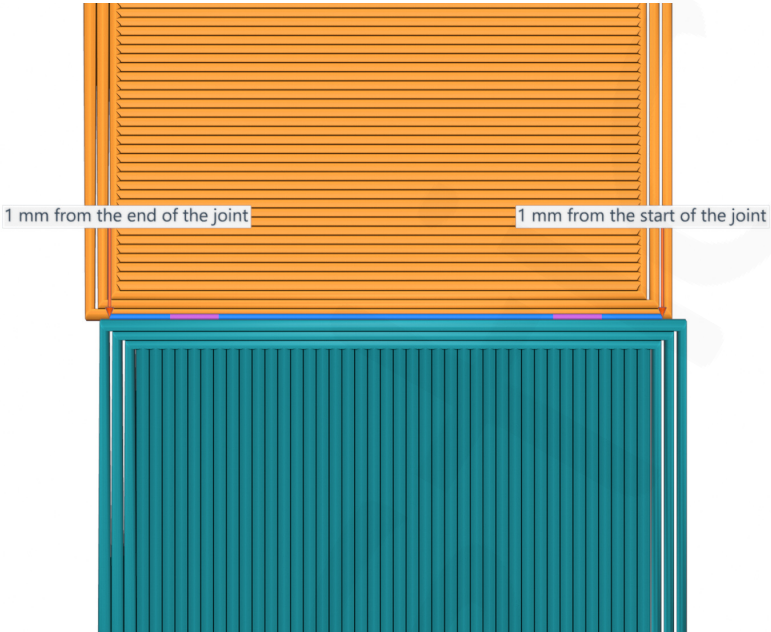
T and R form an even right angle; the seam joins both panels.

If it does not work

Allow it to cool, check the alignment, and correct the local joint. Do not bend rigid PLA.

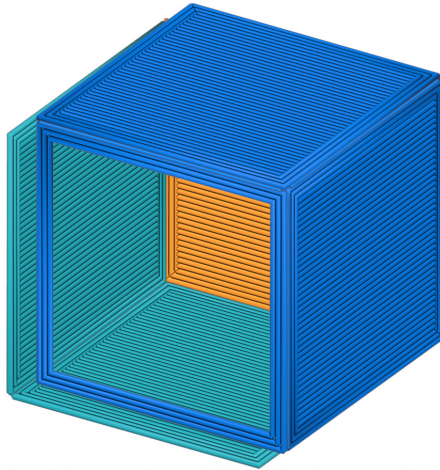
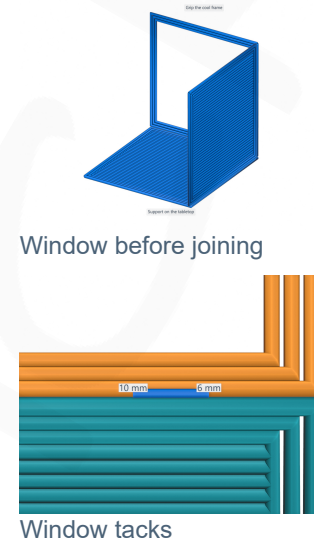
Second corner: top T and right wall R — construction details

Full seam



STAGE 05 / 08 • Session 1

Add window O and turn the cool corner



Stage outcome

NOW R — right wall · T-R: set of 2 tacks, 4 mm each; 45.6 mm seam · T — top · O — window · T-O: set of 2 tacks, 4 mm each; 46.8 mm seam · R-O: set of 2 tacks, 4 mm each; 46.8 mm seam

Blue / dark emphasis: the part used in this action. Arrows: visual guides. Illustration not to scale.

PARTS FOR THIS STAGE

1 × T — top; 1 × O — window · PLA | template follow the written method

1 × T-O: set of 2 tacks, 4 mm each; 46.8 mm seam; 1 × R-O: set of 2 tacks, 4 mm each; 46.8 mm seam · PLA | template follow the written method

→ T001, T002 • Techniques — reference appendix

T lies on the tabletop. Holding the cool center of the upper O frame, test-fit the window against T and R. The edges reach the inner surfaces of the panels; account for the 1,2 mm thickness. On each T-O and R-O joint, mark sections 6–10 mm from both ends. From the outside, make two 4 mm tacks on each.

Allow them to cool before changing your grip, check the angles, and make both 46,8 mm seams, leaving 1 mm from the ends of the shared edges. Allow it to cool. Set down the pen. With both hands, turn over the cool T-R-O corner and lift it above D-B-L. Approach from the window and right-wall side; lower it leftward and backward.

