

CCX Concrete Canvas

User Guide: Jointing



CCX® is part of a revolutionary new class of construction materials called Geosynthetic Cementitious Composite Mats (GCCMs). It is a flexible, concrete filled geosynthetic, that hardens on hydration to form a thin, durable, water proof layer. Essentially, it's Concrete on a Roll®. Two variants of CCX® are currently available: CCX-UTILITY™ (CCX-U®) and CCX-MAT® (CCX-M®). The following guide provides an overview of methods for jointing these two variants. The versatile nature of CCX™ means that this document is not exhaustive and is intended for guidance purposes only. For details on cutting, edge fixing and intermediate fixing detailing for CCX®, consult the Concrete Canvas® Specification Guides.

General Guidance

Overlapping

CCX® must always be overlapped by a minimum of 100mm and jointed to form a continuous GCCM structure. When used in hydraulic applications, the overlaps must be shingled in the direction of water flow so that water flows over the joints rather than in to them (see Figure 1).

Marker Lines

CCX® is manufactured with two blue marker lines parallel to each machine edge to assist in alignment and correct jointing of CCX® layers. The 'overlap marker line' is used to position overlapping layers, ensuring there is a minimum cement edge to cement edge overlap of 100mm. When lapping, the machine edge of the top CCX® must be aligned with the overlap marker line as shown in Figure 2. The 'fixing marker line' is used to ensure that any sealants and/or mechanical fixings specified for CCX® joints (see Section 2) are positioned in the centre of the 100mm overlap for optimum joint strength.

Joint Methods

CCX-U® and CCX-M® must always be jointed using mechanical fixings. The permeability of the joints can be reduced with the use of suitable sealants or by thermal bonding of the overlapped material.

Hydration of the Overlaps

Unlike the Concrete Canvas® T-Series GCCM, research by Concrete Canvas Limited has shown that CCX® does not specifically require hydration of the underlaps prior to jointing in order to achieve a suitable joint strength. When using a Screwed or Screwed and Sealed joint, an installer may still choose to hydrate the underlaps prior to jointing (eg when removing dirt). **Note that when thermally bonding CCX®, the material must be dry and protected from exposure to water.**

Suitability of Sealants

The smooth, polymeric backing to Concrete Canvas Ltd GCCMs provides unfavourable conditions for an adhesive sealant to stick to both GCCM layers and improve joint strength. Therefore, the use of sealants is for the sole purpose of reducing joint permeability of screwed overlap joints, rather than improving joint strength or being used as a standalone joint method. The designer must specify a suitable sealant for reducing the permeability of the screwed overlap joint. They should check the sealant manufacturers safety data sheet and technical data sheet to verify that the sealant is suitable for the temperature/exposure conditions, can be applied on damp surfaces and is suitable for site specific conditions such as risk of contamination or harm to aquatic life. Traditionally, the most suitable sealants used in GCCM joints are manufactured from SMX hybrid polymer. Concrete Canvas Ltd stock Soudaseal 250XF but a number of other sealants are regularly used globally and information can be provided on request. Sealants have a shelf life and it is not recommended to use products past their expiry date.

CCX-U® and CCX-M® Jointing Specifications

Installing on Soil Substrates

Screwed Overlap Joints

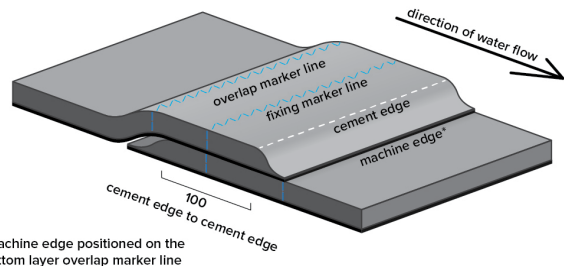
Impermeability Rating: ●○○○○

Mechanical Strength: ●●●○○

This joint is suitable for the majority of CCX-U® and CCX-M® applications. It is fast and simple to apply, providing good mechanical strength but has limited impermeability.

