DINCEL
STRUCTURAL WALLING

CONSTRUCTION MANUAL

VERSION 05.2023

CONTENTS

DINCEL
STRUCTURAL WALLING

OVERVIEW

CONTENTS

A.1. ABOUT DINCEL

Dincel is an Australian owned and Australian manufactured product.

The Dincel Group was founded in 1989 as Dincel & Associates Consulting Engineers. The group originally specialised in structural and design engineering working across both commercial and residential markets.

In 2006 Dincel Structural Walling was created. The years preceding 2006 were spent researching and developing the original PVC based permanent formwork system, refining the initial concept, demonstrating compliance with Australian NCC and finally internationally patenting what is now Dincel Structural Walling.

As a qualified and registered structural engineer, Burak Dincel the owner and founder of the Dincel Construction System Group, knew too well about all the challenges associated with speed of construction, concrete cancer, handleability onsite and durability of both multistorey superstructures, as well as low rise commercial buildings and residential homes.

Today, use and acceptance of Dincel products in the marketplace both locally and internationally is growing rapidly, with Dincel being used across commercial, residential and civil markets in Australia, New Zealand and Fiji.

A.2. SYSTEM DETAILS

Dincel 110

Dincel 155

Dincel 200

Dincel 275

A.2.1 THE DINCEL SYSTEM

Dincel Structural Walling is a permanent polymer formwork system for concrete walling. It can be used to construct a wide range of concrete walls: such as basement walls, intertenancy (party) walls, core (lift and stair) walls, retaining walls, façade walls, balustrades, columns, tanks, pools, sea walls, irrigation walls, curved walls, planter boxes and much more.

The polymer formwork stays in place after the concrete is poured (the formwork is not stripped afterwards), thereby providing the wall with a waterproof and durable skin. This skin protects the concrete and steel reinforcement which increases the lifespan of the walls compared to conventional concrete and masonry structures.

The Dincel material uses a proprietary PVC which does not use plasticisers or heavy metal stabilisers but rather organic stabilisers. This allows Dincel to be a certified non-toxic product and attain Best Environmental Practice (BEP) certification. Our unique PVC formulation also offers superior fire properties, smoke properties and UV resistance.

A.2.2. DINCEL FEATURES AND BENEFITS

Speed

The patented 'snapping' vertical connection of Dincel panels means the formwork can be installed at an incredible rate of 25m² / 2 people / hour, even by non-skilled labour.

Handleability

Each 3m long panel only weighs 13kg (for the 200mm profile), meaning that no crane is required.

Waterproof Skin

The 'stay in place' polymer formwork provides a permanent waterproof skin to the concrete wall, meaning a Dincel wall does not require further waterproofing other than the wall junctions (please refer to the waterproofing section of this manual for more information). This:

- Maximises land usage by building right up to the boundary (over excavations is usually required for waterproofing purposes).
- Minimises the amount of the waterproofing products required and the labour to apply them.
- Minimises rectification works – the durable waterproof skin prevents corrosion of steel reinforcement and therefore minimises the risk of concrete spalling (concrete cancer).

Crack Control Technology

The system contains a unique crack inducing technology which:

- Eliminates requirement for crack control steel reinforcement within the wall. When steel reinforcement is required for structural purposes it can easily be inserted and held into place with the panel's webs or accessories.
- Eliminates requirement for crack control vertical joints - leading to reduced finishing and caulking requirements. However, Dincel recommends incorporating the joints of the suspended concrete slabs in the walls (please refer to the project structural engineers' details).

Elaborate Concrete Wall Shapes

Curved Dincel walls are easily achieved through the use of accessories. In addition, the flexibility of the system means that profiles can be manipulated and cut in order to achieve the desired shape, such as a slope at the top of the wall (please refer to the installation section of this manual for more information).

Synergies Onsite

Builders and formworkers can enjoy the following inherent benefits of the Dincel system:

- Profiles can be installed to be 1.2 metres above the deck height in order to act as temporary edge protection, eliminating safety hand rails.
- Deck edge boards for floor slabs can be eliminated by simply removing the Dincel skin on one side only.
- Minimal bracing required.
- Installation of Dincel walls are not affected by wet weather conditions.

A.2.3 APPLICATIONS

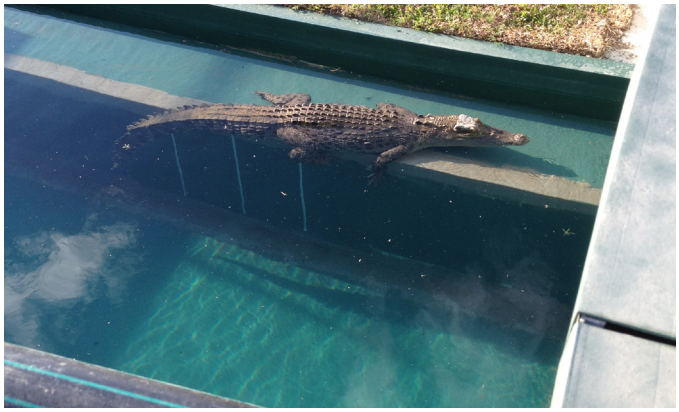
Basement Walls

Shear Walls (Stair and Lift Shafts)

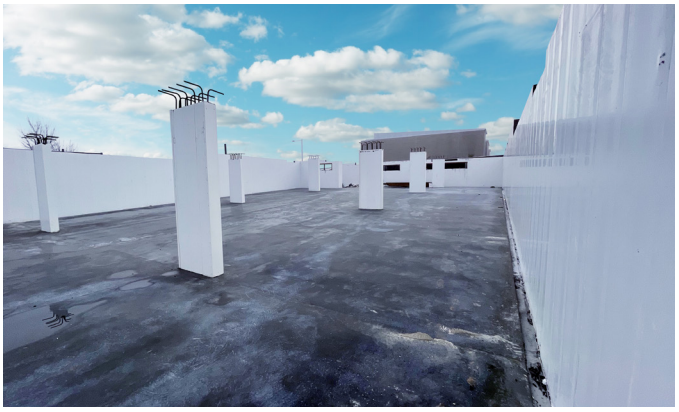
Façade Walls

Planter Boxes

Party/Intertenancy Walls



Tanks and Pool Walls



Columns

Curved Walls

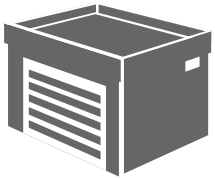
A.2.4.SEGMENTS – BUILDING

Residential

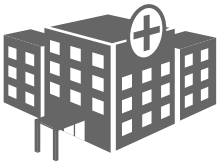
Multi-Residential

Aged Care

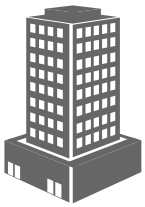
Education



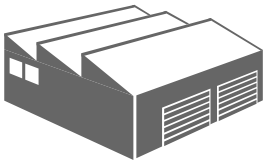
Garage, Carport and Fire Shelters



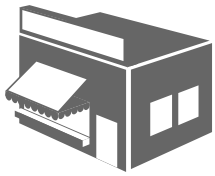
Health Care



Office

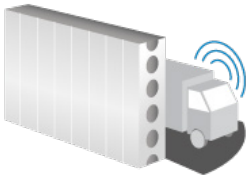


Warehouse & Manufacturing

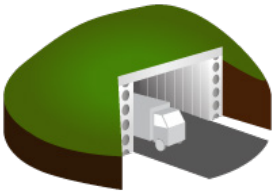


Retail

A.2.4.SEGMENTS – CIVIL

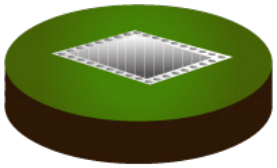


Road & Infrastructure

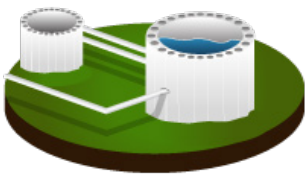


Tunnels & Stations

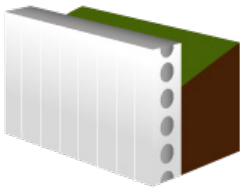
Culverts



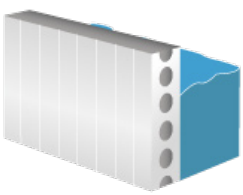
Access Pits & Manholes



Water Supply / Sewerage Infrastructure



Retaining Walls



Revetment / Sea Walls / Erosion Protection Walls

A.2.5.OVERVIEW OF CONSTRUCTION PROCESS

Components List

Our estimating team can prepare a components list from the supplied architectural and structural project drawings. Simply use our website to upload your plans and a member of our estimating team will make contact to discuss further.

The components list will label the walls and outline the components required to construct each wall. The wall heights will simply need to be confirmed by others as part of the quote review process.

Ordering

The order can be directly based upon the components list. There is the option to order:

- Stock Lengths – these are Dincel panels available in certain sizes, which allows for shorter lead times. Stock lengths can be cut on site to suit your exact requirements.
- Custom Lengths – Panel lengths are cut in our factory to suit your requirements, which reduces the necessity for cutting on site.

Delivery or Pickup

Delivery can be arranged by truck with 'hiab' style crane for easy unloading on site.

- Dincel stock orders are generally distributed within two days of an order being placed and payment being received and cleared.
- Custom orders will be manufactured, packed and distributed between 7-14 working days of order being received depending on location and profile ordered.

Customers also have the option of arranging their own transport. Pick-up is also available Monday to Friday from our NSW, VIC and QLD branches.

Installation

Dincel hollow formwork panels are 'snapped' (clicked) together to build and form the wall. This patented snapping action ensures a safer, faster installation. While connecting panels, steel reinforcement can be added inside the wall as required. Once this is complete, concrete is simply poured within the Dincel formwork.

Accessory components such as corners, caps, guides and joiners are available to help streamline the installation process.

Finishing

Once installed and concreted, Dincel walls are capable of being finished in a variety of ways:

- Left Bare - Where a decorative finish is not required (typically for basement walls or stairwells).
- Painted - Dincel walls can be painted with PVC compatible paint systems.
- Rendered - Exterior or interior Dincel walls can be finished with PVC compatible renders (typically acrylic based) in a variety of smooth, textured or stencilled finishes.
- Cladding – Dincel wall can be clad with stone, timber, plasterboard, metal or other commercially available NCC compliant cladding.

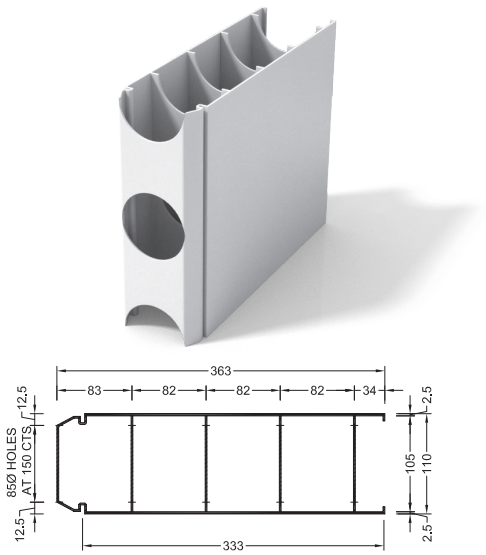
It is important to note that Dincel does not manufacture or supply any of the above finishes. For any finishes being applied, it is important to adhere to the manufacturer recommendations and guidelines provided within Section C.

A.3. COMPONENTS

Dimensions provided within this manual are for guidance purposes and may slightly vary from actual product due to manufacturing tolerances. Allow up to ±5mm deviation from the ordered panel heights and 1mm deviation for the panel width (applicable to both stock and custom panel orders). Simplified connection/barb type is shown for all profiles and accessories.

A.3.1. DINCEL 110 COMPONENTS

110P-1 MAIN PROFILE



Description
The 110P-1 is the main profile/panel within the Dincel 110mm range, which can be installed in the vertical or horizontal direction. Each panel adds 333.3mm to the wall length from clip to clip.

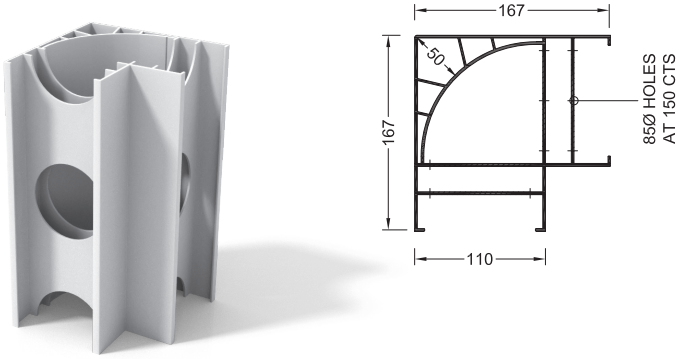
Installation
Click or slide a 110P-1 into another Dincel 110 main profile or accessory by using the snap-lock connection.

Stock Lengths
2850mm, 3000mm, 4000mm.

Custom Lengths
Any length from 1800mm to 7950mm in 1mm increments, or 1200mm to 1650mm in 150mm increments.

Mass
3.5kg per metre length (approximate)

110P-3 CORNER PROFILE

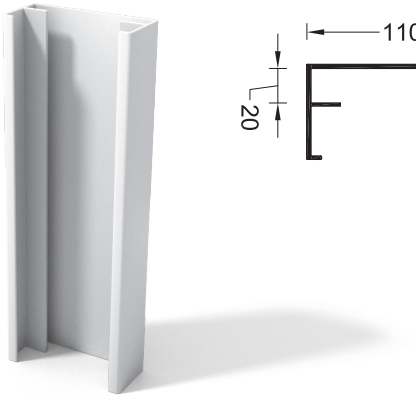


Description
The 110P-3 is used to achieve a 90° wall corner. The accessory extends the overall wall length by approximately 167mm from the clip location.

Installation
Click or slide the 110P-3 into a Dincel 110 main profile or accessory by using the snap-lock connection.

Stock Lengths
Available only in stock lengths of 3000mm.

110P-EC CLIP-ON END CAP ACCESSORY

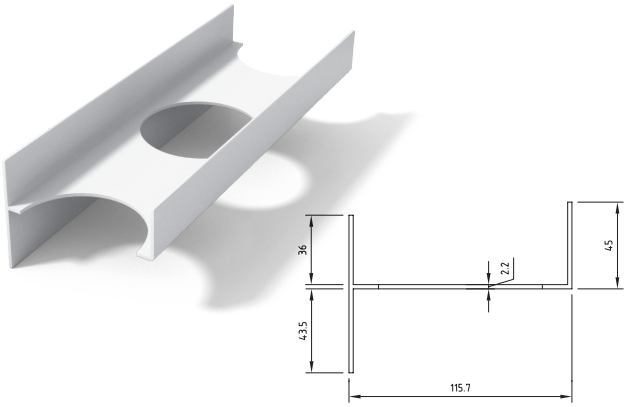


Description
The 110P-EC is used to finish/close off the end of a wall installed vertically. The Clip-On End Cap extends the overall wall length by approximately 56mm from the clip location.

Installation
Click or slide the Clip-On End Cap into a compatible Dincel main profile or accessory by using the snap-lock connection. To prevent bulging from the concrete pour, the Clip-On End Cap requires to be braced.

Stock Lengths
Available only in stock lengths of 3000mm.

110P-EG EDGE GUIDE ACCESSORY

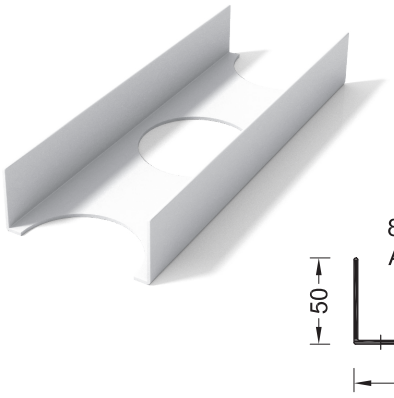


Description
The 110P-EG is used at a floor or slab edge to start the wall above. Accessory only suitable for above ground walls (non-submerged) and subject to approval by a Design Engineer.

Installation
Placed and secured to floor or slab edge and used to guide Dincel profiles above. Some of the internal webs are removed to promote a greater concrete-to-concrete interface.

Stock Lengths
Available only in stock lengths of 3000mm.

110P-G GUIDE TRACK ACCESSORY

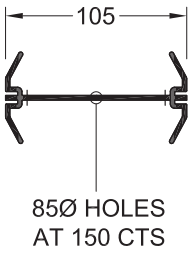


Description
An accessory used as a guide/track to hold the bottom of the walls temporarily. The use of a Guide Track accessory is not recommended for walls that are required to be waterproof, shear walls or where cast-in starter bars are used (instead of post-fixed). Instead, use D-ANG50 PVC Angle on either side.

Installation
The Guide Track accessory is secured to the slab or footing with concrete nails or equivalent. Once this is complete the Dincel main profiles are able to slide down into the track.

Stock Lengths
Available only in stock lengths of 3000mm.

110P-J JOINER ACCESSORY

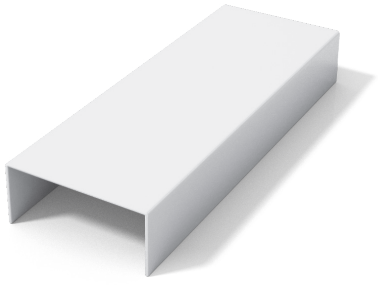


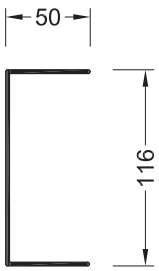
Description
The 110P-J is used to join two Dincel profiles together through their clip connections. The Joiner accessory does not add any length to the wall.

Installation
Click or slide the Joiner into a compatible Dincel main profile or accessory by using the snap-lock connection. The Dincel profiles being joined must have their clip barbs facing the Joiner.

Stock Lengths
Available only in stock lengths of 3000mm.

110P-TC SCREW-ON CAP ACCESSORY



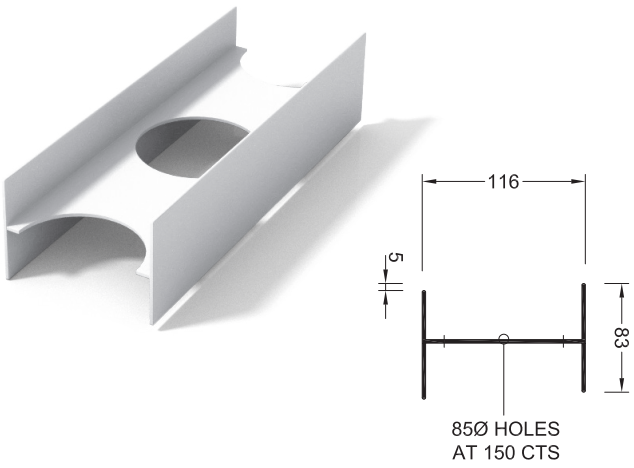


Description
The 110P-TC is used to cap the top or the end of a Dincel wall for aesthetic or finishing purposes.

Installation
The Screw-On Cap simply slides over the Dincel profile at the top or ends of the wall. It is typically secured using screw fixings or a suitable adhesive.

Stock Lengths
Available only in stock lengths of 3000mm.

110P-WS WALL SPLICER ACCESSORY



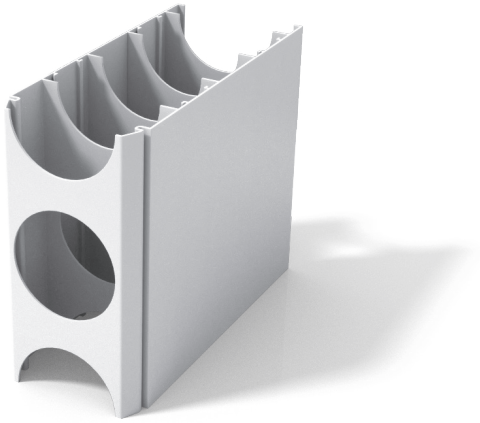
Description
The Wall Splicer accessory is primarily used to connect two Dincel main profiles together without the use of a snap-lock connection. This is typically required when main profiles are cut and the snap-lock connectors cannot be used, or to connect walls which span over one level.

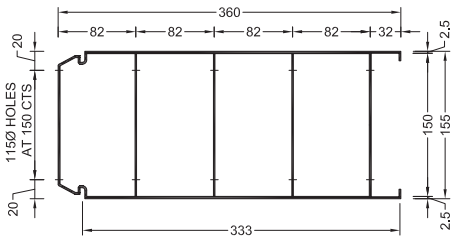
Installation
The flanges of the Wall Splicer can simply slide on top of two Dincel profiles, either at the top, bottom or ends of the wall. It is typically secured using screw fixings or a suitable adhesive. If a waterproof wall is required, the joint is required to be waterproofed using a membrane or suitable sealant.

Stock Lengths
Available only in stock lengths of 3000mm.

A.3.2. DINCEL 155 COMPONENTS

155P-1 MAIN PROFILE





Description
The 155P-1 is the main panel/profile within the Dincel 155mm range, which can be installed in the vertical or horizontal direction. Each panel adds 333.3mm to the wall length.

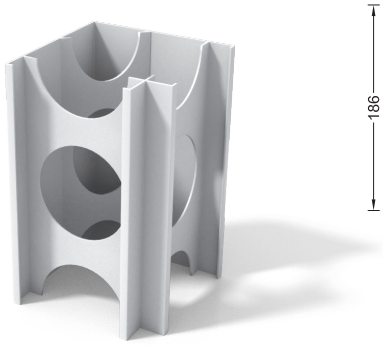
Installation
Click or slide a 155P-1 into another main profile or a compatible accessory by using the snap-lock connection.

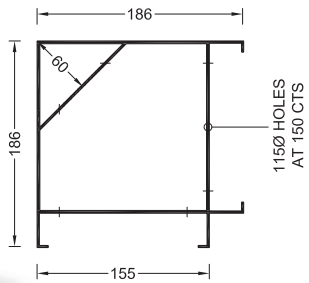
Stock Lengths
2850mm, 3000mm.

Custom Lengths
Any length from 1800mm to 7950mm in 1mm increments, or 1200mm to 1650mm in 150mm increments.

Mass
4kg per metre length (approximate).

155P-3 CORNER PROFILE



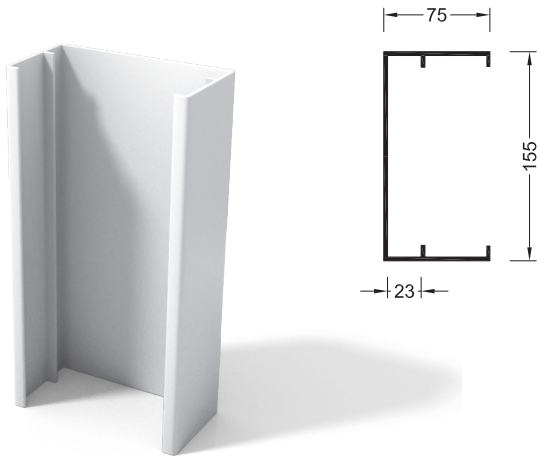


Description
The 155P-3 is used to achieve a 90° wall corner. The accessory extends the overall wall length by approximately 186mm from the clip connection.

Installation
Click or slide the P-3 into a compatible Dincel main profile or accessory by using the snap-lock connection.

Stock Lengths
Available only in stock lengths of 3000mm.

155P-EC CLIP-ON END CAP ACCESSORY



Description

The 155P-EC is used to finish/close off the end of a wall installed vertically. The Clip-On End Cap extends the overall wall length by approximately 75mm from the clip connection.

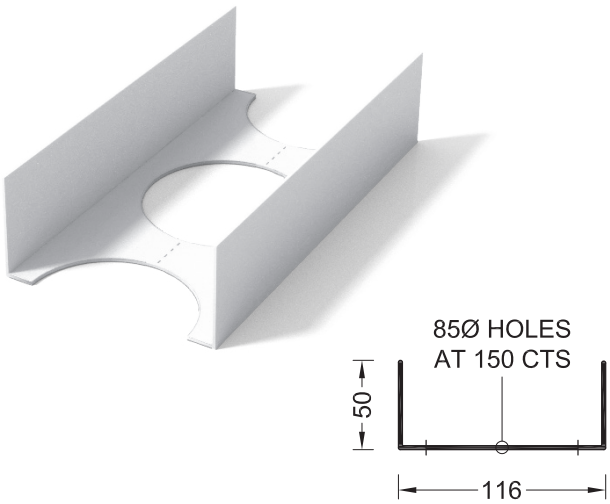
Installation

Click or slide the Clip-On End Cap into a compatible Dincel main profile or accessory by using the snap-lock connection. To prevent bulging from the concrete pour, the Clip-On End Cap requires to be braced.

Stock Lengths

Available only in stock lengths of 3000mm.

155P-G GUIDE TRACK ACCESSORY



Description

The 155P-G is used to as a guide/track to hold the bottom of the walls during concrete pouring. The use of a Guide Track accessory is not recommended for walls which are required to be waterproof, shear walls or where cast-in starter bars are used (instead of post-fixed). Instead, use D-ANG50 or ½ 155P-TC as angles on either side.

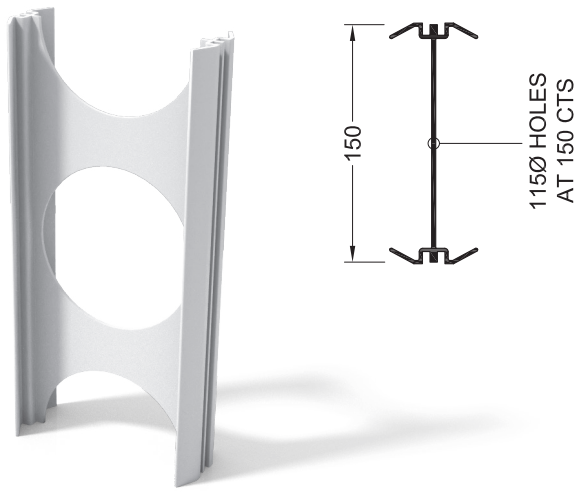
Installation

The Guide Track accessory is secured to the slab or footing with concrete nails or equivalent. Once this is complete the Dincel main profiles are able to slide down into the track.

Stock Lengths

Available only in stock lengths of 3000mm.

155P-J JOINER ACCESSORY



Description

The 155P-J is used to join two Dincel profiles together through their clip connections. The Joiner accessory does not add any length to the wall.

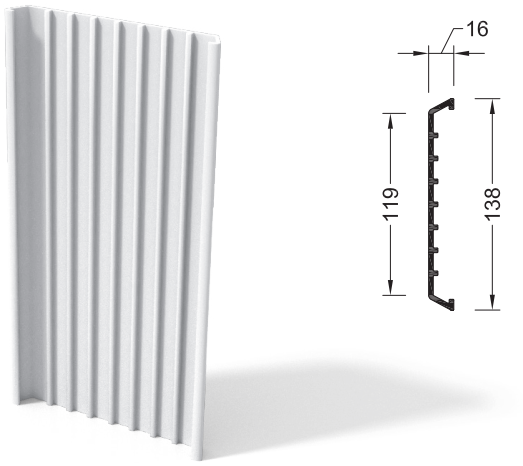
Installation

Click or slide the Joiner into a compatible Dincel main profile or accessory by using the snap-lock connection. The Dincel profiles being joined must have their clip barbs facing the Joiner.

Stock Lengths

Available only in stock lengths of 3000mm.

155P-SE STOP END ACCESSORY

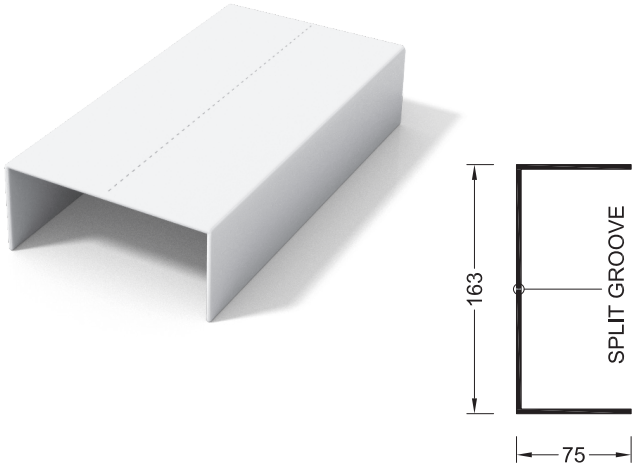


Description
The 155P-SE is used to close the male end of a P-1 Dincel main profile or Clip-On End Cap (EC). This will prevent wet concrete from escaping the profile's horizontal circular openings during concrete pouring and also remove the requirement for edge bracing.

Installation
Slide the accessory vertically into the grooves of the P-1 main profile or Clip-On End Cap (EC), no screws are required. Off cuts can be placed on top of each other to minimise wastage.

Stock Lengths
Available only in stock lengths of 3000mm.

155P-TC SCREW-ON CAP ACCESSORY

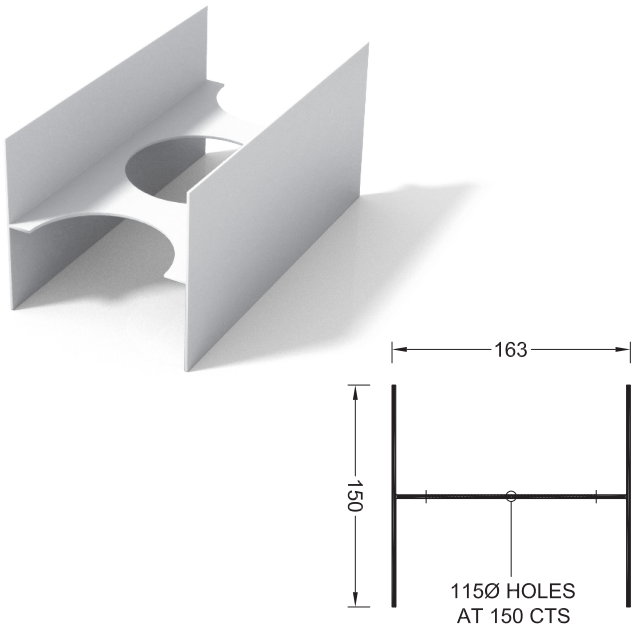


Description
The 155P-TC is used to cap the top or the end of a Dincel wall for aesthetic or finishing purposes. It can also be cut in half using the preformed groove in order to create two separate angles, which can then be used as external wall guides.

Installation
The Screw-On Cap simply slides over the Dincel profile at the top or ends of the wall. It is typically secured using screw fixings or a suitable adhesive. If used as a guide, the angles are held down using concrete nails or equivalent.

Stock Lengths
Available only in stock lengths of 3000mm.

155P-WS WALL SPLICER ACCESSORY



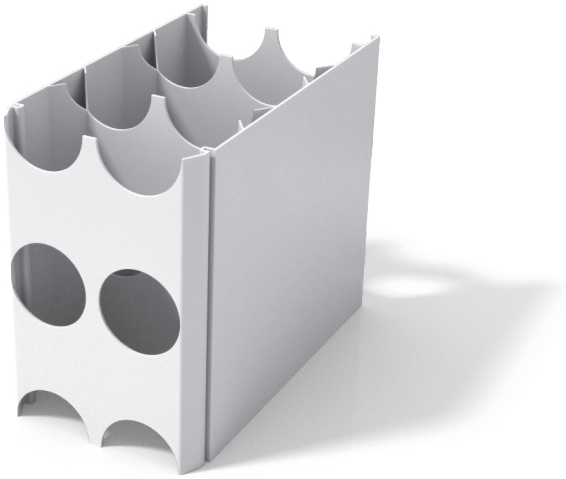
Description
The 155P-WS is primarily used to connect two Dincel main profiles together without the use of a snap-lock connection. This is typically required when main profiles are cut and the snap-lock connectors cannot be used, or to connect walls which span over one level.

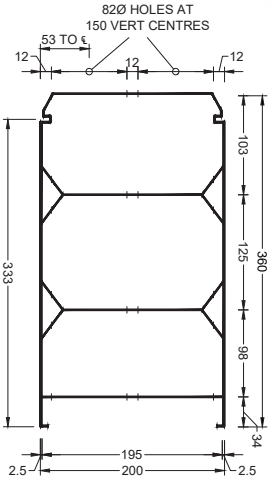
Installation
The flanges of the Wall Splicer can simply slide on top of two Dincel profiles, either at the top, bottom or ends of the wall. It is typically secured using screw fixings or a suitable adhesive. If a waterproof wall is required, the joint is required to be waterproofed using a membrane or sealant.

Stock Lengths
Available only in stock lengths of 3000mm.

A.3.3. DINCEL 200 COMPONENTS

200P-1 MAIN PROFILE





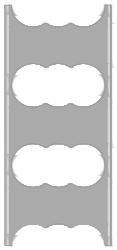
Description
The 200P-1 is the main panel/profile within the Dincel 200mm range, which can be installed in the vertical or horizontal direction. Each panel adds 333.3mm to the wall length.

Installation
Click or slide a 200P-1 into another main profile or a compatible accessory by using the snap-lock connection.

Stock Lengths
2850mm, 3000mm, 3150mm, 3300mm, 3450mm, 3600mm.

Custom Lengths
Any length from 1800mm to 7950mm in 1mm increments, or 1200mm to 1650mm in 150mm increments.

Mass
4.5kg per metre length (approximate).

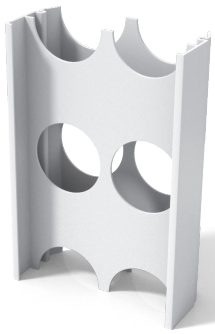


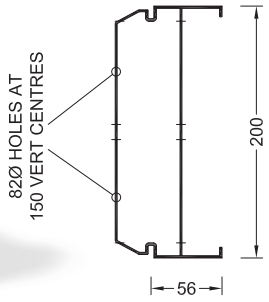
Front elevation.
Optional Modification.

Optional Modification (200P-1C)
The 200P-1 can be ordered to incorporate a centre hole. This is where the webbing in between horizontal web holes is removed for easy placement of closed reinforcement ties or u-bars within the profile. This panel is referred to as 200P-1C and intended to only be ordered for columns, blade walls or difficult access corners.

Stock Lengths
Available only in lengths of 3000mm & 3600mm.

200P-2 SPACER ACCESSORY



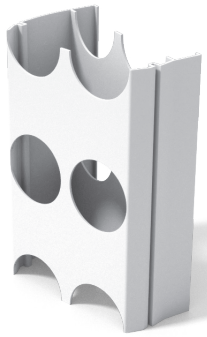


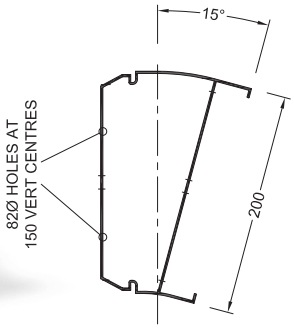
Description
The 200P-2 allows for Dincel walls to be built with 55.5mm increments. Six Spacers connected together provide an equivalent width to one main profile.

Installation
Click or slide the P-2 into a Dincel main profile or another accessory by using the snap-lock connection.

Stock Lengths
Available only in stock lengths of 3600mm.

200P-4 ANGLE ACCESSORY



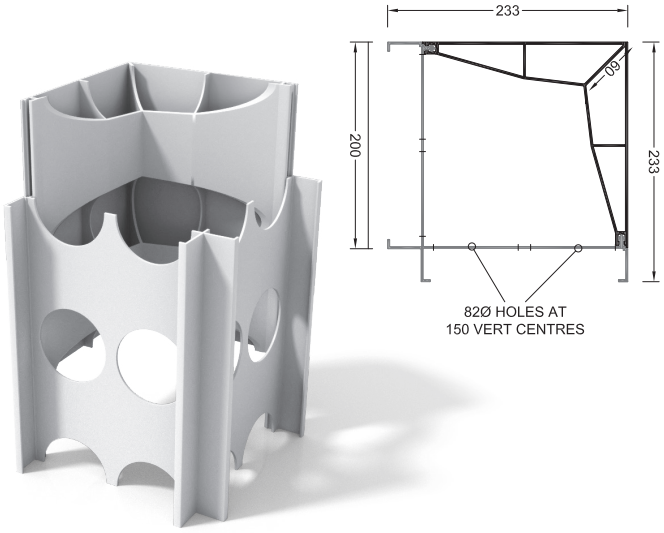


Description
The 200P-4 is used to construct curved walls or curved corners with 15° increments.

Installation
Click or slide the P-4 into a compatible Dincel main profile or accessory by using the snap-lock connection.

Stock Lengths
Available only in stock lengths of 3600mm.

200P-5 CORNER PROFILE (2 PIECE)



Description

The 200P-5 is used to achieve a 90° wall corner. This corner is a two-piece assembly and features an outer component that can be removed for easier access and inspections. The accessory extends the overall wall length by approximately 233mm from the clip connection.

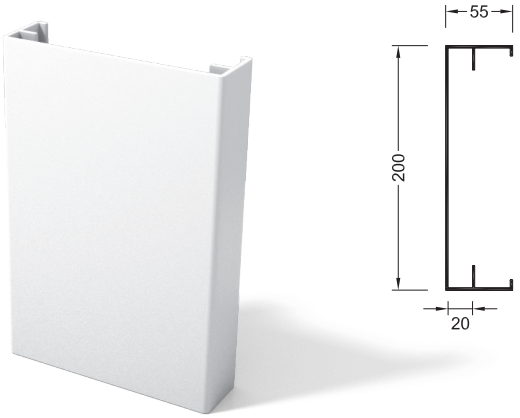
Installation

Click or slide the P-5 into a compatible Dincel main profile or accessory by using the snap-lock connection.

Stock Lengths

Available only in stock lengths of 3000mm or 3600mm.

200P-EC CLIP-ON END CAP ACCESSORY



Description

The 200P-EC is used to finish/close off the end of a wall installed vertically. The Clip-On End Cap extends the overall wall length by 55.5mm from the female clip.

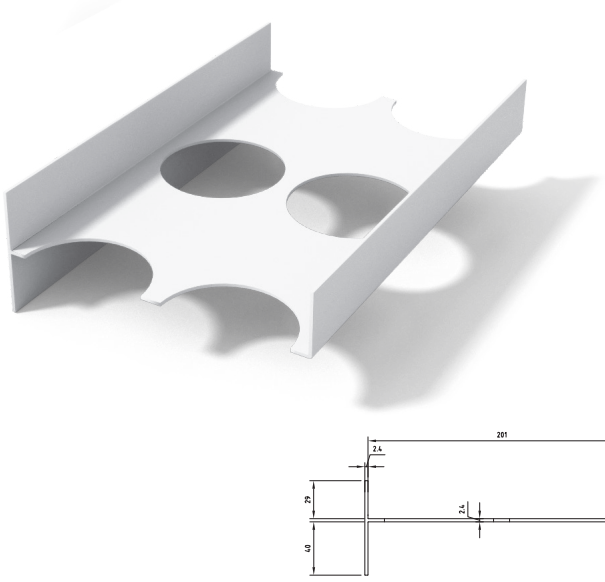
Installation

Click or slide the Clip-On End Cap into a compatible Dincel main profile or accessory by using the snap-lock connection. To prevent bulging from the concrete pour, the Clip-On End Cap requires to be braced using methods detailed in installation section.

Stock Lengths

Available only in stock lengths of 3600mm.

200P-EG EDGE GUIDE ACCESSORY



Description

The 200P-EG is used at a floor or slab edge to start the wall above. Accessory only suitable for above ground walls (non-submerged) and subject to approval by a Design Engineer.

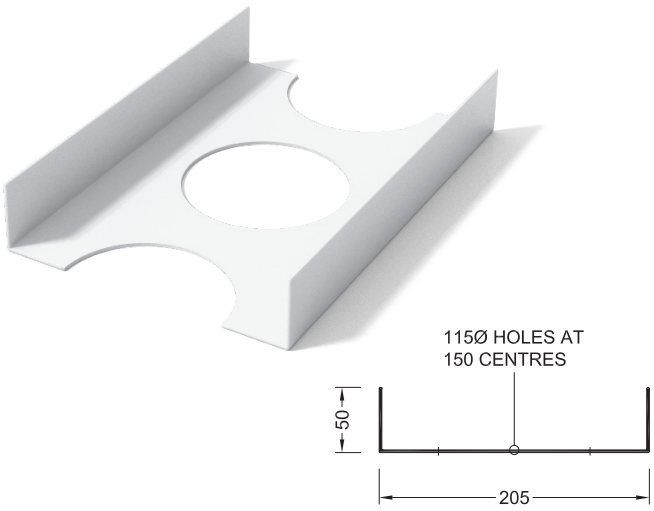
Installation

Placed and secured to floor or slab edge and used to guide Dincel profiles above. Some of the internal webs are removed to promote a greater concrete-to-concrete interface.

Stock Lengths

Available only in stock lengths of 3600mm.

200P-G GUIDE TRACK ACCESSORY

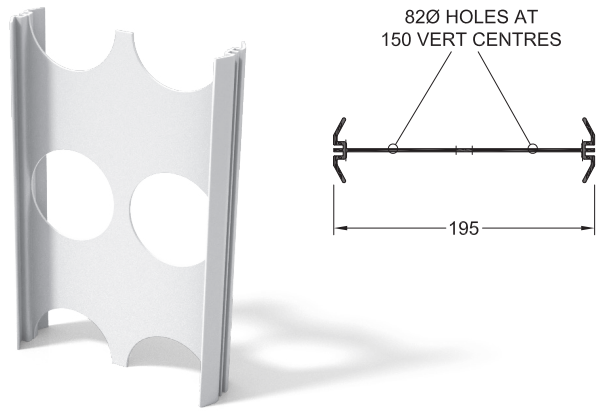


Description
The 200P-G is used as a guide/track to hold the bottom of the walls during concrete pouring. The use of a Guide Track accessory is not recommended for walls that are required to be waterproof, shear walls or where cast-in starter bars are used (instead of post-fixed). Instead, use D-ANG50 PVC angles on either side.

Installation
The Guide Track accessory is secured to the slab or footing with concrete nails or equivalent. Once this is complete the Dincel main profiles are able to slide down into the track.

Stock Lengths
Available only in stock lengths of 3600mm.

200P-J JOINER ACCESSORY

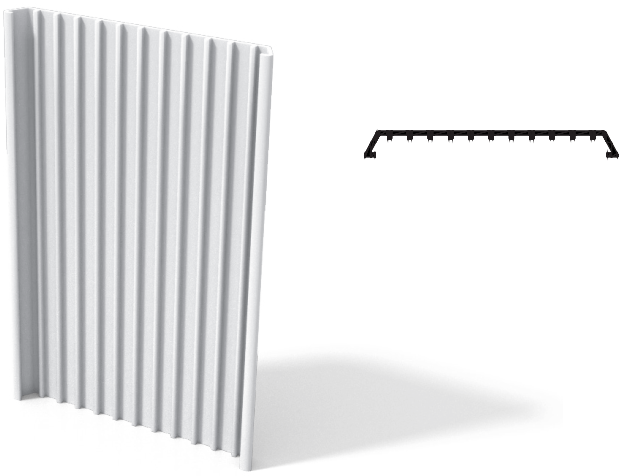


Description
The 200P-J is used to join two Dincel profiles together through their clip connections. The Joiner accessory does not add any length to the wall.

Installation
Click or slide the Joiner into a compatible Dincel main profile or accessory by using the snap-lock connection. The Dincel profiles being joined must have their clip barbs facing the Joiner.

Stock Lengths
Available only in stock lengths of 3600mm.

200P-SE STOP END ACCESSORY

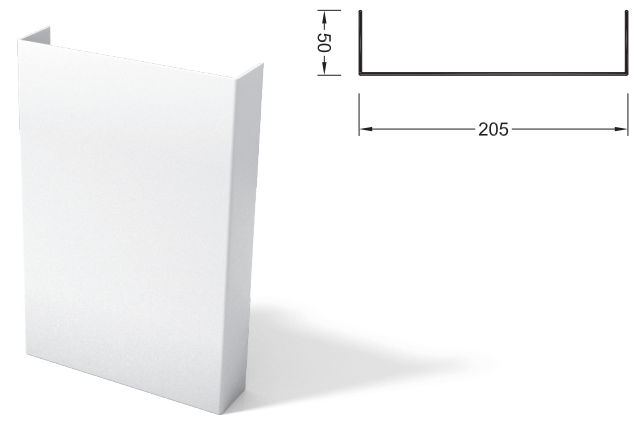


Description
The 200P-SE is used to close the male end of a P-1 Dincel main profile or Clip-On End Cap (EC). This will prevent wet concrete from escaping the profile's horizontal circular openings during concrete pouring and also remove the requirement for edge bracing for standard wall heights.

Installation
Slide the accessory vertically into the grooves of the P-1 main profile or Clip-On End Cap (EC), no screws are required. Off cuts can be placed on top of each other to minimise wastage.

Stock Lengths
Available only in stock lengths of 3600mm.

200P-TC SCREW-ON CAP ACCESSORY

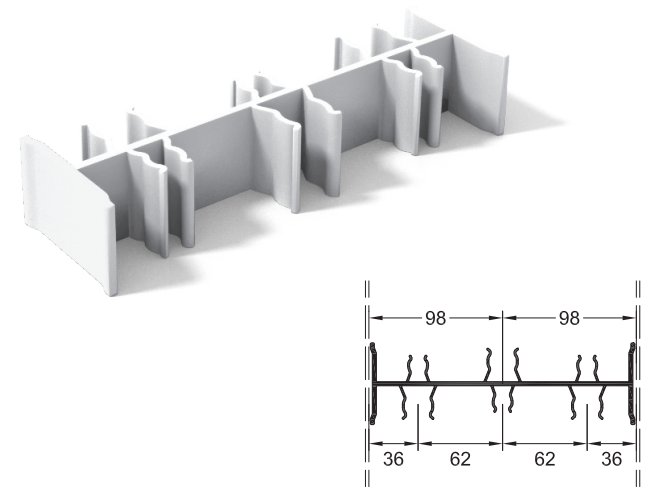


Description
The 200P-TC is used to cap the top or the end of a Dincel wall for aesthetic or finishing purposes.

Installation
The Screw-On Cap simply slides over the Dincel profile at the top or ends of the wall. It is typically secured using screw fixings or a suitable adhesive.

Stock Lengths
Available only in stock lengths of 3600mm.

200P-VRC VERTICAL REOCLIP ACCESSORY

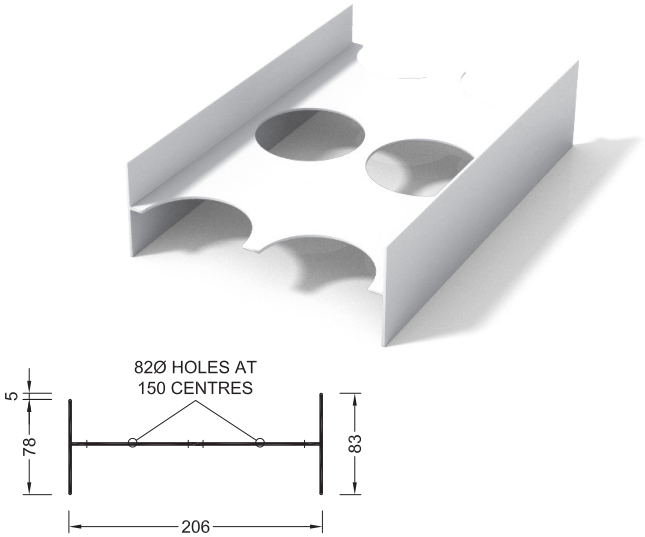


Description
The 200P-VRC is used to hold vertical reinforcement in place during a concrete pour. The clips can accommodate bar sizes of Ø12-20mm in either a central location or at each face of the profile.

Installation
The P-VRC is clipped onto the vertical steel reinforcement before inserting into the wall, typically clipped at the bottom, middle and top of the bars. Tying the bars to the clip with tie-wire is recommended to prevent detachment. Following this, the reinforcement is inserted into the Dincel formwork.

Stock Lengths
Available in packs of 100.