Do not slide the walls through one another.



Check

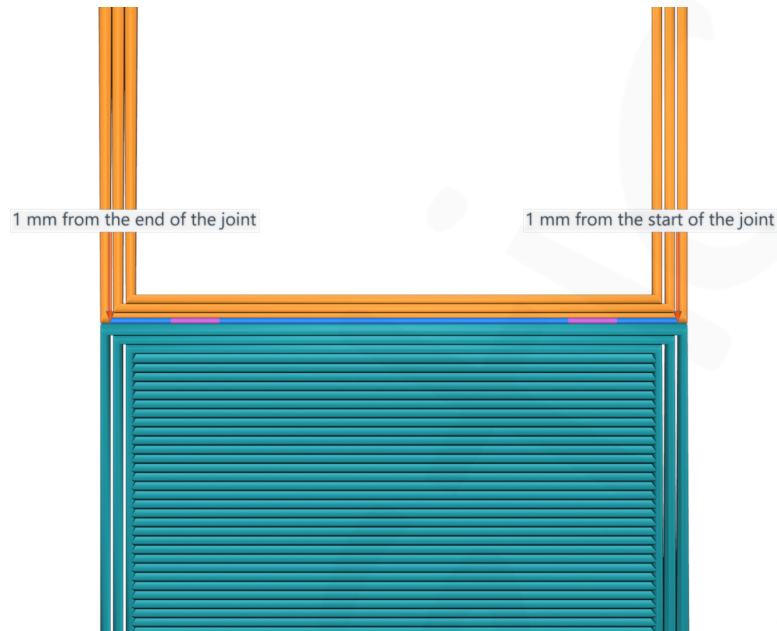
The window remained open. The cool corner is ready to be test-fitted with the first one.

If it does not work

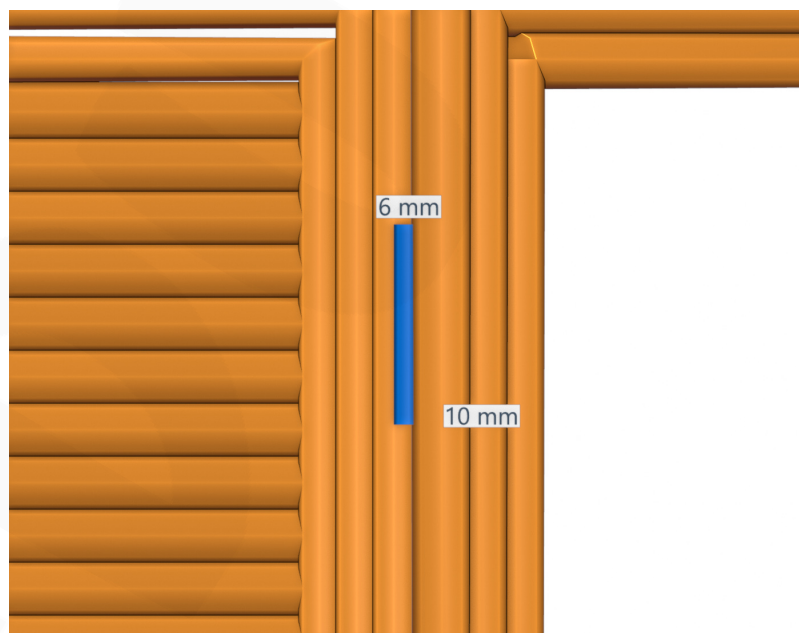
If the corner flexes, place it back on T and correct the cooled joint before turning it.