The following equipment is required:

- 30mm long stainless steel screws, minimum 4mm diameter with a coarse fully threaded shank, collated screws are recommended for large projects (available from Concrete Canvas Ltd)
- Battery powered screwdriver or autofed screwdriver for large projects



*machine edge positioned on the bottom layer overlap marker line

Figure 1. Direction of CCX™ overlap



Figure 2. Marker lines on CCX surface

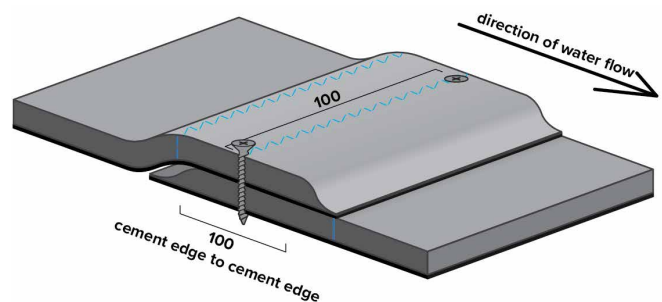


Figure 5. Screwed overlap joint

Procedure:

1. Joint Alignment: Overlap in the direction of water flow, with the machine edge of the top layer positioned on the overlap marker line of the bottom layer. Ensure that the two layers are in contact along the length of the joint.
2. Installation of Screws: Screws must be applied at a maximum of 100mm spacing along the fixing marker line, see Figure 5.
3. Hydrate the CCX® as described in the CCX® User Guide: Hydration. Particular attention should be paid to the overlap area to ensure sufficient hydration through wicking.

Video: [How to Install CCX-M® | Screwed Option](#)

Video: [How to Install CCX-U® | Screwed Option](#)

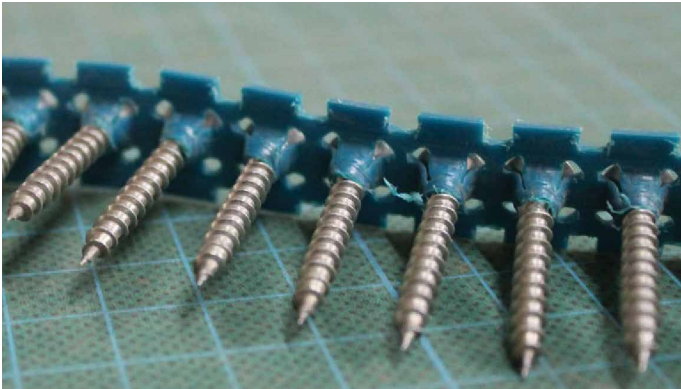


Figure 6. Stainless steel collated screws



Figure 7. Screws inserted through fixing marker line

Screwed & Sealed Overlap Joint

Impermeability Rating: ●●●○○

Mechanical Strength: ●●●○○

For applications where improved impermeability is required, the screwed overlap joint can be installed in combination with a suitable sealant.

The following equipment is required:

- 30mm long stainless steel screws, minimum 4mm diameter with a coarse fully threaded shank, collated screws are recommended for large projects (available from Concrete Canvas Ltd)
- Battery powered screwdriver or autofed screwdriver for large projects
- Suitable sealant and applicator (e.g. cartridge or barrel caulking gun depending on the format of the sealant)

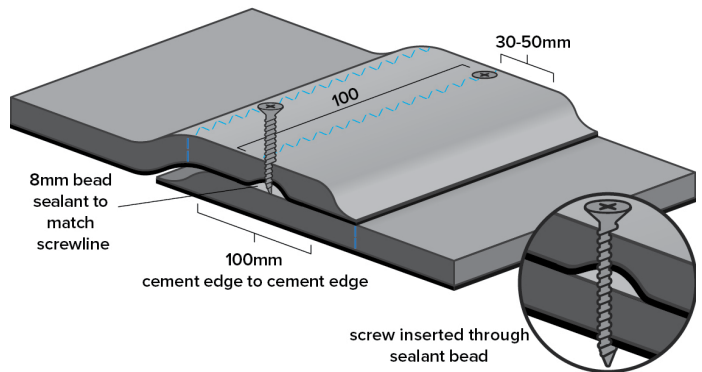


Figure 7. Screws inserted through fixing marker line



Figure 9. Sealant applied along fixing marker line

Procedure:

1. Joint Alignment: Overlap in the direction of water flow, with the machine edge of the top layer positioned on the overlap marker line of the bottom layer. Ensure that the two layers are in contact along the length of the joint.
2. Overlap Preparation: The overlap should be lifted so that the sealant can be applied on the fastening marker line. Surfaces may be damp during installation, but should have no standing water.
3. Sealant: Apply as an 8mm continuous bead along the fixing marker line of the CCX® underlap layer. An 8mm bead is equivalent to a coverage of 50ml/m which is equivalent to 5.8m of joint from a 290ml cartridge or 12m of joint from a 600ml cartridge.
Installation of Screws: Once hydrated and sealant has been applied, fold back the top CCX® layer to ensure both layers are aligned with the overlap marker line and the sealant is compressed. Once hydrated CCX® has a working time of approximately 30 minutes in ambient temperatures of 20°C, screws must be applied before setting begins so the concrete within CCX® will then set around the thread of the screws. The screws should be applied at a maximum of 100mm spacing along the fixing marker line, through the sealant bead to minimise leakage, see Figures 8 and 9.
4. Hydrate the CCX® as described in the CCX® User Guide: Hydration. Particular attention should be paid to the overlap area to ensure sufficient hydration through wicking.

Video: [How to Install CCX-M® | Screwed & Sealed Option](#)

Video: [How to Install CCX-U® | Screwed & Sealed Option](#)

Screwed & Thermal Bond Overlap Joint

Impermeability Rating: ●●●○

Mechanical Strength: ●●●●○

Where the use of sealants to reduce permeability is not suitable, Thermal Bonding can be used. The joint is formed using a Leister Unidrive 500Geo to form a bond between the underside of the CCX® and the polyester top surface.

The following equipment is required:

- Leister Unidrive 500Geo with a specialised nozzle (available from Concrete Canvas Limited) A 240v Leister Unidrive 500Geo typically produces stronger joint results than a 110v Unidrive 500Geo.
- Power supply sufficient to provide uninterrupted power to the Unidrive 500Geo (check manufacturer's recommendations)
- Stiff Brush for cleaning the CCX® surface
- Wire Brush for cleaning the equipment nozzles
- Cleaning rags for wiping the LLDPE backing of CCX®
- Safety Gloves
- Mask (A2P3 filter or equivalent)
- 30mm long stainless steel screws, minimum 4mm diameter with a coarse fully threaded shank, collated screws are recommended for large projects (available from Concrete Canvas Ltd)
- Battery powered screwdriver or autofed screwdriver for large projects

Procedure:

1. **Joint Alignment:** Overlap in the direction of water flow, with the machine edge of the top layer positioned on the overlap marker line of the bottom layer. Ensure that the two layers are in contact along the length of the joint. NOTE: unset material can be bonded to both set and unset material, but the uppermost layer must be unset.
2. **Overlap Preparation:** The fibrous surfaces should be cleaned of any surface dust using a stiff brush and the LLDPE backing of CCX-M® should be clean and dry.
3. **Tool settings:** Determine the initial settings for your Unidrive 500. CCX-M® Jointing using 240v Unidrive: Bond at 1.5m/min, temperature >560C, airflow 80%. CCX-M™ Jointing using 110v Unidrive: Bond at 1m/min, temperature >560C, airflow 80%. For CCX-U®, initial settings may be adjusted to 2m/min and 1.5m/min for 240v and 110v Unidrives respectively. Settings may need to be adjusted after conducting the trial joint, see step 5.
4. **Tool Preparation:** The Unidrive 500Geo (fitted with the specialised nozzle available from Concrete Canvas) should be adjusted to achieve the required joint strength using the calibration guidance in step 5 below to create a 'Trial Joint'. Leave the Unidrive 500Geo on for approximately 5 minutes to reach temperature. Wear heavy gloves and a mask as the Unidrive 500Geo will be hot and give off fumes. Only thermal bond in a well ventilated area.
5. **Thermal Bonding:** Once up to temperature, position the nozzle in between the overlap, so the nozzle is fully inserted and begin thermal bonding. Working your way from one end of the joint to the other, follow the Unidrive 500Geo to ensure it does not get snagged on uneven ground or at profile changes. It is important to ensure that downward pressure is applied to the rear wheel of the Unidrive.
6. **Trial Joint / Calibration:** Prior to bonding a field joint, it is necessary to conduct a 'Trial Joint' to set the Unidrive 500Geo to the correct temperature, air flow and weld rate. If the trial joint is unsatisfactory, repeat the trial with adjusted settings until a satisfactory trial joint is observed. As a rule of thumb the following can be used as a guide:



Figure 12. Trial joint calibration

Correct Speed / Temperature: This should show evidence of detached top geotextile fibres and cement embedded within the LLDPE backing with a 30-40mm wide zone

Too fast / Too cold: Joint will pull apart after cooling without causing detachment of top geotextile fibres or embedment of cement in the LLDPE backing

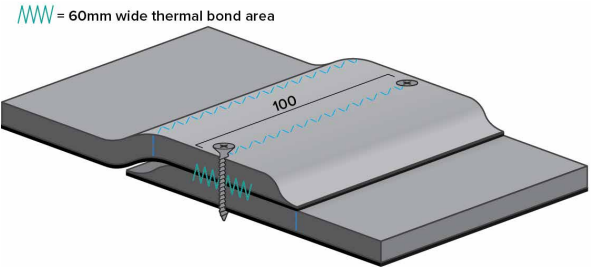


Figure 10. Screwed and Thermal Bond overlap joint



Leister Unidrive 500Geo



Brush to ensure fibres are visible



Wipe clean the LLDPE backing



Thermal Bonding with the Unidrive 500Geo

Figure 11. Thermal bonding procedure

Note that once hydrated, the cementitious material from both CCX™ layers will cure together to increase joint strength.

7. Installation of Screws: The screws should be applied at a maximum of 100mm spacing along the fixing marker line.

8. Hydrate the CCX® as described in the CCX® User Guide: Hydration. Particular attention should be paid to the overlap area to ensure sufficient hydration through wicking.

Video: [How to Install CCX-M® | Thermal Bond & Screw Option](#)

Other useful guidance:

- When powering down the Unidrive 500 it is recommended to turn down the heating element whilst allowing the air to remain running in order to cool the element and avoid damage.
- In the event of power loss to thermal bonding equipment, the nozzle should be removed from the joint and the area marked. Once equipment functionality has been restored and thermal bonding resumes, a bead of suitable sealant should be installed at the point of power loss and at least 150 mm on either side of the area.
- Routine maintenance of the welding equipment is required and particular attention should be paid to the hot air nozzle which should be regularly cleaned with a wire brush to prevent the build-up of residue.
- On uneven ground, sandbags may be used to ensure joints are in contact with the substrate and prevent voids beneath the CCX®.
- A stiff brush can be used to clean the surface of the CCX® prior to hydration in order to remove footprints, dust accumulation and prevent staining on the set material.

When installing on solid subgrades that cannot be penetrated by standard screws, 'short' screws can be used instead. The short screws must be stainless steel, 4mm diameter with a fully threaded shank and 19mm long with a blunt tip, so that the cement can set around the shank but the screw does not significantly penetrate the bottom LLDPE backing layer CCX-M® as shown in figure 12. It is recommended to use a stub or flat ended screw to limit potential penetration of the LLDPE, when using CCX-M®.

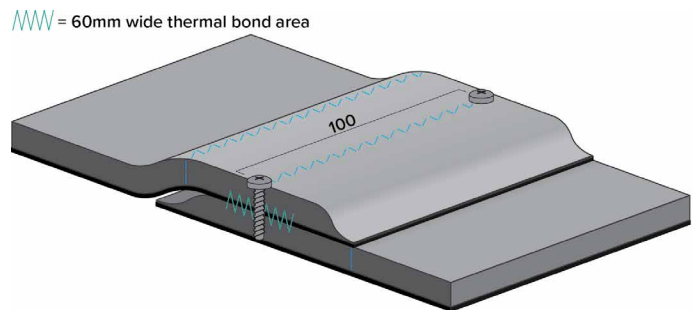


Figure 13. Short screw and Thermal Bond overlap joint

Installing on Solid Substrates (e.g. concrete or rock)

Mechanical Fixings

When installing on solid substrates where screws cannot penetrate the surface, such as concrete or rock, the screws can be replaced with other suitable mechanical fixings, such as stainless steel concrete screw anchors or through bolts. The mechanical fixings must have a minimum head/ washer diameter of 15mm and installed a maximum spacing of 500mm along the fixing marker line as shown in figure 15.