200P-WS WALL SPLICER ACCESSORY



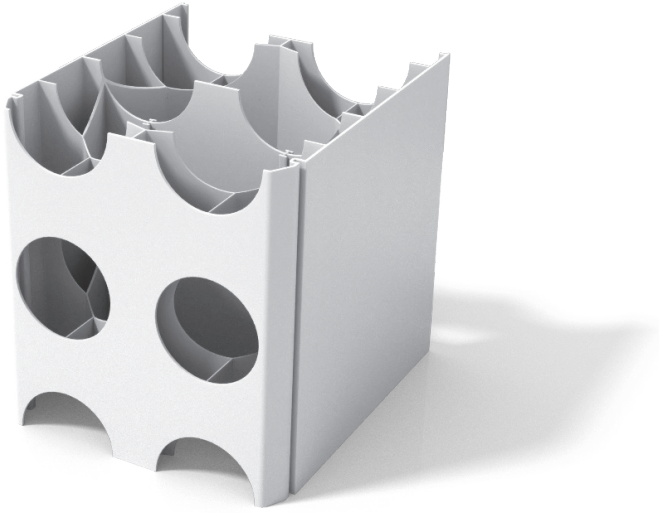
Description
The 200P-WS is primarily used to connect two Dincel main profiles together without the use of a snap-lock connection. This is typically required when main profiles are cut and the snap-lock connectors cannot be used, or to connect walls which span over one level.

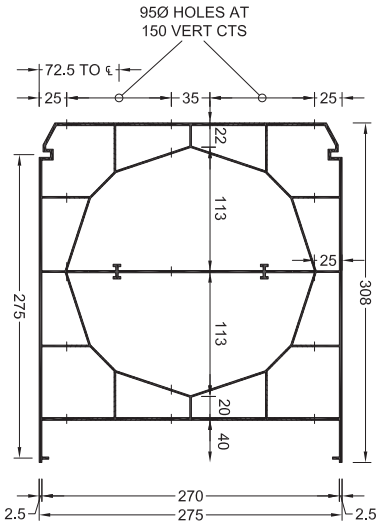
Installation
The flanges of the Wall Splicer can simply slide on top of two Dincel profiles, either at the top, bottom or ends of the wall. It is typically secured using screw fixings or a suitable adhesive. If a waterproof wall is required, the joint is required to be waterproofed using a membrane or sealant.

Stock Lengths
Available only in stock lengths of 3600mm.

A.3.4. DINCEL 275 COMPONENTS

275P-1 MAIN PROFILE





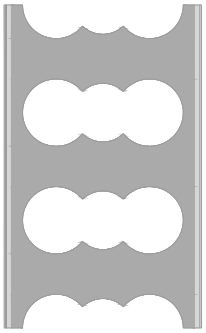
Description
The 275P-1 is the main panel/profile within the Dincel 275mm range, which can be installed in the vertical or horizontal direction. Each panel adds 275mm to the wall length.

Installation
Click or slide a 275P-1 into another main profile or a compatible accessory by using the snap-lock connection.

Stock Lengths
3000mm, 3600mm.

Custom Lengths
Any length from 1800mm to 6525mm in 1mm increments, or 1200mm to 1650mm in 150mm increments.

Mass
7kg per metre length (approximate).

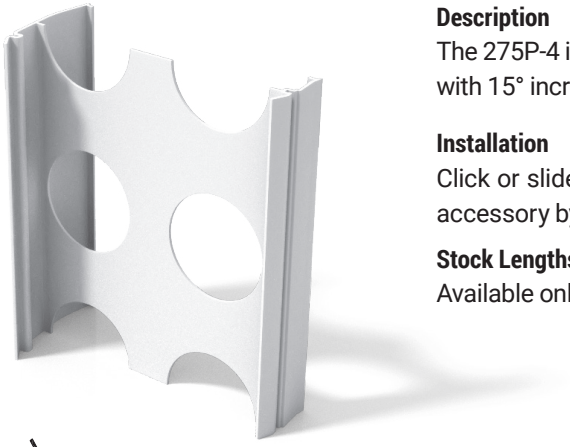


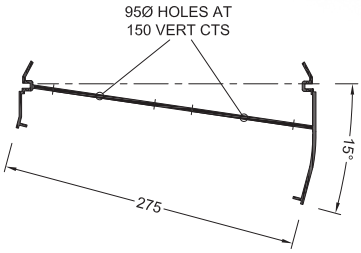
Front elevation.
Optional Modification.

Optional Modification (275P-1C)
The 275P-1 can be ordered to incorporate a centre hole. This is where the webbing in between horizontal web holes is removed for easy placement of closed reinforcement ties or u-bars within the profile. This panel is referred to as 275P-1C and intended to only be ordered for columns, blade walls or difficult access corners.

Stock Lengths
Available only in lengths of 3000mm & 3600mm.

275P-4 ANGLE ACCESSORY



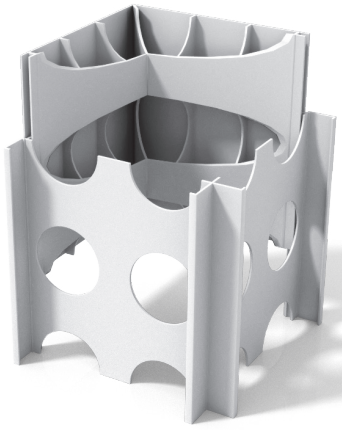


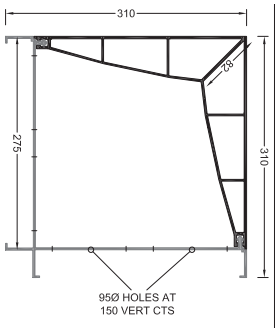
Description
The 275P-4 is used to construct curved walls or curved corners with 15° increments.

Installation
Click or slide the P-4 into a compatible Dincel main profile or accessory by using the snap-lock connection.

Stock Lengths
Available only in stock lengths of 3600mm.

275P-5 CORNER PROFILE (2 PIECE)



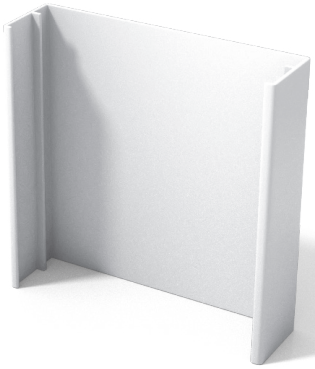


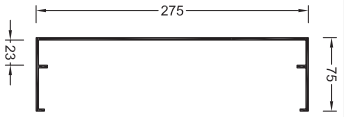
Description
Used to achieve a 90° wall corner. The corner features an outer component which can be removed for easier access and inspections. The accessory extends the overall wall length by approximately 310mm from the female clip.

Installation
Click or slide the P-5 into a compatible Dincel main profile or accessory by using the snap-lock connection.

Stock Lengths
Available only in stock lengths of 3600mm.

275P-EC CLIP-ON END CAP ACCESSORY



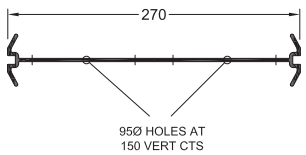


Description
An accessory used to finish/close off the end of a wall installed vertically. The Clip-On End Cap extends the overall wall length by approximately 75mm from the female clip.

Installation
Click or slide the Clip-On End Cap into a compatible Dincel main profile or accessory by using the snap-lock connection. To prevent bulging from the concrete pour, the Clip-On End Cap requires to be braced.

Stock Lengths
Available only in stock lengths of 3600mm.

275P-J JOINER ACCESSORY

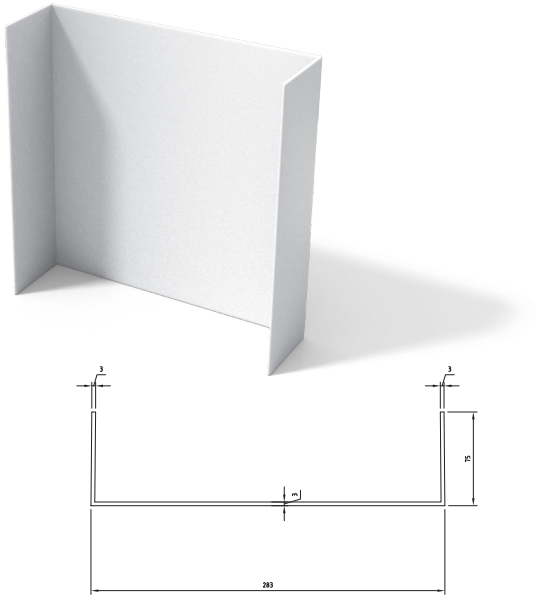


Description
An accessory used to join two Dincel profiles together through their male clips. The Joiner accessory does not add any length to the wall.

Installation
Click or slide the Joiner into a compatible Dincel main profile or accessory by using the snap-lock connection. The Dincel profiles being joined must have their male clip ends facing the Joiner.

Stock Lengths
Available only in stock lengths of 3600mm.

275P-TC SCREW-ON CAP ACCESSORY

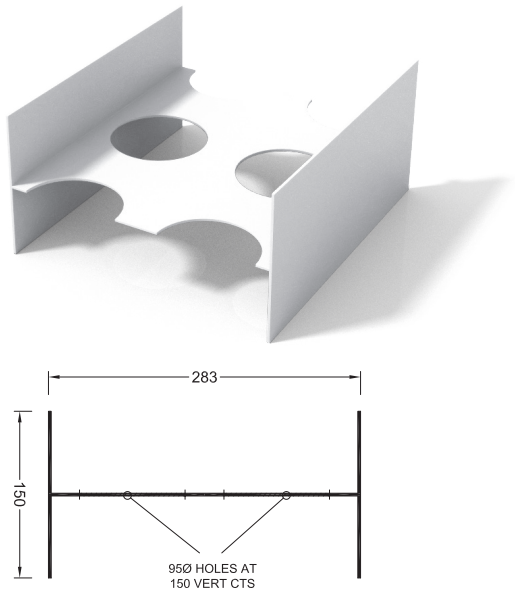


Description
Used to cap the top or the end of a Dincel wall for aesthetic or finishing purposes.

Installation
The Screw-On Cap simply slides over the Dincel profile at the top or ends of the wall. It is typically secured using screw fixings or a suitable adhesive. If used as a guide, the angles are held down using concrete nails or equivalent.

Stock Lengths
Available only in stock lengths of 3600mm.

275P-WS WALL SPLICER ACCESSORY



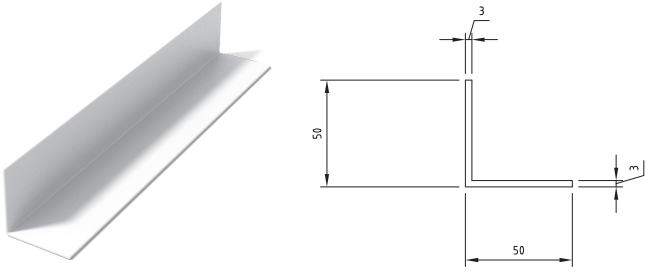
Description
The Wall Splicer accessory is primarily used to connect two Dincel main profiles together without the use of a snap-lock connection. This is typically required when main profiles are cut and the snap-lock connectors cannot be used, or to connect walls which span over one level.

Installation
The flanges of the Wall Splicer can simply slide on top of two Dincel profiles, either at the top, bottom or ends of the wall. It is typically secured using screw fixings or a suitable adhesive. If a waterproof wall is required, the joint is required to be waterproofed using a membrane or sealant.

Stock Lengths
Available only in stock lengths of 3600mm.

A.4. UNIVERSAL ACCESSORIES

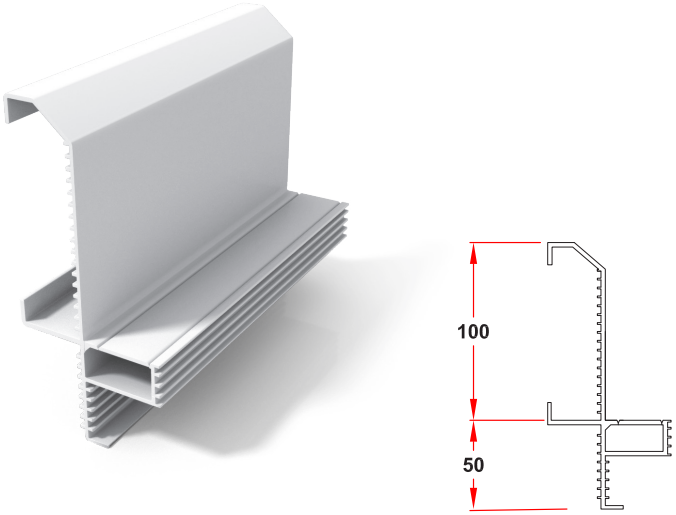
D-ANG50 DINCEL PVC ANGLE



Description
The D-ANG50 is a 50x50x3 PVC equal angle. It can be fixed temporarily or permanently to a surface to act as Dincel panel wall guides. It can also be used to secure or join other profiles together.

Quantity
Available only in 3000mm

DWS DINCEL WATERSTOP

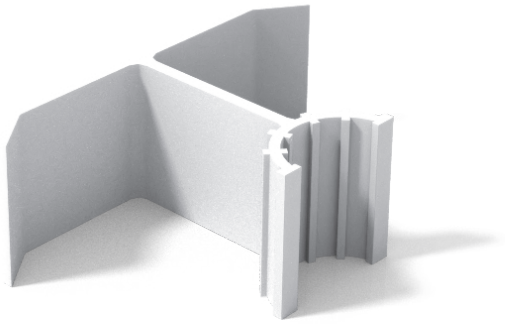


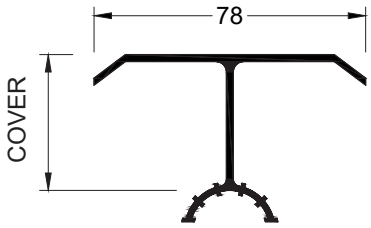
Description
The DWS accessory is part of a waterproofing system. The system incorporates a re-injectable hose and is installed as part of the hob prior to Dincel wall construction. In the event of any water seepage at the base wall junction, injection material is pumped through the re-injectable hose to fill and seal any voids where water ingress has occurred.

Installation
The DWS is secured to formwork to act as a shutter to form a hob. The re-injectable hose is installed into the DWS cavity prior to Dincel wall installation.

Quantity
Available only in stock lengths of 3000mm.

D-VRC DINCEL VERTICAL REOCLIP ACCESSORIES





Description
D-VRC accessories can be used to ensure that the cover and positioning of vertical reinforcement bars are maintained within the profiles. The accessories are cross compatible between 110, 155 and 200 Dincel.

Variants
The accessories are available in either 20mm, 30mm, 40mm or 50mm cover variants.

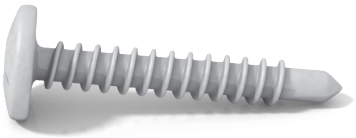
- D-VRC20 = 20mm Cover
- D-VRC30 = 30mm Cover
- D-VRC40 = 40mm Cover
- D-VRC50 = 50mm Cover

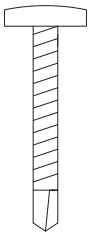
(cover is measured from the internal PVC surface / concrete surface)

Installation
The D-VRC is secured onto the vertical steel reinforcement before inserting into the wall, typically at the bottom, middle and top of the bars. The bars are secured by tying them to the D-VRCs using tie-wire. Following this, the reinforcement is inserted into the Dincel formwork with the D-VRCs attached. Where D-VRCs are used, the horizontal reinforcement should be placed prior to the vertical reinforcement.

Quantity
Available in packs of 250.

SCREWS





Description
8g button head screws (8-18 x 25mm), used for fixing Dincel accessories where required. Screws are galvanised with white finish provided to head.

Quantity
Sold per box (1000 screws per box).

DINCEL
STRUCTURAL WALLING

SPECIFICATION & DETAILING

CONTENTS

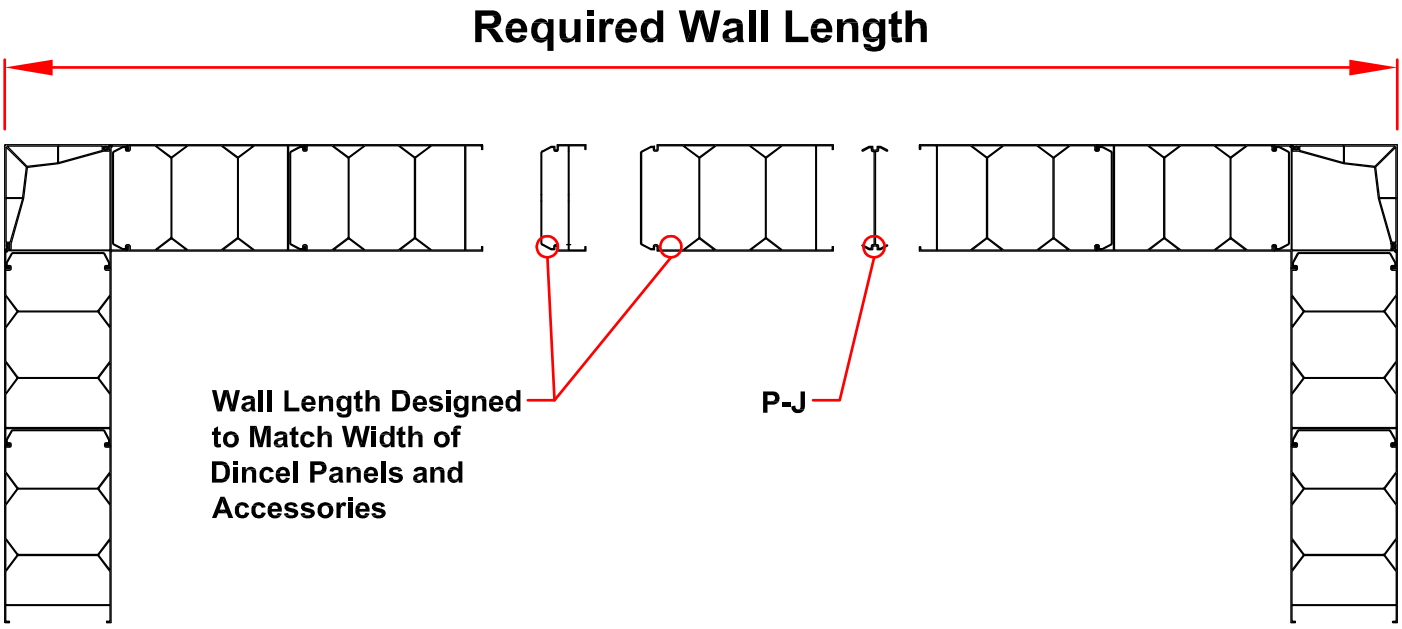
B.1. INCORPORATION INTO PLANS

Although Dincel walling is a formwork system comprised of predetermined module widths, it is flexible in accommodating site and design requirements. It is preferred to have wall lengths match the Dincel module sizes, however if this is not possible, the system can be cut and modified to suit.

B.1.1. WALL ASSEMBLY EXAMPLES

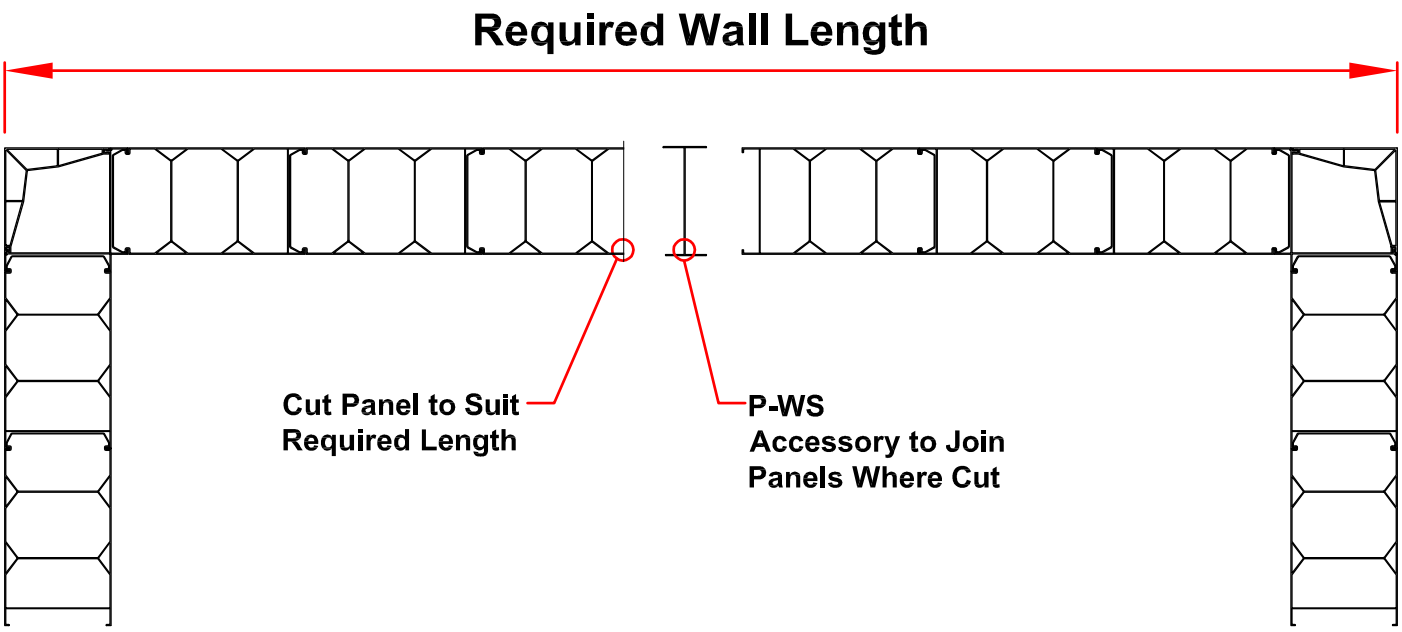
Option 1 - Match Dincel panel standard sizes

Use of Dincel panels and accessories to achieve required wall length. For this option, the wall length must be designed to suit Dincel module sizes. As no cutting is required, this option is better suited for walls which are under submerged conditions, such as basement walls and water tanks.

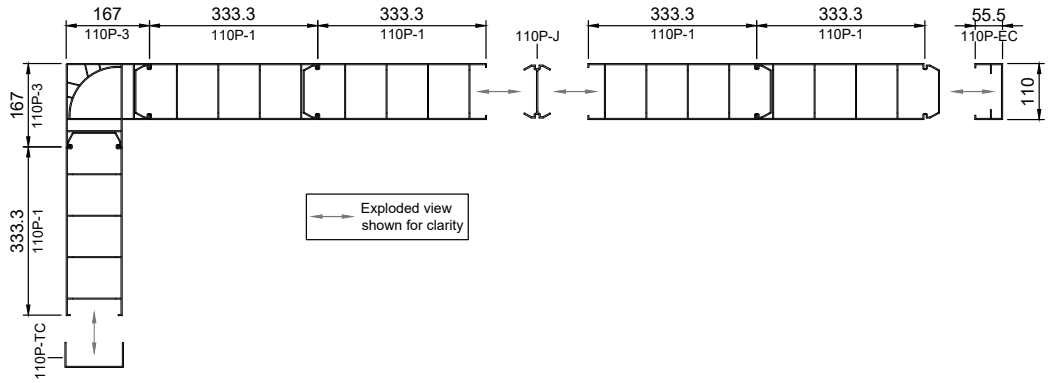


Option 2 - Cut profiles to suit

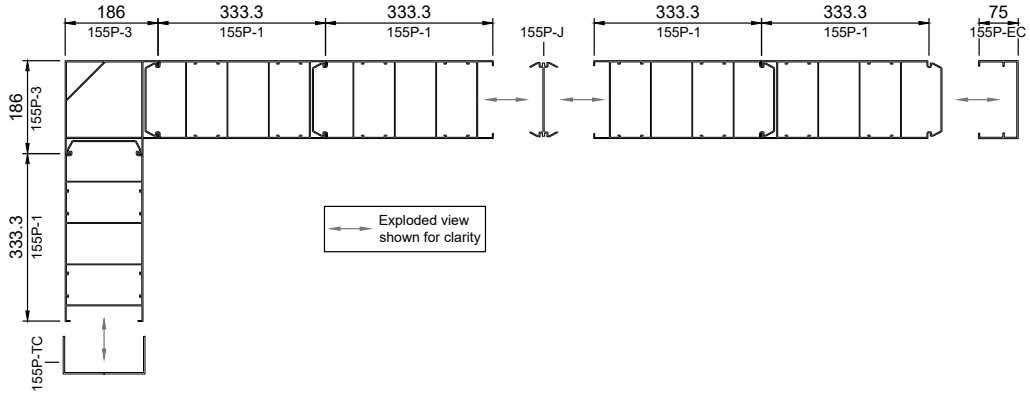
Cut Dincel profile to suit required length and join panels together using a P-WS accessory. For waterproof applications, this joint must be waterproofed using the methods highlighted in Section B.2.



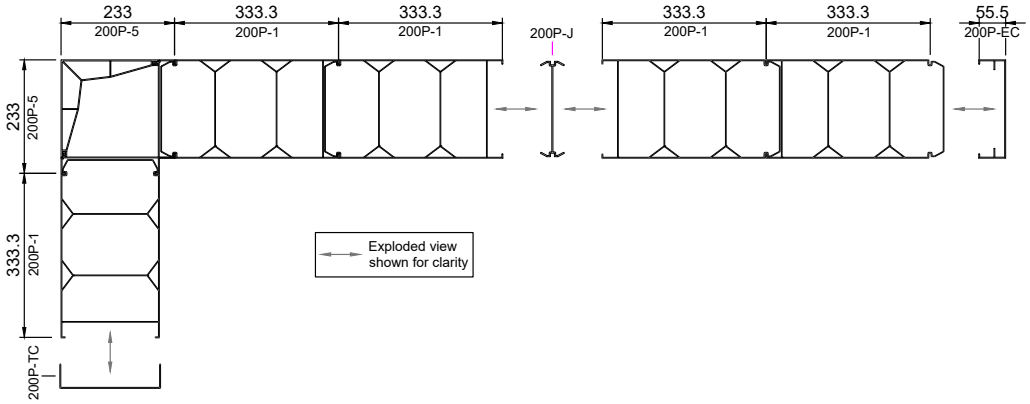
Dincel 110
Example Assembly



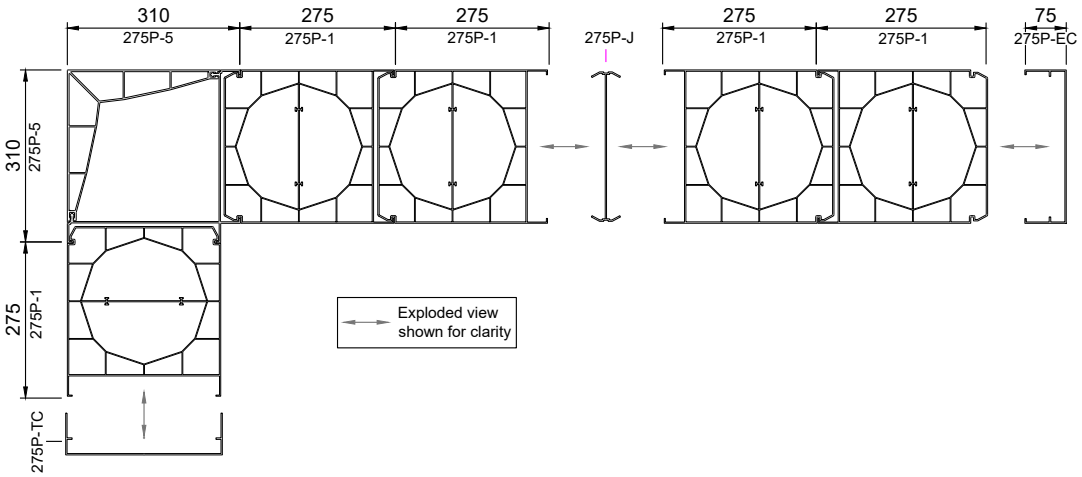
Dincel 155
Example Assembly



Dincel 200
Example Assembly



Dincel 275
Example Assembly



B.2. WATERPROOFING

The permanent polymer skin of a Dincel wall along with the panel 'snap-lock' joints acts as a protective waterproof membrane for up to 6m of waterhead pressure. It is important to adequately waterproof all wall junctions and any Dincel walling connections which do not utilise the 'snap-lock' joint (such as where panels are cut and joined together). The below diagram provides an illustrative example of the key areas which must be additionally waterproofed in a below ground or submerged application.

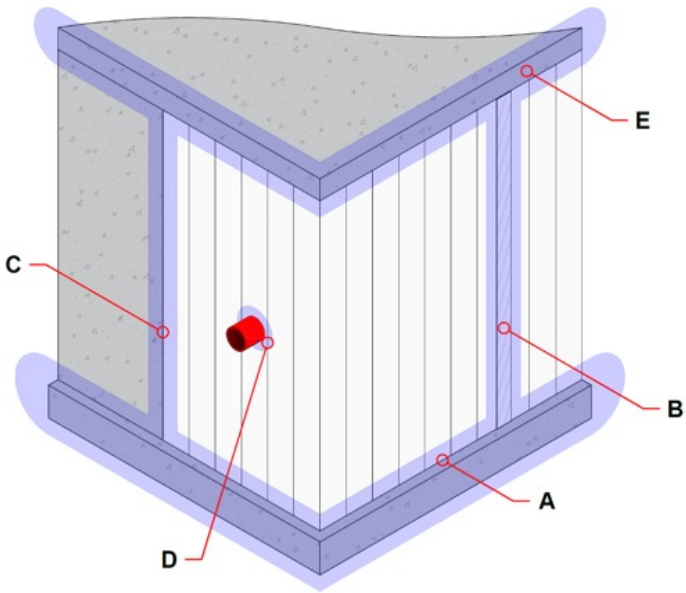
A - Wall to slab junction at base.

B - Any panel/accessory joints which do not utilise the 'snap-lock' connection (such as where a panel is cut and a P-WS accessory is used). Please refer to Section B.1.1. Option 2.

C - Junctions with other walling types.

D - Any wall opening or penetration.

E - Junctions with concrete slab above wall.
Note: an exposed slab edge is not recommended, please refer to Section B.3 for detailing.



AREAS HIGHLIGHTED MUST BE ADDITIONALLY WATERPROOFED

When waterproofing the above locations, best results will be achieved where the waterproofing is applied to the positive (exterior/wet) face. This way, water is prevented from entering into the system in the first instance. Compatible waterproofing membranes applied over these surfaces are usually the most reliable way to achieve this where sufficient access is provided.

B.3. BASEMENT WALLS

B.3.1. ON STRIP FOOTING

B3.1.1. Wall-Footing Joint ABOVE Ground Water Table

A - Dincel Wall.

B - Steel reinforcement to engineers' details

C - Strip footing to engineer's details.

D - Starter bars, tied to footing by either casting in or post-fixing (drill & epoxy) as per engineer's detail.

E - Ag-line placed below wall junction, connected to appropriate discharge point. Free draining granular backfill provided to surrounding soil.

F - D-ANG50 PVC Angle as a temporary wall restraint to either side of the wall (both sides for SCC), suitably fixed to the wall and slab. Do not use a Guide Track underneath wall.

G - Min 25mm triangular bead of MS Polymer Sealant applied against angle, immediately before placement of panels. Ensure sealant is compressed in between the angle and panel faces.

H - Optional waterproofing membrane applied to junction and minimum 300mm up Dincel wall face (option only possible where access is provided to positive face).

I - Concrete floor slab to engineer's details. Waterproofing must be provided to floor slab by way of membranes or concrete admixtures.

J - Min 75x100mm gravel filled drainage channel.

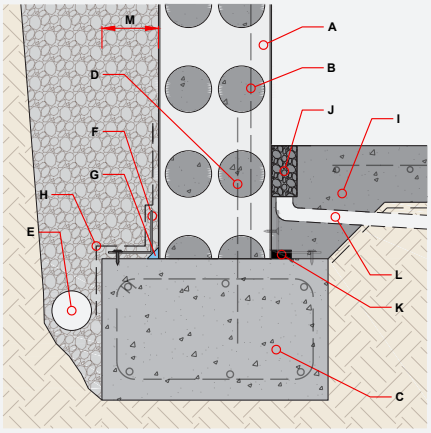
K - Hydrophilic waterstop, min 75mm from footing edge.

L - Drainage to pump out pit or similar.

M - Min 100mm clearance between edge of footing and wall, to allow for angle placement and adequate concrete finish.

NOTE: Footing steps should be designed in increments of 150mm to avoid alignment issues.

NOTE: No accessories to be used underneath wall.



B.3.2. ON SLAB

B3.2.1. Wall-Slab Joint ABOVE Ground Water Table

A - Dincel Wall.

B - Steel reinforcement to engineers' details.

C - Concrete floor slab to engineer's details. Waterproofing must be provided to floor slab by way of membranes or waterproofing concrete admixtures.

D - Starter bars, tied to footing by either casting in or post-fixing (drill & epoxy) as per engineer's detail.

E - Ag-line placed below wall junction, connected to appropriate discharge point. Free draining granular backfill provided to surrounding soil.

F - D-ANG50 PVC Angle as a temporary wall restraint to both sides of the wall, suitably fixed to the wall and slab. Do not use a Guide Track underneath wall.

G - Min 25mm triangular bead of MS Polymer Sealant applied against angle, immediately before placement of panels. Ensure sealant is compressed in between the angle and panel faces.

H - Optional hydrophilic waterstop for increased waterproofing performance to junction.

I - Min 75x100mm gravel filled drainage channel.

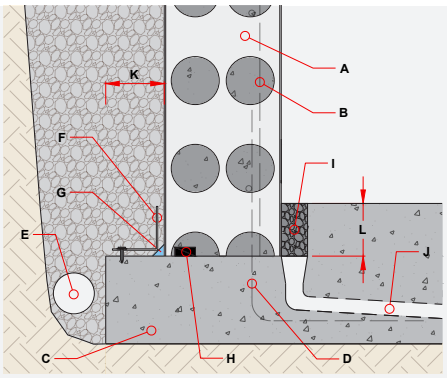
J - Drainage to pump out pit or similar.

K - Min 100mm clearance between edge of footing and wall, to allow for angle placement and adequate concrete finish.

L - Min 100mm set down. Timber can be used to form rebate and also as temporary restraint (see Section B.3.2.4).

NOTE: Pouring of concrete within the wall must be completed within 48 hours of applying gunnable hydrophilic waterstop. The joint must be protected from any rain or moisture during this time.

NOTE: No accessories (such as Guide Track P-G) to be used underneath wall.



B.3.2. ON SLAB

B3.2.2. OPTION 1; Wall-Slab Joint ABOVE Ground Water Table Position

This detail is applicable to basement slab with negligible falls so that basement slab and footing is poured at the same time.

A - Dincel Wall (wall must be designed for hydrostatic water pressure if ag-line is not used or assumed to be non-functional in time) .

B - Steel reinforcement to engineer's details.

C - Starter bars, tied to footing by either casting in or postfixing (drill & epoxy) as per engineer's detail.

D - Concrete floor slab to engineer's details.

E - Dincel Water Stop (DWS) used as cast-in shutter to form hob.

F - Re-injection hose system to provide waterproofing injection material.

G - Min 100mm.

H - Min 100mm set down. Timber can be used to form rebate and also as temporary restraint.

I - Min 300mm.

J - Min 75x100mm gravel filled drainage channel.

K - Drainage to pump out pit or similar.

L - OPTION; Ag-line placed below wall-footing junction level prior Dincel wall installation, connected to appropriate discharge point. Blue metal to surround ag-line.

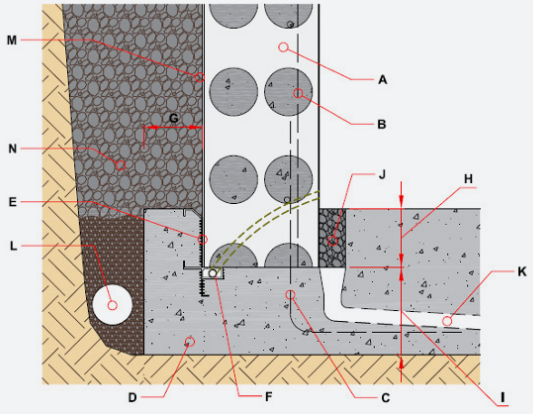
M -Ensure no damage or ruptures of Dincel panels during backfilling.

N - Free draining granular backfill to engineer's details.

NOTE: Use this detail over B3.2.1. of DCM when Dincel Waterproofing Warranty is required.

NOTE: Self Compacting Concrete (SCC) and injection material MUST be used with the following detail.

NOTE: No accessories (such as guide track P-G) to be used underneath Dincel wall.



B.3.2. ON SLAB

B3.2.2. OPTION 2; Wall-Slab Joint ABOVE Ground Water Table Position & Footing is Placed Prior to Basement Slab

This detail is applicable to basement slab with significant falls. The footing is poured first. Basement slab after.

A - Dincel Wall.

B - Steel reinforcement to engineer's details.

C - Starter bars, tied to footing by either casting in or postfixing (drill & epoxy) as per engineer's detail.

D - Concrete floor slab to engineer's details.

E - Dincel Water Stop (DWS) used as cast-in shutter to form hob.

F - Re-injection hose system to provide waterproofing injection material.

G - Min 100mm.

H - Min 100mm set down to suit basement slab fall.

I - Min 300mm.

J - Min 75mm wide gravel filled drainage channel.

K - Drainage to pump out pit or similar.

L - Ag-line placed below wall-footing junction level prior Dincel wall installation, connected to appropriate discharge point. Blue metal to surround ag-line. Agricultural line is required to be maintained for the building's service life.

M - Basement/ground floor slabs to engineer's details.

N - Footing steel reinforcement to engineer's details.

O - Waterproofing of this pour break joint to architect's / engineer's details.

P - Steel reinforcement to engineer's details. Min 50mm from slab edge face.

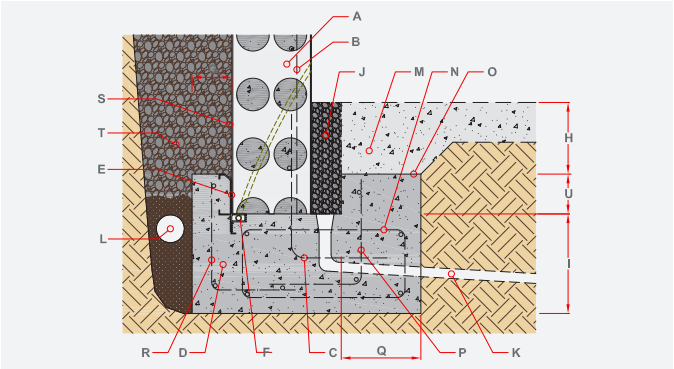
Q - Min. 200mm.

R - Steel reinforcement to engineer's details.

S - Ensure no damage or ruptures of Dincel panels during backfilling.

T - Free draining granular backfill to engineer's details.

U - Min. 100mm.



B.3.2. ON SLAB

B3.2.3. Wall-Slab Joint BELOW Ground Water Table Position

A - Dincel Wall (wall must be designed for hydrostatic water pressure to suit water table position).

B - Steel reinforcement to engineers' details.

C - Starter bars, tied to footing by either casting in or postfixing (drill & epoxy) as per engineer's detail.

D - Concrete floor slab to engineer's details.

E - Dincel Water Stop (DWS) used as cast-in shutter to form hob.

F - Re-injection hose system to provide waterproofing injection material.

G - Min 100mm.

H - Min 100mm set down. Timber can be used to form rebate and also as temporary restraint

I - Min 300mm

J - Min 75x100mm gravel filled drainage channel.

K - Drainage to pump out pit or similar.

L - Concrete fines/sand to Engineer's details.

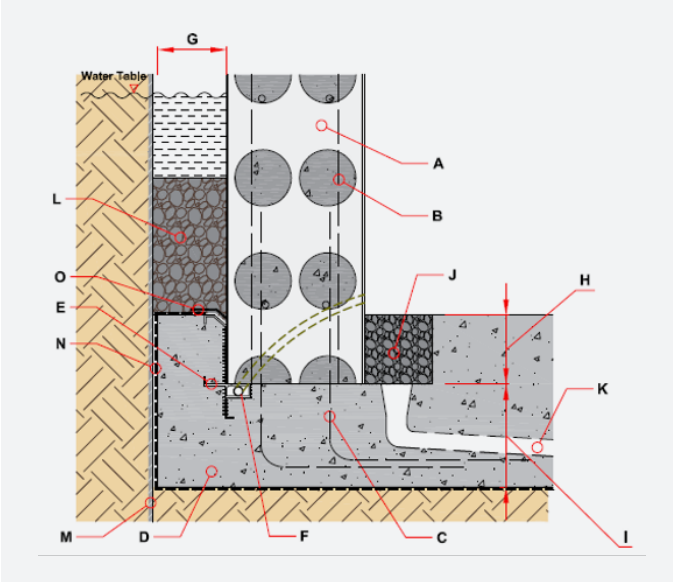
M - Shoring.

N - OPTIONAL nominated membrane or equivalent.

O - Dincel nominated waterproofing bandage over lapping nominated membrane on DWS if nominated membrane under slab is used.

NOTE: Self Compacting Concrete (SCC) and injection material MUST be used with the following detail.

NOTE: No accessories (such as guide track P-G) to be used underneath wall.



B.3.2. ON SLAB

B3.2.4. Construction of Slab Rebate with Dincel Water Stop (DWS)

A - Dincel Water Stop (DWS) used as cast-in shutter to form hob.

B - Timber batten held in place to stabilise the timbers used to form rebate using nails or screws. Preferably screws for ease of removal.

C. Steel reinforcement provided to hob design subject to engineer's details.

D. Plywood shutter (fixed/pinned appropriately to ground) or face of shoring/sheet piling.

E. Min. 100mm.

F. Total rebate width = Panel thickness + drainage cavity size.

G. Slab and slab reinforcement to engineer's details.

H. Timber positioned to suit required rebate.

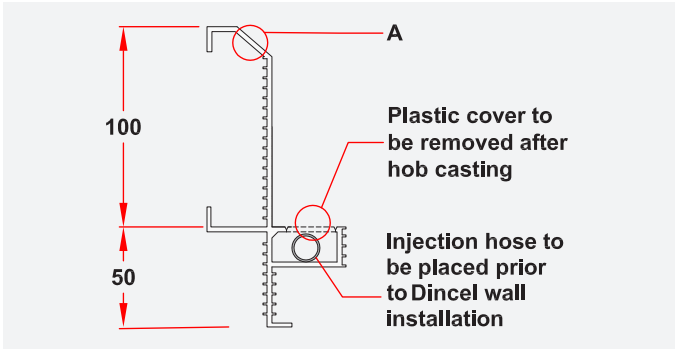
I. Min. 55mm concrete cover from face of Dincel to starter bar.

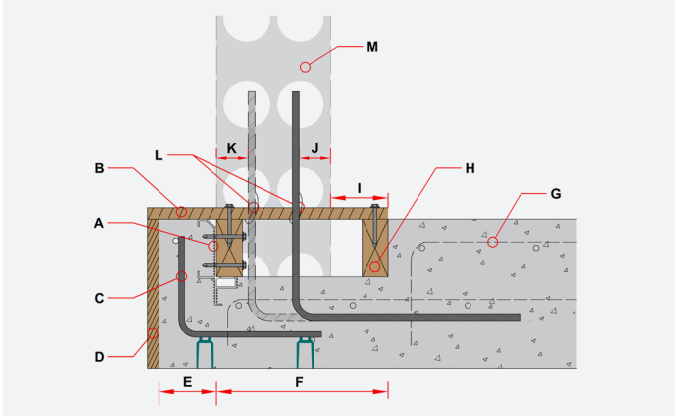
J. Min. 55mm concrete cover from face of Dincel to starter bar and to provide clearance to DWS.

K. Dincel wall to be installed (shown for visual aid purposes)

L. Option of one or two starter bars secured to timber batten using tie-wire as required by design engineer.

NOTE: Maximum one layer of starter bars for Dincel 155 profiles to allow for sufficient concrete cover and clearance to DWS.





B.3.3. HABITABLE SPACE OR PLENUM

A - Dincel Wall

B - Wall-to-slab or wall-to-footing junction, detail varies depending on selected construction and waterproofing method. Refer to manual details for treating this junction.

C - Non-shrink grout, provided with appropriate falls to drainage points.

D - Drainage to pump out pit or similar.

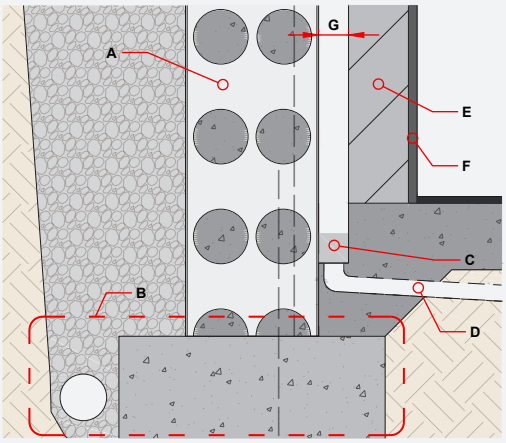
E - Secondary wall constructed from light weight timber/steel studs or 110 Dincel.

F - Selected wall finish (e.g. plasterboard).

G - Min cavity space to match drainage channel (75mm or greater).

NOTE: **Where a mechanical plenum is required, increase cavity space (G) to suit (min 650mm).** In this case, ensure secondary wall (E) is constructed from 110 Dincel or another form of airtight construction.

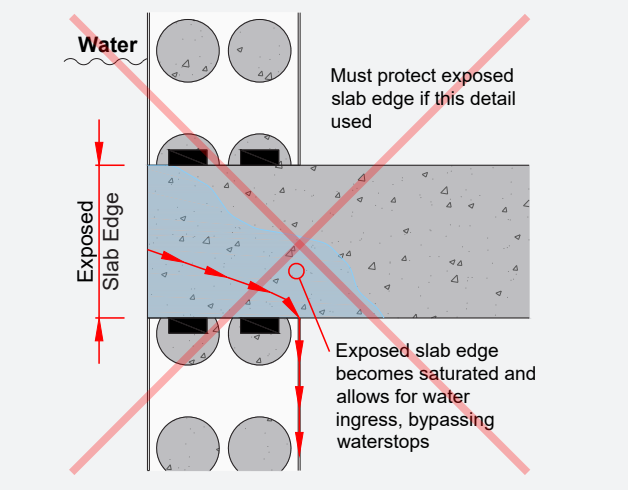
NOTE: No accessories (such as Guide Track P-G) to be used underneath wall.



B.3.4. SUSPENDED SLAB

A - Core 100ø holes for steel reinforcement ('L' bars) to be fed through as required. Refer to detail F.10.1 for coring instructions. Alternatively, provide dowel connection as detailed by design engineer.

B - Continuous Dincel wall spanning past suspended slab level (no horizontal panel joints below water table level). Do not allow exposed slab edge submerged:



C - Steel reinforcement to engineer's detail.

D - Pour break location 1 if required.

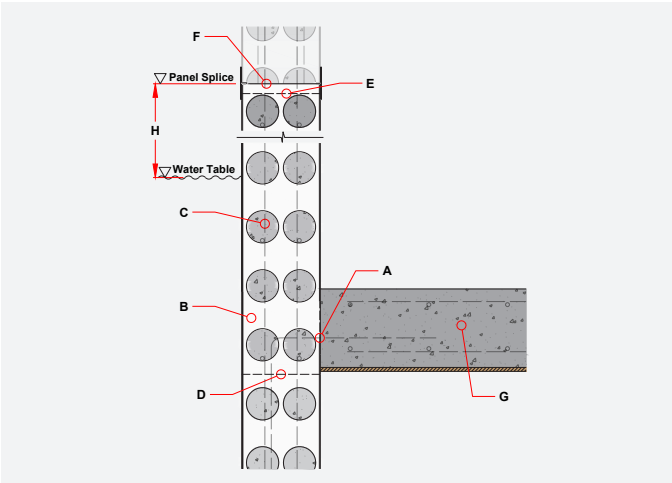
E - Pour break location 2 if required.

F - Horizontal panel joint. Panels spliced together using P-WS as detailed in Section F.8.2.1 or as required.

G - Suspended basement slab, to be poured after pouring Dincel basement wall.

H - Horizontal panel splice min 500mm above water table location.

NOTE: Horizontal panel splice min 500mm above water table location.



B.3.5. POST TENSIONED SLAB

A - Continuous Dincel wall spanning past suspended slab level (no horizontal panel joints below water table level).

B - Load bearing Dincel walls or columns supporting slab.

C - Slip joint, refer to Detail B.5.3.

D - Suspended basement slab.