Add window O and turn the cool corner — construction details

Seams before cooling and turning

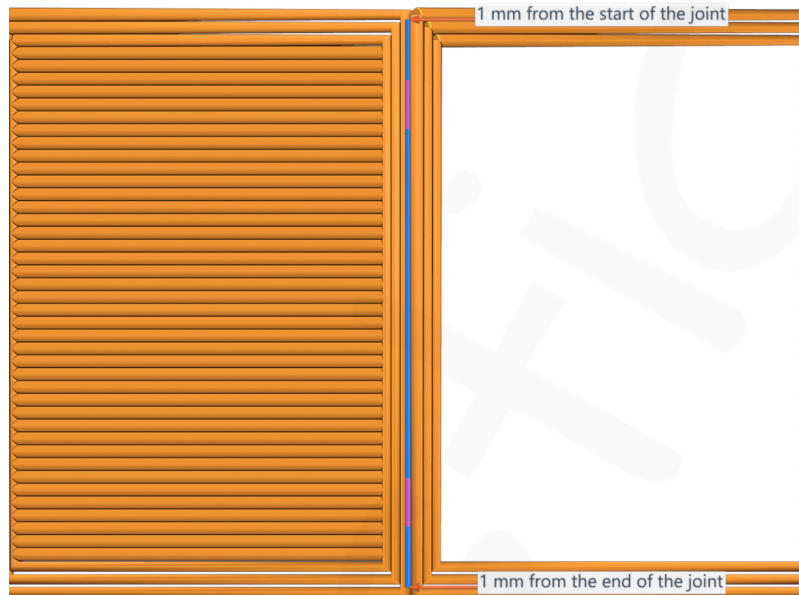


R–O: first 4 mm tack; second placed symmetrically

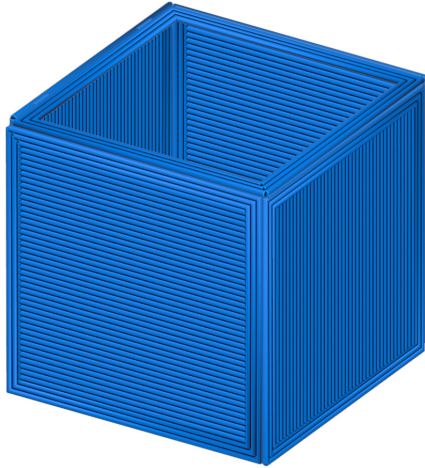
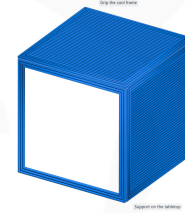


Add window O and turn the cool corner — construction details

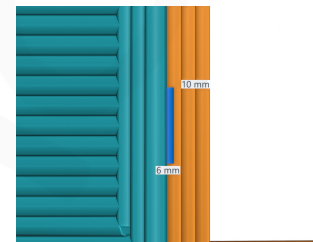
R–O: 46.8 mm seam between the markers



Join the corners and place the cube on back B



Fit the two corners together



Vertical tacks

Stage outcome

NOW Work on the parts listed under Parts for this stage.

Blue / dark emphasis: the part used in this action. Arrows: visual guides. Illustration not to scale.

PARTS FOR THIS STAGE

1 × L-O: set of 2 tacks, 4 mm each; 45.6 mm seam; 1 × B-R: set of 2 tacks, 4 mm each; 45.6 mm seam; 1 × L-T: set of 2 tacks, 4 mm each; 46.8 mm seam; 1 × B-T: set of 2 tacks, 4 mm each; 45.6 mm seam · PLA | template follow the written method

→ T002 • Techniques — reference appendix

Lower T-R-O: the lower edges of R and O rest on the tabletop beside D, and T touches the upper sides of B and L. Align the surfaces without forcing them. Wrap one hand around the cool top and hold both corners on the tabletop. On joints L-O and B-R, then L-T and B-T, mark sections 6–10 mm from both ends. Make two 4 mm tacks on each joint.

Approach the rear joint from behind; do not put the nozzle inside. Allow it to cool before changing your grip. Do not make full seams yet. Let all eight tacks cool, set down the pen, and use both hands to place the cube on its filled back B, with the window facing upward.