The permeability of the mechanical fixing joint can be reduced using sealant or by thermal bonding as described in sections 2.1.2 and 2.1.3 above. Note that the use of shot fired nails is not recommended.

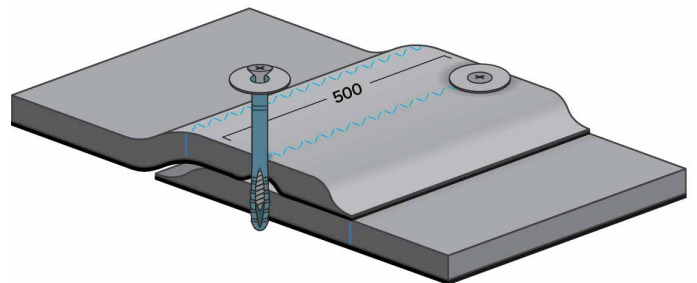


Figure 14. Mechanical fixing overlap joint

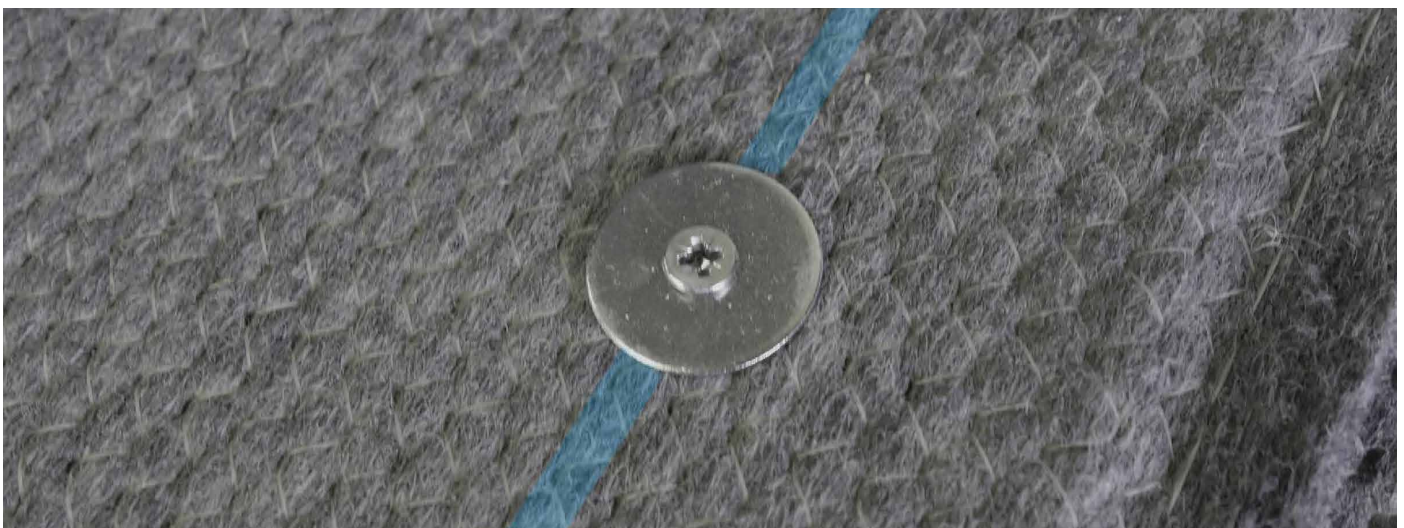
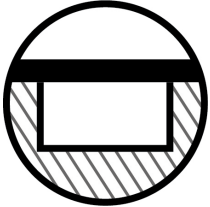


Figure 15. Mechanical fixing overlap joint

Installation Principles

The unique material properties of CCX® mean that it can be used for a variety of applications. Following the Four Installation Principles below will help ensure a successful installation.



Avoid Voids

1. Avoid Voids

Prepare the substrate so it is well compacted, geotechnically stable and has a smooth and uniform surface.

- For soil substrates, remove any vegetation, sharp or protruding rocks and fill any large void spaces. Ensure the CCX® makes direct contact with the substrate to minimise soil bridging or potential soil migration under the layer.
- For concrete substrates, remove any loose or friable material, cut away any protruding exposed re-bar and fill any large cracks or voids.