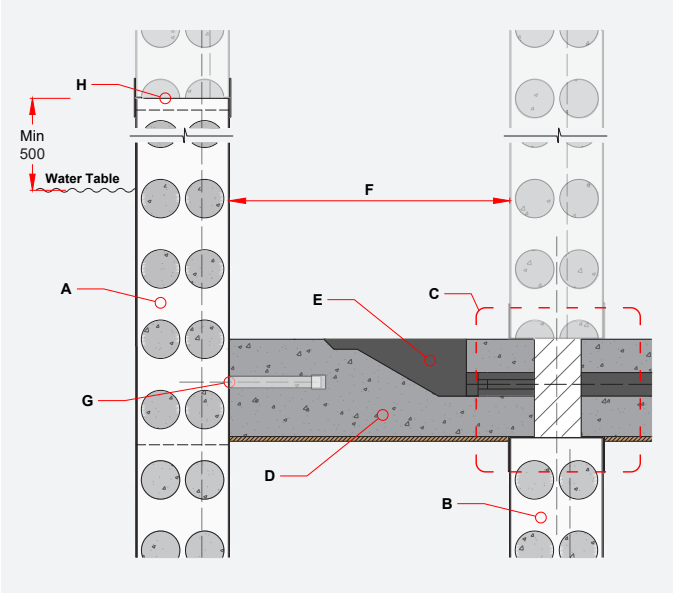
E - Prestressing pan.

F - Generally 650mm clearance if space used as plenum or requires to be accessible. Alternatively, walls or columns can be placed directly against basement perimeter wall as per detail B.4.4.

G - Sleeved dowel connection if required, as detailed by design engineer. Note: Segment of wall must only be poured following prestressing of slab.

H - Horizontal panel joint, min 500mm above water table location. Panels spliced together using P-WS as detailed in Section F.8.2.1 or as required.

NOTE: Refer to detail B.4.4 for further post stressing details and pour break locations.



B.3.6. BASEMENT WATERPROOFING CONSIDERATIONS

B3.6.1. Gravel Filled Drainage Channels

For all basement walls, drainage channels are highly recommended to capture water in the event of the following:

- Failure of the waterproofing products used (i.e. sealants, membranes or concrete admixtures). This can occur due to excessive building movements and structure cracking.
- Cleaning activities within basements, such as washing cars or routine maintenance cleaning to walls.
- Sprinkler system use and/or failure.
- Inadequate concrete compaction due to poor installation or concrete mix used.

No Australian standard currently exists which covers the waterproofing of basements. Instead, many Australian professionals refer to the British standard BS8102:2009, which details the use of a water management system (such as drainage channels) to accompany waterproofing barriers/layers for external below ground walls. The design life of membranes and sealants can be questioned in the long term, particularly when considering structural movements and contaminated soil conditions. The provision of a drainage channel can mitigate this concern and ensure a reliable long-term solution. For this reason, it is highly recommended that all basements are provided with a gravel drain on the inside of the wall.

B3.6.2. Concrete Quality

For a Dincel wall to be waterproof, the concrete within the permanent formwork must be free of air-voids. Inadequate concrete compaction will lead to leakage within the walls. To ensure that Dincel walls are void free, use the specification referred to in Section B.20.

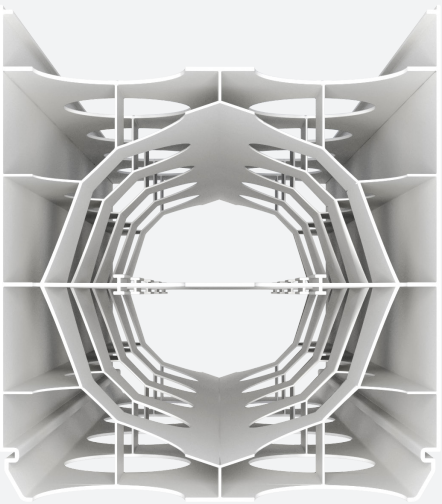
B3.6.3. Additional Waterproofing Measures

The details shown in this manual will provide acceptable protection against ingress of water in accordance with the allowances of BS8102:2009 (where water ingress is permitted when appropriately discharged). However, where further protection is required, the following measures can be considered by the designer in order to provide additional waterproofing mechanisms:

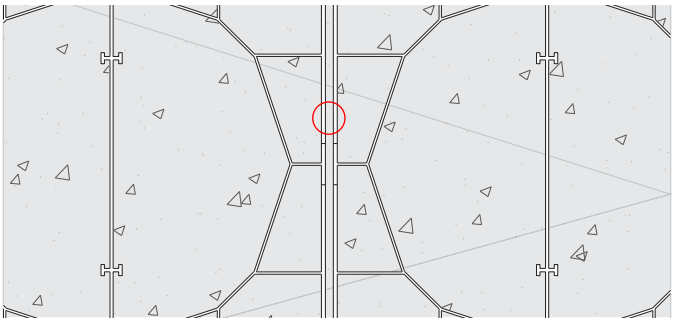
- Hydrophilic waterstop strips underneath wall.
- Cast-in hoses to permit injection of acrylic resin, microfine cement suspensions, polyurethane or epoxy in the event of a leak (as advised by injection manufacturer or waterproofing contractor).
- Waterproofing admixtures added to concrete mix design.

B3.6.4. Dincel 275 Profile

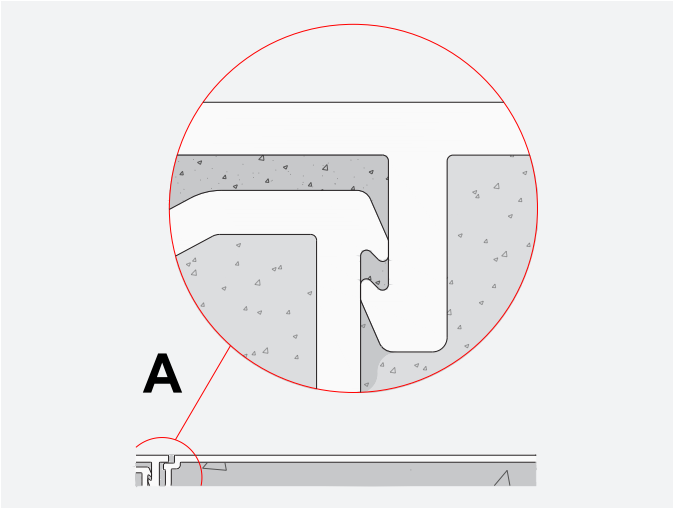
The Dincel 275 profile is recommended for waterproofing applications such as basements, particularly when the walls are subject to constant hydrostatic conditions from the permanent water table. The following features are what make Dincel 275 ideal as a waterproof basement wall:



Patented innovated ring form allows for SCC or super workable concrete in a single pour up to 5 metres. The elimination of air voids is essential to achieve a waterproof wall.



6mm gap in between panel joints does not allow coarse aggregate to enter, ensuring that the space is fully filled with cement slurry.



Slurry from SCC or super workable concrete fills barbed connection, ensuring that vertical panel joint is waterproof.

Early Backfill

In addition, Dincel 275 walls can be backfilled as soon as 24 hours after concrete pour (must be appropriately braced). Refer to Section E.1.2 for more details.

B.4. FAÇADE WALLS

B.4.1. W/ EDGE PROTECTION

A - Dincel Wall from previous level.

B - Core 100ø holes for steel reinforcement ('L' bars) to be fed through as required. Refer to detail F.10.1 for coring instructions. Alternatively, provide dowel connection as detailed by design engineer.

C - Non-shrink grout, provided with appropriate falls to drainage points.

D - Suggested pour break locations.

E - Deck formwork.

F - Join Dincel profiles together using P-WS accessory or plywood on each side (see Section F.8.2 for details).

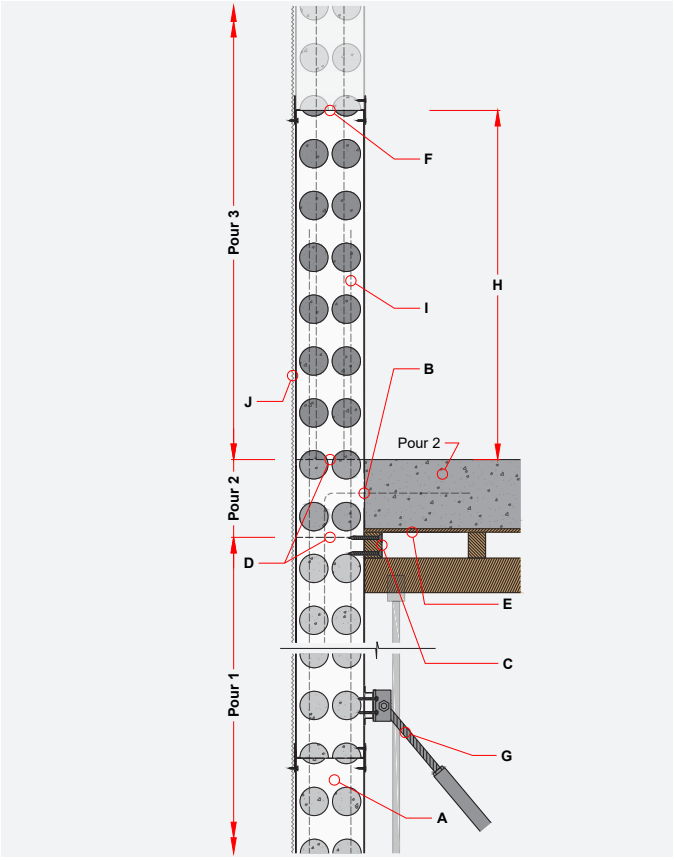
G - Brace lower portion of wall if required (when panels relied upon as edge protection).

H - Min 1000mm when Dincel wall used as temporary edge protection.

I - Vertical wall reinforcement used as starter bars for next level.

J - Optional finish for aesthetic purposes.

NOTE: Use as edge protection only suitable for Dincel 200 & 275. 110 & 155 Dincel may be considered if additional bracing is provided to stiffen and stabilise the profiles.



B.4.2. SLAB SETDOWN

A - Dincel Wall above, after pouring slab below.

B - Vertical wall reinforcement used as starter bars for next level, to engineer's details.

C - Optional pour break location, max 25mm below slab soffit.

D - Deck formwork.

E - Concrete floor slab to engineer's details.

F - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab.

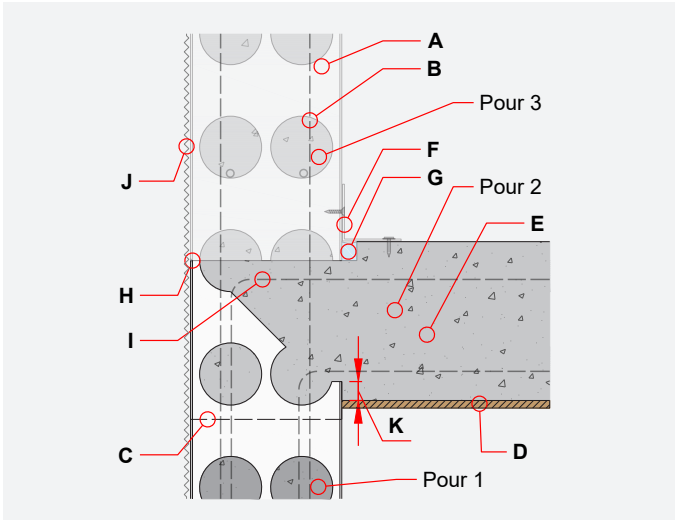
G - Min 25x50mm gap in set down to be filled with compatible sealant or high flow non-shrink grout.

H - Fill joint with waterproof sealant. Alternatively, use detail B.4.2.1 (below) for where there is no access to exterior face.

I - 'L' bars for structural connection to slab, temporarily secured with tie-wire.

J - Optional finish for aesthetic purposes.

K - Recommended 25mm lip to prevent deck water run-off & debris entering Dincel panels before pour.



B.4.2.1. ALTERNATE JOINT DETAIL – NO ACCESS TO EXTERIOR FACE

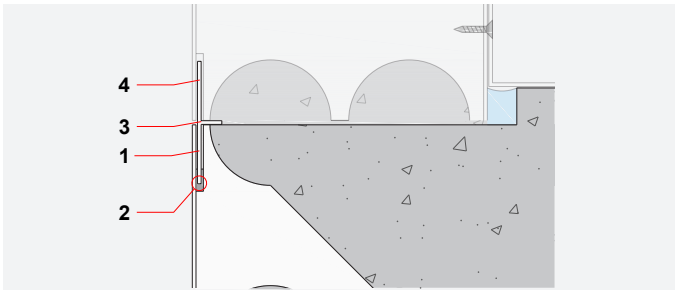
This detail is suited for façade walls where there is no access to the exterior face and where for aesthetic purposes the P-WS flanges cannot be exposed.

1 - Cut horizontal slot into webs of panels below and above rebate level (through the use of circular saw or angle grinder). Slot size to be approximately 5mm x 50mm.

2 - Apply MS Polymer sealant into slot.

3 - Cut P-WS in order to create T Section (see image to right). Insert cut P-WS into slot and secure with additional adhesive or screws as required.

4 - Once floor slab has been poured, cut slot into panels to be installed above. Slide panels into position.



B.4.3. METAL DECKING

A - Dincel Wall above, after pouring slab below.

B - Vertical wall reinforcement used as starter bars for next level, to engineer's details.

C - Pour break location.

D - Temporary support.

E - Steel deck for concrete slab.

F - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab.

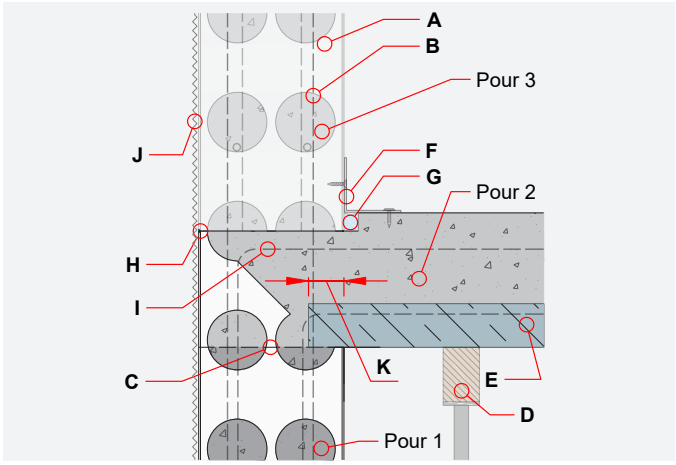
G - Min 25x50mm gap in set down to be filled with compatible sealant or high flow non-shrink grout.

H - Fill joint with waterproof sealant. Alternatively, use detail B.4.2.1 for where there is no access to exterior face.

I - 'L' bars for structural connection to slab, temporarily secured with tie-wire.

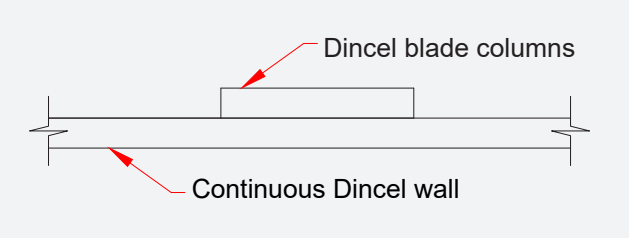
J - Optional finish for aesthetic purposes.

K - Min 50mm bearing onto Dincel wall.



B.4.4. POST TENSIONED SLAB

A - Dincel blade columns, positioned behind Dincel façade wall (see below plan view). Position of column or wall may vary, refer engineering design.



B - Dincel façade wall.

C - Cast-in 100Ø PVC sleeve, to be grouted after prestressing.

D - Cast-in or post-fixed starter bar.

E - Suggested pour break location.

F - If required, dowels to tie continuous Dincel wall to blade Dincel wall, to engineer's details.

G - P-TC Screw-On Cap on top of wall to provide slip joint, or 2 strips of greased steel. Note: waterstop or waterproofing membrane may be required to the joint depending on the finishing type and exposure to rain.

H - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab.

I - Dincel to span min 1000mm above slab level where profiles are used as edge protection.

J - Prestressing pan.

K - Prestressing duct to receive tendons.

L - Axial shortening due to prestressing. Area to be finished, coated or grouted as required.

M - Min 25x50mm gap in set down to be filled with compatible sealant.

Construction Sequence

1 - Pour wall / blade column with cast-in bars or post-fixed protruding above.

2 - Place P-TC and 100Ø sleeves into position, core holes into accessory as required to place over bars.

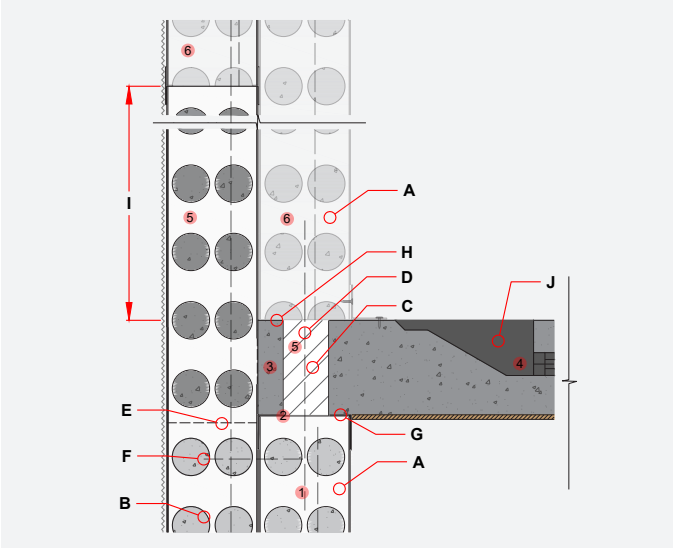
3 - Place L-bars for wall as required.

4 - Pour and stress the slab.

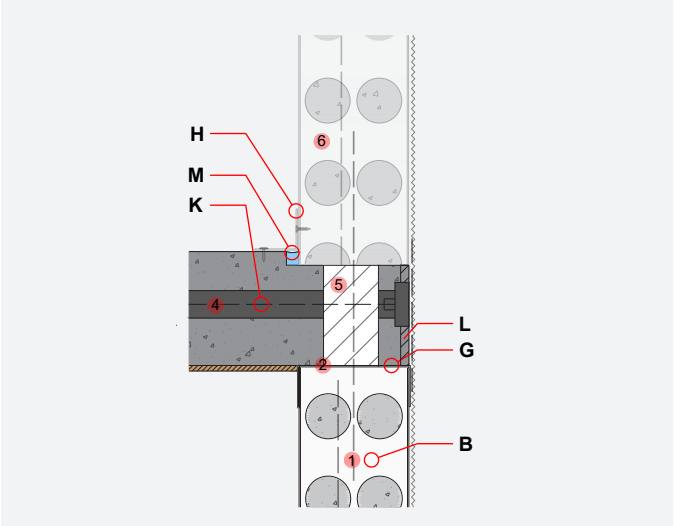
5 - Grout PVC sleeve. For Option 1 only, pour the external façade wall up to the pour break location.

6 - Pour concrete to walls and/or blade columns over.

Option 1
Concealed Slab Edge



Option 2
Exposed Slab Edge (requires waterproofing)



B.4.5. CONNECTION TO SUSPENDED FLOOR

A - Dincel Façade Wall.

B - Steel reinforcement to engineer's details.

C - Waling plate/bearer.

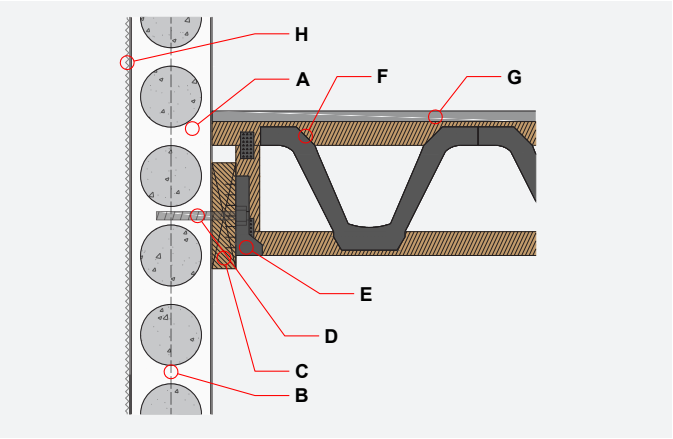
D - Post-fixed or cast-in anchor.

E - Joist hanger.

F - Truss flooring system (i.e. PosiStrut) or similar.

G - Sheet flooring and selected finish.

H - Optional finish for aesthetic purposes.



B.4.6.CONNECTION TO TIMBER/STEEL FRAME ROOF

A - Dincel Façade Wall.

B - Steel reinforcement to engineer's details.

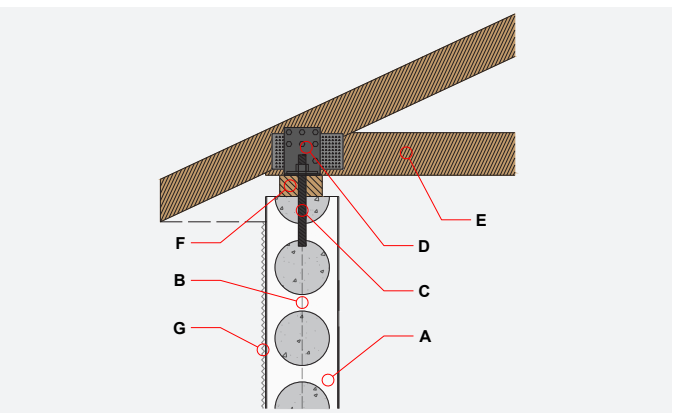
C - Post-fixed or cast-in anchor.

D - Tie down brackets (i.e. CPB bracket or similar).

E - Roof truss.

F - Bearing timber (optional), for achieving level mounting surface.

G - Optional finish for aesthetic purposes.



B.4.7. WAFFLE-POD SLAB (ABOVE GROUND)

A - Dincel Façade Wall.

B - Steel reinforcement to engineer's details.

C - Cast-in starter bars for wall.

D - Damp-proof membrane for slab.

E - Steel bars provided for termite protection (as per AS3660) where there is a pour break/joint.

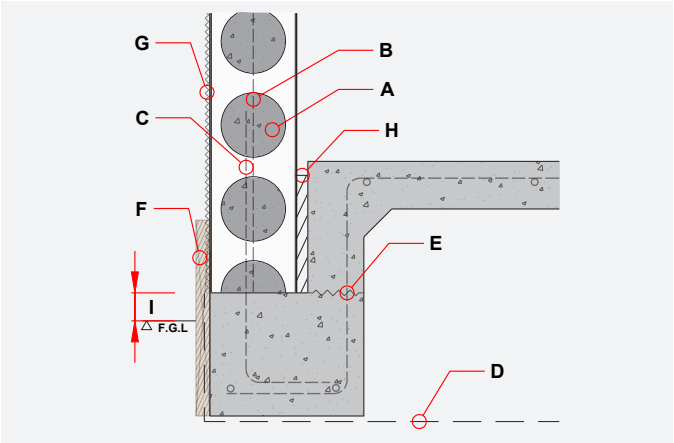
F - Temporary formworking edge board for both slab and Dincel wall.

G - Optional finish for aesthetic purposes.

H - Min 25mm gap between slab and wall to allow for site installation tolerances. Gap to be later filled with high flow non-shrink grout.

I - Min 75mm between slab rebate and FGL.

NOTE: No accessories to be used underneath wall.



B.4.8. SLAB ON GROUND (ABOVE GROUND)

A - Dincel Façade Wall.

B - Steel reinforcement to engineer's details.

C - Cast-in starter bars for wall.

D - Damp-proof membrane for slab.

E - 50mm min rebate.

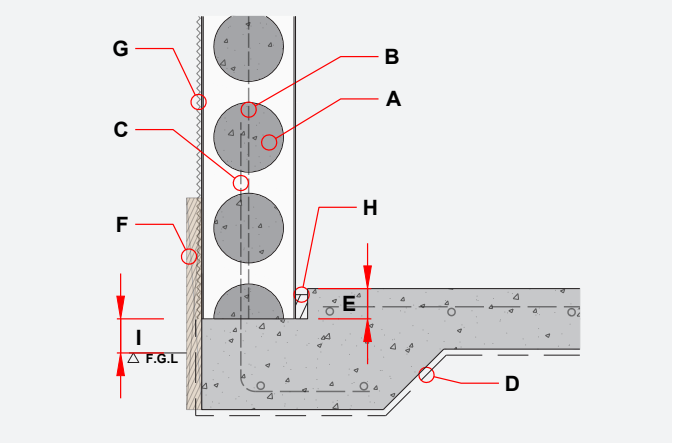
F - Temporary formworking edge board for both slab and Dincel wall.

G - Optional finish for aesthetic purposes.

H - Min 25mm gap between slab and wall to allow for site installation tolerances. Gap to be later filled with high flow non-shrink grout.

I - Min 75mm between slab rebate and FGL.

NOTE: No accessories to be used underneath wall.



B.5. INTERNAL WALLS

B.5.1. CONVENTIONAL DECK

A - Dincel Wall above if required.

B - Vertical wall reinforcement used as starter bars for next level, or post-fixed starter bars, to engineer's details.

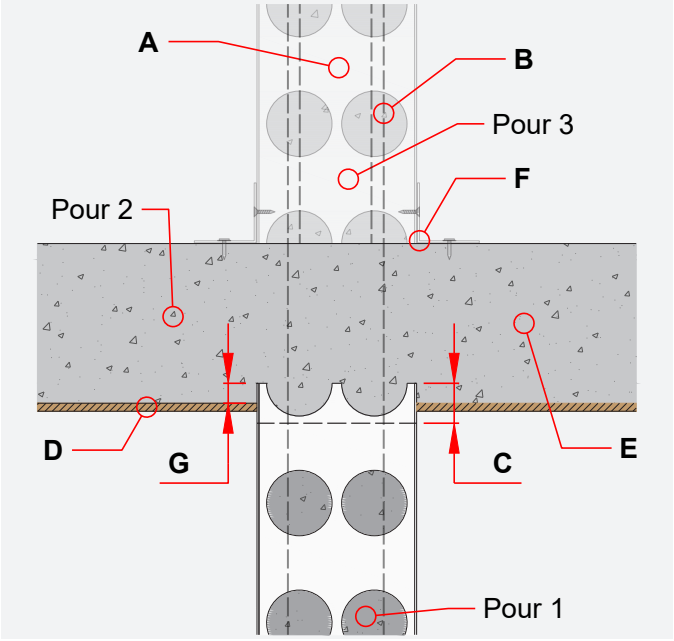
C - 50mm maximum from slab soffit to pour break.

D - Deck formwork.

E - Concrete slab to engineer's details.

F - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab. Guide Track (P-G) can only be used if in accordance with Section A.4 and permitted by design engineer.

G - Optional 25mm lip to prevent deck water run-off & debris entering Dincel panels before pour. Lip additionally allows for temporary fixings to restrain top of Dincel profiles.



B.5.2. METAL DECKING

A - Dincel Wall above if required.

B - Vertical wall reinforcement used as starter bars for next level, or post-fixed starter bars, to engineer's details.

C - Optional pour break location.

D - Metal decking/formwork.

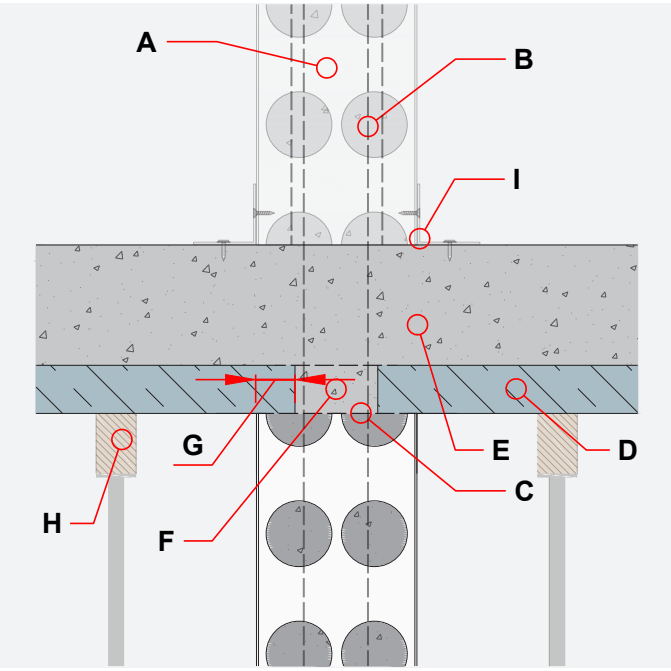
E - Concrete slab to engineer's details.

F - Where metal forms are continuous over Dincel walls, provide ø100mm holes in the forms at required centres.

G - Min 50mm bearing onto Dincel wall.

H - Temporary support.

I - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab. Guide Track (P-G) can only be used if in accordance with Section A.4 and permitted by design engineer.



B.5.3. POST TENSIONED SLAB

A - Dincel Wall with starter bar protruding above (alternatively a post-fixed dowel can be used, to engineer's detail).

B - Cast-in 100Ø PVC sleeve, to be grouted after prestressing.

C - P-TC Screw-On Cap on top of wall to provide slip joint, or 2 strips of greased steel. Note: Slip joint is typically only required where large axial compression is expected to slab (i.e. extremities of slab).

D - Prestressing duct to receive tendons.

E - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab. Guide Track (P-G) can only be used if in accordance with Section A.4 and permitted by design engineer.

Construction Sequence

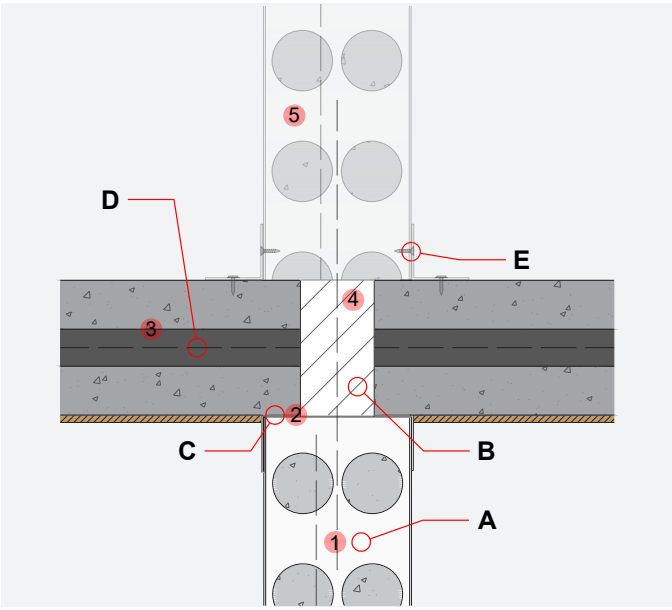
1 - Pour wall / blade column with cast-in bars or post-fixed protruding above.

2 - Place P-TC and 100Ø sleeves into position, core holes into accessory as required to place over bars.

4 - Pour and stress the slab.

5 - Grout PVC sleeve.

6 - Pour concrete to walls and/or blade columns over.



B.6. CORE (STAIR & SHAFT) WALLS

B.5.4. METAL ROOFING

A - Dincel Wall.

B - Steel reinforcement to engineer's details.

C - Structural steel frame for roofing (i.e. C-Purlins).

D - Selected steel roofing profile.

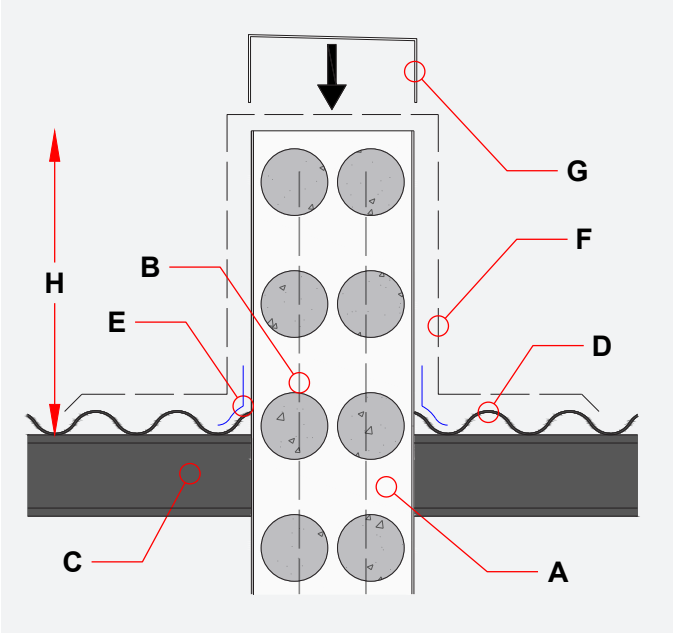
E - High-elasticity waterproofing membrane.

F - Continuous steel flashing.

G - Steel coping or similar, provided with adequate fall.

H - Wall extension above roof level as required for fire rating.

NOTE: Any insulation required is assumed to be added below, within roof cavity.



B.6.1. W/ EDGE PROTECTION

A - Dincel Wall from previous level.

B - Core 100ø holes for steel reinforcement ('L' bars) to be fed through as required. Refer to Detail F.10.1 for coring instructions.

C - All Dincel panel joints to be screwed into deck joists (to be designed by temporary works engineer).

D - Suggested pour break locations.

E - 'L' bars to be secured with tie wire to vertical reinforcement.

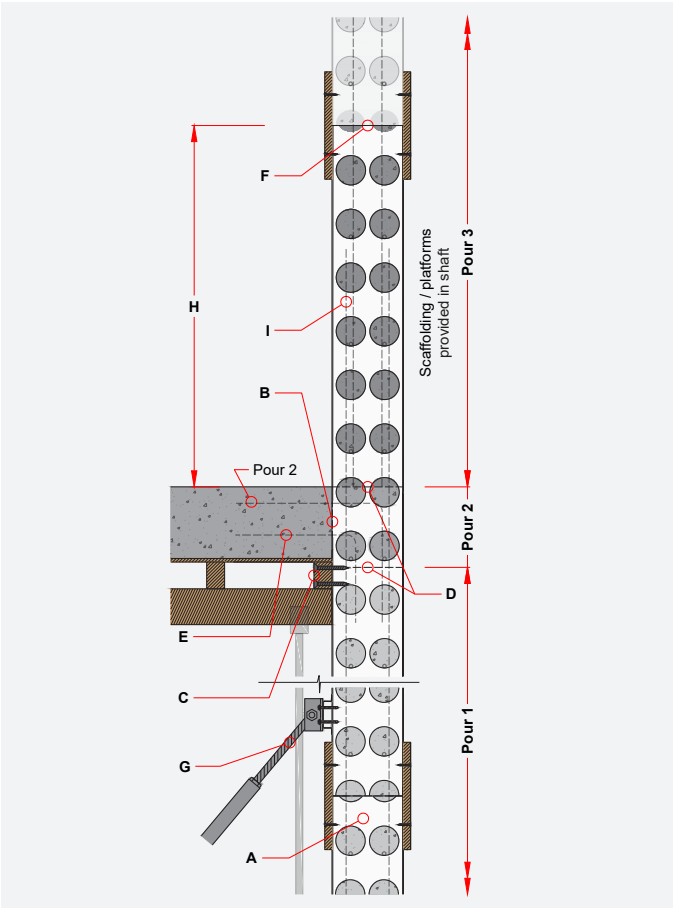
F - No Dincel accessories to be used horizontally between Dincel panels for shear walls. Instead, use plywood formwork on both sides. See Section F.8.2.2 for details.

G - Brace lower portion of wall if required (when panels relied upon as edge protection).

H - Min 1000mm when Dincel wall used as temporary edge protection.

I - Vertical wall reinforcement used as starter bars for next level.

NOTE: Use as edge protection only suitable for 200 & 275 Dincel.



B.6.2. ALTERNATE DETAIL

A - Dincel Wall above.

B - Vertical wall reinforcement used as starter bars for next level, to engineer's details.

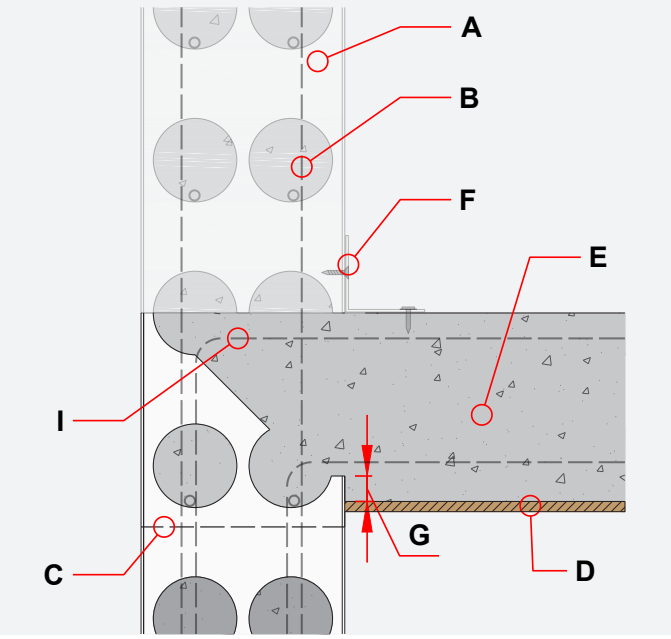
C - 50mm maximum from slab soffit to pour break.

D - Deck formwork.

E - Concrete slab to engineer's details.

F - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab. Accessories (such as a P-G or P-WS) should not be used underneath a shear wall.

G - Optional 25mm lip to prevent deck water run-off & debris entering Dincel panels before pour.



B.6.3. STAIR LANDINGS

A - Dincel Wall.

B - Steel reinforcement to engineer's details.

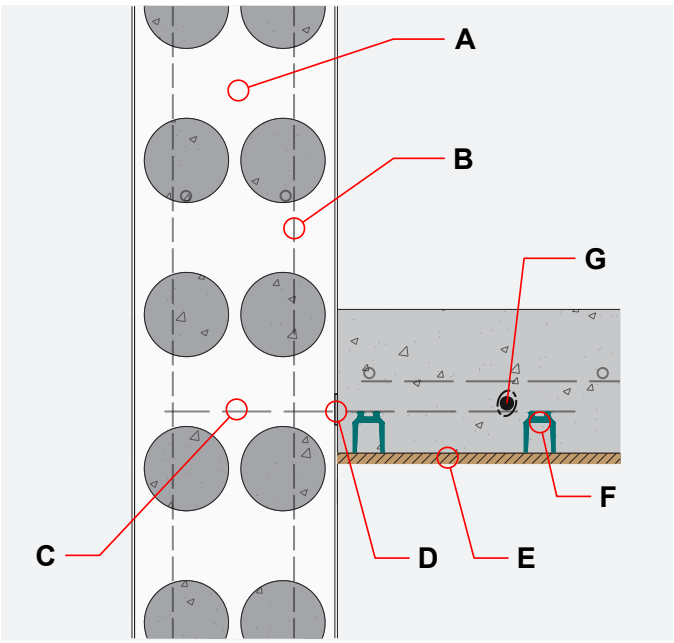
C - Cast-in or postfixed dowels to engineer's specification. Alternatively, cast-in 'L' bars can be used.

D - Drill neat holes in profiles for dowels to pass through. Where 'L' bars are used, 100ø holes can be cored from the profiles at required centres (see Detail F.10.1 for procedure).

E - Formwork for stair landing.

F - Bar chairs to support dowels.

G - Support bar, secured to all dowels using tie-wire to restrain position.



B.6.4.TOP TERMINATION

A - Dincel Wall.

B - Steel reinforcement to engineer's details.

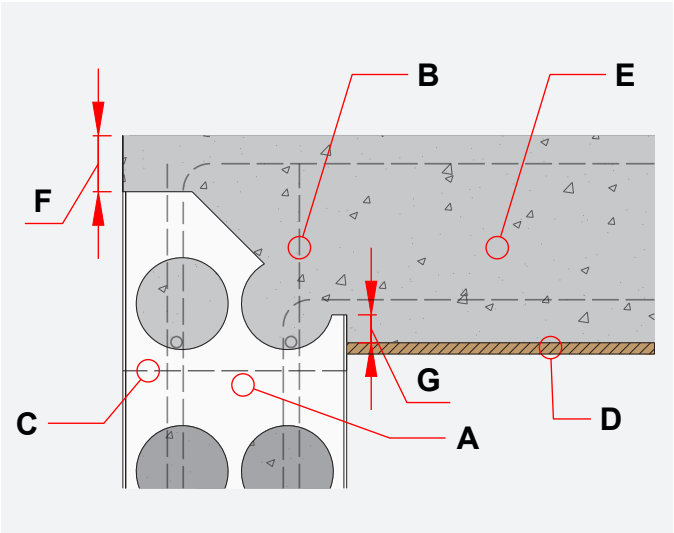
C - 50mm maximum from slab soffit to pour break.

D - Deck formwork.

E - Concrete slab above, waterproofed as required.

F - 50mm minimum concrete over Dincel profile to prevent water ingress.

G - Optional 25mm lip to prevent deck water run-off & debris entering Dincel panels before pour.



B.7. RETAINING WALLS

B.7.1. CANTILEVER

A - Dincel Wall.

B - Steel reinforcement for footing and wall to engineer's details.

C - Footing key, if required.

D - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab. Junction waterproofed as required.

E - Suitable drainage provided behind retaining wall, such as ag-line with weep holes provided through wall if required.

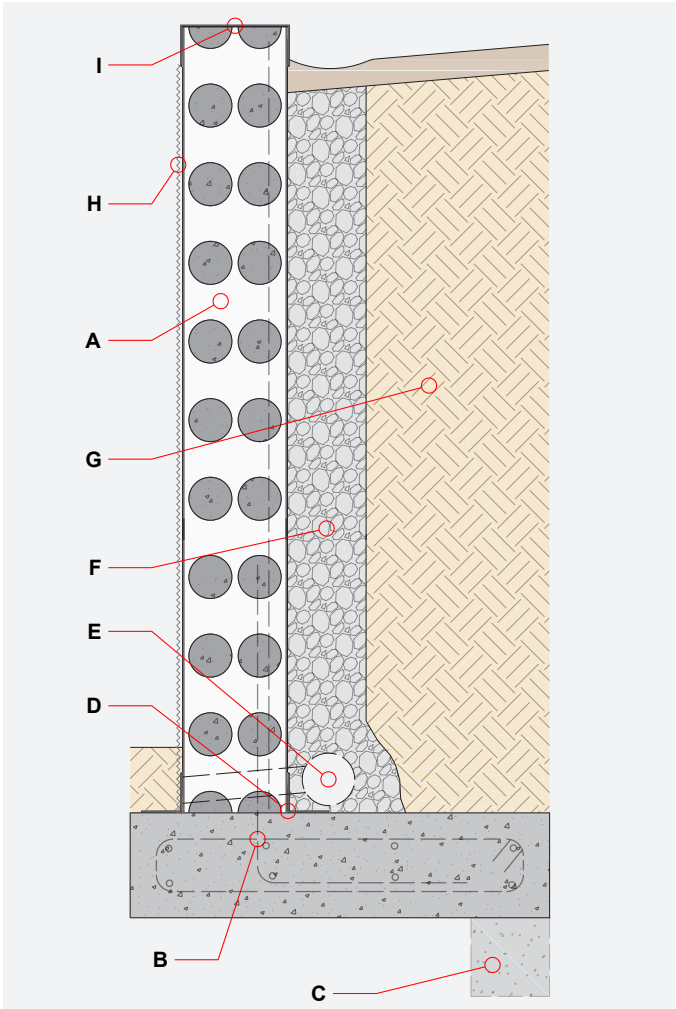
F - Granular backfill to support drainage.

G - Retained earth.

H - Optional finish for aesthetic purposes.

I - Capping to top of wall (such as folded metal cap or block coping). If capping not used, surface must be adequately waterproofed.

NOTE: Maximum height of wall, steel reinforcement and footing details must be designed by structural engineer.



B.7.2. COUNTERFORT

A - Return Dincel walls as counterfort support (i.e. perpendicular blade walls) at required spacings (steel reinforcement not shown for clarity).

B - Steel reinforcement for footing and wall to engineer's details.

C - Footing key, if required.

D - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab. Junction waterproofed as required.

E - Suitable drainage provided behind retaining wall, such as ag-line with weep holes provided through wall. PVC pipe to be cast into counterfort wall to allow for ag-pipe.

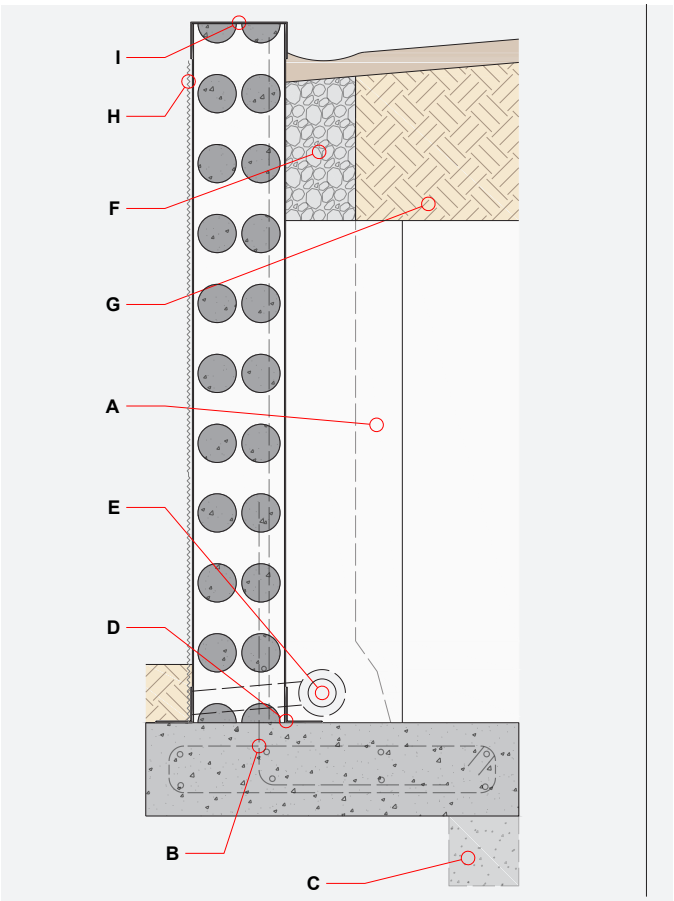
F - Granular backfill to support drainage.

G - Retained earth.

H - Optional finish for aesthetic purposes.

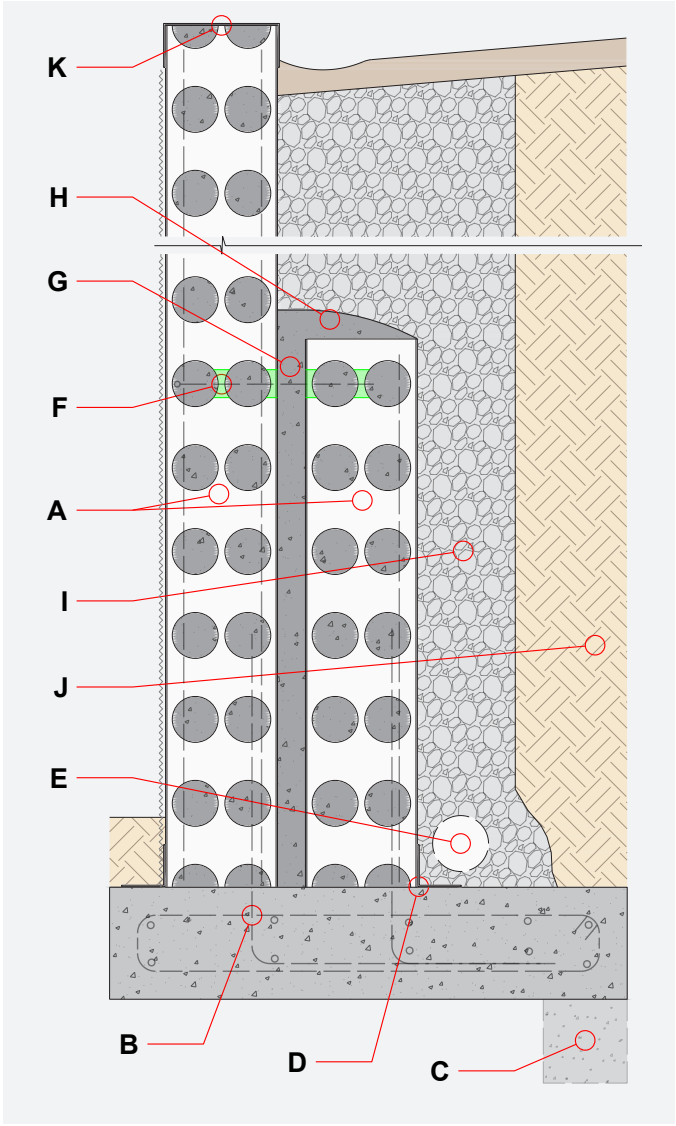
I - Capping to top of wall (such as folded metal cap or block coping). If capping not used, surface must be adequately waterproofed.