✓ Check

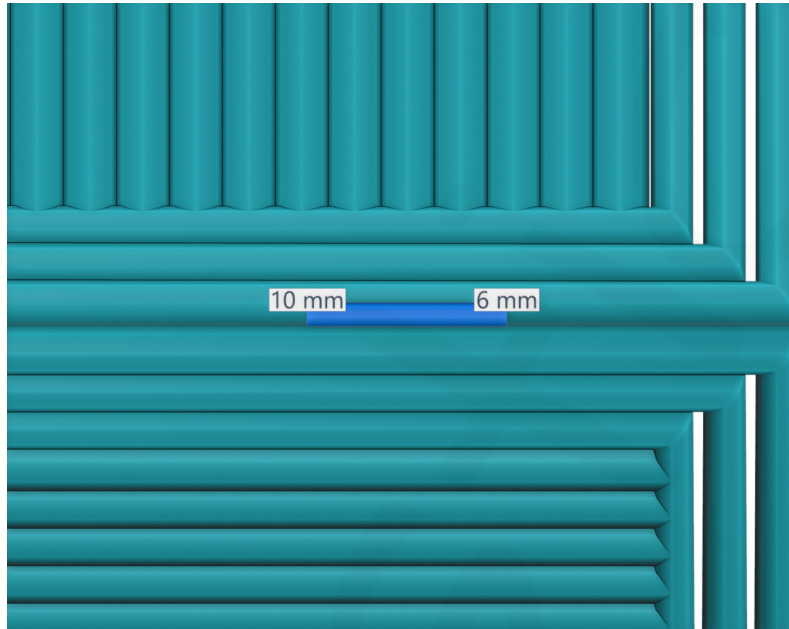
The cube measures approximately 50 mm on each side. B supports the whole cube; bottom joints D-R and D-O are accessible from the side.

If it does not work

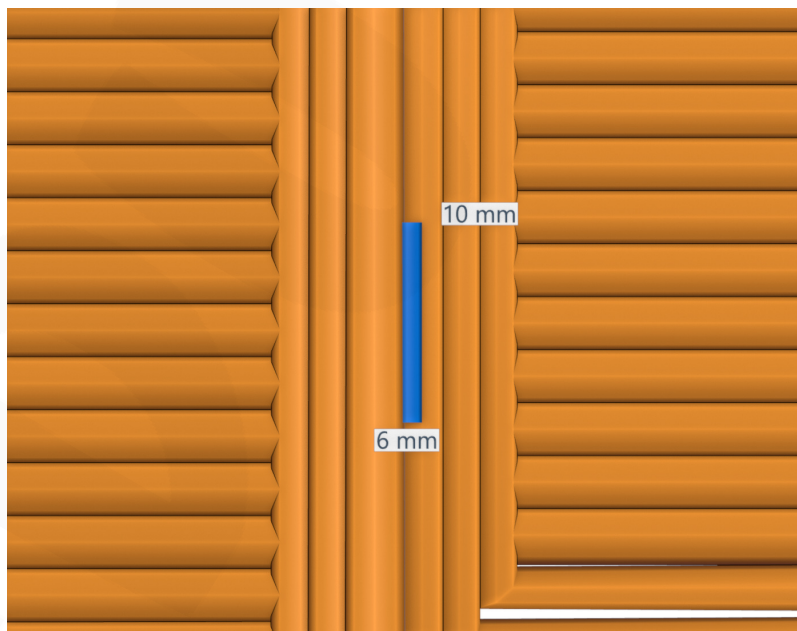
If the panels do not fit, let them cool and check the joints and frame thickness. Do not force or bend the walls.

Join the corners and place the cube on back B — construction details

Upper tacks before turning



B–R: first 4 mm tack; second placed symmetrically

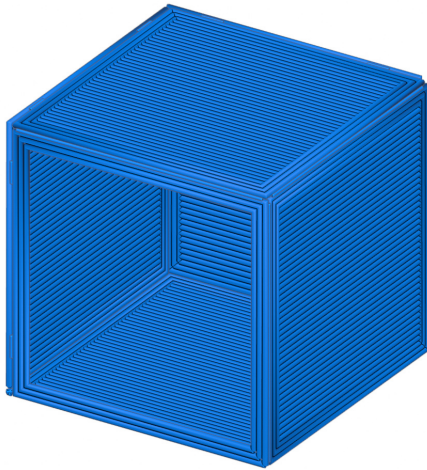
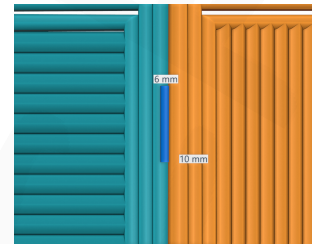


Join the corners and place the cube on back B — construction details

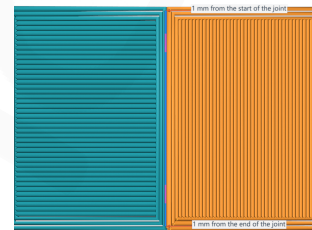
B–T: first 4 mm tack; second placed symmetrically



Join the bottom and close the lower corner



Final tacks



Two bottom seams

Stage outcome

NOW Work on the parts listed under Parts for this stage.

Blue / dark emphasis: the part used in this action. Arrows: visual guides. Illustration not to scale.