Secure Canvas

2. Secure Canvas

It is important to ensure that the CCX® is Jointed at every overlap between layers and that those layers are Fixed to the substrate.

- **Jointing:** Overlapped CCX® layers should be securely jointed together. For CCX-U® and CCX-M®, typically this is achieved using stainless steel screws applied with an auto-fed screw gun at regular intervals. Correct screw placement will help ensure intimate contact between CCX-U® and CCX-M® layers, prevent washout of the substrate, and limit potential weed growth. A suitable sealant can be applied between the layers to improve the joint impermeability.
- **Fixing:** When fixing to a soil substrate, ground pegs (e.g. J-pegs) are typically used. On rock or concrete substrates, CCX® layers can be jointed together and fixed to the substrate using masonry bolts, or concrete screw anchors. Stainless steel fixings with washers are recommended.

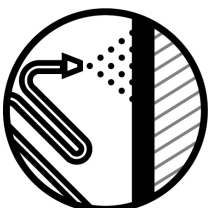


Prevent Ingress

3. Prevent Ingress

It is important to prevent water or wind ingress between the CCX® and the substrate, both around the perimeter of the installation and along the joints.

- For soil substrates, this is typically achieved by capturing the entire perimeter edge of the CC within an anchor trench.
- On rocky or concrete substrates, the perimeter edge should be secured using mechanical fixings and washers or clamping bar, sealed with a gasket or suitable sealant and finished with an optional grout fillet.
- All overlapped CCX® layers should be lapped in the direction of water flow.



Fully Hydrate

4. Hydrate Fully

It is critical to properly hydrate CCX®, taking into account the quantity of material used and ambient temperature conditions.

- Always ensure hydration through the fibrous top surface.
- Ensure to hydrate any overlapped areas and anchor trenched material prior to backfilling.
- Spray the fibre surface with water until it feels wet to touch for several minutes after hydration (the 'Thumb Test'). Rinse hands immediately after the touch test. Consult the CCX® SDS document.
- Always respray within 30 minutes of initial hydration.
- Follow the CCX® User Guide: Hydration.

Fixing Component	Code	Description
Screws	CCCNPSS-4.0/35	CC Collated Screw 4.0x35mm SS 1000pk
Pin 12mm /50mm Head	CCP250/12	CC PIN 250 x 12mm HDG
Pin 16mm / 50mm Head	CCP380/16	CC PIN 380 x 16mm HDG
Pin 13mm / 20mm Head	TPIN360	M/TEX Concrete 360mm Fixing Pin 13mm
Sealant Cartridge	40-121970	T-Rex Power Fast Grab 290ml Steel Grey
Sealant Sausage	40-147559	T-Rex Power Fast Grab 600ml Steel Grey

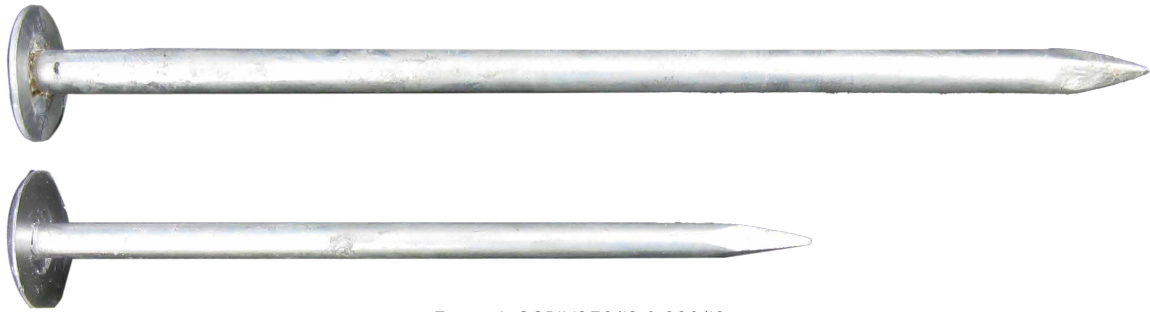


Figure 1- CCPIN250/12 & 380/16



Figure 2 - TPIN360



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