NOTE: Maximum height of wall, steel reinforcement and footing details must be designed by structural engineer.



B.7.3. DUAL WALL CANTILEVER

A dual cantilever wall can be used for taller walls where a single Dincel wall may be too slender, and is an alternative to other arrangements such as counterfort or buttress Dincel walls. Dual cantilever walls are only recommended using 200 or 275 Dincel walls.



A - Dincel Wall with secondary support wall to reduce slenderness and increase wall capacity (only required for very tall cantilever walls)..

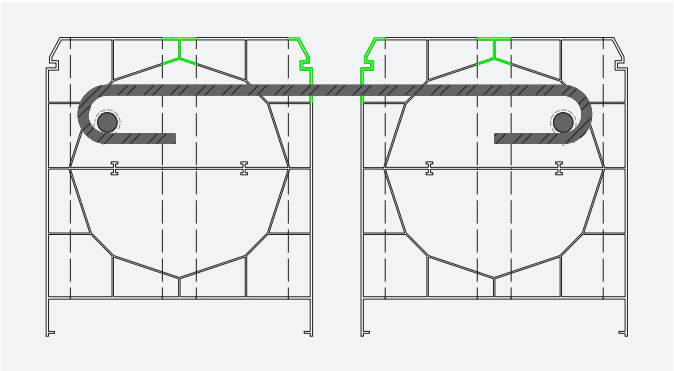
B - Steel reinforcement for footing and wall to engineer's details.

C - Footing key, if required.

D - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab. Junction waterproofed as required.

E - Suitable drainage provided behind retaining wall, such as ag-line with weep holes provided through wall. PVC pipe to be cast into counterfort wall to allow for ag-pipe.

F - If required, steel reinforcement ties between walls can be provided at the necessary spacings. For 200 and 275 Dincel, the formwork must be cut in the areas as highlighted in green.



G - 70mm cavity between walls or as required. Cavity to be filled after concrete has set within Dincel walls.

H - Form concrete pad trowelled to shape. Once cured, provide waterproofing membrane to top surface.

I - Granular backfill to support drainage.

J - Retained earth.

I - Capping to top of wall (such as folded metal cap or block coping). If capping not used, surface must be adequately waterproofed..

NOTE: Maximum height of wall, steel reinforcement and footing details must be designed by structural engineer.

B.7.4. DIAPHRAGM TERRACED

A - Dincel Walls

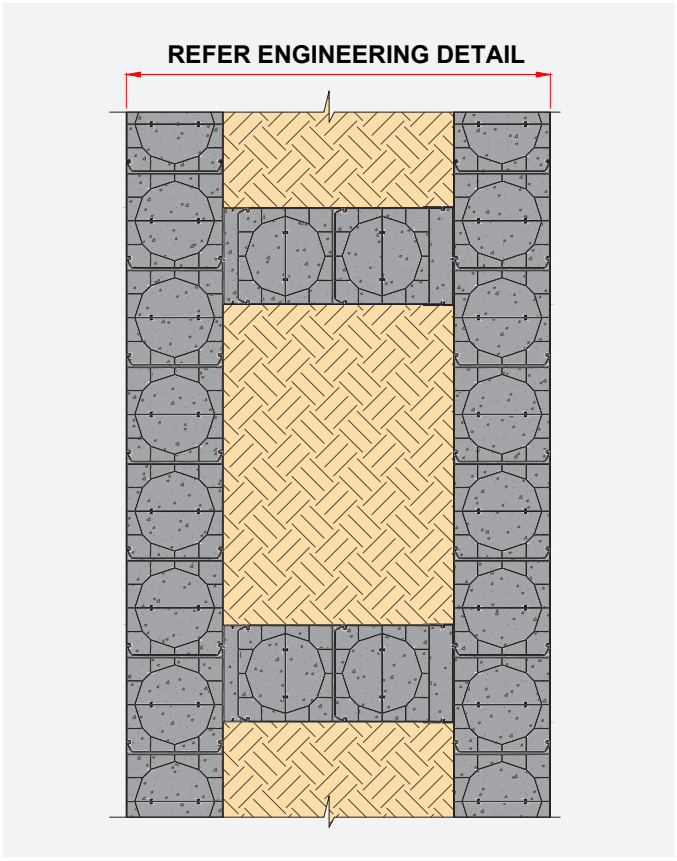
B - Steel reinforcement for footing and wall to engineer's details.

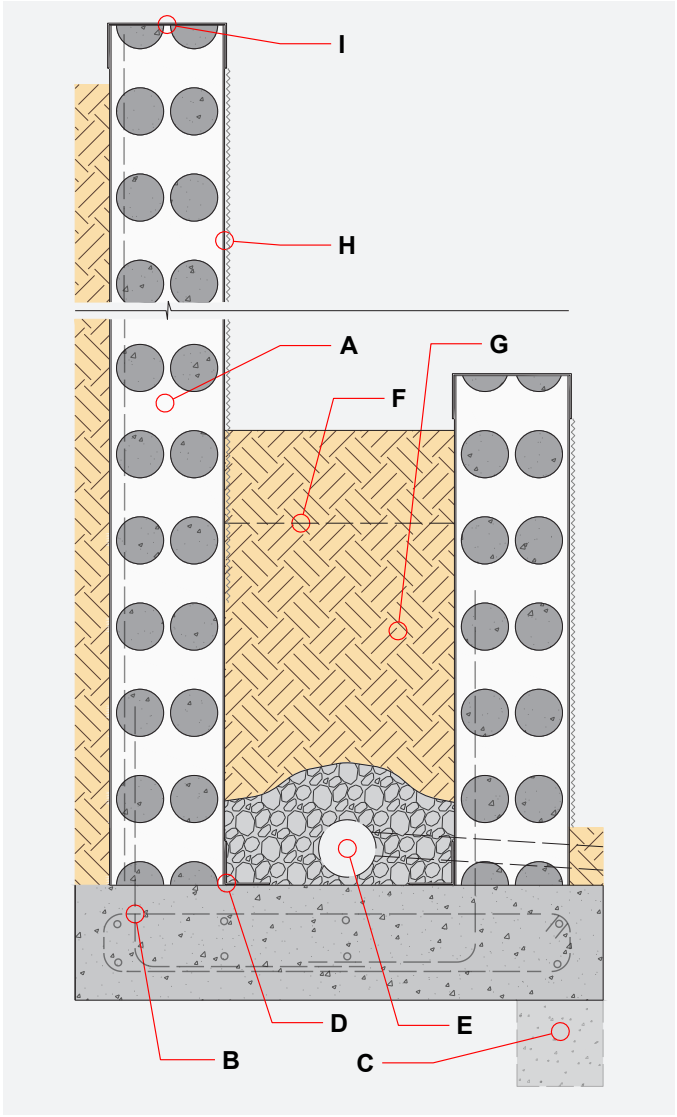
C - Footing key, if required.

D - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab. Junction waterproofed as required.

E - Drainage as required

F - Perpendicular Dincel walls to form diaphragm (refer to plan view below). Consult project design engineer for design and detailing.





G - Retained earth.

H - Optional finish for aesthetic purposes.

I - Capping to top of wall (such as folded metal cap or block coping). If capping not used, surface must be adequately waterproofed.

NOTE: Maximum height of wall, steel reinforcement and footing details must be designed by structural engineer.

B.8. BALUSTRADES

B.8.1 BALUSTRADES

A - Dincel Wall.

B - Concrete slab to engineer's details.

C - Deck formwork, with drip groove cast in.

D - Dincel profiles cut at bottom for connection to slab.

E - PVC overflow cast into balustrade if required.

F - Starter bars tied to slab reinforcement. Dincel panels are to be installed by sliding down from above bar position.

G - Temporary bracing to deck as required.

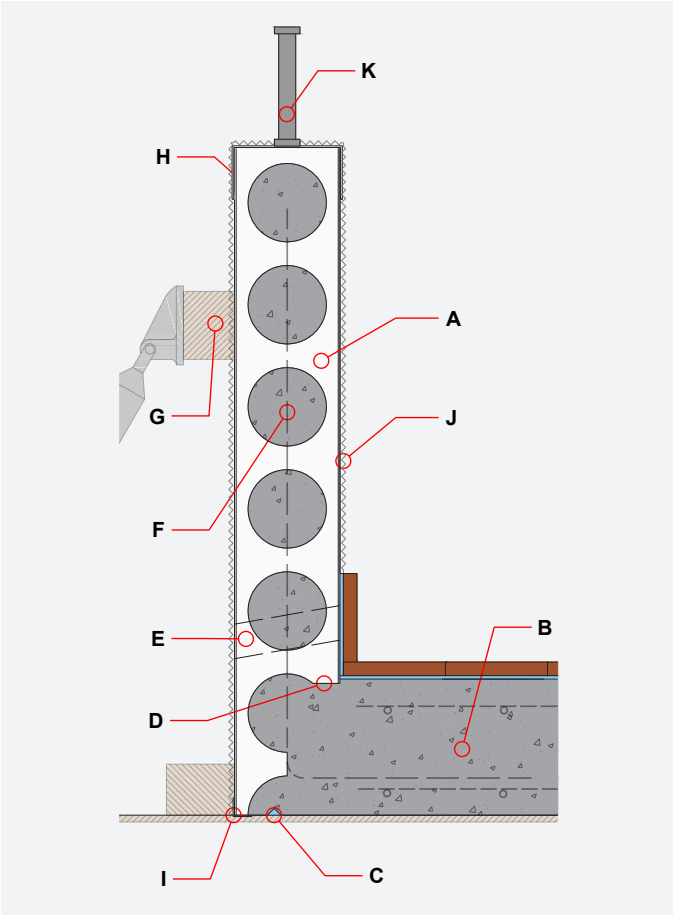
H - Capping to top of wall (such as folded metal cap or block coping). If capping not used (i.e. render), surface must be adequately waterproofed.

I - 25mm x 25mm EA PVC glued to balustrade corner if required.

J - Optional finish to external and internal faces for aesthetic purposes.

K - Handrail if required.

NOTE: Detail shows a monolithic pour. If Dincel wall is provided ontop of slab, then the exterior joint created will need to be aesthetically finished and waterproofed. Height of balustrade as per designer requirements.



B.9. WAREHOUSE & FACTORY

B.9.1. DADO (UPSTAND) WALLS

A - Dincel Wall with infused footing.

B - Steel reinforcement to engineer's details.

C - Concrete slab to engineer's detail.

D - Temporary "chocks" to contain concrete within footing trench.

E - Core 90mm max holes @ 333mm centres to allow concrete to fill trench to form infused footing for Dincel Wall.

F - Min. 450mm wide x 400mm deep continuous trench. 100mm Densely Graded Base to seat Dincel panels.

G - Isolated pad footing for structural steel frame (prior dado wall being installed).

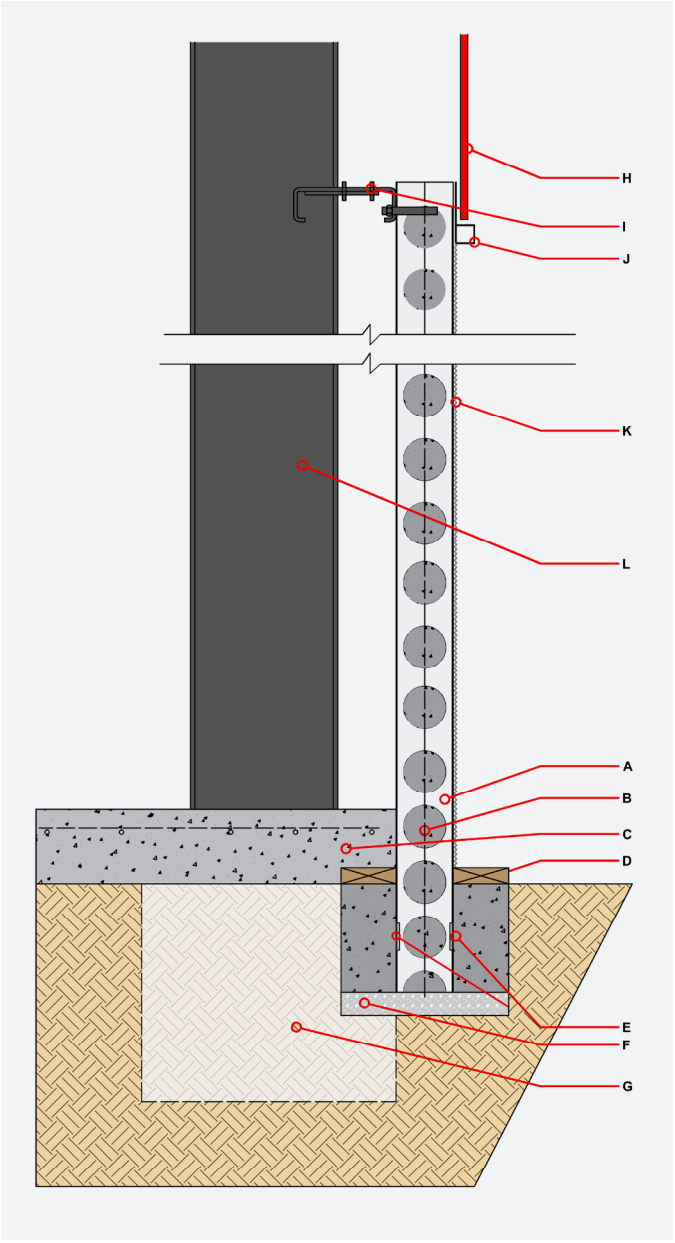
H - Wall sheeting.

I - Permanent girt for propping Dincel wall prior concrete infilling.

J - Toe mould flashing.

K - Optional finish for aesthetic purposes.

L - Portal frame column.



B.9.2. FULL HEIGHT WALLS

A - Dincel Wall.

B - Steel reinforcement to engineer's details.

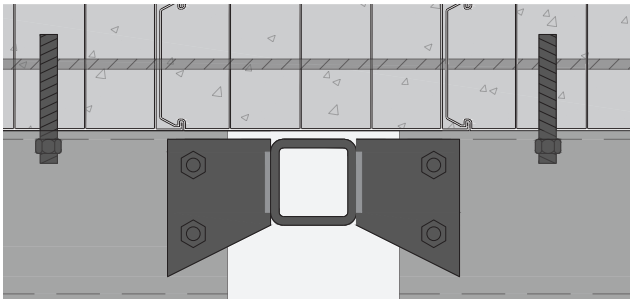
C - Starter bars as per engineer's detail.

D - Concrete floor slab to engineer's details.

E - Dincel wall can extend up if required. Box gutter, eave detail and wall capping to top should be considered at this location to suit.

F - Roof structure (rafters or trusses).

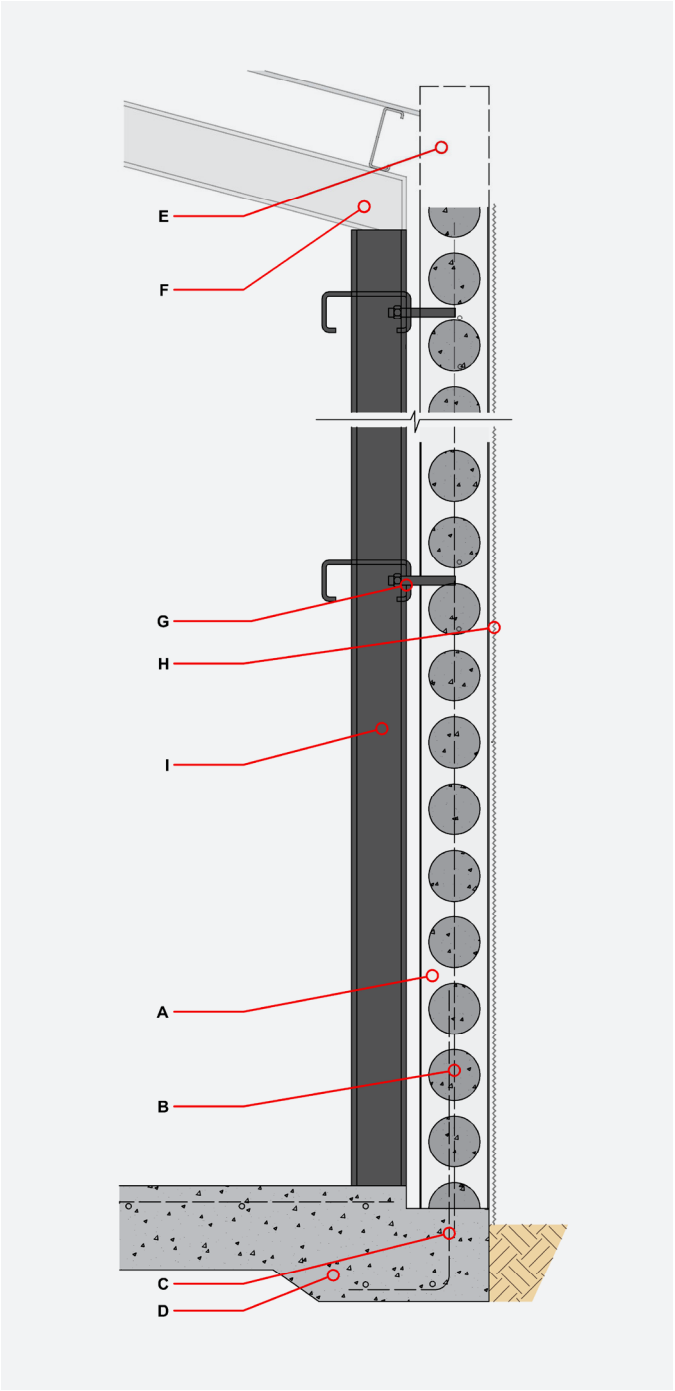
G - Welded plate and fixings to connect steel columns to Dincel wall (see below plan view for illustrative purposes). Fixing type and spacings as per structural engineer's detail.



H - Optional finish for aesthetic purposes.

I - SHS, RHS or I section steel column to carry roof members and provide bracing during erection of Dincel walls.

NOTE: All slab steps should be designed in increments of 150mm to avoid alignment issues of web holes.



B.9.3. INTERNAL WALLS

A - Dincel Wall.

B - Steel reinforcement to engineer's details.

C - Strip footing to engineer's details.

D - Subgrade soil.

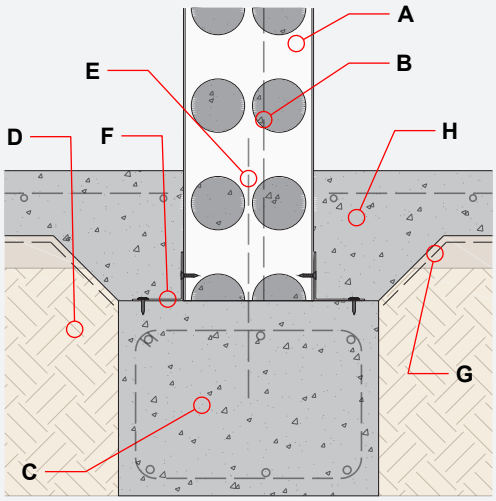
E - Starter bars to engineer's details. Starter bars are tied to footing by either casting in or drill & epoxy.

F - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab.

G - Membrane/underlay to slab as required.

H - Concrete floor slab.

NOTE: All footing steps should be designed in increments of 150mm to avoid alignment issues of web holes.



B.9.4. INTERNAL WALLS ALTERNATE DETAIL

A - Dincel Wall.

B - Steel reinforcement to engineer's details.

C - Strip footing to engineer's details.

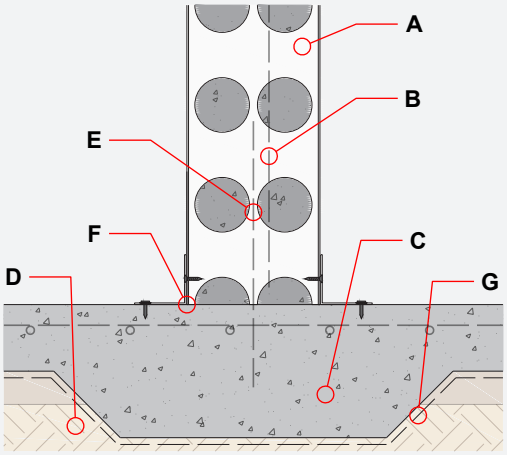
D - Subgrade soil.

E - Starter bars, as specified by structural engineer. Starter bars are tied to footing by either casting in or drill & epoxy.

F - D-ANG50 PVC Angle or 100x75 timber as a temporary wall restraint, suitably fixed to the wall and slab.

G - Membrane/underlay to slab as required.

NOTE: All footing steps should be designed in increments of 150mm to avoid alignment issues of web holes.



B.10. TANKS & PITS

B.10.1. TANKS & PITS

The below detail can be utilised where there is no external water pressure (subject to Design Engineers approval). However, it is recommended to incorporate item E (DWS + hob) and item G (hose + injection material) to add extra waterproofing provisions (refer to section B.6.4) rather than relying on the internal applied membrane system alone.

A - Dincel Wall.

B - Steel reinforcement to engineer's details.

C - Optional hob (to assist structurally, particularly when drill & epoxy starter bars are used). Alternatively, use D-ANG50 as a temporary wall restraint.

D - Starter bars, as specified by structural engineer. Starter bars are tied to slab by either casting in or drill & epoxy.

E - Hydrophilic waterstop. Successful use of waterstops is workmanship dependant. Affecting factors include uneven/unsuitable slab surface, incorrect splicing technique and exposure to moisture before concreting.

F - MS Polymer sealant or equivalent. Min 25mm triangular bead to form waterproof seal. Ensure that sealant is compressed in between angle and Dincel panels.

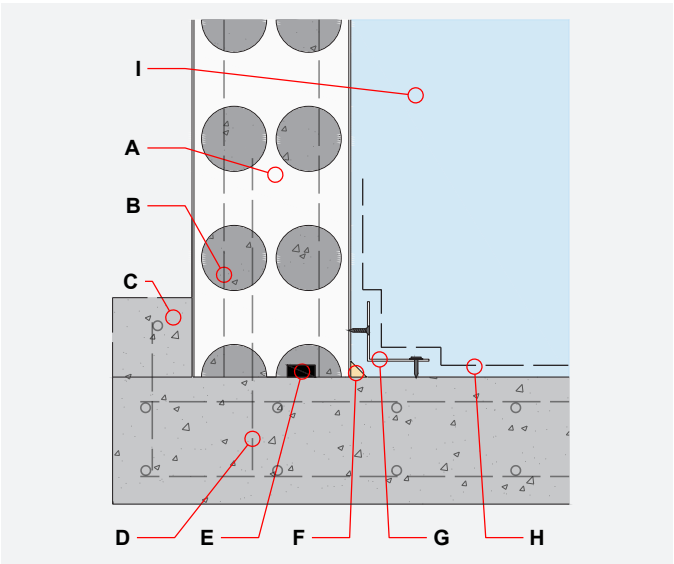
G - D-ANG50 as a temporary or permanent wall restraint, suitably fixed to the wall and slab. Guide track accessory (P-G) must strictly not be used for waterproof applications.

H - Waterproof membrane applied to slab and minimum 300mm up Dincel wall face.

I - Liquid contained by tank (e.g. water). .

NOTE: No accessories (such as guide track P-G) to be used underneath wall.

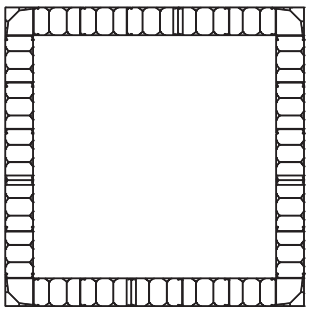
NOTE: Self Compacting Concrete (SCC) use is recommended using following detail.



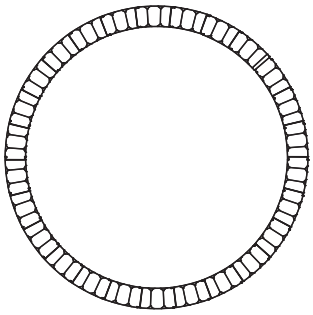
TANK HEIGHT		DINCEL PROFILE
Up to 2.1m		110, 155, 200 or 275
2.1m to 2.7m	With slab over or ring beam	200 or 275
	Cantilever tank walls	275
Greater than 2.7m		275
Note: The profile used Dincel water tanks or pits is dependent upon on requirements from the structural engineer. A guide has been provided to the right taking into account a typical scenario.		

B.10.2. EXAMPLE TANK SHAPES

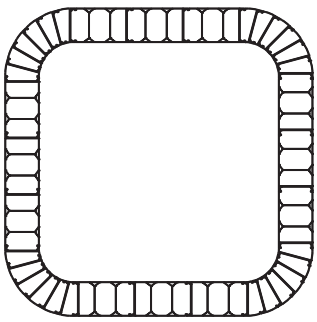
Square or Rectangular Tank/Pit



Circular Tank/Pit



Rounded Corners



B.11. POOLS

Details shown in the following are for in-ground pools.

NOTE: Adopt lift pit/tanks & pits details for above ground pools.

B.11.1. CONSTRUCTION

A - Dincel Wall.

B - Steel reinforcement to engineer's details.

C - 25mm min compacted levelling sand bed in conjunction with membrane/underlay underneath slab as required.

D - Existing soil (excavated).

E - Soil fill, after adequate curing of concrete.

F - Internal and external temporary bracing (as designed by engineer).

G - Structural concrete coping required.

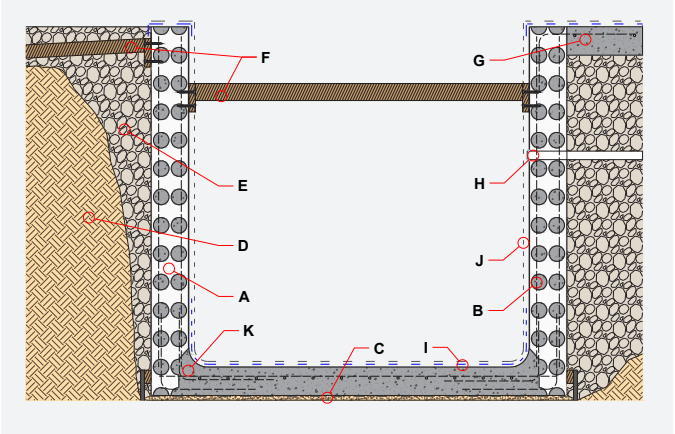
H - Pool plumbing cast into wall. Note: any penetrations into wall must be adequately waterproofed through the use of sealant or membranes.

I - Waterproofing membrane to slab and min 300mm up Dincel wall.

J - Render or tile for aesthetic purposes.

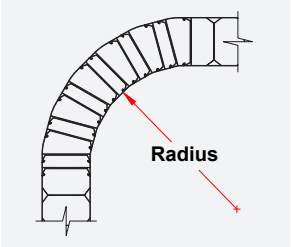
K - Monolithic pour between wall and slab junction for enhanced waterproofing. Refer to detail B.11.3.

NOTE: Use of waterproofing admixtures in concrete for Dincel wall and slab are optional and can be used as an additional waterproofing measure.



B.11.2. CORNERS

When Dincel 200 or 275 is used, curved corners can be utilised and are recommended for extra aesthetic appeal and ease of cleaning. For radius arrangements, please refer to Section B.14.



B.11.3. MONOLITHIC POUR

A - Dincel Wall.

B - Steel reinforcement to engineer's details.

C - Cast in L-bars.

D - Adequate temporary bracing and support provided to base of panel.

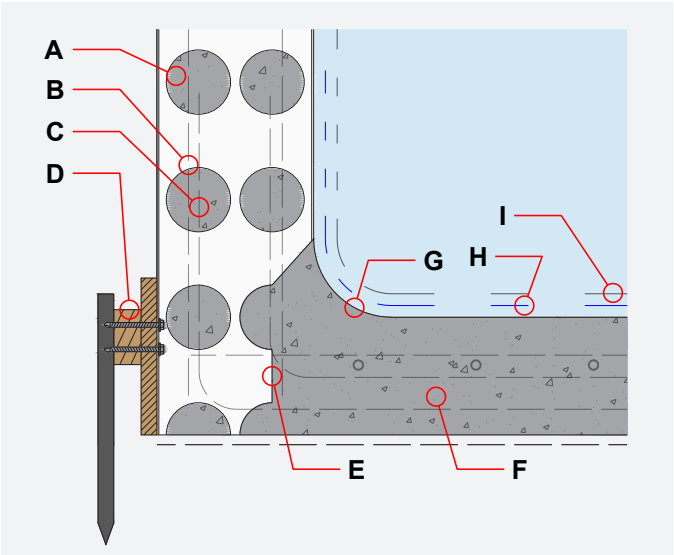
E - Cut internal polymer face and portion of webbing to allow for monolithic pour.

F - Concrete slab for pool base, thickness and steel reinforcement as required by structural engineer.

G - Curved/cove edging can be provided if required for pool cleaners and achieved by a trowel/screed finish to the edges. For a larger radius, curved formwork shuttering can be used instead.

H - Waterproofing membrane to slab and min 300mm up Dincel wall.

I - Render or tile finish for aesthetic purposes.



B.11.4. TWO PART POUR

A - Dincel Wall.

B - Steel reinforcement to engineer's details.

C - Cast-in or drill & epoxy starter bars.

D - Plywood formwork shutter can be used to support wall edge temporarily.

E - Concrete slab for pool base, thickness and steel reinforcement as required by structural engineer.

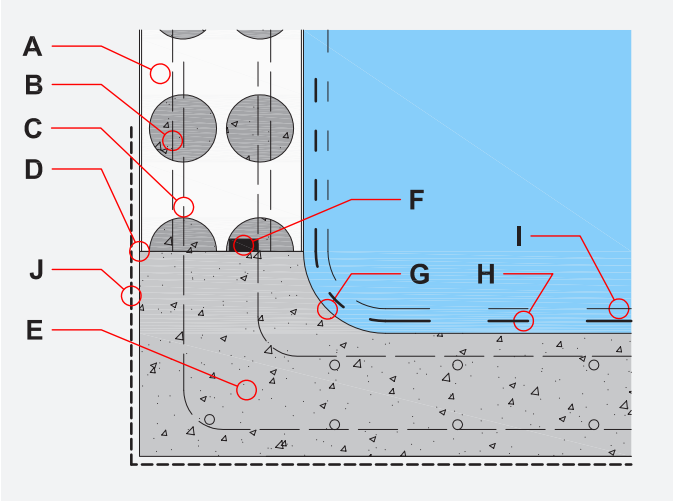
F - Hydrophilic waterstop may be considered in addition to "H" for additional waterproofing measures. Successful use of waterstops is workmanship dependent. Affecting factors include uneven/unsuitable slab surface, incorrect splicing technique and exposure to moisture before concreting.

G - Curved/cove edging can be provided if required for pool cleaners and achieved by a trowel/screed finish to the edges. For a larger radius, curved formwork shuttering can be used instead.

H - Waterproofing membrane to slab and min 300mm up

I - Render or tile finish for aesthetic purposes.

J - Membrane if required



B.12. CHANNELS

B.12. CHANNELS

A - Dincel Wall, typically 110, 155 or 200 depending on dimension 'D'.

B - Surrounding soil.

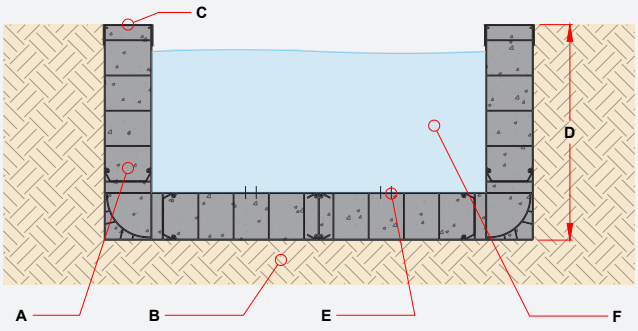
C - In-ground height is dependent on profile thickness and channel loading (as advised by project engineer).

D - Plywood formwork shutter can be used to support wall edge temporarily.

E - Holes cored from panels at regular intervals to allow for the pouring and vibrating of concrete to base. Temporary plywood used to cover holes when pouring sides of channel.

F - Channel content such as storm water, waste water, cabling, etc.

NOTE: This detail is intended for applications where some water egress is permissible. If complete waterproofing is required, membrane entire internal face.



B.13. FENCES

B.13. FENCES

A - Dincel Wall used as fence.

B - Surrounding soil.

C - Anchorage of wall into ground:

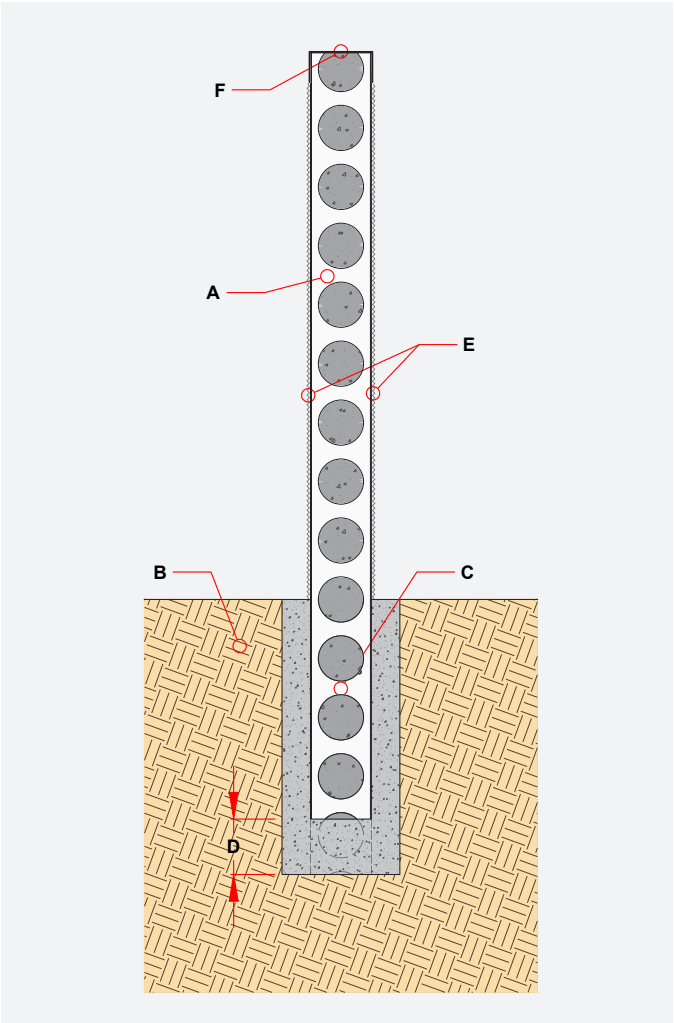
- Option 1 – Continuous trench with mass concrete infill to accommodate Dincel Wall
- Option 2 – Dincel piers provided at required centres (Dincel panels longer at pier locations) with mass concrete infill. Between Dincel piers, bottom of panels flush with ground level.

D - 150mm gap underneath every second panel to allow for concrete flow (for Option 1).

E - Optional finish on either side for aesthetic purposes.

F - Capping to top of wall (such as folded metal cap or block coping). If capping not used, surface must be adequately waterproofed.

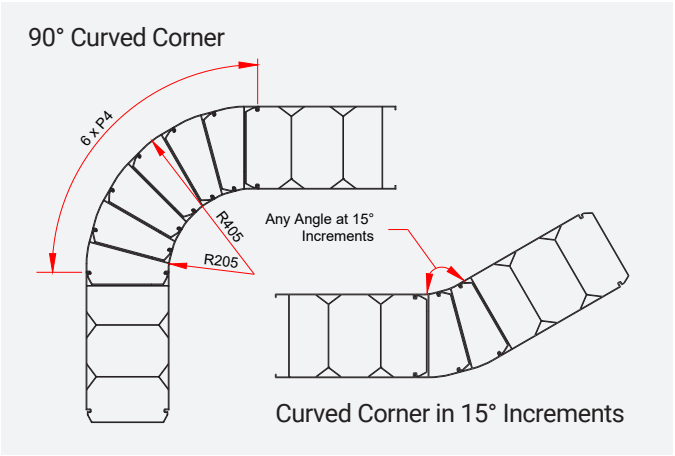
NOTE: Depth and width of trench or pier is required to be designed by the project structural engineer.

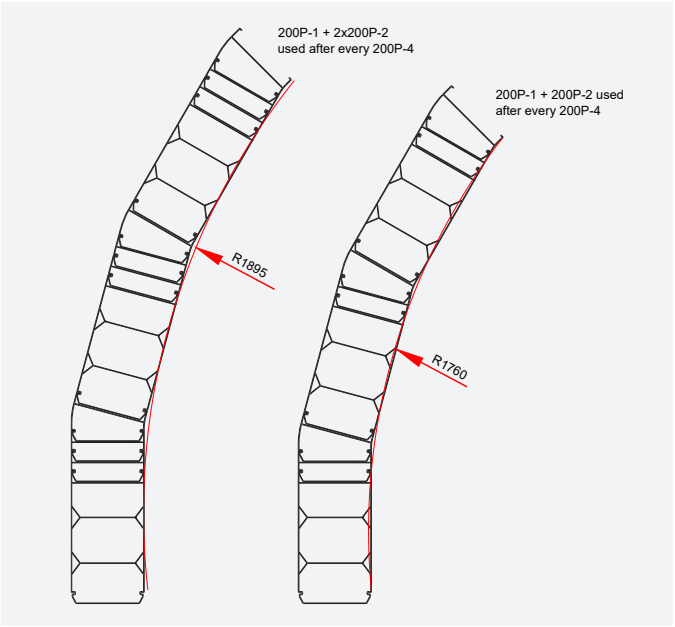


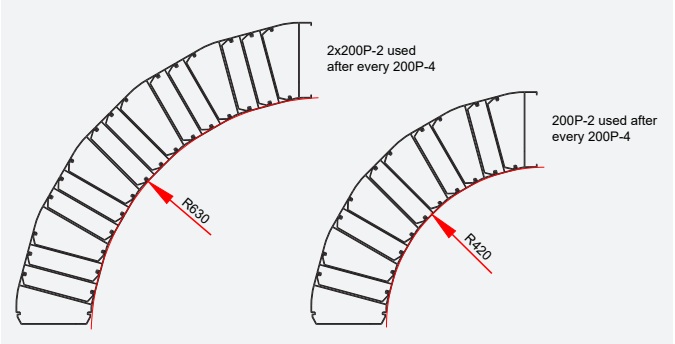
B.14. CURVED WALLS

A curved wall can be easily achieved with Dincel walling through the use of a P4 accessory. This accessory snaps into place and each piece turns the wall by 15°. In addition to use of the P4 accessory, profiles can either be slightly bent or cut and pinned at the required radius. By combining the use of accessories in conjunction with bending/cutting, almost any radius greater than 1.5m can be achieved. Please contact the Dincel estimation team for assistance in specifying the components to achieve a particular radius.

B.14.1. 200 DINCEL – STANDARD RADII

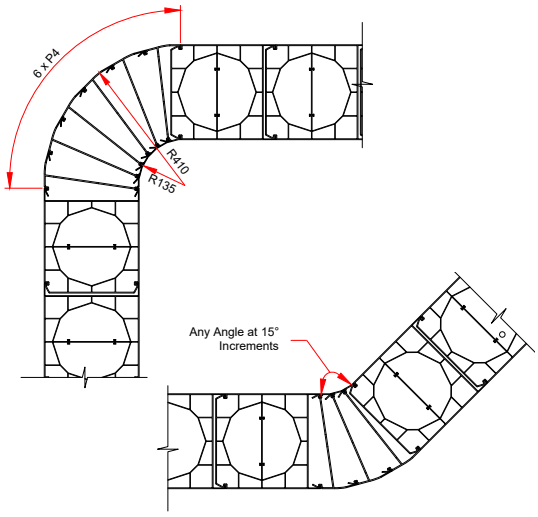




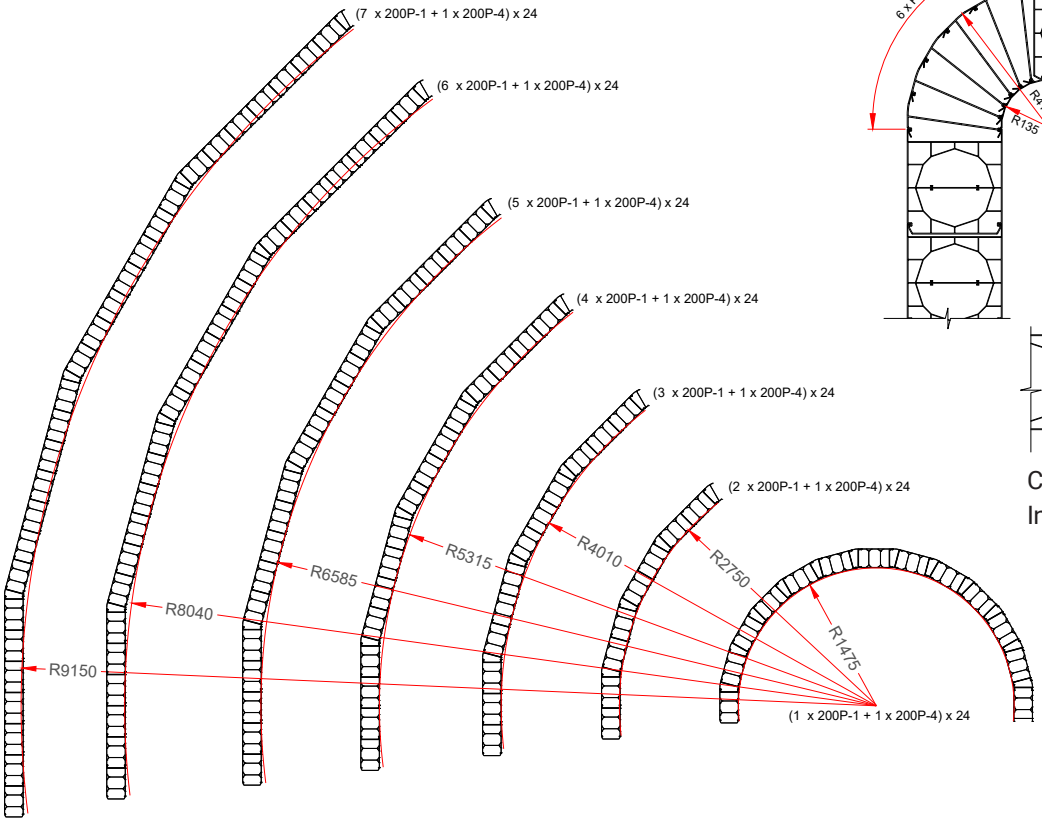


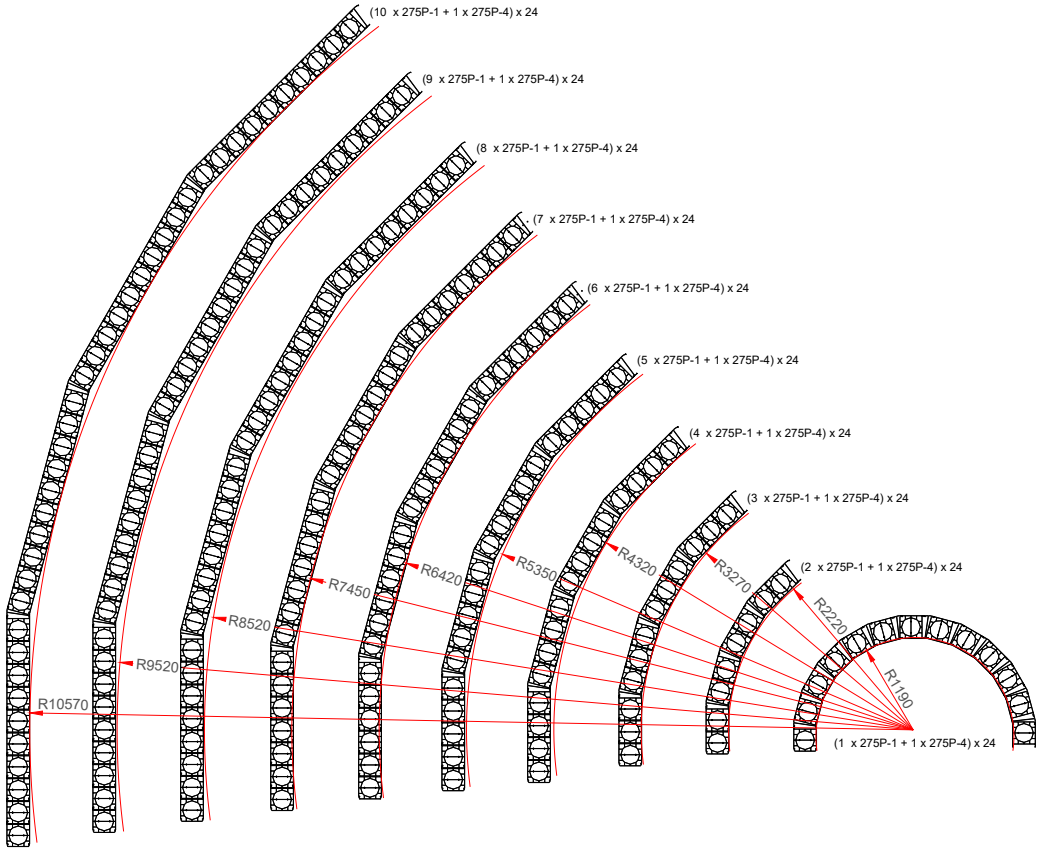
B.14.2. 275 DINCEL – STANDARD RADII

90° Curved Corner



Curved Corner in 15° Increments





B.15. WINDOWS

For external window and door detailing, it is important to consult with the manufacturer as to their specifications for detailing and installation. For most cases, the manufacturers standard detailing for a conventional concrete wall, block wall, or precast wall can be replicated. The details below have been based upon instructions from the Australia Glass & Window Association (AGWA) for solid masonry construction, which can also be applied to Dincel walling. An instructional video from AGWA can be viewed by scanning the QR Code:

B.15.1. CONVENTIONAL DETAIL

A - Horizontal steel reinforcement used above opening to act as lintel, as detailed by structural engineer.

B - If P-TC accessory used for concrete pour, remove before window installation if required. Note: refer to Section F.11.4 for opening bracing details.

C - Window sub-sill, fixed and sealed to opening. Packers used underneath as required.

D - 150mm gap underneath every second panel to allow for concrete flow (for Option 1).

E - Window sub-head, fixed and sealed to opening.

F - Window frame as specified for project installed into sub-head and against angles.

G - Decorative angles fixed and sealed to window frame.

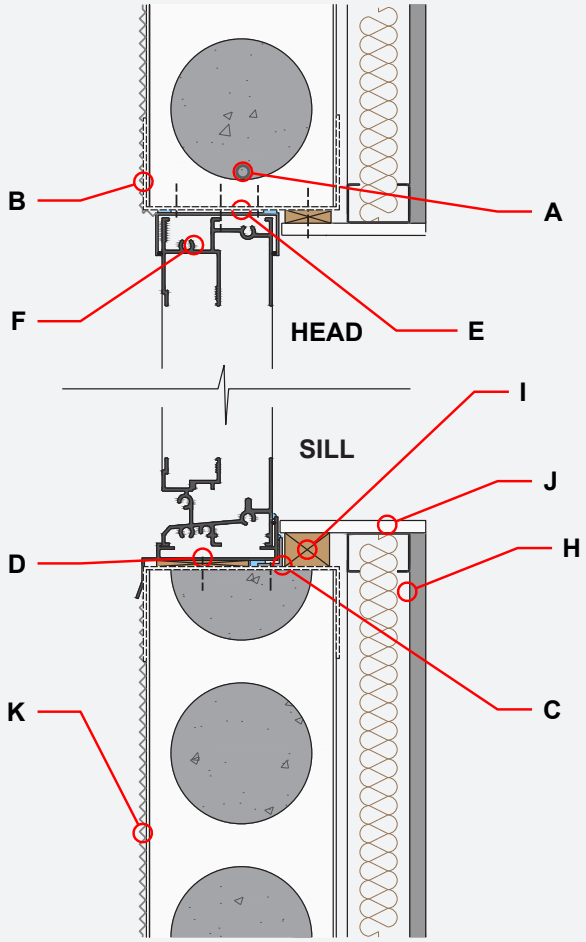
H - Insulation and plasterboard finish on internal face of wall as required.