PARTS FOR THIS STAGE

1 × D–R: set of 2 tacks, 4 mm each; 46.8 mm seam; 1 × D–O: set of 2 tacks, 4 mm each; 45.6 mm seam · PLA | template follow the written method

1 × Close the lower front-left corner · PLA | template follow the written method

→ T002, T003 • Techniques — reference appendix

The cube rests on B; hold the cool frame on the opposite side of the work area. On D–R and D–O, mark sections 6–10 mm from both ends and make two 4 mm tacks on each. The nozzle approaches from the side, outside. Allow it to cool before changing your grip.

Reinforce D–R with a 46,8 mm seam and D–O with a 45,6 mm seam, leaving 1 mm from the ends of the shared edge. Allow it to cool. Use a short drop of PLA to close the lower front-left corner: rest it on the three cool frame ends without protruding beyond the 50 mm outline.

B continues to support the cube; grip the opposite frame and guide the nozzle from outside. Allow it to cool, set down the pen, and use both hands to stand the cube on D.

✓ Check

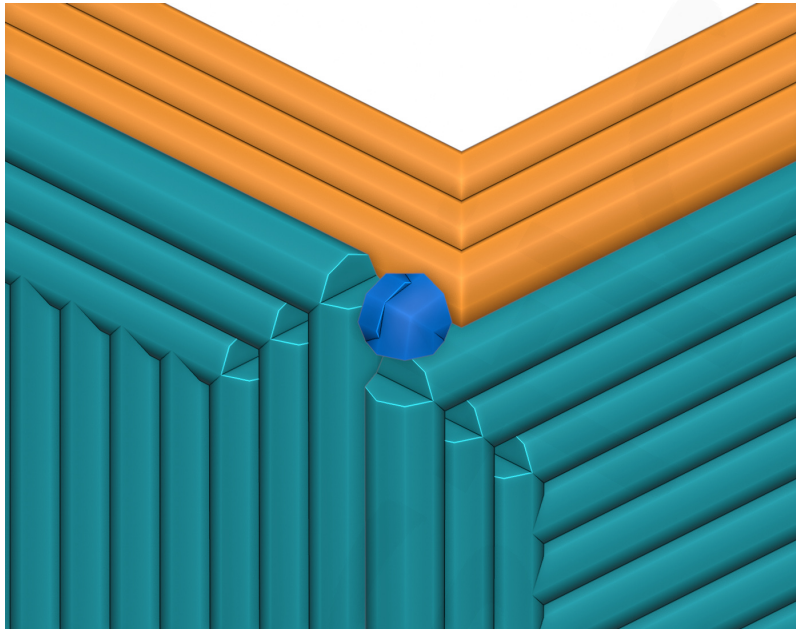
The six joints between the corners have a total of 12 tacks; the two bottom joints are reinforced. The lower corner is closed, and the cube stands on D.

If it does not work

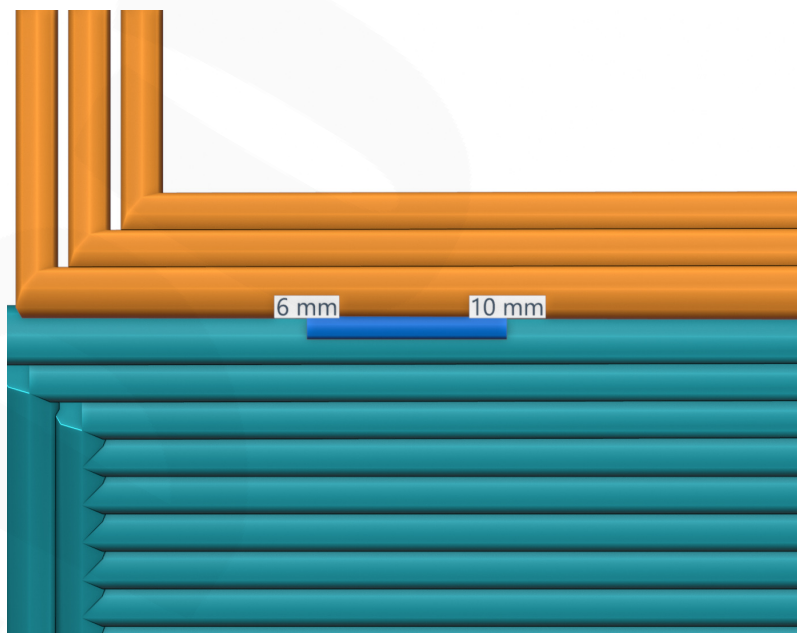
Allow it to cool. Fill the gap with PLA supported on the cool edges; do not press hot material with your hand.

Join the bottom and close the lower corner — construction details

Closed corner before turning

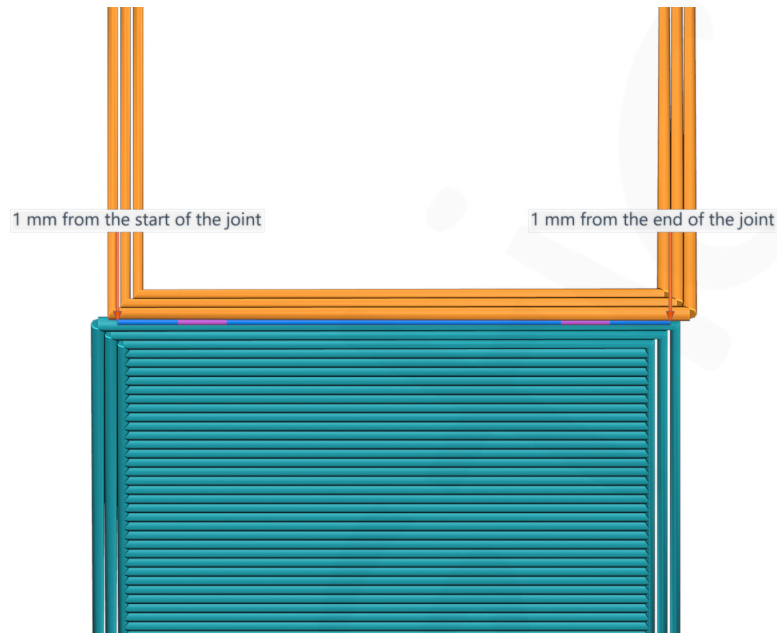


D–O: first 4 mm tack; second placed symmetrically

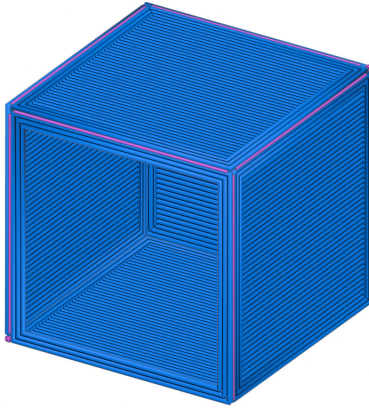
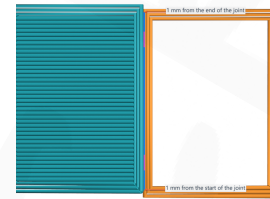


Join the bottom and close the lower corner — construction details

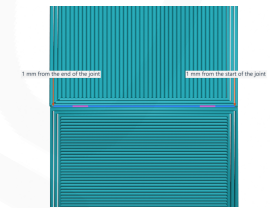
D–O: 45.6 mm seam between the markers



Reinforce the cube and check its interior



Reinforced vertical joints



Reinforced upper joints

Stage outcome

NOW Work on the parts listed under Parts for this stage.

Blue / dark emphasis: the part used in this action. Arrows: visual guides. Illustration not to scale.

PARTS FOR THIS STAGE

1 × L–O: set of 2 tacks, 4 mm each; 45.6 mm seam; 1 × B–R: set of 2 tacks, 4 mm each; 45.6 mm seam; 1 × L–T: set of 2 tacks, 4 mm each; 46.8 mm seam; 1 × B–T: set of 2 tacks, 4 mm each; 45.6 mm seam · PLA | template follow the written method

1 × Close the upper rear-right corner · PLA | template follow the written method

→ T002, T003 • Techniques — reference appendix

D lies on the tabletop. Grip the cool upper frame; from the outside, reinforce L–O and B–R with 45,6 mm seams. Approach the rear seam from behind. Allow it to cool before changing your grip. Grip the cool O frame below its center and, working from above and outside, reinforce L–T (46,8 mm) and B–T (45,6 mm).

Each seam begins and ends 1 mm from the ends of the shared edge. Allow it to cool. Close the upper rear-right corner with a short drop of PLA supported on the three cool frame ends, without protruding beyond the 50 mm outline. Hold the cool frame on the opposite side; work from outside. Allow the entire model to cool.