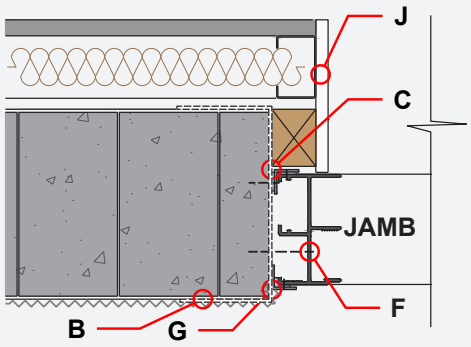
I - Timber used as required underneath window reveals.

J - Window reveal in desired finish (i.e. timber or plasterboard).

K - Optional finish for aesthetic purposes.

NOTE: Any exposed concrete surrounds of opening must be waterproofed using an appropriate membrane to AS 4654.2





B.15.2. ALTERNATE DETAIL (PREFERRED)

For increased weatherproofing performance, rebates can be casted into the Dincel walling using conventional formwork such as plywood sheeting and timber.

A - 25mm window head rebate cast into Dincel wall. Dincel panels are to be cut and braced as detailed within Section F.11.4.

B - Min 10° slope to window sill cast into Dincel wall. Dincel panels are to be cut and braced as detailed within Section F.11.4.

C - Horizontal steel reinforcement used above opening to act as lintel, as detailed by structural engineer.

D - Finish used for exposed concrete surface, dependant on finish to Dincel wall, such as angle, flashing, render or paint finish.

E - Sub-sill flashing (aluminium, pressed metal or uPVC). Arrangement may alter from detail depending on window type.

F - Window sub-head fixed into Dincel wall after concrete has set. Packers used as required for installation.

G - Waterstop angles, installed and sealed as required before window installation.

H - Window frame as specified for project installed into sub-head and against angles.

I - Waterstop angles, installed and sealed as required after window installation.

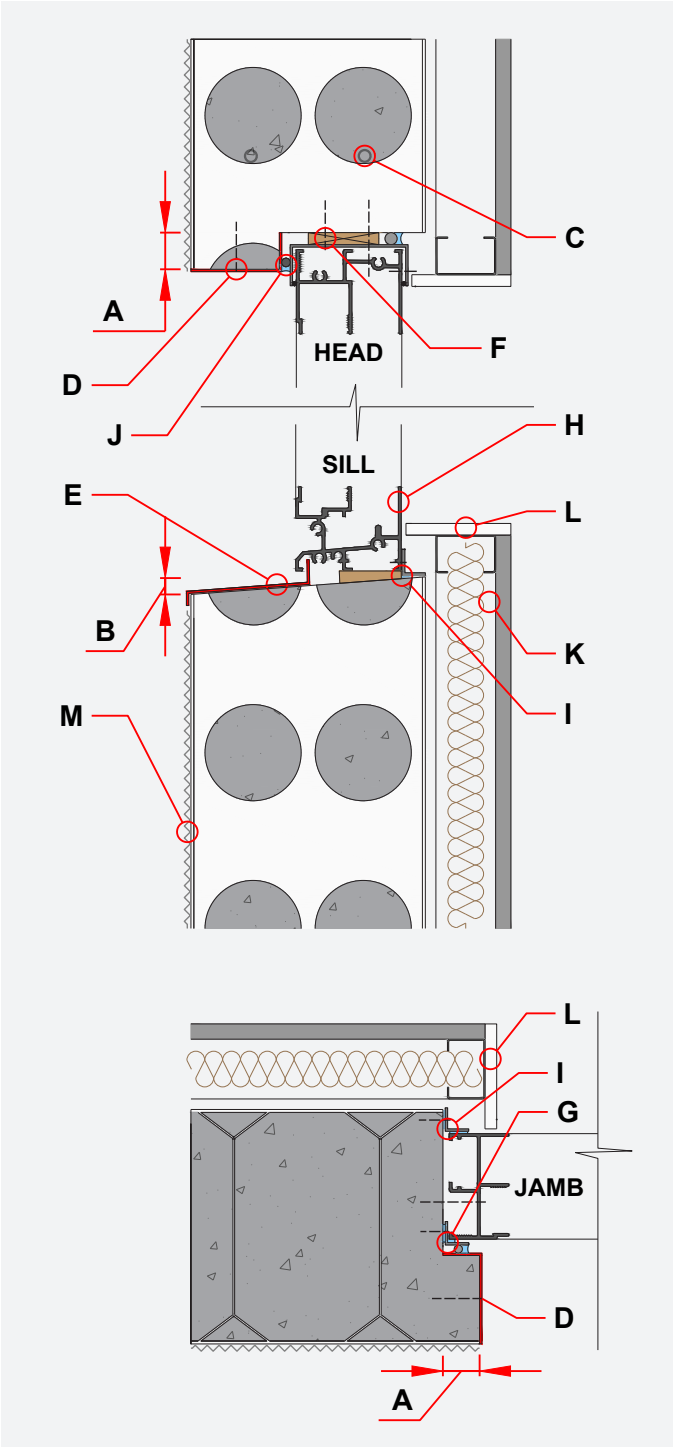
J - Sealant with backing rod used as required.

K - Insulation and plasterboard finish on internal face of wall as required.

L - Window reveal in desired finish (i.e. timber or plasterboard).

M - Optional finish for aesthetic purposes.

NOTE: Any exposed concrete surrounds of opening must be waterproofed using a paint membrane to AS 4654.2



B.16. FIRE DOORS

Fire door details and installation instructions must be obtained from the selected door manufacturer, the below demonstrates generic details only. Certification for the door frame must be obtained from the door manufacturer. The fire performance of cast in door frames within Dincel walls replicates that of conventional concrete walls. Note: galvanised or suitably protected frames are recommended for frame durability.

B.16.1. CAST-IN FRAME

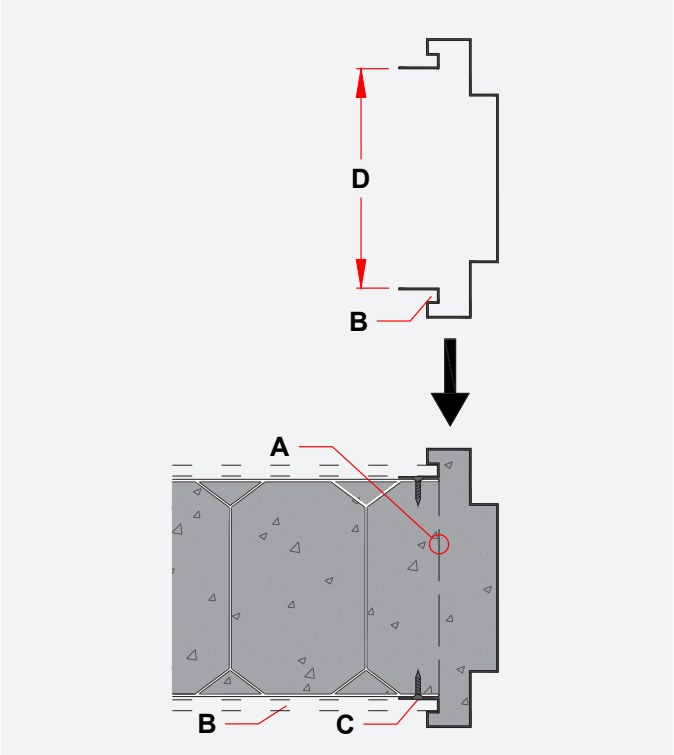
DINCEL PROFILE	DIMENSION 'D'
110	113
155	157
200	202
275	277

A - Dincel Wall. If required cut profiles to door opening width (refer to Section F.11.4. for instructions). Concrete between door frame and wall to be monolithic (poured simultaneously).

B - Rebate in door frame for accommodation of plasterboard. Rebate can be omitted where plasterboard finish is not required or for square set finish.

C - Screw in steel door frame to Dincel panel for temporary restraint during concrete pour.

D - Distance between internal faces of flanges to match Dincel profile and allow for site tolerances. See below for recommended sizes:



B.16.2. RETROFITTED FRAME

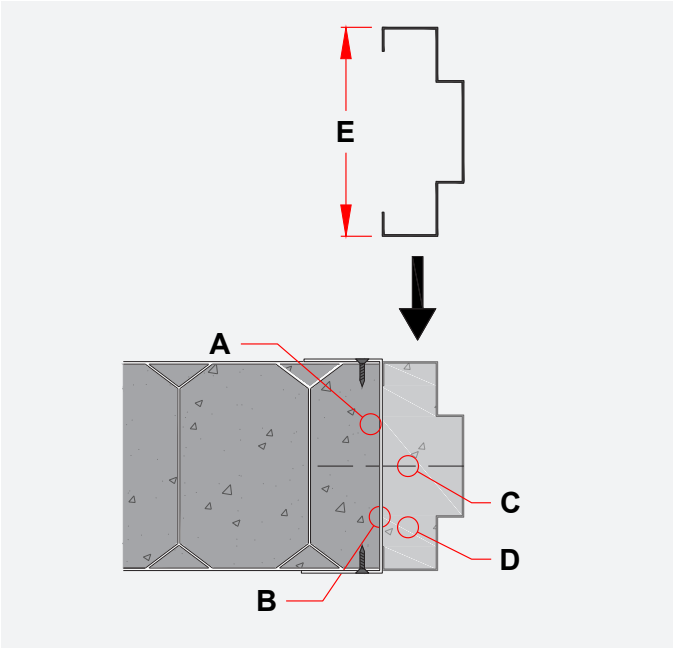
A - Dincel Wall. If required cut profiles to door opening width (refer to Section F.11.4 for instructions).

B - Temporary Dincel Screw-On Cap used for during pour (suitably braced). Screw-On Cap to be removed before installation of retrofitted door frame.

C - Suitable fixings for door frame, as specified by door manufacturer.

D - Grout infill door frame. Grouting tubes to be cast into Dincel wall above door to accommodate grout.

E - Door frame width to suit Dincel profile.



B.17. SERVICES

B.17.1. CAVITIES

A - Dincel Wall.

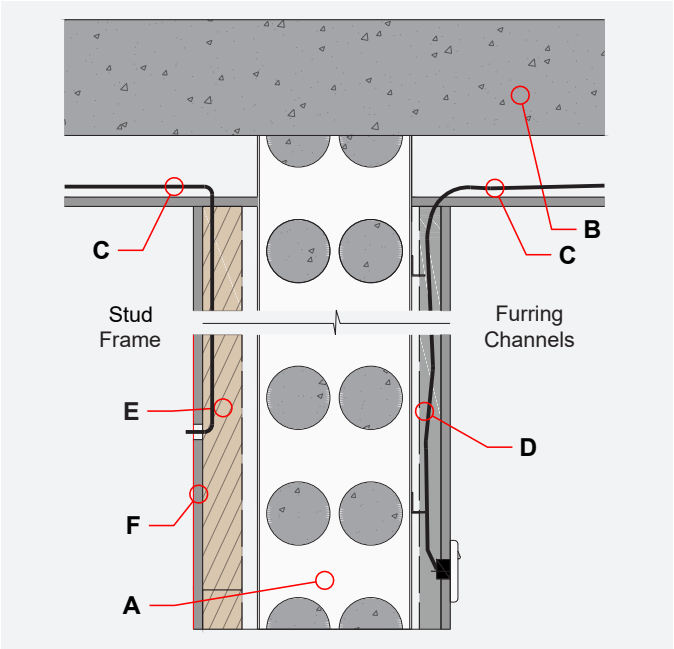
B - Concrete floor slab.

C - Electrical or plumbing services chased through ceiling cavity and down wall cavity. Dedicated cavity ensures that services can be changed, repaired, inspected, added or removed at any time.

D - Wall cavity created by furring channels affixed to Dincel wall via clips. Alternatively, chase cabling within Dincel 200 service channels (requires triangular section to be cut/ removed following concrete pour).

E - Wall cavity created by discontinuous stud frame, constructed from either timber or steel studs.

F - Plasterboard finish for internal walls.



B.17.2. CAST-IN CONDUITS OR PIPES

A - Dincel Wall.

B - Cast in electrical conduit of required diameter, to accommodate wiring which can be chased through the wall after concreting.

C - Conduit connected to electrical wall mounting box, to allow for installation of GPO or lighting.

D - Cast in PVC pipe of required diameter, to accommodate PEX plumbing pipes (or similar) which can be chased through the wall after concreting.

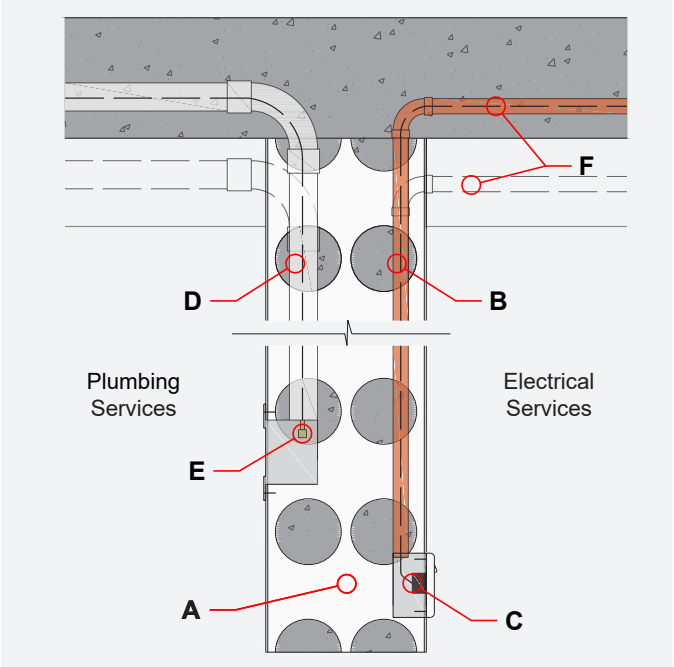
E - Recessed plumbing outlet box cast into wall allowing for plumbing connection point.

F - Pipes & conduits cast into floor slab, or alternatively, below soffit level if a ceiling cavity is available.

NOTE: Conduits and pipes to be temporarily secured by tying to Dincel internal webs. This should be carried out before snapping/sliding panel into position.

NOTE: Cast-in services must be spaced so that they are min. 150mm clear from each other in any direction (in order to allow for adequate concrete flow and compaction).

NOTE: The effect of cast in chasers and services must be considered by the project structural engineer in accordance with the requirements of AS3600.



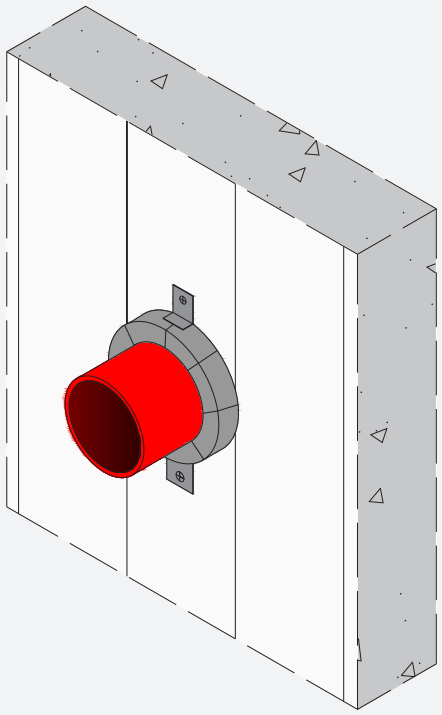
B.18. PENETRATIONS

B.18.1. FIRE PROTECTED

The Dincel walling system has been tested with various penetration types by Warringtonfire. In the tests, TBA Firefly and Hilti fire protection products were applied directly onto the Dincel polymer skin or wall (such as fire collars, intumescent sealants, plug and wrap products). It was verified that the Dincel polymer skin and webbing does not unduly affect the FRL in comparison to an equivalent conventional concrete wall. Please contact us before installation to obtain a copy of the assessment reports. The reports specify achievable FRLs for the scenarios detailed below.

Penetration types within the Warringtonfire report(s)

- Blank Openings
- Single Electrical Cables
- Cable Bundles
- Cable Trays
- Steel Conduits
- uPVC Conduits
- Plastic Conduits
- PEX Pipes
- uPVC Pipes
- Metal Pipes
- Insulated metal pipes
- Insulated plastic pipes
- Timber and Steel beams



No requirement to remove Dincel skin underneath fire penetration products when installed in accordance with Warringtonfire report(s).

Where the Warringtonfire test reports do not cover a particular application, the Dincel polymer skin can simply be removed underneath the fire protection product (i.e. underneath fire collar or intumescent sealant). This will allow the fire protection product to be applied directly onto concrete and therefore compared to a conventional concrete wall, the same conditions are replicated. The FRL and test data for a conventional concrete wall can then be utilised.

B.18.2. FIRE DAMPER

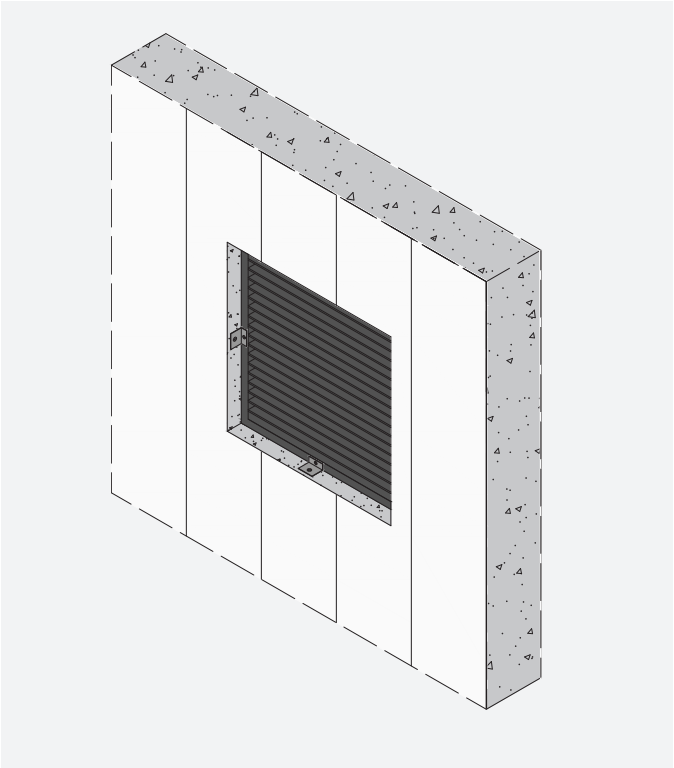
Where fire damper cast into wall:

- Solid concrete embedment ensures BCA DTS compliance. Fire damper results for conventional concrete wall can be utilised.

Where fire damper retrofitted:

- Option 1: Use TBA Firefly Insubatt around damper opening, in accordance with product specifications and Warringtonfire report
- Option 2: Remove Dincel polymer skin where fire damper makes contact with wall to ensure any sealant or grout contacts concrete core directly. Fire damper results for conventional concrete wall can then be utilised.

For guidance on how to cast in a square or rectangular opening, see Section F.11.4.

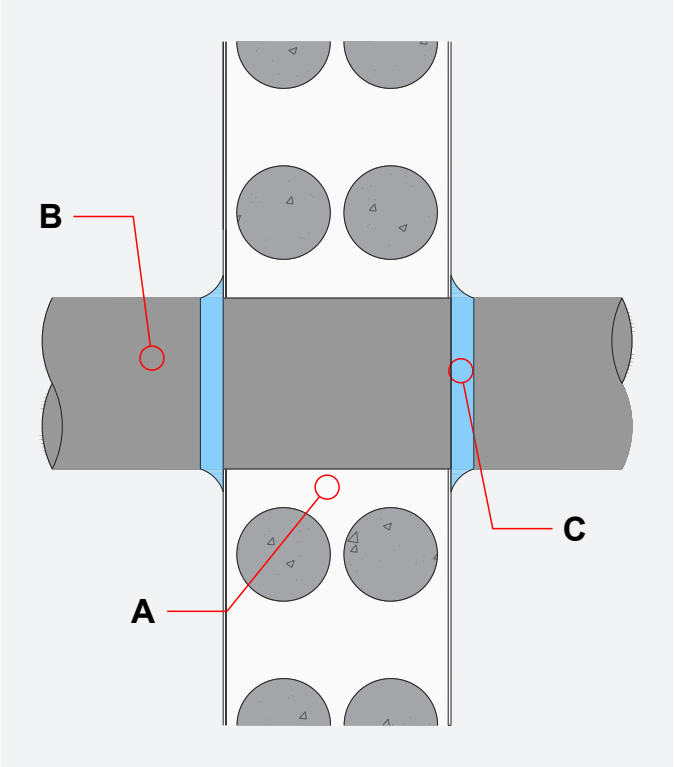


B.18.3. GENERAL PIPE PENETRATION

A - Dincel Wall. Hole saw used to cut neat hole which is slightly larger than the pipe diameter. If any webbing is cut, additional bracing may need to be provided to the required area.

B - Insert PVC or metal pipe before pouring concrete and cast into wall.

C - If wall is required to be waterproof, provide MS polymer sealant or waterproofing membrane to the joint area on each wall face. Alternatively for PVC pipes, use PVC solvent cement glue.



B.19. JOINTS

B.19.1. FIRE PROTECTED

The Dincel walling system has been tested for junctions with various other fire rated walling types by Warringtonfire. In the tests, Hilti and TBA Firefly fire protection products were applied directly onto the Dincel polymer skin or wall. It was verified that the Dincel polymer skin and webbing does not unduly affect the FRL in comparison to an equivalent conventional concrete wall. Please contact us before installation to obtain a copy of the assessment reports. The report specifies FRLs for the scenarios detailed below.

JOINT TYPES WITHIN THE WARRINGTONFIRE REPORT(S)
Dincel-to-Dincel Wall
Steel Stud Wall lined with plasterboard
Concrete Wall
Masonry Wall
Block Wall
Autoclaved Aerated Concrete (e.g. Hebel) Wall
Large expansion or service joints to slabs and walls (either horizontal or vertical)
No requirement to remove Dincel skin underneath fire penetration products when installed in accordance with Warringtonfire report(s).

SCAN HERE

Scan QR Code to see Dincel-Hilti Joints Fire Test (AS 1530.4)

Where the Warringtonfire test reports do not cover a particular application, the Dincel polymer skin can simply be removed underneath the fire protection product (i.e. underneath the intumescent sealant). This will allow the fire protection product to be applied directly onto concrete and therefore compared to a conventional concrete wall, the same conditions are replicated. The FRL and test data for a conventional concrete wall can then be utilised.

B.20. CONCRETE MIX DESIGN

B.20.1. CONCRETE MIX SPECIFICATION

Concrete mixes are specified by the project's consulting structural engineer to suit project requirements. The concrete must consist of a high degree of workability and flow to ensure that air voids do not occur. The use of Self-Compacting Concrete (SCC) has been tested with Dincel and is highly recommended. High-slump conventional concrete can also be used, however it must comply with the specification below and must be vibrated adequately.

	SELF-COMPACTING CONCRETE (SCC)	HIGH-SLUMP CONCRETE
Aggregate Size	Maximum 10mm	Maximum 10mm
Concrete Spread/Slump	Nominal 680mm spread	Nominal 220mm (min. 180mm at truck discharge)
Max Spread/Slump Tolerance	± 50mm	± 40mm
Compaction Method	No vibration required (self-compacting. Refer to section 12.4)	Must vibrate, please refer to section F.12.4 for vibration details
Characteristic Strength (MPa)	As required by design engineer	As required by design engineer
Cement Type And Mix Additives	As nominated by concrete manufacturer and/or design engineer	As nominated by concrete manufacturer and/or design engineer

B.21. DINCEL WALL JUNCTIONS

B.21.1. DINCEL CLIP-ON END CAP AT "T" JUNCTION

A - Existing Dincel or concrete wall

B - Dowel connection (drill and epoxy). Away from panel joints where permissible.

C - Connecting Dincel wall.

D - Vertical bracing. Refer to section F11 for various bracing configurations.

E - Screw-on Cap to finish wall (capping off cut panels if required). Screws provided at max:

- 150mm centres for bottom 1/3 of wall
- 300mm centres for top 2/3 of wall

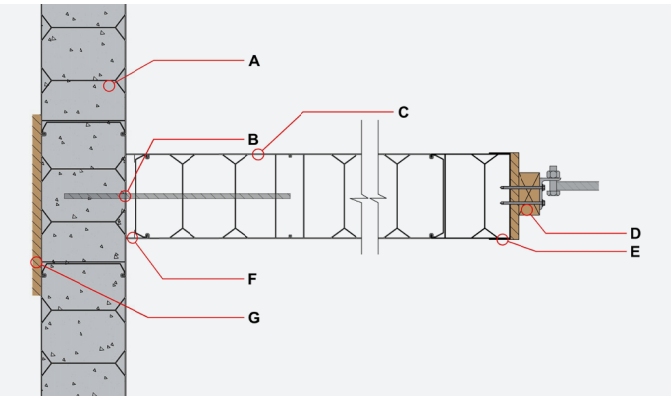
For an external or exposed wall, galvanised or stainless-steel screws must be used to prevent corrosion

F - Clip-On End Cap. Screws provided at max:

- 150mm centres for bottom 1/3 of wall
- 300mm centres for top 2/3 of wall

For an external or exposed wall, galvanised or stainless-steel screws must be used to prevent corrosion

G - Bracing required on opposite end of T-Junction to prevent bulging. For bracing and installation details refer to section F.11.7.



B.21.2. "T" JUNCTION / BLADE NIB WALL

A - Dincel or formed wall.

B - Hook bar reinforcement.

C - Connecting Dincel wall.

D - Vertical bracing. Refer to section F11 for various bracing configurations.

E - Screw-on Cap to finish wall (capping off cut panels if required). Screws provided at max:

- 150mm centres for bottom 1/3 of wall
- 300mm centres for top 2/3 of wall

For an external or exposed wall, galvanised or stainless-steel screws must be used to prevent corrosion

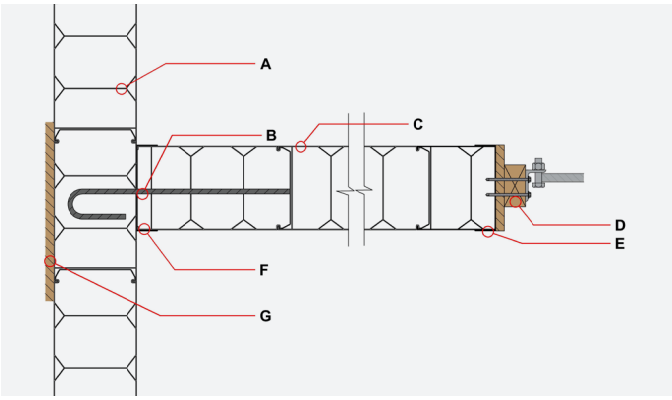
F - Dincel Guide Track or Screw-On Cap. Core holes for hook bar reinforcement and concrete placement.

Screws provided at max:

- 150mm centres for bottom 1/3 of wall
- 300mm centres for top 2/3 of wall

For an external or exposed wall, galvanised or stainless-steel screws must be used to prevent corrosion

G - Bracing required on opposite end of T-Junction to prevent bulging. For bracing and installation details refer to section F.11.7.



B.21.3. FIRE COMPARTMENTS (CONCRETE TO CONCRETE)

A - Existing concrete wall.

B - Dowel connection (drill and epoxy). Away from panel joints where permissible.

C - Connecting Dincel wall.

D - Vertical bracing. Refer to section F11 for various bracing configurations.

E - Screw-on Cap to finish wall (capping off cut panels if required). Screws provided at max:

- 150mm centres for bottom 1/3 of wall
- 300mm centres for top 2/3 of wall

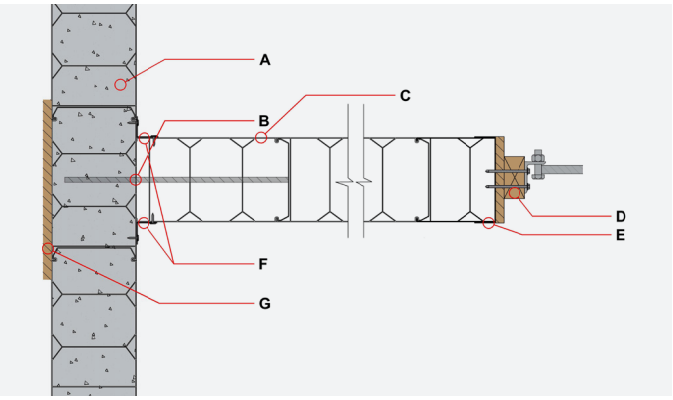
For an external or exposed wall, galvanised or stainless-steel screws must be used to prevent corrosion

F - Screws provided to D-ANG50 angle at max:

- 150mm centres for bottom 1/3 of wall
- 300mm centres for top 2/3 of wall

For an external or exposed wall, galvanised or stainless-steel screws must be used to prevent corrosion

G - Bracing required on opposite end of T-Junction to prevent bulging. For bracing and installation details refer to section F.11.7.



DINCEL
STRUCTURAL WALLING

FINISHING

CONTENTS

FINISHING

The following are typical ways to finish Dincel surfaces after the concrete within has cured. The project architect or designer shall determine what type of finish and tolerances is required in project documentation.

Typically, surface finishes should be viewed from a distance and as a whole. This should not be less than 2m or the closest distance from which the subject area will normally be observed when the project is completed (AS 3610.1:2018).

When using straight edges to check for any deflections, it should be placed away from any penetrations or accessories that form part of the wall.

C.1. BARE

Dincel walls in their bare/raw format present as a clean and maintenance free off-white surface. It has a slightly rippled modular appearance which provides a permanent feature whenever an architectural surface finish is not required. This typically includes applications such as basement walls, stair shaft walls, retaining walls, planter boxes and many others.

- For information about tolerances of the surface finish, please refer to Section D.10.1
- For information about the UV resistance of the Dincel polymer, please refer to Section D.9.2.
- For information about patching of any damaged bare surface, please refer to Section F.13.
- For information about cleaning bare Dincel panels, please refer to Section F.14.

C.2. PAINT

The Dincel surface can receive a direct paint application with a PVC compatible paint system. It is required to follow the specifications of the particular paint system being used as application methods may vary. Typically, most paint systems consist of a primer and top coats which are applied on by roller or spray. It is important that the paint has sufficient elastomeric properties in order to span over Dincel panel joints and prevent paint cracking. The same elastomeric properties required for render (as discussed in Section C.3) can also be considered for paint. The paint should be compatible with PVC as a substrate.

After painting, Dincel panel joints will still be visible. If a less modular appearance is desired, a textured or stencil paint can assist in hiding the panel joints.

In accordance with C1.14 of the NCC (Volume 1), a paint is considered an ancillary element and can be used on an external wall which requires to be non-combustible.

C.3. RENDER

The Dincel polymer surface can receive a direct render application with a PVC compatible render system. It is required to follow the specifications of the particular render system being used as application methods may vary depending on the manufacturer and type. Note that Dincel is not a render manufacturer or applicator, however the following information is provided to assist and guide Dincel users only.

C.3.1. SUITABLE TYPES OF RENDER

When selecting a render manufacturer, it is strongly recommended to check the following:

Warranty

The manufacturer for the render system selected is able to offer a warranty covering cracking and delamination, and provide custom written specifications for the specific application onto Dincel walling for the project.

Properties

- Adhesion/compatibility with PVC: Render systems which provide adequate adhesion with the PVC are typically 100% acrylic-based renders. These form a strong chemical bond with the PVC to prevent delamination.
- Elasticity: The render system has sufficient elasticity to span over the Dincel panel joints in order to prevent cracking. The amount of elasticity required depends on the colour selected, refer to information in Section C.3.3.
- Heat Resistance: Sun-ray reflectors within the paint coat are highly recommended for dark colours or those exposed to North and West facing walls. In addition, some render systems may contain insulating polystyrene balls within the filler layer.

Application

- Render should be applied through the use of applicators accredited with the render manufacturer only.
- Preparation of the Dincel surface, by either lightly scuffing or applying a roll-on primer (depending on render manufacturer requirements).
- Application consists multiple layers such as a high build, texture coating, paint, heat reflective coating, etc.
- Render system is provided with crack/expansion joints

Thickness

Appropriate render thickness is selected to take into account:

- Requirements to prevent cracking
- Render colour being used (darker colours require thicker render)
- Minor corrections of walls which are not perfectly plumb or straight.

Generally, a suitable render thickness is a minimum of 10mm.

Fire Compliance

If the render is proposed to be used on an external wall of a Class 2-9 (type A or B) building, seek a render system which has been subject to large scale façade tests (i.e. AS5113/BS8414) or is classified as non-combustible.

C.3.2. BENEFITS OF RENDERING ONTO DINCEL

Rendering onto a Dincel surface is in-fact commonly superior to rendering onto conventional porous materials (such as fibre-cement, brick, block & concrete) for the following reasons:

- The Dincel walling system is proven to be waterproof for up to 6m of water head pressure, inclusive of panel joints. Therefore:
  - There is no requirement to wait for curing or drying out before application of the render (depending on the render colour and wall conditions, read Section C.3.1)
  - The wall is not susceptible to varying humidity or wetting/drying which may affect the render system
- The render applied onto Dincel is for aesthetic purposes only, and is not required for waterproofing or protecting the wall.
- Any shrinkage cracks which occur within the concrete infill does not carry through to the render (the micro-cracks which occur due to the Dincel crack-inducing webs are within the concrete only).

C.3.3. PREVENTION OF CRACKING

C.3.3.1. Building Design

Movement in a building's walls caused by factors such as foundation/slab settlement, nearby trees, leaking sewer/stormwater pipes, new neighbouring developments, or similar can result in cracking of the render. Any wall which is to receive a render finish must be designed adequately to prevent the above building movement, and the building is provided with the necessary construction or expansion joints.

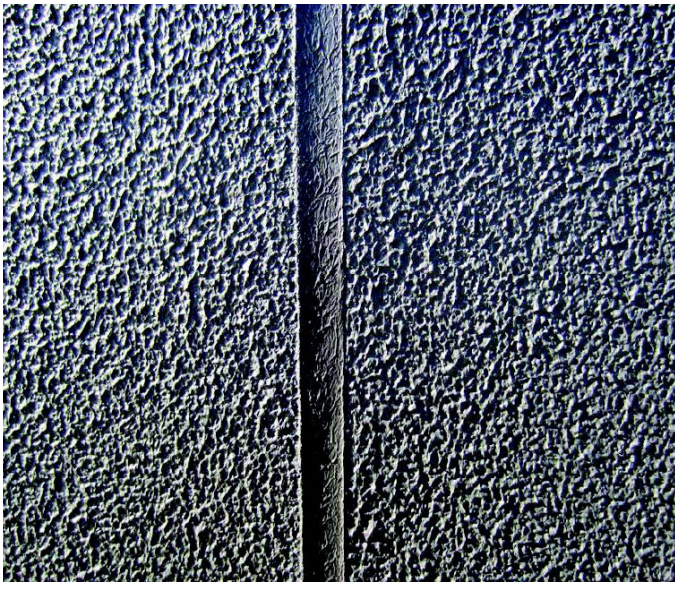
C.3.3.2. Thermal Effects

It is important for the render manufacturer to consider the effects of thermal expansion of the substrate. Dincel panel joints, located at either 275mm or 333mm centres, when left bare have been designed to accommodate approximately 1.5mm of movement at each joint. As a result, bare Dincel walls have successfully been constructed up to 300m long without any vertical expansion joints. However, when render is applied the 1.5mm gap at each joint is blocked and as a result the render will crack if not provided with adequate elasticity performance and separate articulation joints.

The degree of elasticity required depends on the sun exposure of the wall and the colour - dark colours attract significantly more heat than light colours and therefore require more joints and elasticity. Where dark colours are proposed, it is important to work in close communication with the render manufacturer as to the specifications required.

C.3.3.3.Joints in Render

Although the Dincel wall itself does not require joints for crack-control purposes (for the concrete infill), the same does not apply for render systems. Joints in the render should be as specified by the render manufacturer – as an example, typically provided at 5m centres or at wall openings as a 5mm wide groove joint.



C.3.3.4. Concrete Moisture Content

When a concrete wall is exposed to a high amount of heat (such as from a north or west facing wall with a dark colour), any excessive moisture from the concrete is drawn to the warm surface and eventually escapes. When the wall has a paint or render finish applied, this may result in peeling, bubbling or flaking of the finish. This same phenomenon can still occur with Dincel Walling, however in a different manner.

Dincel panel joints have been verified as waterproof for up to 6m of water head pressure by CSIRO (refer to Section D.4). In addition, the Dincel polymer vapour transmission rate was found to be 180 times better than the requirement for flexible waterproofing membranes. When a Dincel wall is exposed to a high amount of heat from the sun, this may lead to some pressure build-up due to excess moisture within the walls which escape through the panel joints as a vapour. This is possible as although the panel joints are waterproof, they are not resistant to pressurised vapour. Escape of vapour can predominantly be expected in the early stages (after concrete infill) when the concrete is still undergoing curing.

When Dincel walls do not contain a render finish, this is not a concern as the vapour can slowly escape through the panel joints. However, when a render is applied, the vapour transmission at Dincel joints is significantly reduced. As the pressurised vapour tries to escape, it leaves the potential for panel joints to move outwards (ridging).

In order to reduce the likelihood of render cracking or ridging, particularly for dark coloured renders with full sun exposure:

- It is essential to protect the top of the wall through the use of a capping, such as the Dincel Screw-On Cap accessory (P-TC), stone capping or metal to prevent rainwater from entering into the system.
- Use of a thicker render (i.e. >10mm generally) and possibly a render mesh to provide greater resistance against cracking and ridging.
- Provide consistent and regular joints within the render
- Wait a minimum of 4 weeks prior to the application of render to allow the concrete to adequately cure
- Use a concrete mix with a low water-to-cement ratio. Although Dincel recommends a high slump concrete be used, this should be achieved through the use of admixtures rather than the addition of extra water.
- For further information on this topic, please refer to the 'Render Cracking' document which can be accessed by scanning the following QR Code.

C.4. PLASTERBOARD

C.4.1. DIRECT FIX

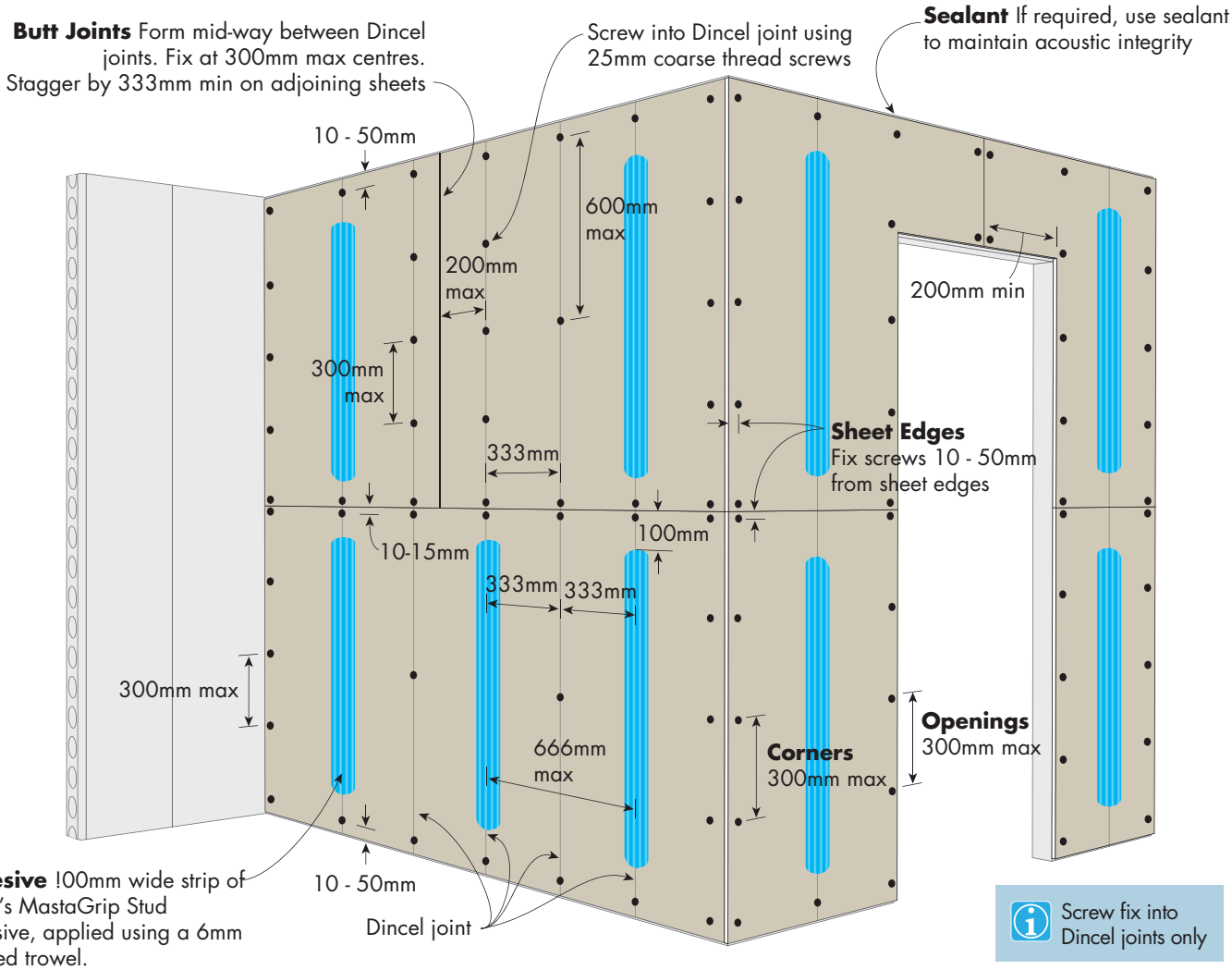
Plasterboard can be directly fixed onto Dincel walling. Please check with the plasterboard manufacturer as to their recommendations regarding fixing methods, as this may vary between brands or types. For direct fixing of plasterboard, as a guide the maximum deviation of the Dincel surface should not exceed 4mm over a 1.8m straight edge. This will control the thickness of daub glue that is required and will assist in reaching a satisfactory finish. To achieve this, it is important that care is taken during installation and concreting, particularly the adherence of pour rates specified in Section F.12.2 of this manual.

Specifications for Knauf plasterboard is provided below for guidance purposes (please confirm details with selected plasterboard manufacturer):

KNAUF PLASTERBOARD

3.1.3 INSTALLATION	PLASTERBOARD WITH MASONRY WALLS Plasterboard fixing

Non-Fire Rated 1 Layer – Horizontal



C.4.2. FURRING CHANNEL OR STUD FRAME

A plasterboard finish can also be achieved by firstly creating a cavity using either furring channels or a stud frame.

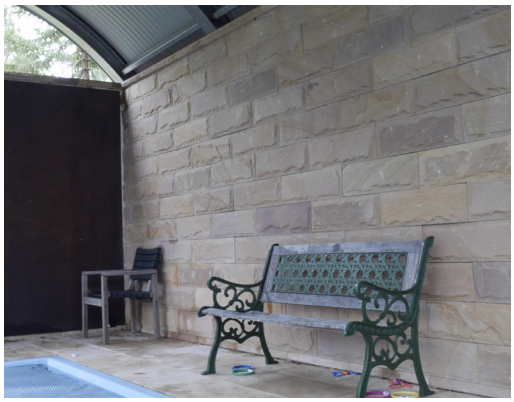
- Furring Channels – Furring channel clips can be fixed directly into the concrete infill of a Dincel wall through the use of suitable masonry/concrete anchors. Once furring channels are attached to the clips, plasterboard can be mounted onto the furring channels.
- Stud Frame – A stud frame can be built directly in front of the Dincel wall, either from a timber or steel construction. This option is preferred for where discontinuous construction is required for acoustic purposes. Once the stud frame is constructed, the plasterboard can be mounted directly onto the stud frame.

Example of furring channel attachment onto Dincel walling

C.5. CLADDING, TILING & OTHER

There is a wide range of cladding materials available which can be used to provide an aesthetic finish to a Dincel wall. With any cladding, it is important to check that the material is compliant with NCC fire requirements for the application it is being used in. Examples of the most common cladding materials have been provided below:

Board/Sheet cladding systems



Stone cladding

'Green Wall' (live vegetation)

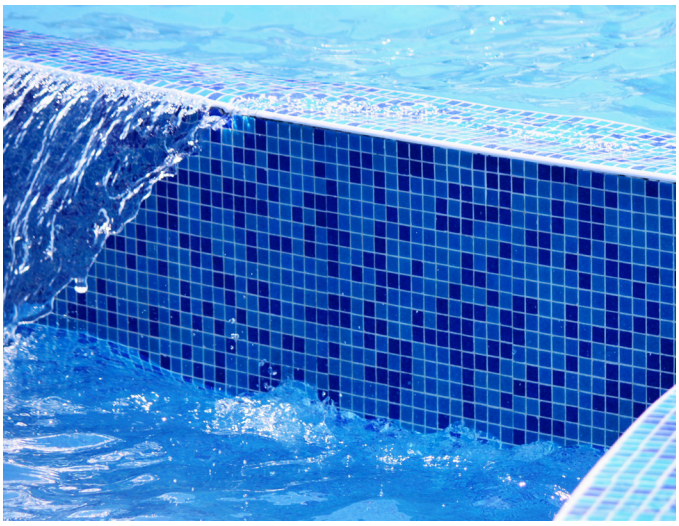
Timber cladding

Brick cladding systems

Weathered 'Corten' steel cladding

Profiled/corrugated steel cladding

Insulated panel cladding systems



Tiles

C.5.1. MECHANICAL ATTACHMENT

Most cladding types should be fixed onto Dincel walling using mechanical fixings. This will ensure longevity and prevent delamination of the cladding materials during a fire scenario (as opposed to using adhesives). Cladding can be mechanically attached to Dincel walling through one of the following methods:

- **Top Hats:** For board and sheet type cladding systems, typically these are fixed onto steel top hats. The top hats can be anchored directly into the concrete infill of Dincel walling in either a vertical or horizontal orientation. The cavity created will enable a provision for services, allow for some minor plumbness adjustments and also provide an additional weatherproofing barrier.
- **Stone Clips:** For stone cladding, typically these are fixed using proprietary stone clips which are directly anchored into the concrete infill of Dincel walling.
- **Direct Fixing:** Cladding can also be directly anchored onto Dincel walling using concrete fixings.

C.5.2. ADHESIVE ATTACHMENT

Where materials are directly fixed to the Dincel wall using adhesive, the adhesive specifications should be checked to ensure it is compatible with PVC as a substrate. Use of adhesives as an attachment method should only be considered for internal areas or where mechanical fixing is not a possibility. When relying upon adhesives as an attachment method for façade walls, the following should be considered:

- Risk of delamination of cladding due to a fire event (as adhesive will melt)
- Longevity of adhesive

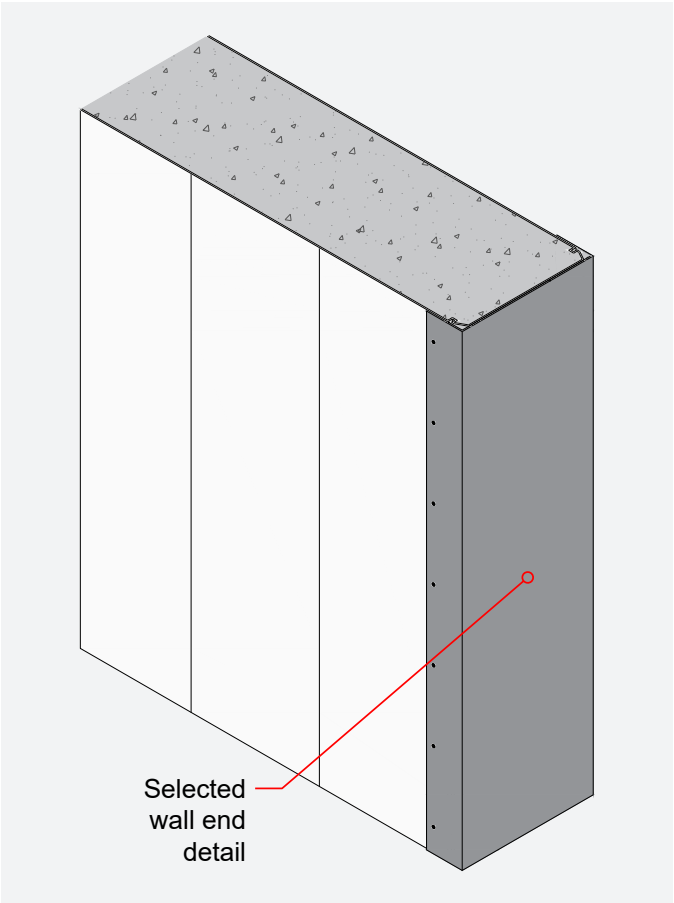
Use of adhesives are generally only recommended for where a tile finish is required on Dincel walls (such as for some wet areas and pools). It is important to check that the tile adhesive system is compatible with PVC as a substrate.