Stand the cube in turn on D, B, L, T, and R, releasing it each time. Look through O: find the opposite wall and two inner corners. Turn the cube and choose how to display it.



Check

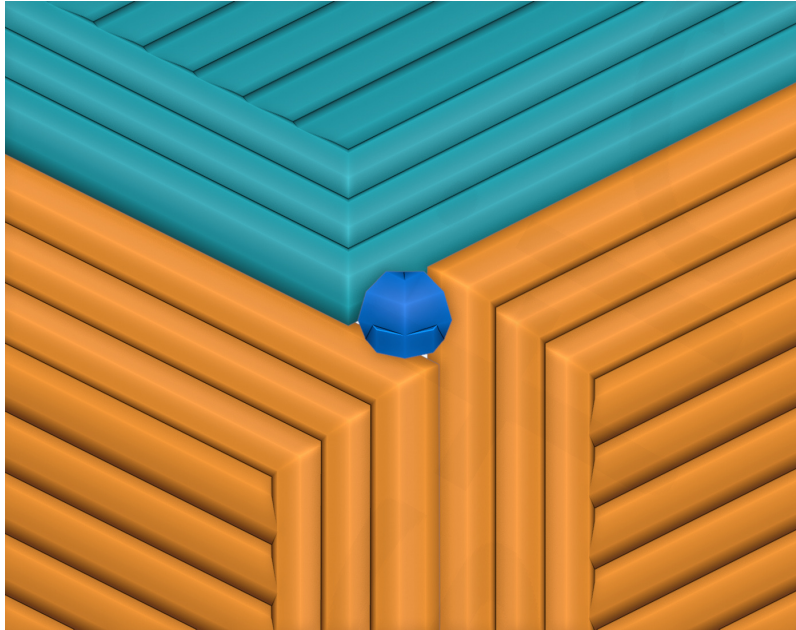
The cube stands unsupported on each of its five filled walls. The real hollow interior is visible through the open window.

If it does not work

If it wobbles, find the uneven wall or seam. Allow it to cool before correcting it and repeat the test; do not bend rigid PLA or touch a hot seam.

Reinforce the cube and check its interior — construction details

Closed upper corner

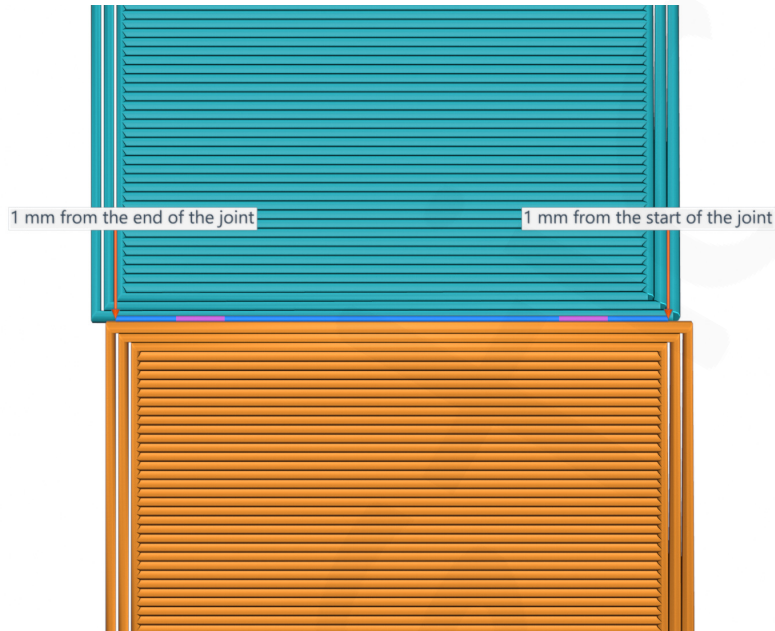


B–R: 45.6 mm seam between the markers



Reinforce the cube and check its interior — construction details

B–T: 45.6 mm seam between the markers



Finished — check the outcome



Check

Five filled walls and one open window.



Check

External dimensions of approximately 50 × 50 × 50 mm.