C.6. WALL TERMINATIONS

C.6.1. WALL ENDS

Where the sides of a Dincel wall are exposed and aesthetics are of concern, consideration should be given regarding how such ends are to be finished. Dincel panel web holes will still be visible with unfinished wall ends. Where render or cladding is added to the wall system, finishing of wall ends is more straight forward as the same finish can be applied. Where no finish additional finish is applied, the following options can be considered:

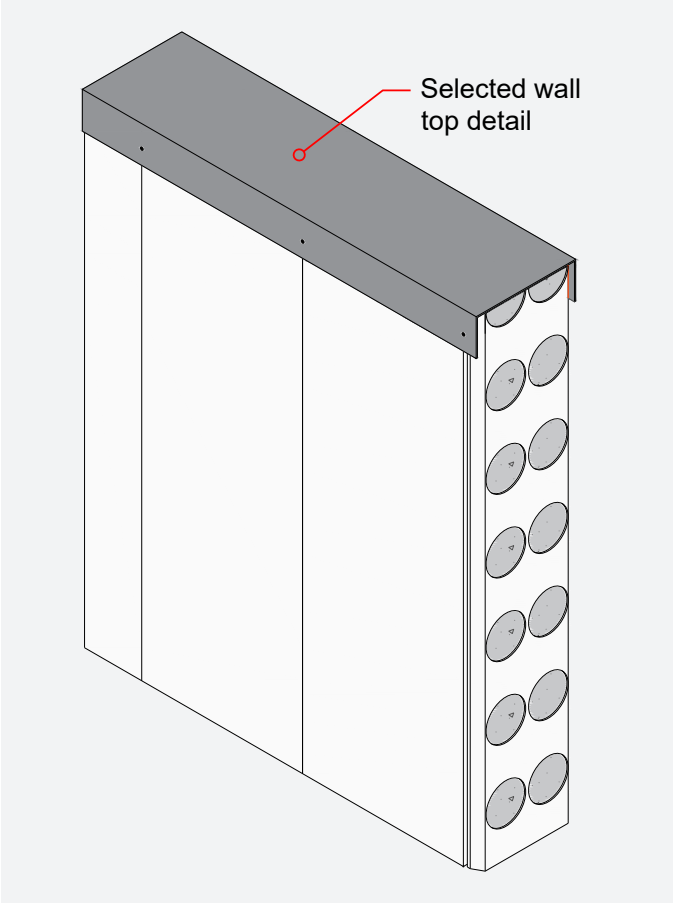
- **Option A** – Use of Dincel Screw-On Cap or Clip-On End Cap accessories. Where these accessories are used, they require to be braced prior to concreting as per Section F.11.5 in order to prevent bulging.
- **Option B** - For walls which may be subject to future impact (i.e. carpark blade walls or warehouse/ manufacturing applications), folded metal 'C' sections or similar (min 3mm thick) can be cast into the wall ends. This will provide an appropriate finish, impact protection and temporary bracing against concrete. Metal section should be screwed to wall end at 150mm centres.
- **Option C** – Retrofitted folded metal 'C' sections (i.e. metal coping) installed after concrete set. This option is well suited to where the wall ends have been braced by the Stop End accessory or other means.



C.6.2. WALL TOP

Where the top of a Dincel wall is exposed, consideration should be given regarding how this edge is to be finished. Internal Dincel panel webbing will still be visible from the top when left unfinished. If the wall is exposed to rain or subterranean conditions (and uncapped), the top surface should be treated and provided with a protective barrier in order to prevent water ingress. In all cases, the following options can be considered:

- **Option A** – Use of stone capping, installed after concrete pour and secured to Dincel wall.
- **Option B** – Folded metal 'C' sections (i.e. metal coping) installed after concrete pour. Screws provided at every panel joint on both sides.



DINCEL
STRUCTURAL WALLING

COMPLIANCE & PERFORMANCE

CONTENTS

D.1. COMPLIANCE SUMMARY

	REQUIREMENT	EVIDENCE OF SUITABILITY			
		STANDARD/REPORT TYPE	AUTHORITY	DESCRIPTION	DOC NO.
FIRE	VARIOUS FIRE	CodeMark Certification	SAI Global	Certification of the Dincel Wall System for internal and external loadbearing walls	CM20242
	SPREAD OF FIRE	BS 8414-2 Test Report	Warringtonfire	Testing of full-scale Dincel façade wall	RTF180124
		BR 135 Classification Report	Warringtonfire	Passed all performance criteria of BR135	RTF180124
		AS 5113 Classification Report	Warringtonfire	Assessment against 8 criteria	RTF180124
		Evidence of Suitability Report	Omnii Consulting Fire Engineers	Evidence of Suitability Report for External Dincel Walls	7147101
		BRAC Accreditation	Building Regulations Advisory Committee	Accreditation for external walls – use where a non-combustible external wall is required	170173v2
	FLAMMABILITY	C1.9 Material Comparison	Warringtonfire	The Dincel polymer provides better flammability resistance compared to paper faced plasterboard (a material permitted under C1.9)	RTF200276
	FRL (FIRE RATING)	Assessment Letter	Warringtonfire	Dincel polymer webs do not adversely affect the FRL performance of the wall	FAS190305
		AS 1530.4-2014 Report	CSIRO	200mm Dincel - 240/240/240 FRL	FCO-2674
	GROUP NO.	AS 5637.1 Classification Report	Warringtonfire	Group Number - 1 Smoke Growth Rate (SMOGRA) - 14	ASCRRTF180310
	PENETRATIONS & JOINTS	Regulatory Information Report (AS1530.4 / AS4072.1)	Warringtonfire	No requirement to cut away Dincel skin underneath or adjacent to TBA Firefly penetration and joint products	FAS210256
			Warringtonfire	No requirement to cut away Dincel skin underneath or adjacent to TBA Firefly Intubatt	FAS190234
	PENETRATIONS	AS 1530.4-2014 Assessment Report	Warringtonfire	No requirement to cut away Dincel skin underneath Hilti fire stopping product for penetrations	FAS190067B
	JOINTS	AS 1530.4-2014 Assessment Report	Warringtonfire	No requirement to cut away Dincel skin underneath Hiliti fire rated caulking for wall joints	FAS190067
	BUSHFIRE	AS 1530.8.2-2018 Assessment Report	CSIRO	Dincel bushfire resistance of BAL - FZ	FCO-2725
	FUME TOXICITY	BS 6853:199 Test Report	TÜV SÜD Asia Pacific	Fumes generated from burning was under international toxicity thresholds/limits	7191127129 -CHM15 -TSL_CR2

	REQUIREMENT	EVIDENCE OF SUITABILITY			
		STANDARD/REPORT TYPE	AUTHORITY	DESCRIPTION	DOC NO.
STRUCTURAL	EARTHQUAKE	Analysis and Test Report	University of Technology Sydney (UTS)	Dincel walling suitability to resist earthquakes with a magnitude of up to 9.0 on the Richter scale	N/A
	AS3600 COMPLIANCE	Structural Engineering Certification	University of New South Wales (UNSW)	Concrete and steel reinforcement within Dincel can be designed to AS 3600, Eurocode and other relevant design codes.	J084829
	AS3600 COMPLIANCE	Structural Engineering Certification	University of Technology Sydney (UTS)	Concrete and steel reinforcement within Dincel can be designed to AS 3600, Eurocode and other relevant design codes	N/A
	STRENGTH & PERFORMANCE	Test Report and Certification	University of Technology Sydney (UTS)	Strength testing of Dincel 275 for flexural, shear and stiffness	N/A
	CONCRETE QUALITY	Assessment Report	Mahaffey Associates	Dincel Structural Walling withstands the pressures of using Self Compacting Concrete (SCC), ensuring no air-voids within fully concrete filled walls	DRM/L01/20180

	REQUIREMENT	EVIDENCE OF SUITABILITY			
		STANDARD/REPORT TYPE	AUTHORITY	DESCRIPTION	DOC NO.
ACOUSTIC	RW AND RW + CTR VALUES	Acoustic Tests	CSIRO	Airborne Sound Transmission Test	ATF1916, ATF1918, ATF1920
		Acoustic Report	Day Design	Acoustic values for various 110mm Dincel walling system arrangements	5880-1.1R
		Acoustic Report	Day Design	Acoustic values for various 155mm Dincel walling system arrangements	5880-4.1R
		Acoustic Report	Day Design	Acoustic values for various 200mm Dincel walling system arrangements	5880-3.1R
		Acoustic Report	Day Design	Acoustic values for all Dincel walling systems	5880-6.1R

	REQUIREMENT	EVIDENCE OF SUITABILITY			
		STANDARD/REPORT TYPE	AUTHORITY	DESCRIPTION	DOC NO.
BEP	BEST ENVIRONMENTAL PRACTICE	BEP Certificate	ApprovalMark International	Best Environmental Practice (BEP) Approval covering the Dincel PVC manufacture and end of life management	BEP-PVC 0786

WATER	REQUIREMENT	EVIDENCE OF SUITABILITY			
		STANDARD/REPORT TYPE	AUTHORITY	DESCRIPTION	DOC NO.
	WEATHERPROOF/ WATERPROOF	AS 3740, ASTM E514, AS/NZS 4347.1, ASTM E96/M	CSIRO	Dincel panels along with snap-joints when filled with concrete is waterproof for up to 6m of water head pressure. Compliance with FP1.4 and FP1.7 (NCC Volume 1) and P2.4.1 (NCC Volume 2)	5091
		Conformity Assessment	Mahaffey Associates	Compliance with FP1.4 and FP1.7 (NCC Volume 1), and P2.2.2 and P2.4.1 (NCC Volume 2)	20180

CONDENSATION	REQUIREMENT	EVIDENCE OF SUITABILITY			
		STANDARD/REPORT TYPE	AUTHORITY	DESCRIPTION	DOC NO.
	CONDENSATION	Assessment and Hygrothermal Report	Fabric First	Dincel wall systems detailed within report deemed to meet performance requirements FP6.1 (Volume 1) and P2.4.7 (Volume 2)	0053

VOC	REQUIREMENT	EVIDENCE OF SUITABILITY			
		STANDARD/REPORT TYPE	AUTHORITY	DESCRIPTION	DOC NO.
	VOLATILE ORGANIC COMPOUNDS	ASTM D5116-97 Test Certificate	CETEC	Volatile Organic Compounds (VOCs) 25 times less than the Australian Green Star rating threshold at time of manufacture	CV071106

DURABILITY	REQUIREMENT	EVIDENCE OF SUITABILITY			
		STANDARD/REPORT TYPE	AUTHORITY	DESCRIPTION	DOC NO.
	DIESEL RESISTANCE	Test Report	Australian Vinyls	Dincel polymer resistance to diesel	LTR0394
	PETROL RESISTANCE	Test Report	Australian Vinyls	Dincel polymer resistance to petrol	Dincel polymer resistance to petrol
	ACID RESISTANCE	Test Report	BEAL	Dincel polymer resistance to Nitric, Hydrochloric, Sulphuric and Phosphoric acids	TR091102

D.2. FIRE COMPLIANCE

A Dincel wall consists primarily of concrete and steel reinforcement, which are safe and proven materials used within almost all multi-storey buildings. What makes a Dincel wall unique is it also contains a stay-in-place polymer shell which is not only used for formwork purposes but also enhances the properties of a conventional concrete wall (such as by providing waterproofing, increased durability, crack control mechanisms, etc). The polymer material has been meticulously tested and analysed by some of Australia's largest NATA accredited laboratories and renowned fire professionals in order to prove its safety and compliance with the NCC/BCA.

The Dincel polymer is a proprietary formulation and significantly different to common PVC. It is comprised of certain additives which enhances fire performance. In the event of a fire, the material safely chars and intumesces (it does not form molten droplets or spread fire). It has been verified as suitable for use for both internal and external walling applications of all building types within Australia (that is, Types A, B & C construction and Class 1-10 buildings).

D.2.1. CODEMARK CERTIFICATION

What is CodeMark?

The CodeMark scheme is currently the only nationally accepted process for demonstrating compliance with the BCA/NCC through a certificate of conformity. The CodeMark scheme was developed by the Australian Building Codes Board (ABCB) in order to streamline the approvals process, particularly new and innovative building materials. The ABCB states "Because the CodeMark scheme is now embedded within State and Territory building control legislation, obtaining a CodeMark certificate of conformity for a product or system will be the only way to gain mandatory acceptance of a product or system compliance with the BCA throughout Australia". To obtain a CodeMark certificate, a product must be carefully reviewed by independent certification bodies and building professionals.

Has Dincel been issued a CodeMark Certificate?

Dincel has been issued a CodeMark Certificate of Conformity to the 2019 Amendment 1 BCA by certification body SAI Global. The CodeMark certificate verifies that the system satisfies the relevant fire performance requirements of the 2019 BCA for both internal and external loadbearing wall applications. To obtain the CodeMark certificate, SAI Global required the fire performance of Dincel to be independently reviewed by a third-party fire engineer. The Dincel CodeMark Certificate in particular has no limitation or condition to be reassessed for each and every project for compliance with CP2 (no requirement for a site-specific assessment).

In addition, SAI Global have provided an explanatory note for clarification purposes regarding C1.9(a)(i) within the certificate: *"As compliance with Performance Requirement CP2 – Spread of fire has been demonstrated for external walls, there is no need to certify against the corresponding deemed-to-satisfy provision C1.9(a)(i) for the Dincel Wall itself."*

AUTHORITY	STANDARD/REPORT TYPE	REPORT/CERTIFICATE NUMBER
SAI Global	CodeMark Certificate of Conformity	CM20242

Furthermore, the ABCB advise that *"when relying on a CodeMark Certificate to demonstrate that a performance Solution complies with the relevant performance requirements, a construction practitioner need not undertake the process in A2.2(4) again."*

For more information regarding CodeMark and compliance pathways, refer to the following information published on the ABCB website:

D.2.2. BRAC ACCREDITATION

What is BRAC?

The Building Regulations Advisory Committee (BRAC) is a Victorian government body, appointed under Division 4 of Part 12 of the Building Act 1993. As part of their role, BRAC assesses the performance of products and issues accreditation if deemed compliant with the BCA. The VBA states the following in regards to BRAC accreditation "A certificate of building product accreditation is proof that a product meets the performance requirements of the Regulations or the BCA. Once a product is accredited, there is no need to prove its suitability each time building work requires a building permit."

Has Dincel been issued BRAC accreditation?
Dincel has been issued a product accreditation by BRAC. The BRAC certificate of accreditation verifies that Dincel is compliant with the performance requirement CP2 – Spread of fire, and subsequently confirms that Dincel can be used where a non-combustible external wall is required.

AUTHORITY	STANDARD/REPORT TYPE	REPORT/CERTIFICATE NUMBER
BRAC	Accreditation for external walls	170173v2

D.2.3. COMPLIANCE FOR INTERNAL WALLS

The Dincel skin is classified by NATA testing laboratories as a polymer lining attached to a concrete wall. Therefore, for the internal walls of Class 2-9 buildings, the most appropriate method to assess the fire hazard properties is in accordance with the DTS provision specification C1.10, Clause 4, of the NCC. This clause of the BCA requires a Group number which is determined in accordance with AS 5637.1.

For most permanent formwork systems, AS 5637.1 requires a large scale AS ISO 9705 room test to be carried out. Dincel was subject to this test by Warringtonfire Victoria in 2019, where:

- A Group number classification of 1 was achieved. A Group 1 classification is the highest rating and permits a material to be used in critical applications such as fire-isolated exits and fire control rooms (in accordance with the BCA, Specification C1.10, Clause 4).
- A SMOGRA (smoke growth rate index) of 14 was achieved, which is over 7 times less than the requirement specified in the BCA, Specification C1.10, Clause 4.

Therefore, Dincel walls are compliant with the DTS provisions for all internal wall applications of a building. As verification of suitability for all internal walls, please refer to the Dincel CodeMark certificate issued by SAI Global.

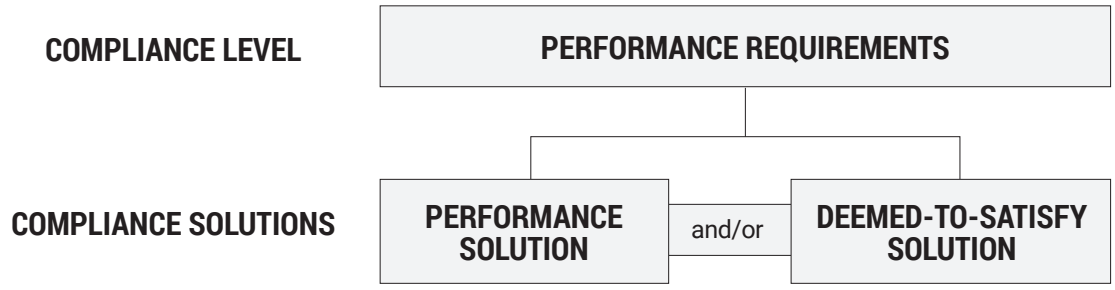
AUTHORITY	STANDARD/REPORT TYPE	REPORT/CERTIFICATE NUMBER
Warringtonfire	AS5637.1 Classification Report (Test to AS ISO 9705)	ASCRRTF180310
SAI Global	CodeMark Certificate of Conformity	CM20242

D.2.4. COMPLIANCE FOR EXTERNALL WALLS

Compliance with the NCC/BCA for an external wall is achieved once the performance requirements are satisfied. There are two ways to satisfy the performance requirements:

- • A Deemed-To-Satisfy (DTS) solution and/or
- • A Performance Solution

As per the below extract from the ABCB, both of these solutions are equally accepted:



For external/façade wall applications, the relevant performance requirement for fire spread is **CP2 – Spread of Fire**. One way of demonstrating this performance requirement has been satisfied is through the DTS provision C1.9.

AS1530.1 'Non-Combustibility' Test

In Types A & B construction of Class 2-9 buildings, C1.9 of the NCC DTS provisions states that materials used for an external wall of a building are to be classified as 'non-combustible'. To be defined as non-combustible, the NCC only provides one test method, a small-scale AS 1530.1 test. The specimens used in this test are just 45mmx50mm. To put this into perspective, it is approximately the same size as three match stick boxes stacked on top of each other. In addition, composite materials are not permitted to be tested in AS 1530.1, the material must be homogeneous throughout. For a composite material to be tested in AS 1530.1, all components must be tested in isolation from each other and can be layered in order to achieve the required height. Testing in this manner for a composite material is not representative of the fire performance in an actual fire scenario. In fact, AS1530.1 states this within the standard:

- *"The test results relate only to the behaviour of the test specimens of the material under the particular conditions of the test, and are not intended to be the sole criteria for assessing the potential fire hazard of the material in use"*
- *"The test method is not applicable to products which are coated, faced or laminated" and "the performance of coated, faced or laminated products may be determined by other reaction to fire tests"*

For a composite wall such as Dincel, a more suitable and holistic test method is AS 5113 (BS 8414). This test is yet to be referenced within the DTS provisions of the NCC.

AS5113 (BS8414) Test

AS 5113 (BS 8414) is a large-scale test which consists of a 9m high winged wall and 9 different criteria in total are evaluated. An AS 5113 (BS 8414) test is able to determine system behaviours which AS 1530.1 cannot, such as:

- Behaviour of an entire system in a fire event rather than individual component materials
- Flame Spread
- Skin Delamination - Large pieces of linings or wall materials delaminating and falling off during a real fire scenario could potentially harm fire-fighters/public passers-by and also block exits, hindering escape and rescue efforts.

To demonstrate compliance with the NCC, Warringtonfire carried out an AS 5113 (BS 8414) large-scale façade test on Dincel. Following this, a robust Evidence of Suitability Report was prepared by a reputable consulting fire engineering firm, which assessed not only the façade test but an array of other relevant fire tests carried out on Dincel wall. The report concluded that Dincel walls comply with the NCC for where a non-combustible external wall is required. Notably, satisfaction of the performance requirement CP2 (Spread of Fire) was verified.

External Wall Compliance Summary

Following all of these tests and assessments, Dincel was issued a CodeMark Certificate of Conformity and BRAC accreditation. The CodeMark Certificate states Dincel is suitable for both internal and external loadbearing wall applications. The BRAC accreditation states that Dincel can be used wherever a non-combustible external wall is required. To be issued these certificates and accreditations, the Dincel product and all associated fire tests/reports were required to be reassessed by independent fire engineers.

AUTHORITY	STANDARD/REPORT TYPE	REPORT/CERTIFICATE NUMBER
Warringtonfire	BS 8414 Test Report	BS 8414 Test Report
Omnii Consulting Fire Engineers	Evidence of Suitability Report	7147101
SAI Global	CodeMark Certificate of Conformity	CM20242
BRAC	Accreditation for external walls	170173v2

D.2.5. FUME TOXICITY

Currently in Australia, the NCC only considers smoke quantity from a fire, not toxicity. Regardless, Dincel has been tested in accordance with BS 6853:1999 where it was found that the fumes generated by the burning test were well under international toxicity thresholds/limits (under ILDH values as developed by NIOSH). This can be attributed to Dincel's unique polymer composition, which is manufactured without the use of heavy metal stabilisers or plasticisers.

AUTHORITY	STANDARD/REPORT TYPE	REPORT/CERTIFICATE NUMBER
TÜV SÜD Asia Pacific	BS 6853:199 Test Report	7191127129-CHM15-TSL_CR2

D.2.6. FIRE RESISTANCE PERIOD (FRP)

The solid concrete and steel reinforcement within a Dincel wall provides the necessary fire rating. Warringtonfire and CSIRO have confirmed that the polymer webs do not melt away or negatively affect the concrete wall's performance for FRP. As such, in accordance with AS 3600, a Dincel wall can achieve up to the following FRLs:

DINCEL WALL THICKNESS	MAXIMUM FRL ACHIEVABLE
110mm	90/90/90
155mm	180/180/180
200mm	240/240/240
275mm	240/240/240

It is important to note that the 'structural adequacy' component of a Dincel wall (or any other structural wall) for a specific project requires to be calculated and provided by the project's structural engineer to AS 3600 or other relevant concrete codes, just like for a conventional concrete wall (keeping in mind that Dincel is simply formwork for a concrete wall). This is verified within Dincel's CodeMark certificate issued by SAI Global. The engineer must take into account project specific variables such as wall height, thickness and loading. Design engineers are encouraged to read Section E.5. for further guidance on how to calculate FRP for a concrete wall.

AUTHORITY	STANDARD/REPORT TYPE	REPORT/CERTIFICATE NUMBER
CSIRO	AS1530.4-2014 Report	FCO-2674
Warringtonfire	Assessment Letter	FAS190305

D.2.7. BUSHFIRE ATTACK LEVEL (BAL)

Dincel was assessed by CSIRO and confirmed as suitable for use in bushfire conditions of up to Flame Zone (FZ), which is the most severe rating. The report compares test results to the requirements of AS 1530.8.2-2018 and confirms the report has been prepared to meet the requirements of AS 3959-2018 Clause 3.8.

AUTHORITY	STANDARD/REPORT TYPE	REPORT/CERTIFICATE NUMBER
CSIRO	AS 1530.8.2-2018 Report	FCO-2725

D.2.8. OTHER RELATED FIRE CONSIDERATIONS

The installation of an external cladding system to a wall has the potential to create a cavity within the system. The presence of cavities is known to promote upward vertical fire spread through the cavity space. Fire professionals have noted that when flames are confined within a vertical cavity they elongate, leading to flame extension of up to five to ten times the expected unconfined flame lengths. This is true even in cavities without additional combustible materials present, but is made worse by the presence of combustible materials. As such, the topic of cavity barriers is important, particularly when combustible cladding or those that fall under general concessions which are not non-combustible are used.

Where a Dincel external wall is used in conjunction with non-combustible cladding there is no additional requirement to incorporate cavity barriers, unless required by the NCC DTS provisions. For example, the use of fire-protected timber requires the provision of cavity barriers in accordance with the NCC (Volume 1 – Clause C1.13). Therefore, if a Dincel external wall was proposed to be used in conjunction with fire-protected timber cladding, then the cavity barrier requirements for fire-protected timber must be followed.

D.3. ACOUSTIC

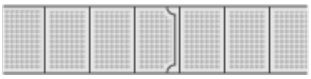
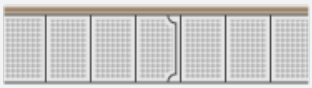
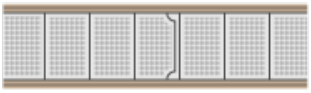
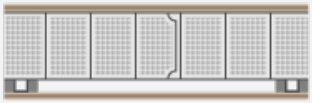
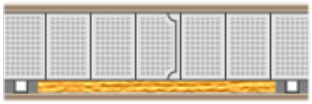
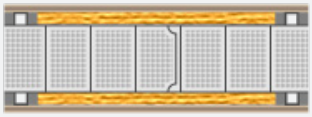
Dincel has been tested at CSIRO within their reverberation chambers. Based on these test results, Day Design acoustical engineers created assessment reports which details various Dincel walling arrangements and their associated acoustic performance.

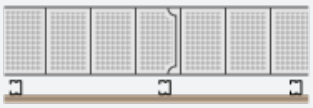
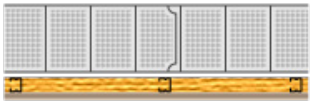
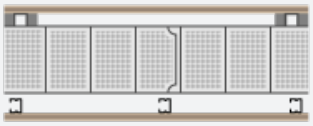
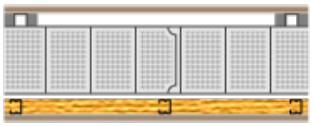
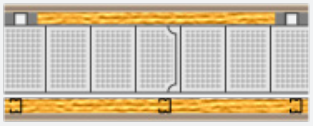
For guidance on which Dincel walling arrangements can be considered for a particular type of building, please refer to the performance table below.

AUTHORITY	STANDARD/REPORT TYPE	REPORT/CERTIFICATE NUMBER
CSIRO	Acoustic test reports for testing completed within CSIRO's reverberation chambers	ATF1916, ATF1918, ATF1920
Day Design	Acoustic opinion for 110 Dincel based upon test results	5880-1.1R
Day Design	Acoustic opinion for 155 Dincel based upon test results	5880-4.1R
Day Design	Acoustic opinion for 200 Dincel based upon test results	5880-3.1R
Day Design	Acoustic opinion for all Dincel profile thicknesses	5880-6.1R

D.3.1. ACOUSTIC PERFORMANCE

The following information has been extracted from report 5880-6.1R:

	SYSTEM COMPONENTS	DINCEL PROFILE	MIN. PLASTER BOARD (MM)	TOTAL WALL WIDTH (MM)	RW (RW+CTR)
DIN-IW1 	Side 1: Left bare Side 2: Left bare	110	N/A	110	48 (43)
		155	N/A	155	51 (45)
		200	N/A	200	53 (48)
		275	N/A	275	53 (48)
DIN-IW2 	Side 1: Plasterboard Side 2: Left bare	110	10	120	45 (41)
		155	13	168	50 (45)
		200	10	210	51 (46)
		275	10	285	51 (46)
DIN-IW3 	Side 1: Plasterboard Side 2: Plasterboard	110	10	130	45 (41)
		155	13	181	50 (45)
		200	10	220	51 (46)
		275	10	295	51 (46)
DIN-IW4 	Side 1: Plasterboard Side 2: 28mm furring channels (600 c/c, 30mm cavity), plasterboard	110	13	166	45 (42)
		155	10	205	48 (43)
		200	10	250	53 (46)
		275	10	325	53 (46)
DIN-IW5 	Side 1: Plasterboard Side 2: 28mm furring channels (600 c/c, 30mm cavity), 25mm glasswool (HD), plasterboard	110	10	160	53 (46)
		155	10	205	55 (48)
		200	10	250	57 (50)
		275	10	325	57 (50)
DIN-IW6 	Side 1: 28mm furring channels (600 c/c, 45mm cavity), 25mm glasswool (HD), plasterboard Side 2: 28mm furring channels (600 c/c, 45mm cavity), 25mm glasswool (HD), plasterboard	110	16	232	63 (50)
		155	13	271	60 (52)
		200	13	316	63 (54)
		275	13	391	63 (54)

	SYSTEM COMPONENTS	DINCEL PROFILE	MIN. PLASTER BOARD (MM)	TOTAL WALL WIDTH (MM)	RW (RW+CTR)
DIN-IW7 	Side 1: Left bare Side 2: 51mm steel studs (600 c/c, 71mm cavity), plasterboard	110	10	191	51 (43)
		155	10	236	54 (45)
		200	10	281	57 (47)
		275	10	356	57 (47)
DIN-IW8 	Side 1: Plasterboard Side 2: 51mm steel studs (600 c/c, 71mm cavity), 50mm glasswool (LD), plasterboard	110	13	207	57 (50)
		155	13	252	63 (51)
		200	10	291	61 (53)
		275	10	366	61 (53)
DIN-IW9 	Side 1: 28mm furring channel (600 c/c, 30mm cavity), plasterboard Side 2: 51mm steel studs (600 c/c, 71mm cavity), plasterboard	110	10	231	47 (41)
		155	10	276	51 (43)
		200	10	321	55 (46)
		275	10	396	55 (46)
DIN-IW10 	Side 1: 28mm furring channel (600 c/c, 30mm cavity), plasterboard Side 2: 51mm steel studs (600 c/c, 71mm cavity), 50mm glasswool (LD), plasterboard	110	13	237	57 (50)
		155	13	282	63 (51)
		200	13	327	61 (53)
		275	13	402	61 (53)
DIN-IW11 	Side 1: 28mm furring channel (600 c/c, 30mm cavity), 25mm glasswool (HD), plasterboard Side 2: 51mm steel studs (600 c/c, 71mm cavity), 50mm glasswool (LD), plasterboard	110	HD13	237	62 (50)
		155	HD13	282	67 (52)
		200	HD13	327	68 (53)
		275	HD13	402	68 (53)

Discontinuous Construction.

The above performance is based upon the following product densities:

- 10mm thick plasterboard - 650 kg/m³ bulk density
- 13mm thick plasterboard - 623 kg/m³ bulk density
- HD13mm thick plasterboard (HD = High Density, typically fire rated plasterboard) - 808 kg/m³ bulk density
- 16mm thick plasterboard - 766 kg/m³ bulk density
- 25mm thick glasswool insulation (HD) - 24 kg/m³ bulk density
- 50mm thick glasswool insulation (LD) - 11 kg/m³ bulk density
- Concrete within Dincel formwork - 2350 kg/m³ bulk density

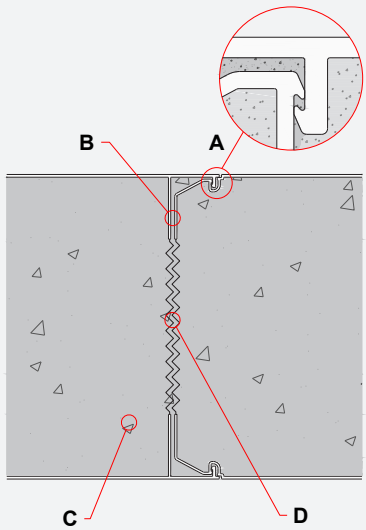
D4. WATERPROOFING

One of the unique features of the Dincel walling system is that, as tested by the CSIRO, the 'stay in place' polymer formwork provides a permanent waterproof skin to the concrete wall, meaning that in most cases a Dincel wall does not require further waterproofing other than to wall junctions (refer to B.2.).

The Dincel polymer skin is formulated from a proprietary polymer (re-engineered PVC), which was tested and proven to be completely impermeable (like a PVC pipe). When using a permanent formwork system, the panel joints must also be waterproof. The Dincel system consists of a unique and patented joint design which are also deemed waterproof by CSIRO once infilled with concrete.

The watertightness at Dincel panel joints is attributed to the patented 'snap-lock' connection consisting of barbs. The joint mechanism ensures waterproofing through the following:

- **A** – Patented Dincel barbs coupled with slurry infill proven to provide waterproof joint. The barbs engage with each other, similar to the clutches of sheet piling.
- **B** – 6mm gap between panels only allows slurry to enter (not coarse aggregate) - slurry fills all possible voids/ gaps.
- **C** – Min 180mm slump (at the point of discharge) or SCC concrete to ensure compaction and eliminate air voids. Compacted concrete with no voiding is critical in ensuring waterproofing performance.
- **D** – Any cracks induced due to the panel webs are sealed in time due to the concrete autogenous healing process. Cracks are controlled in both location and width, being no more than 0.01mm in standard conditions.



Verifying that Dincel panel joints are waterproof, CSIRO tested concrete filled Dincel panels along with the vertical 'snap-lock' joint. 6 metres of hydrostatic water head pressure was placed on the panel joint for 100 hours, as per ASTM E514 and AS/ NZS 4347.1. No water passed through the wall during the test and subsequently CSIRO were able to verify that the wall was waterproof. CSIRO carried out the following tests:

ASTM E514 - 03	Pass
AS/NZS 2904:1995	Pass
ASTM E 96/M	Water vapour transmission was found to be 180 times better than the requirement for a waterproof membrane

CSIRO were able to achieve the waterproof wall by using a 110mm concrete slump in 200 Dincel. It should be noted that Dincel recommend a minimum nominal 220mm slump (min 180mm at point of discharge) or SCC should be used to alleviate any concerns over concrete compaction and subsequently ensure waterproofing. The Dincel 275mm profile is recommended for submerged conditions where waterproofing is critical.

D.4.1. COMPLIANCE WITH NCC

CSIRO confirmed within test report 5091 (page 4) that Dincel walls satisfy the performance requirements of FP 1.4 and FP 1.7 (Volume 1 – Class 2 to 9 Buildings) and P2.4.1 (Volume 2 – Class 1 and Class 10 Buildings). Furthermore, Mahaffey Associates have prepared a conformity assessment report which confirms compliance with FP1.4 and FP1.7 (NCC Volume 1), and P2.2.2 and P2.4.1 (NCC Volume 2).

AUTHORITY	STANDARD/REPORT TYPE	REPORT/CERTIFICATE NUMBER
CSIRO	Waterproof Testing to AS3740, ASTM E514, AS/ NZS 4347.1, ASTM E96/M	5091
Mahaffey Associates	Compliance with FP1.4 and FP1.7 (NCC Volume 1), and P2.2.2 and P2.4.1 (NCC Volume 2)	20180

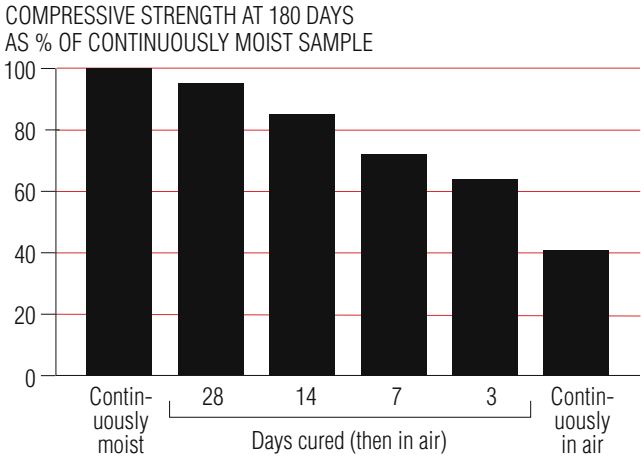
D5. CONCRETE CURING

D.5.1. BACKGROUND

Curing is the process of controlling moisture loss from concrete during cement hydration. Moist-curing is where the concrete is encapsulated/surrounded in moisture for the duration of the curing period. There are significant benefits which can be achieved through moist-curing such as:

- **Increased concrete strength**
  The longer that concrete is cured for, the more strength is gained within. This is because curing ensures that sufficient moisture and temperature is provided for the cement hydration process. The strength benefits from moist-curing concrete are well known and accepted. For example, Cement Concrete & Aggregates Australia (CCAA) have published how concrete which has been continuously moist-curing for 180 days achieves 2.5 times more strength compared to concrete which has been air cured.
- **Improved durability/waterproofness**
  Moist-curing allows for the by-products of cement hydration to fill small pores, capillaries and cracks, and essentially encourages the concrete to 'self-heal'. This phenomenon is referred to as autogenous healing, where the lime of cement reacts with CO2 to develop carbonation. The process reduces the porosity of the concrete and increases density. In addition, problems such as drying shrinkage cracking can be eliminated as there is no rapid moisture loss.

For conventional concreting methods, moist-curing for an extended period (i.e. 28 days or greater) can be difficult, time consuming and expensive. It is typically carried out by continuous wetting through sprinklers, applying specialty curing compounds, or retention of formwork for a certain period of time.



Credit: CCAA, Curing of Concrete
www.ccaa.com.au/imis_prod/documents/Library%20Documents/CCAA%20Datasheets/DS2006Curing.pdf

D.5.2. CURING WITH DINCEL WALLS

Dincel walls provide ideal moist-curing conditions via polymer encapsulation from the permanent polymer skin. This allows for the above curing benefits to be realised to their full potential. Best of all, no additional work is required to achieve these curing benefits, the functionality is built into the system. The opportunity for curing will be present for the life time of the wall, rather than stopped prematurely as with conventional methods.

D6. THERMAL

The thermal resistance (R-Value) provided by a Dincel wall can be conservatively considered the same as a conventional concrete wall of equivalent thickness. Although the Dincel polymer achieves a more favourable thermal conductivity than concrete, at a skin thickness of approximately 2.5mm, the difference can be considered negligible. Any standard density concrete wall will still require insulation where thermal performance is required (such as a habitable room). Unlike other types of permanent formwork systems which use steel webs/studs, Dincel polymer webs do not allow for thermal bridging to deteriorate the R-value within the wall.

There are known benefits of using concrete construction from an energy perspective due to its weight. Thermal mass refers to a material's ability to store up thermal energy. The mass absorbs heat during the day and releases this heat at night. Ultimately, this can ensure a warmer home at night in winter and a cooler home during the day in summer.

Thermal mass can moderate the temperature of occupied spaces, minimise the need for mechanical cooling and reduce winter heating requirements. The greater the volume of thermal mass, the greater its ability to store heat and maintain a uniform temperature. In fact, correct use of concrete as thermal mass can delay heat flow through the building envelope by as much as 7 hours. However, thermal mass must be carefully used in conjunction with passive solar design and insulation, otherwise it may create a negative outcome. Thermal mass on its own is not sufficient to meet the total R-value requirements by the NCC for habitable rooms.

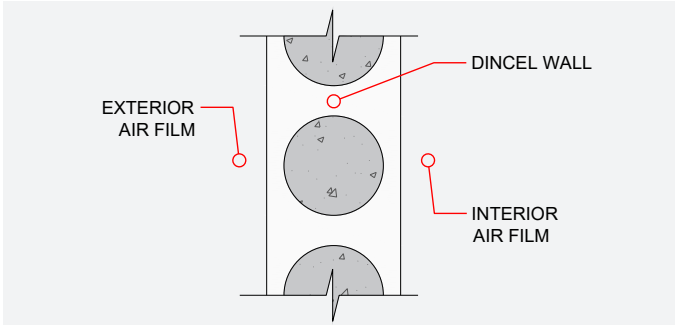
For more information regarding the benefits of thermal mass, it is recommended to visit the YourHome guide published by the Australian Government (scan code to right).

The R-Value of the Dincel wall itself can be determined using values as provided in Specification J1.2 of the NCC (Volume 1):

MATERIAL	THERMAL CONDUCTIVITY (W/M K)
Standard Concrete (density of 2400kg/m3)	1.44
Dincel Polymer (uPVC)	0.19

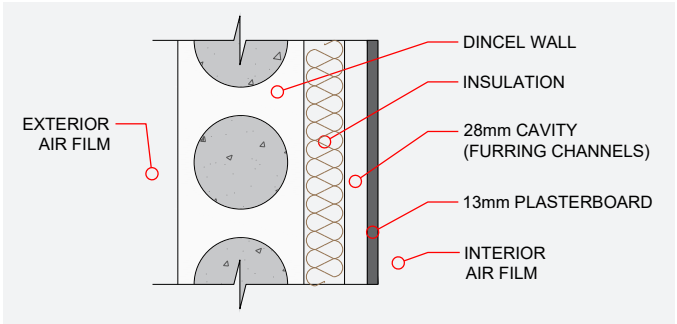
AIR FILM	R-VALUE (M^2 K/W)
Still (interior) air	0.12
Moving (exterior) air	0.03

With the above taken into consideration, the R-Values for the Dincel wall itself is shown below:



DINCEL PROFILE	R-VALUE
110 Dincel:	0.25
200 Dincel:	0.28
155 Dincel:	0.31
275 Dincel:	0.36

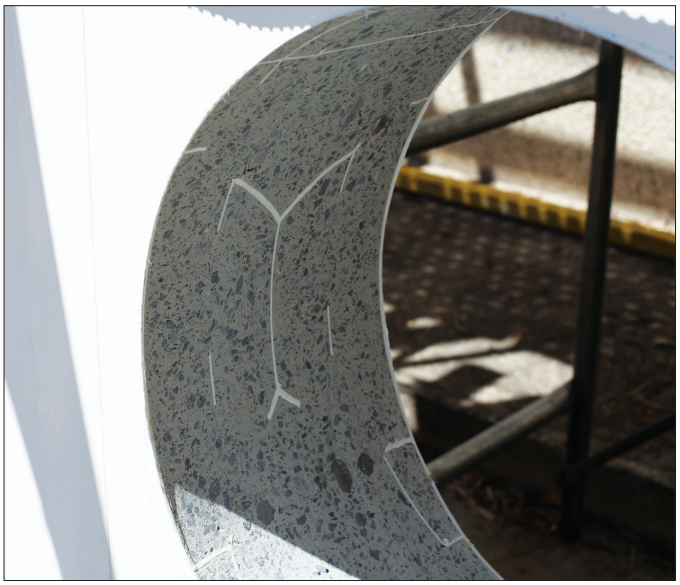
To increase the R-Value, insulation must be added to the walling system. As an example, the R-Value of a typical walling system (including 50mm thick high-performance insulation board and plasterboard) is shown below:



DINCEL PROFILE	R-VALUE
110 Dincel:	3.0 – 3.2
200 Dincel:	3.0 – 3.2
155 Dincel:	3.1 – 3.2
275 Dincel:	3.1 – 3.3

The range in R-value above represents the fluctuation in calculation from winter and summer values. It should be noted that any finishes, window openings or cast-in items will affect the R-value. To determine the R-Value for a specific project or walling arrangement, it is recommended to consider the Dincel wall as a conventional concrete wall and obtain the R-value from the insulation provider.

D7. ENVIRONMENT & HEALTH



D.7.1. AIR-TIGHT CONSTRUCTION

Air-tight construction, or 'Passivhaus' design, is becoming ever increasing in popularity. And it is no wonder why – by ensuring a draught free building envelope, energy consumption from heating and cooling the interior air can be substantially reduced.

Dincel walls can be used as the external building envelope in order to achieve air-tight construction. There are a few unique features of the Dincel system which assist with this:

- **Impervious polymer skin** - Dincel walls consist of permanent polymer formwork encapsulating concrete filling to form a monolithic concrete wall. The permanent polymer formwork not only provides an impervious barrier to air but also water, moisture, and external contaminants.
- **No requirement for crack-control joints** - Dincel walls do not require joints for crack control purposes due to the unique crack inducing webbing within the formwork. For further information, please refer to Section E.9.3.

This is different to conventional structural walls (such as raw concrete or masonry) which are susceptible to cracks and require expansion joints for crack-control purposes. For conventional walls, this makes it difficult to achieve a completely air-tight envelope without additional membranes or layers.

D.7.2. CONDENSATION MANAGEMENT

The amount of water vapour that air can hold is a function of temperature. Condensation occurs when warm moist air comes into contact with cold air or a cold surface. The air is unable to retain the same amount of moisture and the water is released to form condensation in the air on the surface. The moisture generated from condensation can reduce the service life of materials in the building envelope and cause long-term deterioration. There are a few commonly accepted ways to mitigate condensation for walls:

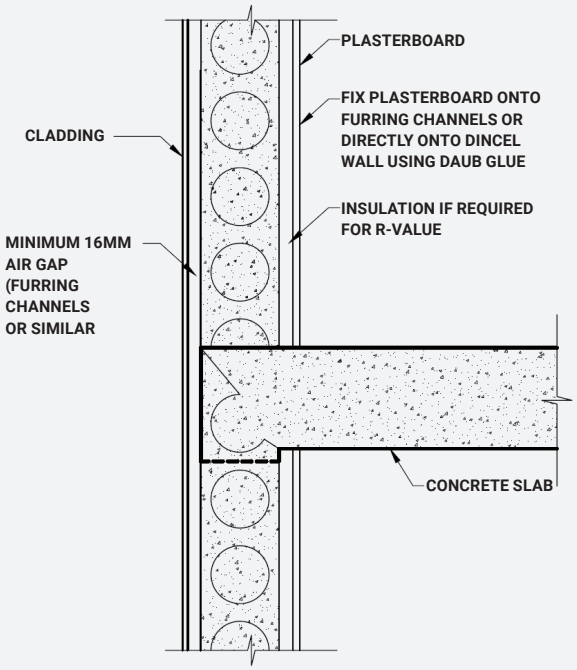
- Insulation – Insulation will assist in moderating the temperature on the wall surface of a habitable space. This is particularly beneficial in winter, as it prevents the internal wall surface from reaching extremes of the cold external temperatures and thus reduces the amount of condensation generated. The same applies to thermal bridging, which must be restricted in order to prevent the influence of external temperatures. It is important that the wall surface remains above the 'dew point' in order to prevent condensation.
- Membranes & Vapour Barriers – Use of a waterproof membrane or vapour barrier will prevent external moisture sources, such as from rain & humidity, from entering into the building. This is particularly beneficial for climate zones where the vapour drive is predominantly from the external environment, such as tropical and subtropical climates (hot and humid).
- Ventilation – Ventilation is the air exchange between the interior and exterior environment and allows for any built-up vapour to be relieved from the building. This is particularly beneficial for cooler and dry climate zones where the vapour drive is predominantly from the building interior, and caused by occupant activity such as showering, cooking, laundry activities, humidifiers, etc. Buildings designed with cross ventilation principles applied and mechanical ventilation will be able to effectively control condensation within a building.This is different to conventional structural walls (such as raw concrete or masonry) which are susceptible to cracks and require expansion joints for crack-control purposes. For conventional walls, this makes it difficult to achieve a completely air-tight envelope without additional membranes or layers.

Use of Dincel structural walling system already provides positive measures in regards to condensation management in comparison to conventional construction materials such as raw concrete, masonry and fibre cement sheeting. These materials are porous so moisture is contained within them and also passes through which can transpire to condensation.

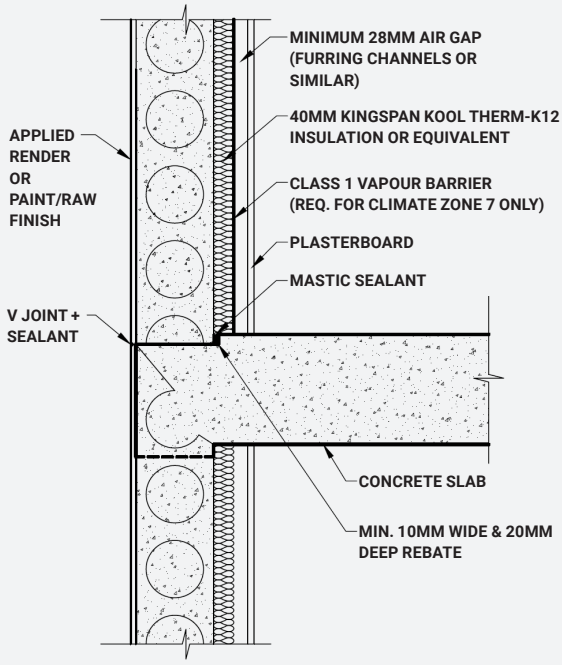
Whereas a Dincel wall contains a polymer shell which provides dual vapour impermeable barriers and prevents any external moisture from entering into the building. The only moisture/vapour source to therefore consider is from internal sources.

Compliance with the deemed-to-satisfy provisions of the NCC is outlined in F6.2 of Volume 1 and 3.8.7.2 of Volume 2, which can be applied for all wall types including Dincel. As stated in part (b) of these clauses, the deemed-to-satisfy provisions can be met when a drained cavity is provided which separates the exterior finish (such as cladding or brick veneer, which is classified as the primary water control layer) from the rest of the walling system.

Where a raw, paint or render finish is used instead of cladding or veneer, use of Dincel still complies with the BCA through a performance-based approach. A hygrothermal analysis was undertaken to determine the amount of condensation generated with various Dincel external wall systems. Various Dincel walling arrangements were found to be compliant with the 2019 National Construction Code (NCC/BCA) condensation management requirements FP6.1 of Volume 1 and P2.4.7 of Volume 2 – please contact us for a copy of this report. An extract of drawings from this report has been provided below.



Deemed-to-Satisfy Compliant Option
Drained cavity provided to exterior face via cladding.



Performance Based Solution
Insulation provided mitigates potential for condensation.

D.7.3. BEP CERTIFICATION

The Dincel polymer formulation is based upon a proprietary and re-engineered uPVC. There is a concern by some in industry over the environmental sustainability of common PVCs because the formulations contain plasticisers and heavy metal stabilisers. However, the Dincel polymer formulation does not use plasticisers or heavy metal stabilisers but rather organic stabilisers. This has allowed the Dincel polymer to be issued with Best Environmental Practice (BEP) certification by ApprovalMark International. The certification states that the manufacture and use of Dincel complies with:

> *"...the requirements of Best Environmental Practice – PVC as per the relevant Australian or International Standard and Section 7 as specified in the Green Building Council of Australia ('the Requirements") Literature Review and Best Practice Guidelines for the Life Cycle of PVC Building Product's using the compliance pathway Number 2 – Manufacturer's Declaration as measured by the Green Star PVC Credit Auditor Verification Guidance – November 2013 ("the Criteria")."*

D.7.4. VOCS

Volatile Organic Compounds (VOCs) are gases emitted from certain solids and liquids. Exposure to VOCs may have adverse health effects so it is important to carefully consider the VOC emissions with any construction material. The potency of VOCs emitted generally varies depending when a material is first manufactured, cut or unconcealed.

Dincel polymer has been tested for VOCs by CETEC Australia and classed as a low volatile organic compound (VOC) emitting product in accordance with ASTM D5116-97. Test results demonstrated that VOC emissions were less than the recognised threshold as a newly manufactured product and below detection limit 30 days after manufacture.

DINCEL POLYMER	VOC (MG/M²/HR)
Newly Manufactured (24 hours)	0.02 (well below Green Star limit of 0.5)
Aged (ca. 30 days)	0.01 (below detection limit, and well below Green Star limit of 0.5)

D.7.5. GREEN STAR RATING

The Green Building Council of Australia (GBCA) is an industry association that promotes sustainability within the construction industry and the built environment. GBCA founded the Green Star rating system, which is a voluntary and holistic rating system to encourage use of sustainable practices and materials within construction.

If a project participates in the Green Star rating system, use of the Dincel structural walling system can assist in achieving the following Green Star credits:

GBCA CREDIT NO.	GBCA REQUIREMENT SUMMARY	POTENTIAL BENEFIT USING DINCEL WALLING
19B.1.1 Portland Cement Reduction	1 point is available where Portland cement is reduced by 30% in all concrete elements. 2 points are available where the Portland cement content is reduced by 40% in all concrete elements.	The permanent polymer skin provided with Dincel formwork allows for Portland cement content to be replaced with an increased amount of supplementary cementitious materials (mix design provided by Concrete supplier and structural engineer) due to the enhanced wall durability and increased curing conditions. Such features have seen previous projects utilise concrete designs with 50% of cement content substituted with alternate cementitious materials.
19B.2B Steel Reinforcement Reduction	Up to 1 point is available when there is a 5% reduction in the mass of steel reinforcement used for the building when compared to standard practice.	Dincel walls do not require steel reinforcement for crack control purposes, for further information see Section E.9.2. In addition, structural steel reinforcement can be substituted with synthetic fibre reinforcement in Dincel 275. Depending on the design application, steel reinforcement can be completely omitted in some instances.
20.3 Use of PVC	1 point is available where 90% (by cost) of all permanent formwork, pipes, flooring, blinds and cables in a project meets the GBCA's Best Practice Guidelines for PVC.	Dincel polymer is Best Environmental Practice (BEP) certified and meets the GBCA PVC requirements, as verified by ApprovalMark International.

D.7.6. RECYCLING

Dincel formwork can be recycled throughout the entire life cycle:

- **Manufacturing** – During the manufacturing/extrusion process, the profiles' webs are cored by robotic arms. Instead of scrapping these materials, the cuts remaining from the extruded profiles are collected by conveyor belts and transferred to granulators, micronisers and to the material production silos. This ensures that all cored material, extrusion rejects, extrusion start offs and off-cuts are completely recycled at the manufacturing plant. Almost no waste is generated using this process.
- **Construction** – Dincel provides custom profile lengths between 1800mm and 7950mm which significantly minimises the need for cutting and creating construction site wastage. Any Dincel product that cannot be used on site can be sent to third parties for recycling (the same standard practice as the PVC pipe industry). In NSW Australia, Dincel has partnered with plastic recyclers to offer free recycling of Dincel formwork off-cuts.
- **End of Life** – Current recycling technologies enable the recycling and separation of Dincel walling components. Firstly, the process generally involves crushing the Dincel wall into finer components. Steel reinforcement is extracted from the wall through the use of magnetic equipment. Following this, the Dincel polymer can be extracted by using a trommel and liquid bath process. The components can then all be recycled separately as follows:
    - Steel reinforcement – purchased by steel recyclers where the material undergoes the process of melting and purification for reuse.
    - Dincel polymer – PVC recycler granulates polymer. Micronised powder can then be purchased and reused by the PVC industry (such as to manufacture PVC pipes).
    - Concrete – Can be further granulated if required and used as road base, some civil works or raw material for new concrete production.

D8. TERMITE RESISTANCE

A Dincel wall is constructed from 3 materials being: concrete, steel reinforcement, and a permanent polymer formwork. All 3 of these materials are resistant to termite attack which are wood eating insects, as stated in AS3660 (Termite Management Code):

AS3660 CLAUSE	MATERIAL TYPE PERMITTED	COMPLIANCE WITH DINCEL WALLING
3.2 (b)	Concrete elements - complying with AS 3600	The concrete inside Dincel complies with the requirements of AS 3600 (refer to Section E.1.1 for certification regarding design and compliance with AS 3600).
3.2 (d)	Steel	Standard steel reinforcement, if required, is used inside Dincel walling.
3.2 (f)	Unplasticized polyvinyl chloride (PVC)	Dincel polymer is a type of unplasticized PVC, as confirmed within the ApprovalMark BEP certificate.

The relevant extract from AS3660 has been provided below:

3.2 STRUCTURAL ELEMENTS BELOW TERMITE MANAGEMENT SYSTEMS

All structural elements below the termite management system or any penetration through a structural element or in contact with the ground shall be termite resistant.

NOTE: Common penetrations of structural elements include pipes, conduits, pins and wires.

The following materials shall be deemed to be termite resistant:

(a) *Masonry*—fired clay and concrete bricks, concrete blocks and stone.

NOTE: Termites may gain entry through mortar and other joints.

(b) *Concrete elements*—complying with AS 2870 or AS 3600.

(c) *Timber*—complying with the following:

(i) Naturally termite-resistant timbers listed in Appendix C.

NOTE: When considering using timbers listed in Appendix C for use in ground contact, appropriate reference should be made to AS 5604. Reference was made to AS (AS/NZS) 1604 (series), AS 1720.2 and AS/NZS 1148 in compiling the list of termite-resistant timbers given in Paragraph C5, Appendix C.

(ii) Preservative-treated timbers in accordance with AS (AS/NZS) 1604 (series) and specified for the appropriate hazard level in accordance with Appendix D.

NOTE: Where preservative-treated timbers are cut, notched, or planed, the affected surface should be treated with a suitable remedial preservative.

(d) *Steel, aluminium or other metals.*

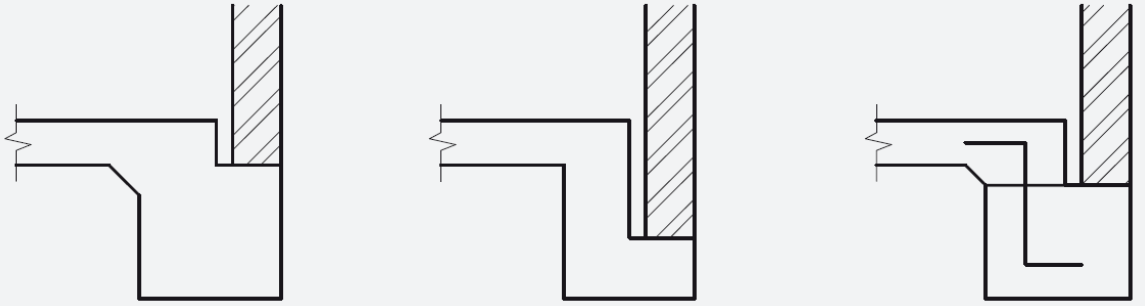
(e) *Fibre-reinforced cement.*

(f) *Unplasticized polyvinyl chloride (PVC)*—having a minimum thickness of 1 mm and a minimum hardness Shore D 80 (instantaneous).

NOTE: The use of termite-resistant materials in contact with the ground does not in itself form a termite management system. Termite-resistant materials may provide termites with concealed access to other parts of the building.

D.8.1. HORIZONTAL JOINTS

For compliance with AS 3660, concrete construction can provide an effective barrier against termite access if the appropriate detailing is adopted, as confirmed in AS3660 Figure 4.1:



(a) Stiffened raft (no joint)

(b) Waffle raft (no joint)

(c) Footing slab construction joint

FIGURE 4.1 EXAMPLES OF FOOTING SYSTEMS REQUIRING NO JOINT TREATMENT

As demonstrated in the above figure and AS3660 Clause 4.3.2.2, there are two ways to prevent termite access through concrete construction:

- Provide monolithic construction, where the concrete elements are all poured at the same time, OR
- Concrete elements are tied together suitably through the use of steel reinforcement (as detailed in AS 2870). This will involve the Dincel walls being tied into the slab below through cast in starter bars and any strip footings to be tied into the slab.

D.8.2. VERTICAL PANEL JOINTS

In accordance with the CCAA 'Concrete Slabs as Barriers to Subterranean Termites' data sheet, a minimum crack width of 1.4mm is required to gain access through a building element (scan QR Code to download).

Any crack formed at a Dincel formwork panel joint location is expected to be less than 0.1mm (see Section E.9), which is 14 times less than the permissible crack width for termites. In addition, shrinkage is reduced due to the ideal curing conditions provided by the polymer encapsulation, which is in line with the recommendations of AS 3660 Clause 4.3.1 (Note 3). Therefore, it is not possible for termites to pass through the vertical panel joints of the Dincel walling system when appropriately concreted and installed.

Dincel walls can offer a superior barrier against termites in comparison to conventional walling types (i.e. masonry brick, block, in-situ concrete and precast concrete). Conventional walling types are required to contain construction and/or expansion joints at regular intervals for crack control purposes. These joints can be a potential avenue for termite invasion if the sealant/caulking loses bondage. In addition, any cracks which form throughout the wall are a potential avenue for termite invasion. As Dincel walls do not require construction joints (see Section E.9.3) and has a protective polymer skin to protect any potential cracks, it overcomes the issues associated with conventional walling types.

D.9. DURABILITY

D.9.1.DINCEL POLYMER CHEMICAL RESISTANCE

In a recent independent study by the Sustainable Solutions Corporation in 2017, it was found that PVC used in the water and sewer pipe industries conservatively has a service life of over 100 years. This life expectancy will only be increased for the PVC used with Dincel walls as they are not subject to cyclical loading of water pressure.

The key findings of the study are as follows:

- *"PVC pipe has a 100-year plus service life as verified by numerous studies and dig ups"*
- *"PVC gravity pipe has the lowest 100 year life cycle embodied energy – no replacements, no infiltration and no corrosion protection compared to other materials"*

The study can be downloaded by scanning the QR Code.

This demonstrates that the Dincel PVC skin will not deteriorate or dissolve even in underground or submerged settings and will achieve a 100-year life for most project conditions. In fact, some studies detail that under low stress conditions, PVC life can be over 1,000 years (Janson, L.E., 1996. Plastic Pipes – How long can they last?, KP Council).

Part of the reason why PVC has an exceptional life span is due to its known chemical resistance. The Dincel skin in particular has been tested against the following liquids and chemicals:

- Petrol
- Diesel
- Sulphuric acid, phosphoric acid, hydrochloric acid and nitric acid

This demonstrates that the Dincel polymer does not readily degrade or deteriorate even in the presence of harsh chemical exposure and thus suitable for applications which requires contact with acid sulphate soils. PVC in general has a proven resistance to chemical attack from sewerage, soil, alcohols, oils, fats and most corroding agents

D.9.2.DINCEL POLYMER UV RESISTANCE

Dincel polymer is suitable for use in external environments exposed to the sun and exhibits similar behaviour to conventional uPVC in this regard. uPVC is proven in industry to provide a sufficient level of resistance against UV radiation – a few popular examples of uPVC in exposed environments include window/door frames, down pipes, floor coverings, automotive parts, roadside guideposts, and many others.

Resistance of the PVC skin against UV radiation is only a consideration when there is no finish applied and the material is directly exposed to the sun. This would not be a consideration for basement walls which are not exposed to direct sunlight. However, even when directly exposed the Dincel polymer does not readily degrade due to natural inhibitors used within the PVC composition (titanium dioxide/TiO2).

UV radiation causes an excitation of molecular bonds to the exposed face, which only affects up to the first 50 microns of the 2500-micron skin. The effects of this are:

- Loss of gloss, chalking and discolouration (yellowing). This is only an aesthetic concern, and easily mitigated if required by applying a finish. As Dincel is produced in an off-white colour this is already a positive measure against yellowing.
- An increase in tensile strength, yield strength and moduli, which subsequently increases the possibility of a brittle type fracture. As Dincel walls contain solid concrete on the inside, any impact onto a Dincel wall is absorbed by the concrete infill and not the PVC skin (unlike a hollow pressure pipe subject to cyclic loading). Therefore, the skin of Dincel walls will be largely resistant to brittle type fractures (if it is even exposed to impact loads in the first place).

As can be seen from the above, the Dincel polymer will continue to act as a protective membrane for the lifetime of the wall, even when left raw and exposed to the sun. Any aesthetic concerns surrounding UV light/radiation can be easily addressed by applying a paint, render or cladding finish to Dincel Walls.

D.9.3. 120 YEAR DESIGN LIFE

Some authorities require a substantial design life for structures, sometimes up to 120 years. This requirement can be satisfied with Dincel walls. A Dincel wall is a concrete wall with an additional PVC skin. This skin is not only 'lost formwork' but also has the additional benefit of acting as a protective membrane. This means the predicted life of a concrete wall is only further enhanced with the Dincel skin.

As has been known for centuries, concrete structures have exceptionally long life-spans. In recent times, steel reinforcement has been added to concrete in order to increase the tensile capacity. However, once the concrete is subject to unavoidable cracks, the steel reinforcement is susceptible to corrosion and this can result in a premature lifespan of the concrete structure. As a Dincel wall provides the concrete with a waterproof protective skin, it eliminates the risk of corrosion to steel reinforcement or concrete degradation and therefore allows for an exceptionally long life-span, which can conservatively be a minimum of 120 years.

Conventional concrete walls can only achieve the required 120-year design life when the concrete is virtually non-porous, free of air voids and constructed with the required minimum concrete cover to steel bars under normal atmospheric conditions. It is therefore very important the concrete cover provided is impervious and crack free to protect the steel reinforcement against corrosion. This often becomes difficult to achieve since concrete cracking is inevitable in the majority of concrete walls, and is the reason why conventional concrete walls must be subjected ongoing maintenance to ensure that any cracks which have formed are rectified for a 120-year life to be achievable.

The circumstances deteriorate when the concrete wall is subject to acidic and salt attacks, due to a lack of adequate chemical resistance of concrete, irrespective of imperviousness of concrete cover to steel reinforcement. Therefore, protection of concrete can only be achieved by the provision of a permanent membrane system, which is exactly what the Dincel polymer provides. The benefits provided by a Dincel wall are substantial, considering the fact that the life of concrete will depend on the corrosion of steel bars and spalling of concrete under chemical reactions which occur under various conditions.

The following details how a Dincel wall can ultimately achieve a minimum 120-year design life:

- Dincel polymer is completely impervious and will not disintegrate for the 120-year design life period (refer to Sections D.9.1 and D.9.2).
- Dincel panel snap-joints are verified by CSIRO as waterproof which prevents corrosion of steel reinforcement (refer to Section D.4).
  - Correct concreting practices are required to minimise possibility of water ingress. Where adequate compaction cannot be guaranteed and the wall is under submerged conditions, there is the possibility of water/moisture ingress through the vertical panel joints. In this case, the design engineer can consider the following to eliminate the potential for corrosion to horizontal bars:
    - > Omit horizontal bars if they are solely provided for crack control purposes (refer to Section E.9.2).
    - > Increase bar diameter to provide an allowance for corrosion.
  - Provide vertical bars away from the vertical panel joints, in order to ensure complete protection by the polymer skin and uncracked concrete.
  - The starter bars at the Dincel wall-to-footing/slab junction should be hot dipped galvanised.
- Any steel reinforcement (other than starter bars) used can still be provided with the standard concrete cover, as required by AS3600 or other relevant concrete design codes.
- Dincel 275 has been tested by the University of Technology Sydney (UTS), where it was verified that Dincel walls can be used without any steel reinforcement or with Macro synthetic (BarChip) fibre reinforcement where structurally appropriate (refer to Section E.1.2). By omitting steel reinforcement corrosion is not possible, which further enhances the design life of a Dincel wall beyond 120 years.

D.9.4. DINCEL POLYMER MAXIMUM SERVICE TEMPERATURE

The service temperature is the temperature when the material starts to deform. The effective service temperature of a polymer can vary significantly with the rate of loading. Literature explains that small load application rates at high temperatures can have the same effect as large load application rates at lower temperatures.

uPVC offers a softening temperature (Vicat) of approximately 75-80°C. The polymer used for Dincel is a reengineered version of common uPVC. Fire testing by CSIRO and Warringtonfire demonstrated excellent heat release properties which are better than common uPVC and even plasterboard. However, irrespective of this it is important to note that a Dincel wall consists predominantly of concrete infill. The strength of the Dincel formwork is only required at the time of concrete pouring to hold the wet concrete pressure. Therefore, the Dincel material, being formwork, only requires serviceability performance at the time of concrete pouring.

Concrete hydration temperatures need to be considered when using high strength concrete in excess of 65 MPa. The concrete hydration temperature is based on many factors including ambient temperature and the concrete mix design. Dincel walls have been used to successfully incorporate an 80 MPa concrete mix. As common practice, concrete mix designs are developed in a way to prevent hydration temperatures exceeding 65°C (contact concrete supplier to confirm for particular mixes). When 65 MPa concrete is prepared and poured under Australian Standards, it is a rare possibility for the concrete's hydration temperature to exceed 50°C if the thickness of the wall is limited to 275mm as is the case of Dincel formwork. Therefore, there are generally no issues with concrete curing temperatures exceeding the Dincel formwork's service temperature. Since the Dincel polymer formwork permanently encapsulates the concrete mix it allows for a controlled curing temperature and prevents evaporation of water from the concrete mix.

D.10. FORMWORK

Permanent formwork is recognised within AS3610 under Clause 4.6.3.

> **4.6.3 Permanent form systems**
>
> For permanent form systems, the project documentation shall provide—
>
> (a) the location, layout and details of any supports, bracing, sealing;
>
> (b) any limitations on deflections; and
>
> (c) any special requirements for the erection, concreting and removal of any supports and/or bracing.
>
> NOTES:
>
> 1 Section 3 tolerances do not apply to permanent form systems and should be specified in the project documentation.
>
> 2 If the surface texture of the permanent form is important, information for its protection should also be provided.

To satisfy items (a) and (c), the supports and bracing for the formwork requires to be designed, documented and certified by a suitably qualified engineer. This process is no different to temporary works design for conventional formwork. Section E.6 provides further guidance on bracing for engineers who are designing the temporary works bracing for Dincel formwork. Parts of this manual can be referenced when generating the formwork project documentation.

D.10.1. TOLERANCES

As stated in Note 1 of Clause 4.6.3, the tolerances within Section 3 of AS3610 do not apply to permanent formwork systems. When Self-Compacting Concrete (SCC) is used within Dincel formwork and poured in accordance with the pour rates specified in Section F.12.2, the designer should allow for a 'ripple' type deflection across the form face as specified below:

WALL HEIGHT (ALL PROFILES)	POTENTIAL DEFLECTION OF PANELS - MEASURED BY A 2M STRAIGHT EDGE AND NOT INCLUSIVE OF CORNERS OR ACCESSORIES
Up to 3.0m	Up to 8mm
3.0m and above	Up to 12mm

If a wall's finished surface is required to provide a higher-class of finish or less 'rippling', a finish such as a render or cladding can be applied onto the surface. Alternatively, measures should be put in place to reduce the amount of pressure placed onto the permanent formwork faces.

For checking the vertical plumbness of a wall, the standard relevant to the state/territory or project should be applied. As a rule of thumb, the following formula is often considered suitable for checking the satisfactory plumbness of a wall:

$$\text{Maximum vertical deviation (mm)} = \left(\frac{10H}{3}\right)$$

where **H** = total height of wall in metres.

Dincel polymer profiles may be subjected to temperature elongation depending on the length, height and daily temperature. Installers should allow a nominal 10mm of movement for every 15m of wall length for each 10°c temperature variation above 20°c.

On top of temperature movement, installers should allow a construction tolerance of 1mm to each main profile.

DINCEL
STRUCTURAL WALLING

TECHNICAL DETAILING FOR STRUCTURAL ENGINEERS

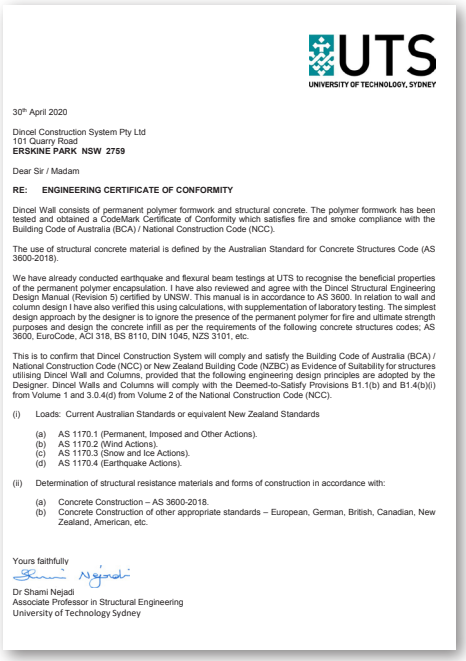
CONTENTS

E.1. STRUCTURAL DESIGN METHODS

There are two methods that can be used to design Dincel walling, what is considered the 'standard' design method and also 'composite' design method. Both these methods are summarised within this Manual. **However, it should be noted that this manual only provides an overview of the engineering concepts. It is recommended that the complete Dincel Structural Engineering Manual is referred to by the design engineer.**

E.1.1. STANDARD DESIGN METHOD

The standard design method is an approach which assumes that the polymer shell does not add any capacity to the wall section. In this design method, only the concrete found within the relative design plane is utilised for design purposes. The effective concrete thickness and steel reinforcement inside the formwork can be designed to AS 3600, NZS 3101, Eurocode, or other relevant design codes. This design methodology for Dincel walling has been thoroughly reviewed and verified by industry leading experts such as the University of Technology Sydney (UTS) and the University of New South Wales (UNSW). To download these certifications, please scan QR Codes below.



UTS
UNIVERSITY OF TECHNOLOGY, SYDNEY

30th April 2020

Dincel Construction System Pty Ltd
101 Quarry Road
ERSKINE PARK NSW 2759

Dear Sir / Madam

RE: ENGINEERING CERTIFICATE OF CONFORMITY

Dincel Wall consists of permanent polymer formwork and structural concrete. The polymer formwork has been tested and obtained a CodeMark Certificate of Conformity which satisfies fire and smoke compliance with the Building Code of Australia (BCA) / National Construction Code (NCC).

The use of structural concrete material is defined by the Australian Standard for Concrete Structures Code (AS 3600-2018).

We have already conducted earthquake and flexural beam testings at UTS to recognise the beneficial properties of the permanent polymer encapsulation. I have also reviewed and agree with the Dincel Structural Engineering Design Manual (Revision 5) certified by UNSW. This manual is in accordance to AS 3600. In relation to wall and column design I have also verified this using calculations, with supplementation of laboratory testing. The simplest design approach by the designer is to ignore the presence of the permanent polymer for fire and ultimate strength purposes and design the concrete infill as per the requirements of the following concrete structures codes; AS 3600, EuroCode, ACI 318, BS 8110, DIN 1045, NZS 3101, etc.

This is to confirm that Dincel Construction System will comply and satisfy the Building Code of Australia (BCA) / National Construction Code (NCC) or New Zealand Building Code (NZBC) as Evidence of Suitability for structures utilising Dincel Wall and Columns, provided that the following engineering design principles are adopted by the Designer. Dincel Walls and Columns will comply with the Deemed-to-Satisfy Provisions B1.1(b) and B1.4(b)(i) from Volume 1 and 3.0.4(d) from Volume 2 of the National Construction Code (NCC).

(i) Loads: Current Australian Standards or equivalent New Zealand Standards

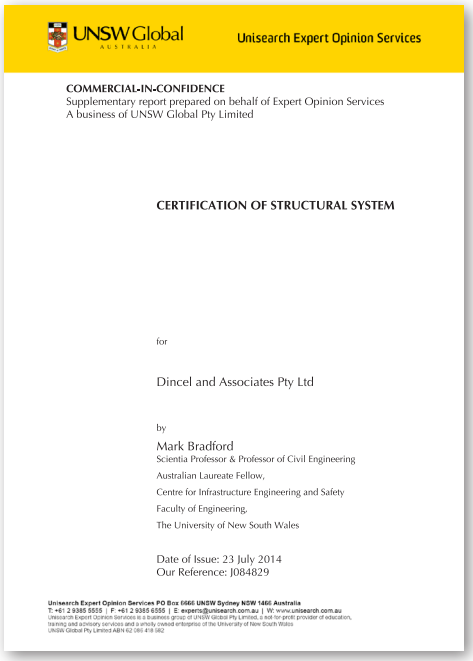
(a) AS 1170.1 (Permanent, Imposed and Other Actions).
(b) AS 1170.2 (Wind Actions).
(c) AS 1170.3 (Snow and Ice Actions).
(d) AS 1170.4 (Earthquake Actions).

(ii) Determination of structural resistance materials and forms of construction in accordance with:

(a) Concrete Construction – AS 3600-2018.
(b) Concrete Construction of other appropriate standards – European, German, British, Canadian, New Zealand, American, etc.

Yours faithfully

Dr Shami Nejadi
Associate Professor in Structural Engineering
University of Technology Sydney



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Supplementary report prepared on behalf of Expert Opinion Services
A business of UNSW Global Pty Limited

CERTIFICATION OF STRUCTURAL SYSTEM

for

Dincel and Associates Pty Ltd

by

Mark Bradford
Scientia Professor & Professor of Civil Engineering
Australian Laureate Fellow,
Centre for Infrastructure Engineering and Safety
Faculty of Engineering,
The University of New South Wales

Date of Issue: 23 July 2014
Our Reference: J084829

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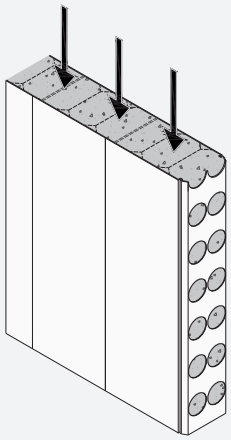
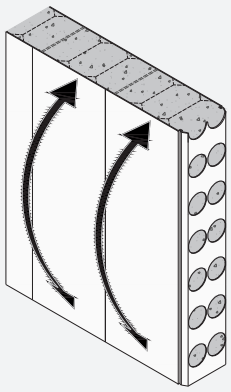
Please refer to the Dincel Structural Engineering Manual for further information regarding design principles and capacity tables. A summary of effective concrete thicknesses within Dincel walling has been provided within this manual for reference purposes, for design to AS3600:2018:

AXIAL LOADING



DINCEL PROFILE	EFFECTIVE CONCRETE THICKNESS (MM) FOR DESIGN CALCULATIONS
110	105
155	150
200	187
275	270

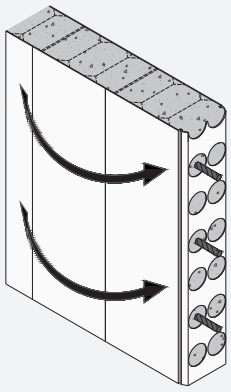
VERTICAL FLEXURAL BENDING (OUT-OF-PLANE)



DINCEL PROFILE	EFFECTIVE CONCRETE THICKNESS (MM) FOR DESIGN CALCULATIONS
110	105
155	150
200	192*
275	270

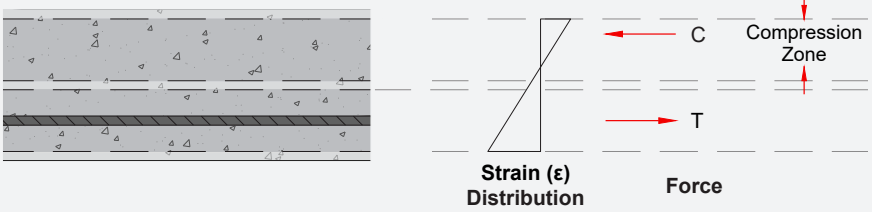
*192 can be used where vertical steel reinforcement is provided to tensile face. Otherwise, effective concrete thickness is 187mm.

HORIZONTAL FLEXURAL BENDING (OUT-OF-PLANE)

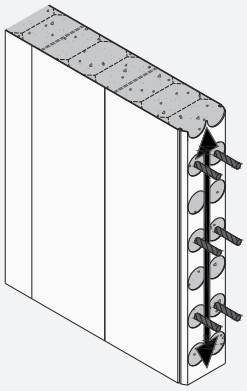


DINCEL PROFILE	EFFECTIVE CONCRETE THICKNESS (MM) FOR DESIGN CALCULATIONS
110	42.5
155	57.5
200	82
275	95

NOTE: Capacity for this design action can be determined from first principles. A strain and 'stress block' diagram can be created, where the tensile capacity is derived from the horizontal steel reinforcement on the tensile face, and the compressive capacity from the concrete within the web holes on the compressive face. Any horizontal steel reinforcement provided to the compressive face should also be considered. Refer to Section A.4 for web hole dimensions and panel dimensions.



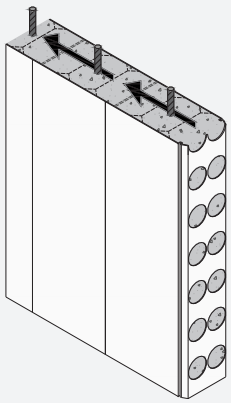
VERTICAL INTERFACE SHEAR BETWEEN PANELS



DINCEL PROFILE	EFFECTIVE CONCRETE THICKNESS (MM) FOR DESIGN CALCULATIONS
110	37.8
155	69.2
200	70.4
275	94.5

NOTE: Capacity for this design action primarily provided by the steel reinforcement within the web holes, not the effective concrete thickness. High capacities can still be achieved through the use of steel reinforcement.

HORIZONTAL INTERFACE SHEAR ABOVE AND UNDERNEATH WALL



DINCEL PROFILE	EFFECTIVE CONCRETE THICKNESS (MM) FOR DESIGN CALCULATIONS
110	105
155	150
200	192
275	270

NOTE: Above effective concrete thickness applies for where a Guide Track or other accessories are not used underneath the wall. For this reason, a Guide Track is not recommended for shear walls (instead angles should be used on the external faces).

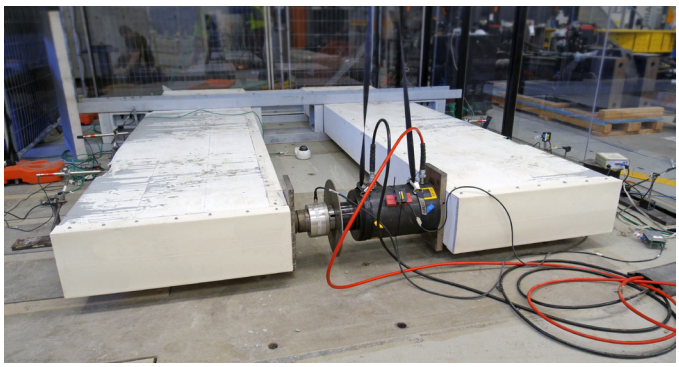
E.1.2. COMPOSITE DESIGN METHOD

Testing completed at the University of Technology Sydney (UTS) has demonstrated that the 'standard' design method described in Section E.1.1 is conservative as it does not take into account the strength that the polymer formwork provides to the walling section. The polymer formwork behaves compositely with the concrete infill and provides a confinement effect to the concrete within the Dincel panels. This additional strength has been observed from testing carried out by the University of Technology Sydney (UTS).

Testing for Dincel 275 determined the actual composite capacity for out-of-plane vertical bending, in-plane vertical interface shear (between panels) and ductility/stiffness. As part of the report, UTS provided factored capacities which can be adopted by engineers within their designs. Use of test data in lieu of calculation is permitted as part of AS3600:2018 Appendix B. Testing was completed with the following infill types:

- Plain mass concrete
- Macro synthetic fibre (BarChip) reinforced concrete
- Steel bar reinforced concrete

The results of the UTS report can be downloaded by scanning the QR Code. The following design actions were tested:



Stiffness Testing

Flexural Testing

Shear Testing

E.2. REINFORCEMENT PLACEMENT – 1 LAYER

E.2.1. DINCEL 110 & 155

E.2.1.1. Main Profiles

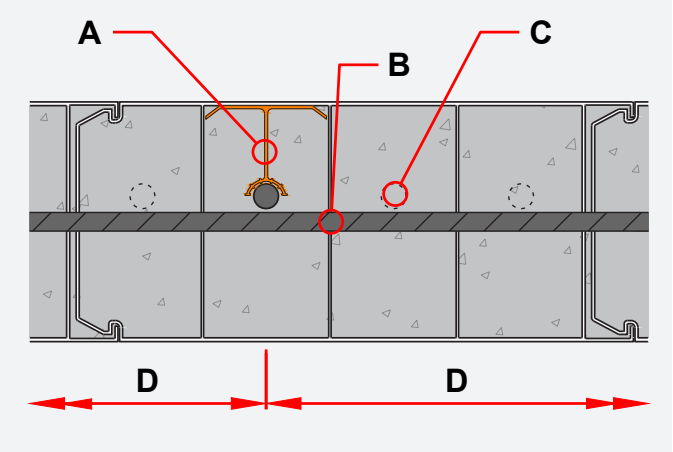
A - Vertical steel reinforcement, if required, secured to D-VRC or similar.

- Bars should be secured to the provided clips/chairs at the bottom, middle and top of the bars.
- At the top of the wall, vertical bars should be tied to a supporting element such as horizontal reinforcement, panel webbing, or temporary horizontal timber/steel bar (lace bar).

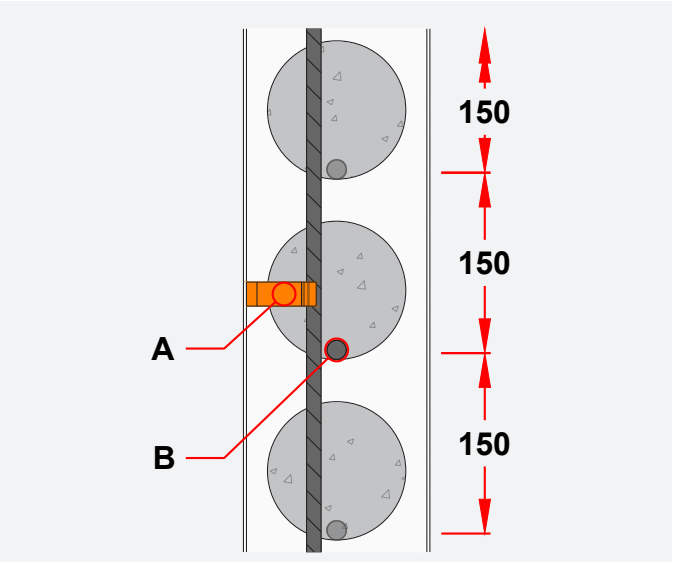
B - Horizontal steel reinforcement, if required, at 150mm increments (to line up with panel horizontal web holes).

C - Additional vertical bars can be placed at adjacent cells, if required. See Section A.4 for cell dimensions.

D - Spacing between vertical steel reinforcement in wall is 333mm where one set of bars are placed per panel.



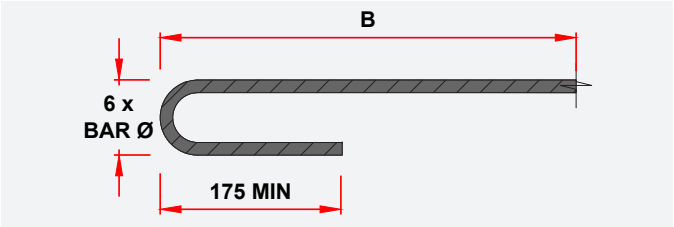
Plan View



Section View

E.2.1.2. Corners

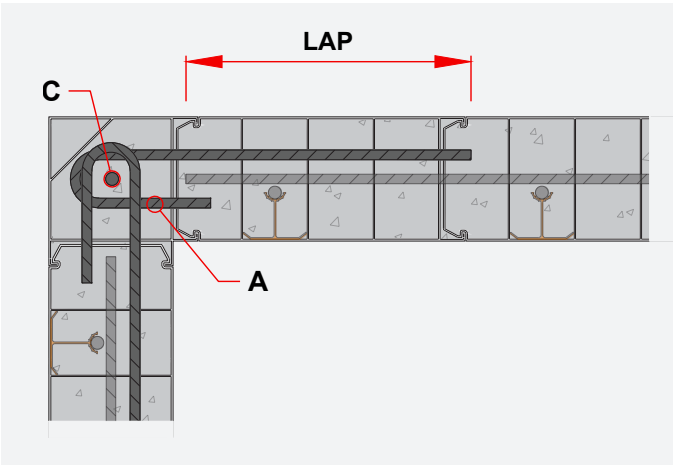
A - Max N12 hook bars, provided at 150, 300 or 450 centres. If > N12 is required, use 2 x N12 hook bars paired together.



B - Hook bar leg to suit required lap length with horizontal bar.

C - Corner vertical bar, inserted following hook bar placement. Do not place starter bar in corner, otherwise hook bars cannot be inserted.

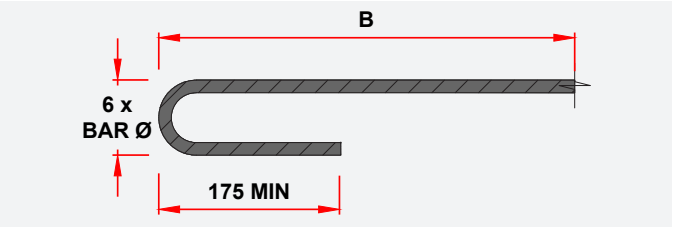
NOTE: Hook bars can be substituted for straight bars (dowels) where structural continuity not required, such as for non-shear walls.



E.2.1.3. T-Junctions

A - Cut 85ø holes (for 110 Dincel) or 115ø holes (for 155 Dincel) at 150mm centres, to match holes in main profile.

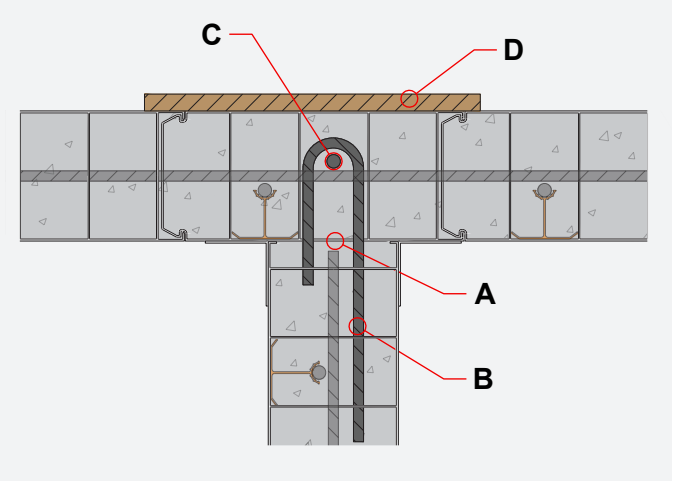
B - Max N12 hook bars, provided at 150, 300 or 450 centres.



C - Vertical bar inserted following hook bar placement.

D - Bracing required on opposite end of T-Junction to prevent bulging. For bracing and installation details refer to section F.11.7.

NOTE: Detail intended for where structural continuity is required. Otherwise, dowel only connection can be used instead of hook bars. Dowel only connection will eliminate the requirement to cut holes in panels.



E.2.2. DINCEL 200

E.2.2.1. Main Profiles

A - Vertical steel reinforcement, if required, secured to P-VRC or similar.

- Bars should be secured to the provided clips/chairs at the bottom, middle and top of the bars.
- At the top of the wall, vertical bars should be tied to a supporting element such as horizontal reinforcement, panel webbing, or temporary horizontal timber/steel bar (lace bar).

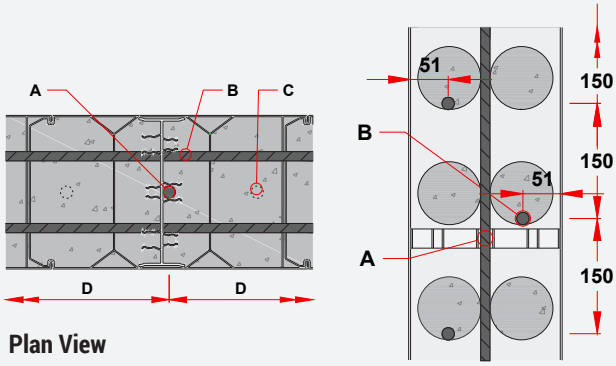
B - Horizontal steel reinforcement, if required, at 150mm increments (to line up with panel horizontal web holes).

C - Additional vertical bars can be placed at adjacent cells, if required. See Section A.4 for cell dimensions.

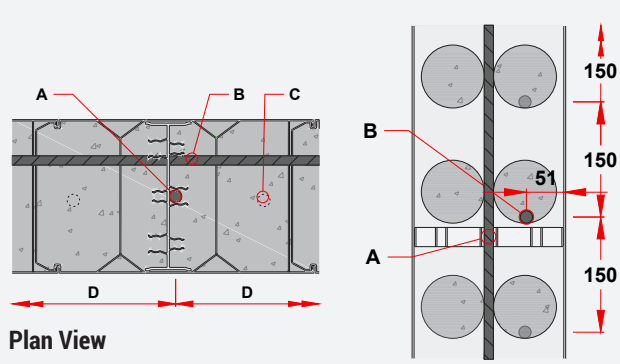
D - Spacing between vertical steel reinforcement in wall is 333mm where one set of bars are placed per panel.

NOTE: Bar spacing from outer skin shown above applies for N12 bars. Measurement is taken from skin inner to bar centre.

Option 1 – Stagger bars

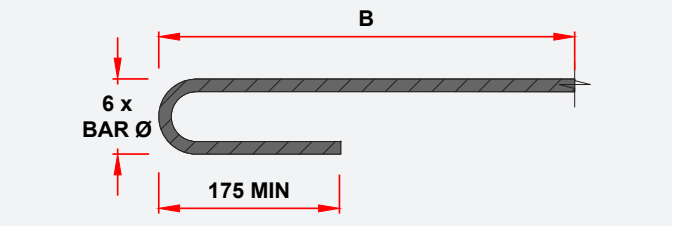


Option 2 – Horizontals to one face



E.2.2.2. Corners

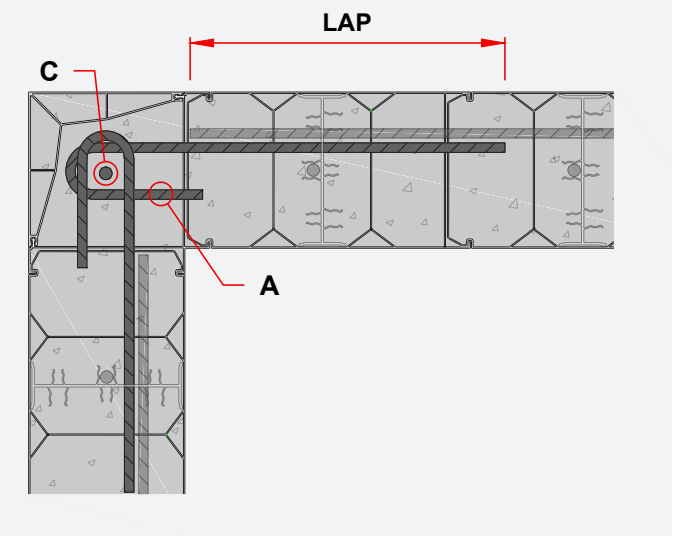
A - Max N12 hook bars, provided at 150, 300 or 450 centres. If > N12 is required, use 2 x N12 hook bars paired together, or use U-bar. Return leg of hook bar to be seated on adjacent hole of 200 profile.



B - Hook bar leg to suit required lap length with horizontal bar.

C - Corner vertical bar, inserted following hook bar placement. Do not place starter bar in corner, otherwise hook bars cannot be inserted.

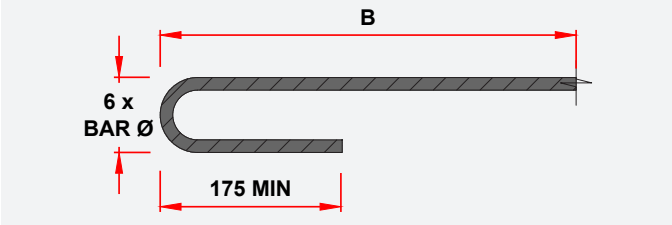
NOTE: Hook bars can be substituted for straight bars (dowels) where structural continuity not required, such as for non-shear walls.



E.2.2.3. T-Junctions

A - Cut 115Ø holes at 150mm centres to match holes in main profile, or remove panel as shown in Detail F.11.7.2.

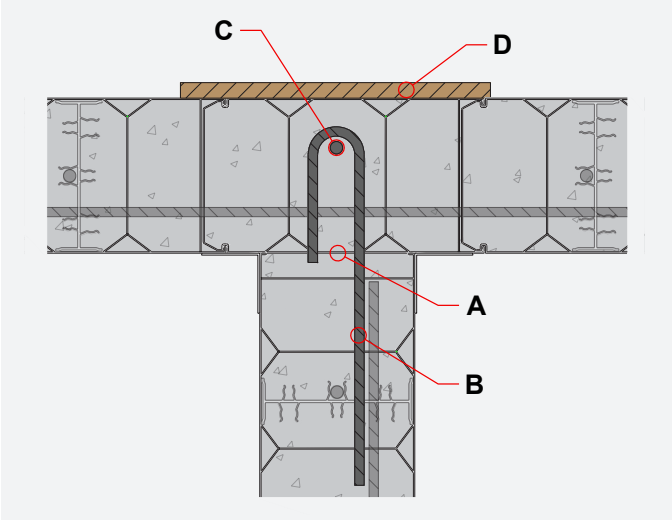
B - Max N16 hook bars, provided at 150, 300 or 450 centres. Dimension 'B' to suit required lap length with horizontal bar.