Check

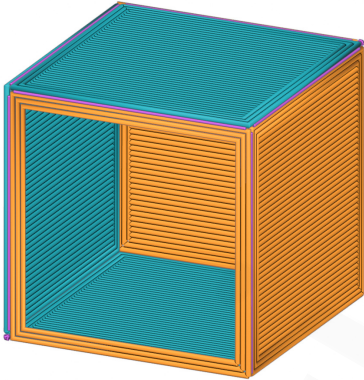
The cube stands in turn on each of its five filled walls; the opening reveals the real interior.

Storage

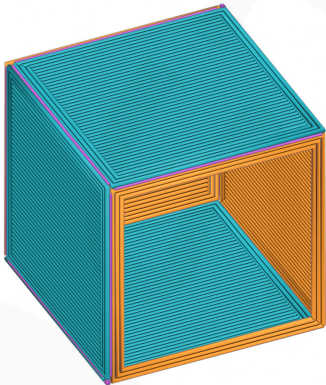
Store the model in a cool place away from sunlight and heat. Repair it on a suitable 3D-pen work surface using the same material as the part.

View from different sides

View 1



View 2



Techniques — reference appendix

T001 • Stage 1 • Stage 2 • Stage 3 • Stage 4 • Stage 5

1 × D — bottom; 1 × B — back; 1 × L — left wall; 1 × T — top; 1 × R — right wall; 1 × O — window · PLA | template follow the written method

1 × D — bottom; 1 × B — back · PLA | template follow the written method

1 × D — bottom; 1 × L — left wall · PLA | template follow the written method

1 × T — top; 1 × R — right wall · PLA | template follow the written method

1 × T — top; 1 × O — window · PLA | template follow the written method

Stage 1: make only the three touching outlines of each square; lay a 1,2 mm strand along the centerlines. Stage 2: only after completing the frames, fill D, B, L, T, and R with parallel strands from one inner edge to the other, joining adjacent strands; O remains open. The first half shows the direction, and the second closes the surface.

Choose the frame and panel colors yourself. Allow everything to cool before assembly. Do not reheat or bend cold PLA.

Techniques — reference appendix — continued

T002 • Stage 2 • Stage 3 • Stage 4 • Stage 5 • Stage 6 • Stage 7 • Stage 8

1 × D-B: set of 2 tacks, 4 mm each; 46.8 mm seam · PLA | template follow the written method

1 × D-L: set of 2 tacks, 4 mm each; 45.6 mm seam; 1 × B-L: set of 2 tacks, 4 mm each; 46.8 mm seam · PLA | template follow the written method

1 × T-R: set of 2 tacks, 4 mm each; 45.6 mm seam · PLA | template follow the written method

1 × T-O: set of 2 tacks, 4 mm each; 46.8 mm seam; 1 × R-O: set of 2 tacks, 4 mm each; 46.8 mm seam · PLA | template follow the written method

1 × L-O: set of 2 tacks, 4 mm each; 45.6 mm seam; 1 × B-R: set of 2 tacks, 4 mm each; 45.6 mm seam; 1 × L-T: set of 2 tacks, 4 mm each; 46.8 mm seam; 1 × B-T: set of 2 tacks, 4 mm each; 45.6 mm seam · PLA | template follow the written method

1 × D-R: set of 2 tacks, 4 mm each; 46.8 mm seam; 1 × D-O: set of 2 tacks, 4 mm each; 45.6 mm seam · PLA | template follow the written method

First apply two 4 mm tacks at the marked points along the joint and let them cool. Only the indicated next step joins them with a continuous strand between the end markers. Do not weld the entire edge at once. Finished cross-section [mm]: 0.6.

Support: Both cooled frames are touching; the lower part rests on the tabletop, and your free hand holds the indicated cool frame. Strand direction: Along the outside groove of the joint, between the ends indicated on the card; tacks before the full seam. Cooling: Allow it to cool before releasing your grip and turning it.

Tip access: The nozzle approaches from outside, from the exposed side indicated on the card; keep your fingers on the opposite side.

T003 • Stage 7 • Stage 8

1 × Close the lower front-left corner · PLA | template follow the written method

1 × Close the upper rear-right corner · PLA | template follow the written method

On the cool, welded corner, join the three frame ends with a short drop of PLA laid over their support points. Keep the outer surfaces flat. Finished cross-section [mm]: 1.2. Support: The three cooled frame ends directly surround the 1,2 mm gap.

Strand direction: Make a short movement from the first frame across the corner to the other two; do not draw a strand through the air. Cooling: Allow it to cool before turning. Tip access: Keep the exposed corner facing upward and outward; grip well away from the drop.