C - Vertical bar inserted following hook bar placement.

D - Bracing required on opposite end of T-Junction to prevent bulging. For bracing and installation details refer to section F.11.7.

NOTE: Detail intended for where structural continuity is required. Otherwise, dowel only connection can be used instead of hook bars. Dowel only connection will eliminate the requirement to cut holes in panels.



E.3. REINFORCEMENT PLACEMENT – 2 LAYERS

E.3.1. DINCEL 200

E.3.1.1. Main Profiles

A - Vertical steel reinforcement, if required, secured to P-VRC or similar.

- Bars should be secured to the provided clips/chairs at the bottom, middle and top of the bars.
- At the top of the wall, vertical bars should be tied to a supporting element such as horizontal reinforcement, panel webbing, or temporary horizontal timber/steel bar (lace bar).

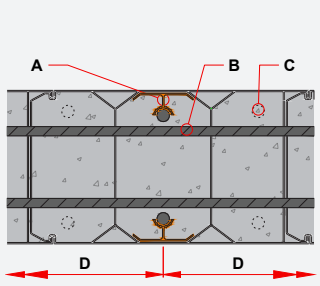
B - Horizontal steel reinforcement, if required, at 150mm increments (to line up with panel horizontal web holes).

C - Additional vertical bars can be placed at adjacent cells, if required. See Section A.4 for cell dimensions.

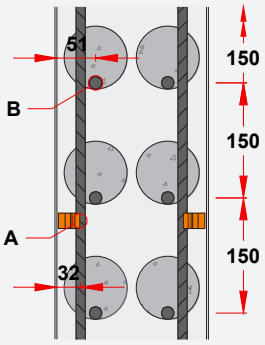
D - Spacing between vertical steel reinforcement in wall is 333mm where one set of bars are placed per panel.

NOTE: Bar spacing from outer skin shown above applies for N12 bars. Measurement is taken from skin inner to bar centre.

Option 1 – Vertical bars to outer faces (horizontal bars placed first)

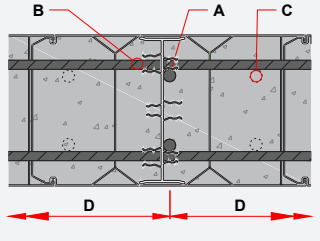


Plan View

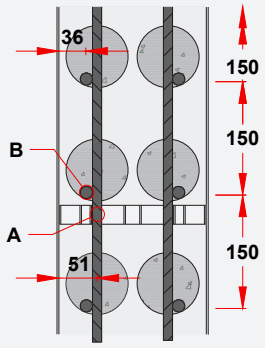


Section View

Option 2 – Horizontal bars to outer faces (vertical bars placed first)



Plan View



Section View

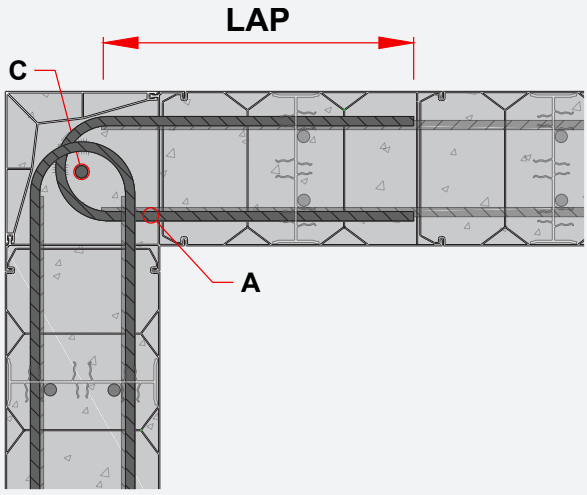
E.3.1.2. Corners

A - N12, N16 or N20 U-bars, provided at 150, 300 or 450 centres.

X = 135, or to suit required cover.
Insert U-bar by sliding the P-5 corner cover up. Where access is insufficient, pre-construct 2xP1 panels and 1xP-5 with reinforcement within and move to required position.

B - U-bar leg to suit required lap length with horizontal bar.

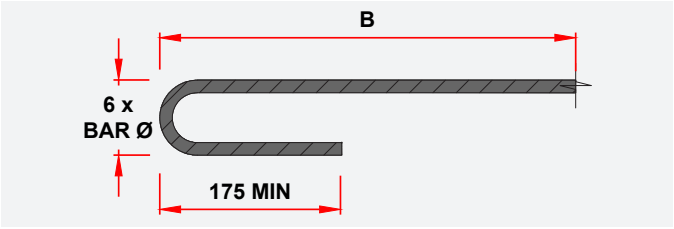
C - Corner vertical bar, inserted following U-bar placement. If there is no access to exterior corner face, do not place starter bar in corner, otherwise U-bars cannot be inserted.



E.3.1.3. T-Junctions

A - Cut 115ø holes at 150mm centres to match holes in main profile, or remove panel as shown in Detail F.11.7

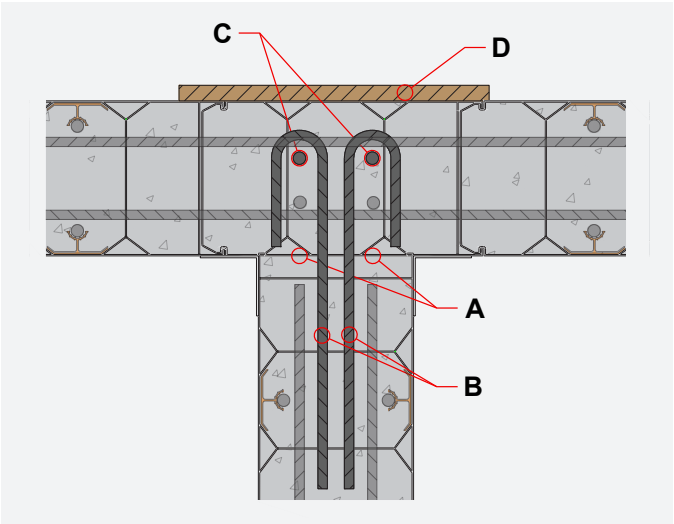
B - Max N12 hook bars, provided at 150, 300 or 450 centres. Dimension 'B' to suit required lap length with horizontal bar.



C - Vertical bar inserted following hook bar placement.

D - Bracing required on opposite end of T-Junction to prevent bulging. For bracing and installation details refer to section F.11.7.

NOTE: Detail intended for where structural continuity is required. Otherwise, dowel only connection can be used instead of hook bars. Dowel only connection will eliminate the requirement to cut holes in panels.



E.3.2. DINCEL 275

E.3.2.1. Main Profiles

A - Vertical steel reinforcement, if required, secured to P-VRC or similar.

- Bars should be secured to the provided clips/chairs at the bottom, middle and top of the bars.
- At the top of the wall, vertical bars should be tied to a supporting element such as horizontal reinforcement, panel webbing, or temporary horizontal timber/steel bar (lace bar).

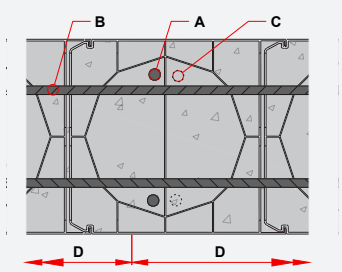
B - Horizontal steel reinforcement, if required, at 150mm increments (to line up with panel horizontal web holes).

C - Additional vertical bars can be placed at adjacent cells, if required. See Section A.4 for cell dimensions.

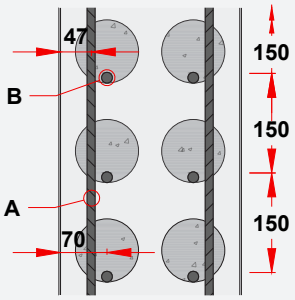
D - Spacing between vertical steel reinforcement in wall is 275mm where one set of bars are placed per panel.

NOTE: Bar spacing from outer skin shown above applies for N12 bars. Measurement is taken from skin inner to bar centre.

Option 1 – Vertical bars to outer faces (preferred - horizontal bars placed first)

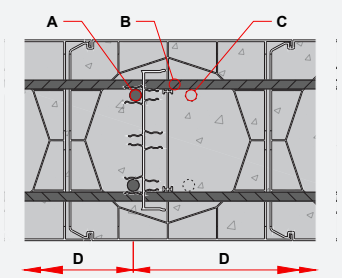


Plan View

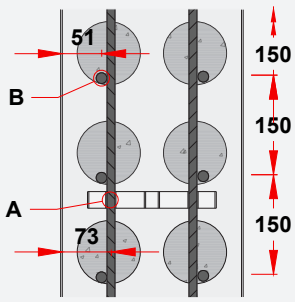


Section View

Option 2 – Horizontal bars to outer faces (vertical bars placed first)



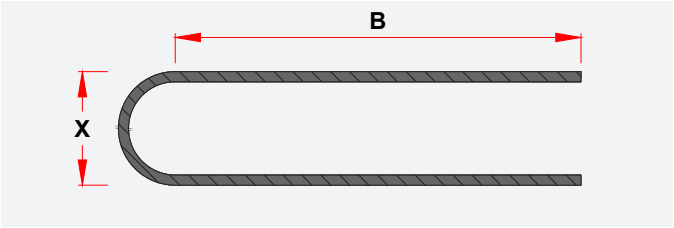
Plan View



Section View

E.3.2.2. Corners (Option 1)

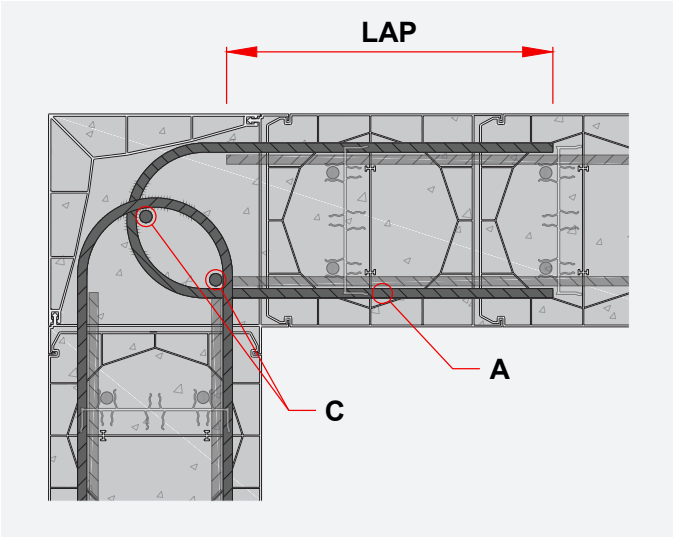
A - N12, N16 or N20 U-bars, provided at 150, 300 or 450 centres.



X = 200, or to suit required cover.
Insert U-bar by sliding the P-5 corner cover up. Where access is insufficient, pre-construct 2xP1 panels and 1xP-5 with reinforcement within and move to required position.

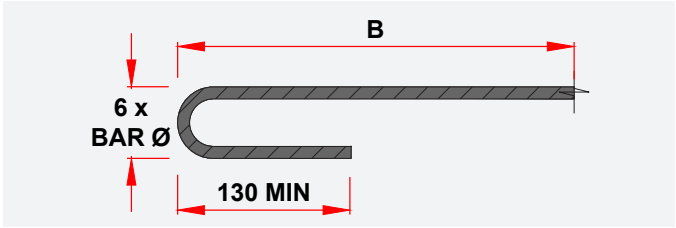
B - U-bar leg to suit required lap length with horizontal bar.

C - Corner vertical bar, inserted following U-bar placement. If there is no access to exterior corner face, do not place starter bar in corner, otherwise U-bars cannot be inserted.



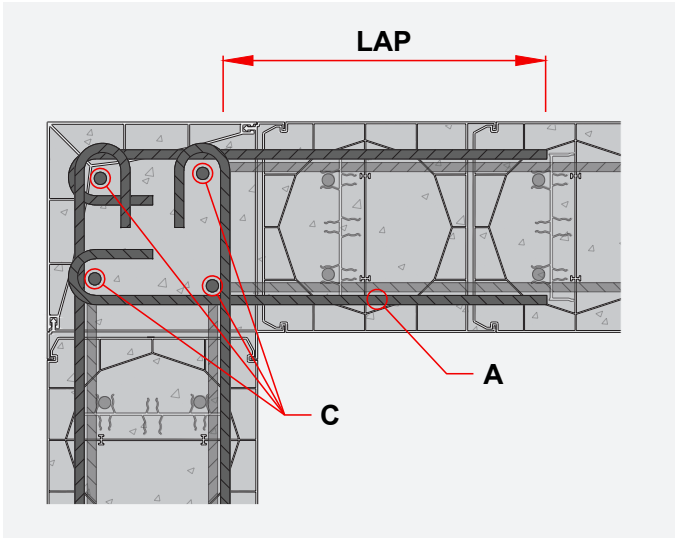
E.3.2.2. Corners (Option 2)

A - N12, N16 or N20 U-bars, provided at 150, 300 or 450 centres.



B - Dimension 'B' to suit required lap length with horizontal bar.

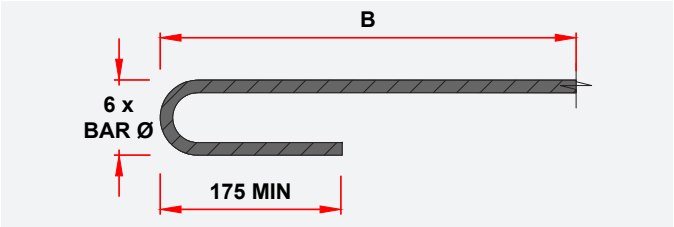
C - Corner vertical bars, inserted following hook bar placement. If there is no access to exterior corner face, do not place any starter bars in corner, otherwise hook bars cannot be inserted.



E.3.2.3. T-Junctions

A - Cut 2 x 95ø holes at 150mm centres to match holes in main profile, or remove panel as shown in Detail F.11.7

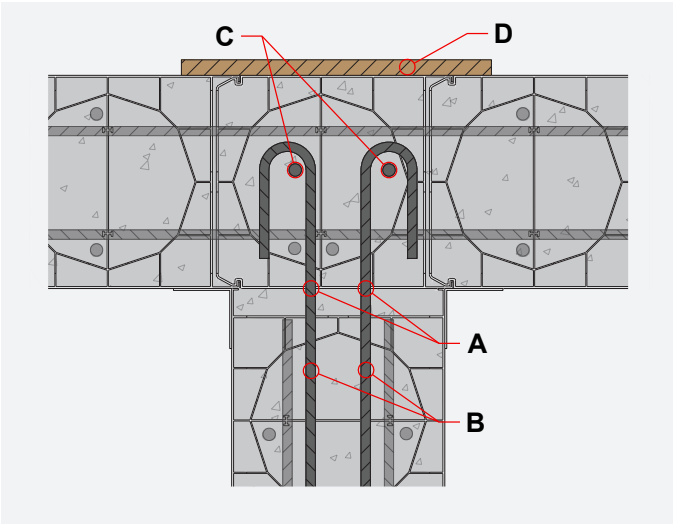
B - Max N12 hook bars, provided at 150, 300 or 450 centres. Dimension 'B' to suit required lap length with horizontal bar.



C - Vertical bar inserted following hook bar placement.

D - Bracing required on opposite end of T-Junction to prevent bulging. For bracing and installation details refer to section F.10.7.

NOTE: Detail intended for where structural continuity is required. Otherwise, dowel only connection can be used instead of hook bars. Dowel only connection will eliminate the requirement to cut holes in panels.



E.4. OTHER REINFORCEMENT DETAILING

E.4.1. STARTER BARS

The open cell design of Dincel panels ensures easy starter bar placement. Starter bars can be provided as post-fixed (drill & epoxy) or cast-in, depending on structural requirements.

It is recommended to provide the spacings of starter bars to match Dincel panel sizes where possible. Preferred spacing options have been provided in the following pages. It is important to note that any spacing between starter bars can be accommodated within Dincel panels. However, a spacing which does not align with Dincel panel sizes will increase the likelihood of a bar clashing with a web.

In the event of a starter bar clash with a web:

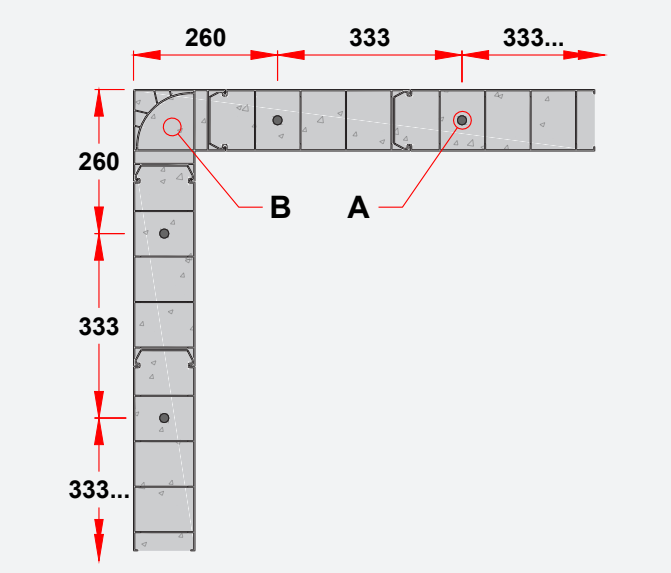
- When the bars are post-fixed (drill & epoxy) the installer can simply move the bar to the left or right of the web. Starter bars should be post-fixed during panel installation rather than before.
- When the bars are cast-in, the starter bar can be slightly cranked in order to avoid the clash (subject to engineer's approval).

When positioning starter bars, a template (sample panel) can be used to assist with placement of starter bar locations.

E.4.1.1. Dincel 110

A - Starter bars. If required, starter bars can be placed in adjacent cells of panel.

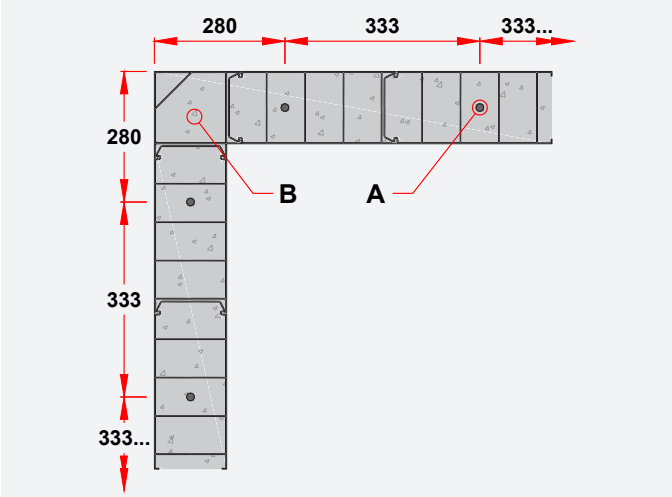
B - Where hook bars are used for corner reinforcement, do not place starter bar at corner as this will prevent insertion for the bottom portion of wall.



E.4.1.2. Dincel 155

A - Starter bars. If required, starter bars can be placed in adjacent cells of panel.

B - Where hook bars are used for corner reinforcement, do not place starter bar at corner as this will prevent insertion for the bottom portion of wall.



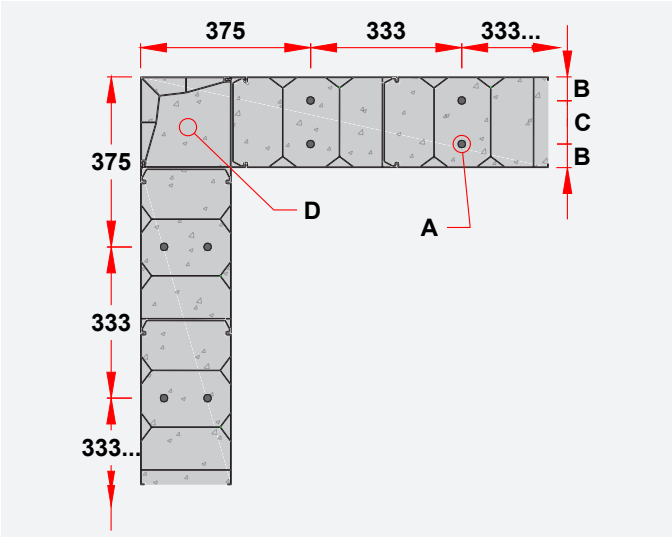
E.4.1.3. Dincel 200

A - Starter bars. If required, starter bars can be placed in adjacent cells of panel. Starter bars can be provided central or each face depending on requirements.

B - To suit selected reinforcement detailing (see Section E.3.1.1.

C - To suit selected reinforcement detailing (see Section E.3.1.1.

D - Only provide starter bars to corner if access is provided to outside face (to allow for insertion of horizontal U-bars).



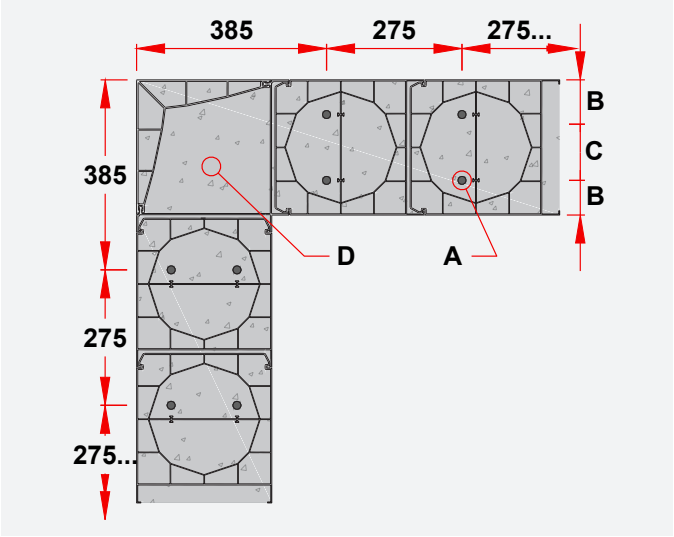
E.4.1.4. Dincel 275

A - Starter bars. If required, starter bars can be placed in adjacent cells of panel. Starter bars can be provided central or each face depending on requirements.

B - To suit selected reinforcement detailing (see Section E.3.2.1.

C - To suit selected reinforcement detailing (see Section E.3.2.1.

D - Only provide starter bars to corner if access is provided to outside face (to allow for insertion of horizontal U-bars).



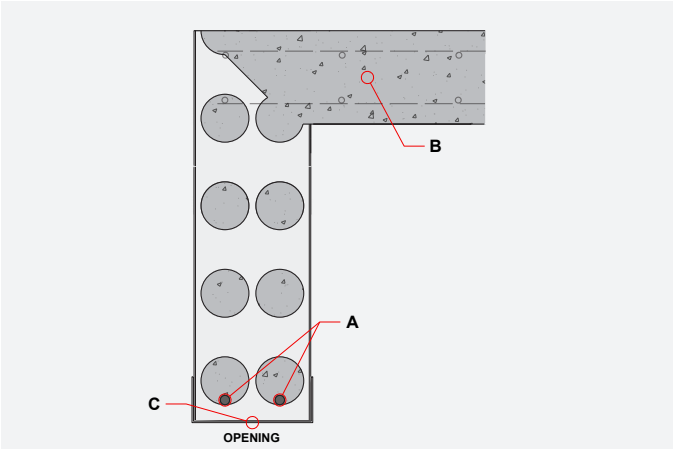
E.4.2. LINTELS

E.4.2.1. Option 1 – Standard Lintel

A - Horizontal reinforcement as required to design lintel as concrete beam.

B - Concrete slab over with reinforcement to engineer's requirements.

C - Finish to underside of Dincel lintel, if required. Refer to Section C.6.2.



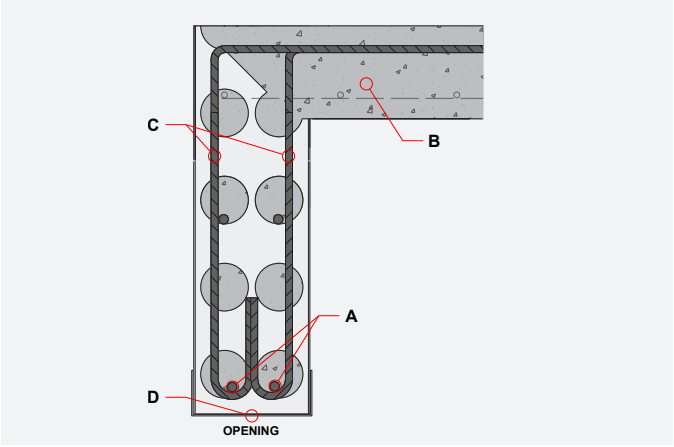
E.4.2.1. Option 2 – Highly Loaded Lintel

A - Horizontal reinforcement as required to design lintel as concrete beam.

B - Concrete slab over with reinforcement to engineer's requirements.

C - Provide L-bars with hook ends to work as L-beam with slab. Alternatively, L-bars can be replaced with stirrups as shear reinforcement. Vertical reinforcement should be tied to horizontal reinforcement from underside of lintel during construction.

D - Finish to underside of Dincel lintel, if required. Refer to Section C.6.2.



E.4.3. BOUNDARY ELEMENTS

E.4.3.1. Structures Less Than Four Storeys

A - Min N12 U-bar, to lap with horizontal wall reinforcement.

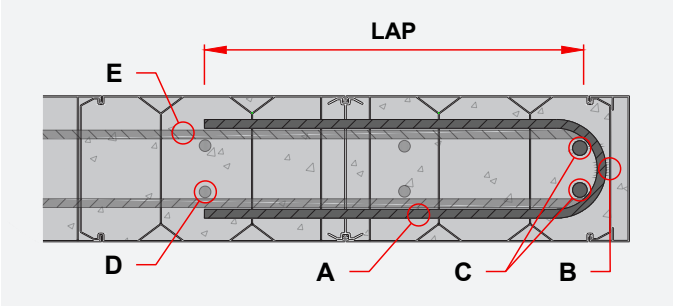
B - Dincel 'Column' panel (200P-1C/275P-1C) ordered, with webbing between web holes pre-removed to allow for insertion of U-bar. Alternatively, webbing can be removed onsite (refer to Section F.9).

C - 2 x N16 vertical bars.

D - Vertical wall reinforcement if required.

E - Horizontal wall reinforcement if required.

NOTE: Detail is based upon requirements of AS3600:2-18 14.6.2.2. Designer must consider project specific conditions before selecting detail. This detail is only required where the portion of wall is considered a boundary element.

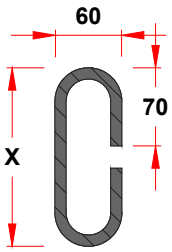


E.4.3.2. Structures More Than Four Storeys

A - Min N12 U-bar, to lap with horizontal wall reinforcement.

B - Dincel 'Column' panel (200P-1C/275P-1C) ordered, with webbing between web holes pre-removed to allow for insertion of U-bar. Alternatively, webbing can be removed onsite (refer to Section F.9).

C - R10 hook ties attached to vertical bars. Ties must be fixed to vertical bars before inserting into wall and assembly inserted prior to horizontal reinforcement.

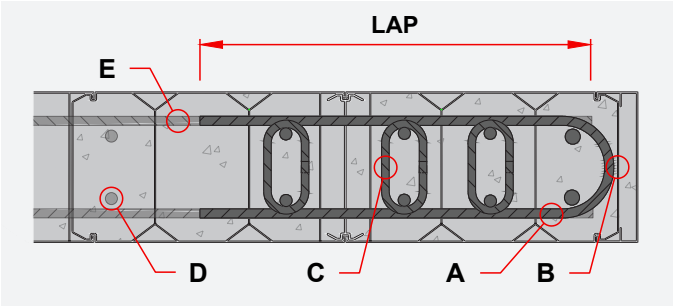


200 Dincel: X = 125mm
275 Dincel: X = 160mm

D - Vertical wall reinforcement if required.

E - Horizontal wall reinforcement if required.

NOTE: Detail is based upon requirements of AS3600:2-18 14.6.2.3. Designer must consider project specific conditions before selecting detail. This detail is only required where the portion of wall is considered a boundary element.



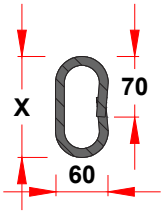
E.4.4. HIGHLY LOADED BLADE WALL

E.4.4.1. 200 Dincel

A - Dincel 'Column' panels (200P-1C) ordered, with webbing between web holes pre-removed to allow for insertion of U-bar. Alternatively, webbing can be removed onsite (refer to Section F.9).

B - Starter bars located clear of vertical bars, ties and Dincel profile webs.

C - Optional R10 hook ties attached to vertical bars, if required for additional restraint. Ties must be fixed to vertical bars before inserting into wall by tack welding or tie-wire.

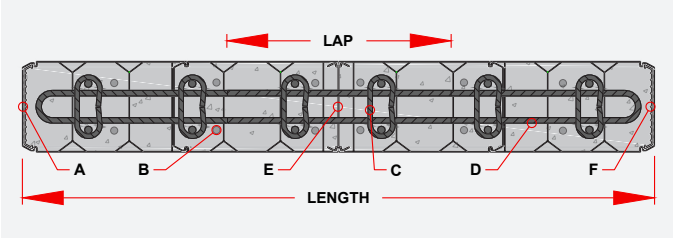


D - N12 U-bars at 150 or 300 centres, inserted from each end and lapped in centre.

X = 72mm

E - Joiner accessory (required if Stop Ends are used on either side).

F - After insertion of horizontal reinforcement, Stop End accessory slid down profile minimising bracing requirements. Alternatively, an Clip-On End Cap accessory + bracing can be used.
If wall is exposed and unlined (i.e. basement carpark wall), additional finishing to wall ends can be considered. Refer to Section C.6.1.

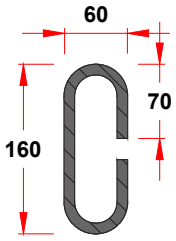


E.4.4.2. 275 Dincel

A - Dincel 'Column' panels (275P-1C) ordered, with webbing between web holes pre-removed to allow for insertion of U-bar. Alternatively, webbing can be removed onsite (refer to Section F.9).

B - Starter bars located clear of vertical bars, ties and Dincel profile webs.

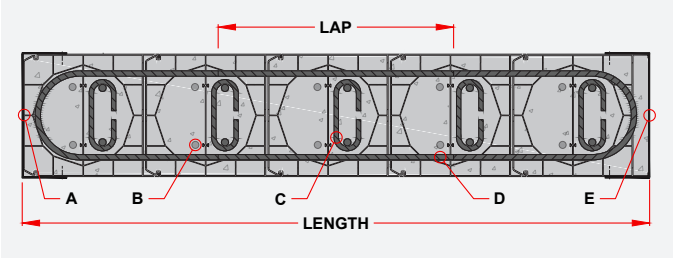
C - Optional R10 hook ties attached to vertical bars, if required for additional restraint. Ties must be fixed to vertical bars before inserting into wall by tack welding or tie-wire.



D - N12 or N16 U-bars at 150 or 300 centres, inserted from each end and lapped in centre

E - If wall is exposed and unlined (i.e. basement carpark wall), additional finishing to wall ends can be considered. Refer to Section C.6.1.

E - After insertion of horizontal reinforcement, Stop End accessory slid down profile minimising bracing requirements. Alternatively, an Clip-On End Cap accessory + bracing can be used.
If wall is exposed and unlined (i.e. basement carpark wall), additional finishing to wall ends can be considered. Refer to Section C.6.1.



DINCEL 200 - STANDARD BLADE WALL SIZES

BLADE WALL LENGTH		DINCEL PROFILES & ACCESSORIES		
TOTAL LENGTH (MM)	CONCRETE LENGTH (MM)	P-1	P-J	P-SE
1060	1040	3	1	2
1393	1373	4	1	2
1726	1706	5	1	2
Custom – Any Length		Cut 1xP1 main profile to suit required wall width. Splice panels together after cutting (Refer to Section F.8.1)		

DINCEL 275 - STANDARD BLADE WALL SIZES

BLADE WALL LENGTH		DINCEL PROFILES
TOTAL LENGTH (MM)	CONCRETE LENGTH (MM)	P-1
1135	1127	4
1410	1402	5
1685	1677	6
1960	1952	7
Custom – Any Length		Cut 1xP1 main profile to suit required wall width. Splice panels together after cutting (Refer to Section F.8.1)

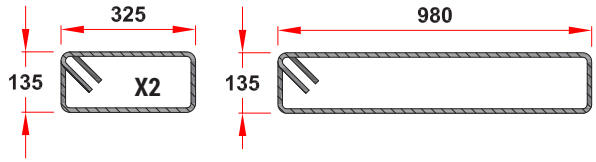
E.4.5.COLUMNS

E.4.5.1. 200 Dincel

A - Dincel 'Column' panels (200P-1C) ordered, with centre webbing pre-removed to make centre hole. Alternatively, webbing can be removed onsite (refer to Section F.9)

B - Starter bars located clear of vertical bars, ties and Dincel profile webs.

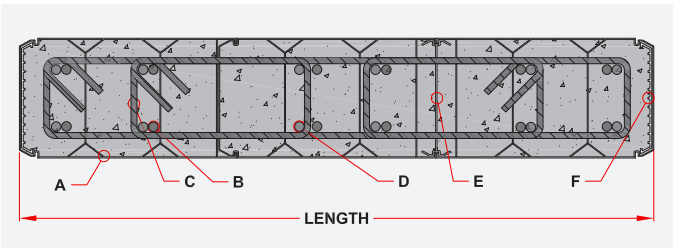
C - Insert R10 closed ties as required. Alternate tie detailing to AS3600 can be considered.



D - Vertical bars, placed into position after inserting ties.

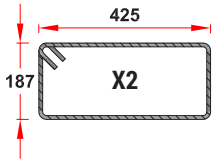
E - Joiner accessory (required if stop ends are used on either side).

F - After insertion of horizontal reinforcement, Stop End accessory slid down profile minimising bracing requirements. Alternatively, an Clip-On End Cap/Screw-On Cap accessory + bracing can be used. Refer to section F11.5.
If wall is exposed and unlined (e.g. basement carpark wall), additional finishing to wall ends can be considered. Refer to Section C.6.1.



E.4.5.2. 275 Dincel

A - Dincel 'Column' panels (275P-1C) ordered with centre webbing pre-removed to make centre hole. Alternatively, webbing can be removed onsite (refer to Section F.9)

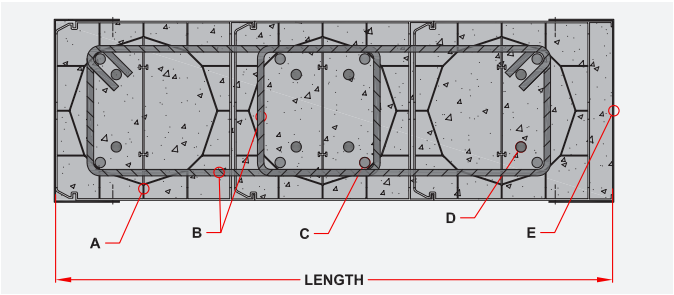


B - Insert R10 closed ties as required. Alternate tie detailing to AS3600 can be considered.

C - Vertical bars, placed into position after inserting ties.

D - Starter bars located clear of vertical bars, ties and Dincel profile webs.

E - After insertion of horizontal reinforcement, 3mm metal "C"-Cap (screwed every 200mm (8-18 x 25mm button head) can be used without bracing. Otherwise, use either Clip-On End Cap or Screw-On Cap with bracing. Refer section F.11.5.
If wall is exposed and unlined (e.g. basement carpark wall), additional finishing to wall ends can be considered. Refer to Section C.6.1



DINCEL 200 – COLUMN SIZES

COLUMN LENGTH		DINCEL PROFILES & ACCESSORIES		
TOTAL LENGTH (MM)	EFFECTIVE CONCRETE LENGTH (MM)	P-1	P-J	P-SE
727	707	2	1	2
1060	1040	3	1	2
Custom – Any Length		Cut 1xP1 main profile to suit required wall width. Splice panels together after cutting (Refer to Section F.8.1)		

DINCEL 275 – COLUMN SIZES

COLUMN LENGTH		DINCEL PROFILES				
TOTAL LENGTH (MM)	EFFECTIVE CONCRETE LENGTH (MM)	275P-1C	3MM METAL "C" CAP	CLOSED TIES	SCREWS	PVC ANGLE
586	540	2	2	150mm	Every 200mm	1 x 2.4m
861	815	3	2	150mm	Every 200mm	1 x 2.4m
1136	1090	4	2	150mm	Every 200mm	1 x 3.0m
Custom – Any Length		Cut 1x275P-1C main profile to suit required column length. Splice panels together after cutting (Refer to section F.8.1)				

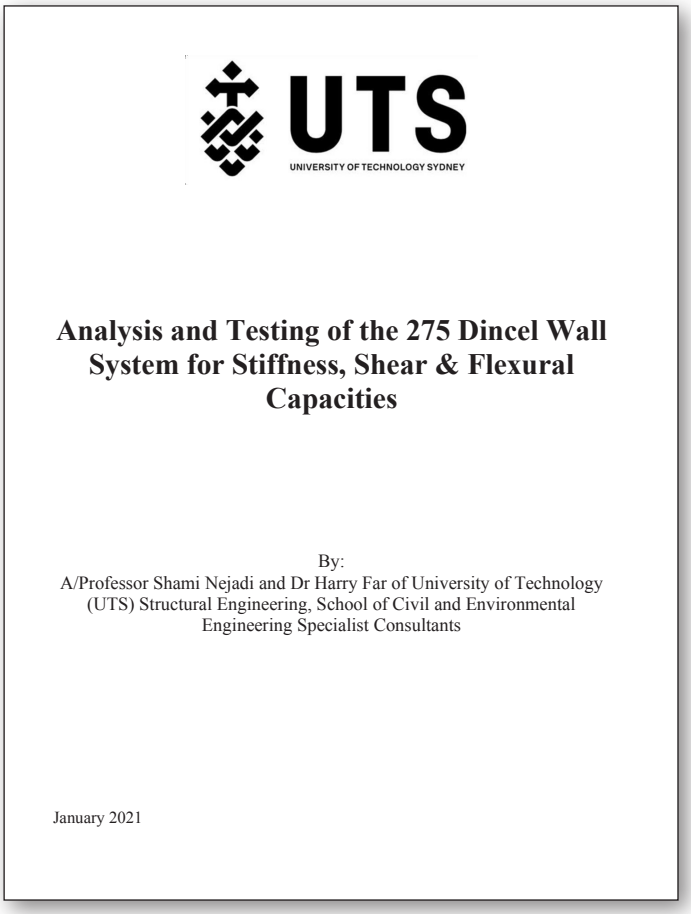
E.4.6. SYNTHETIC FIBRE REINFORCEMENT

In lieu of steel reinforcement bars, synthetic fibre reinforcement can be considered by the design engineer. The use of synthetic fibre reinforcement added to a concrete mix instead of steel reinforcement bars will result in the following benefits:

- No possibility of corrosion
- Reduction in labour costs
- Reduction in carbon emissions
- Increased safety during installation
- Increased speed of construction

BarChip 48 Macro Synthetic Fibre has been tested within Dincel Walling and is recommended as a suitable replacement to steel bar reinforcement. To download a copy of the UTS test report, please download by scanning the QR Code below:

UTS certify within the report that BarChip 48 macro synthetic fibres can be used instead of steel reinforcement bars in accordance with the testing carried out to AS3600:2018 Appendix B.



UTS
UNIVERSITY OF TECHNOLOGY SYDNEY

Analysis and Testing of the 275 Dincel Wall System for Stiffness, Shear & Flexural Capacities

By:
A/Professor Shami Nejadi and Dr Harry Far of University of Technology (UTS) Structural Engineering, School of Civil and Environmental Engineering Specialist Consultants

January 2021

E.4.7. STEEL REINFORCEMENT SPECIFICATIONS

It is important to consider the thickness of bar sizes, spacings and placement in order to ensure that adequate concrete compaction is achieved. Specifications surrounding the permissible steel reinforcement within the Dincel wall system is provided below.

Maximum Permissible Steel Reinforcement for Adequate Compaction:

		1 LAYER OF REINFORCEMENT		2 LAYERS OF REINFORCEMENT	
		HORIZONTAL	VERTICAL	HORIZONTAL	VERTICAL
110 DINCEL	Max Bar Size	N12	N16	-	-
	Min Bar Spacing (mm)	150	166	-	-
	Bar Positioning	Central	Central	-	-
155 DINCEL	Max Bar Size	N16	N20	-	N16
	Min Bar Spacing (mm)	150	166	-	166
	Bar Positioning	Central	Central or one face	-	At each face
	Min Concrete Cover (mm)	20	-	20	-
200 DINCEL	Max Bar Size	N16	N20	N16	N20
	Min Bar Spacing (mm)	150	166	150	166
	Bar Positioning	At one face	Central or one face	At each face	At each face
	Min Concrete Cover (mm)	30	20	30	20
275 DINCEL	Max Bar Size	N20	N28[1]	N20	N28[1]
	Min Bar Spacing (mm)	150	275[1]	150	275[1]
	Bar Positioning	At one face	At one face	At each face	At each face
	Min Concrete Cover (mm)	30	30	30	30

General Notes

[1] If closer spacing is required, 2 x N20 bars each face can be placed within each main profile (1 x N20 bar each face, on either side of the central web).

- Maximum 1 bar to be lapping with another 1 bar at any given location. Bar bundling is not permitted, unless the bar size is restricted to N12 and with 2 bars only.
- For walls where steel bar reinforcement is placed at each face, the clear space at the centre of the wall between the horizontal/vertical bars is required to be a minimum of 60mm.
- The maximum steel reinforcement permissible within AS3600:2018 must also not be exceeded.
- The cover nominated above represents the minimum requirement for compaction purposes only. Consideration should be given by the designer for the concrete cover requirements specified in AS3600:2018 T4.10.3.2 and 4.10.3.3 for rigid formwork (i.e. Dincel formwork).
- Depending on the application, the designer may decide to design to AS 3600 or AS 3735. If the design is to AS 3735-2001: Clause 3.2.2(b) is for the restrained concrete case which will eventuate in more steel being used in comparison to Clause 3.2.2(a). The relevant reinforcement ratio for the restrained concrete case can be reduced if Clause 3.2.2(b)(i) or (ii) are applicable, which allows for a reduction of the reinforcement ratio provided that movement or partial movement joints are provided at the nominated maximum spacings. These “joints” which AS 3735 refers to could be considered to be provided in the form of the Dincel webs. These webs induce cracks in the concrete at the plastic stage, and autogenous healing fills these very small cracks (these cracks being less than 0.1mm in width when the crack inducers are at 0.125m centres in the case of 200 Dincel as endorsed/certified by the UNSW). In the case of 275 Dincel, the crack inducers are located at 0.275m/2 = 0.137m centres.

E.5. DETERMINING FRP

In accordance with the NCC, some building elements are required to have a Fire Resistance Period (FRP) no less than the stated Fire Resistance Level (FRL).

The components of FRP include components of structural adequacy, integrity and insulation. The below table provides an overview of how they are determined:

	STRUCTURAL ADEQUACY	LAYER INTEGRITY	INSULATION
DESCRIPTION	The ability to maintain stability and load bearing capacity as per AS 1530.4.	At each face	At each face
FRP DETERMINATION USING AS 3600:2018	AS 3600:2018 Table 5.7.2 OR By method of calculation using Eurocode (as permitted in Clause 5.3.1 b)	AS 3600:2018 5.3.1 If structural adequacy and insulation are satisfied, integrity is deemed to be satisfied as well. The value is assumed as the lesser of the two other values.	AS 3600:2018 5.3.1 If structural adequacy and insulation are satisfied, integrity is deemed to be satisfied as well. The value is assumed as the lesser of the two other values.

As shown above, the insulation and integrity components are relatively straight forward to determine using the tables provided within AS3600:2018. For the structural adequacy component, Clause 5.3 of AS3600:2018 allows two methods of determination:

- 1. Through tabulated data provided within AS 3600:2018 (simplified method). Note this method generally results in lower values for structural adequacy.
- 2. Through calculation via EuroCode 2 'Zone Method', as permitted by AS3600:2018 Clause 5.3.1 (b). This method is a more robust approach then using the tabulated data and is generally able to provide a higher value for structural adequacy. It should be noted that EuroCode 2 also provides a simplified method (which is similar to AS3600 T5.7.2) however additionally provides a more robust approach being the "Zone Method" (which is permitted to be used under AS3600 Clause 5.3.1). For assistance in calculating structural adequacy using this method, Dincel offers a Eurocode FRP design tool upon request. Please email construction@dincel.com.au to obtain a copy.

Dincel has been subject to large scale AS 1530.4 tests to verify that the polymer skin and webbing does not adversely affect the FRL in comparison to a conventional concrete wall. For further information, please refer to Section D.2.6.

E.6. BRACING

Dincel formwork itself is capable of handling the wet concrete pressures as defined in AS 3610 – Concrete Formwork Specifications, provided that the guidelines in Section F.12.2 of this manual are adhered to by the installer. Just like conventional formwork, Dincel formwork must be suitably restrained/braced in order to be laterally stabilised against site specific factors such as wind loading and early backfilling if applicable. Brace capacities, brace spacings, brace fixings and brace/wall height are all variables which need to be taken into consideration.

The method of calculation to determine bracing requirements should be determined in accordance with the relevant Australian Standards such as AS 3610 and AS 1170. Where fixing into Dincel panels joints, the pull-out capacity achieved by fixing to a 2.5mm thick PVC sheet can be assumed.

Details have been provided below for guidance purposes and represents the minimum requirement for concreting purposes (not taking into consideration other loading such as wind and/or backfilling).

E.6.1. SECURING TO FORMWORK DECK

Where the Dincel wall height is under 3.6m, panels can be secured to the formwork deck rather than using diagonal bracing. This restraint technique will ensure faster installation and easier access for trades on the level below.

A - Dincel profile, filled with concrete on completion of bracing. Panels must be under 3.6m tall, otherwise supplement with conventional bracing and walers.

B - Formwork decking system, suitably propped and braced as required.

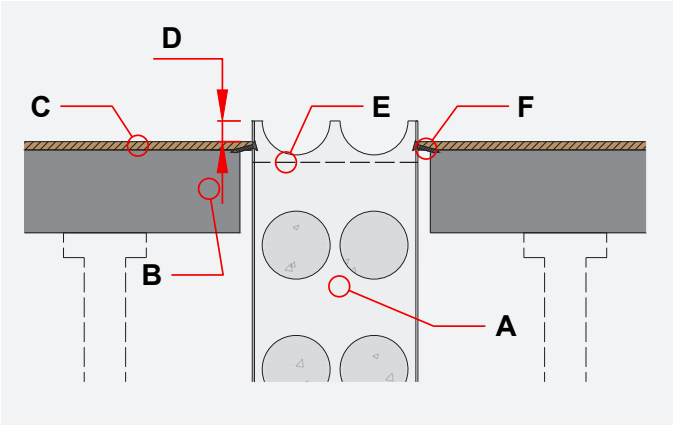
C - Plywood deck surface (min 20mm thick). Plywood to be installed snug surrounding Dincel wall.

D - 25mm lip to enable suitable edge for screw fixings. Lip also prevents deck water run-off & debris entering Dincel panels before pour.

E - Typical pour break location.

F - Screw fixings into plywood deck on one side of wall profile (typically minimum 50mm chipboard screws or minimum 50mm timber hex head screws). Screws should be placed at every panel joint location (refer to F.11.3 for screw placement guidance).

NOTE: The following is provided for illustration and guidance purposes only. Bracing of formwork must be designed by the engineer to suit site conditions.



E.6.2. DIAGONAL BRACES

Diagonal bracing is required if the Dincel panels are freestanding and there is no formwork deck to secure the top of the wall onto. If there is a formwork deck above, refer to the previous Section.

A - Continuous horizontal waler, constructed from steel (top hat) or timber.

B - Min 2 x 12g hex head screws at each panel joint location (refer to F.11.3 for screw placement guidance). Screws to be removed after concrete pour, and holes remaining provided with sealant if required.

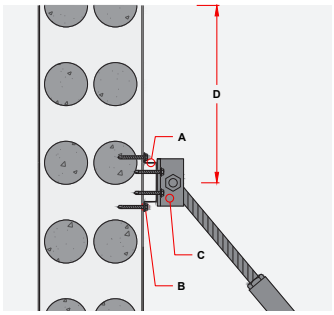
C - Adjustable 'Push-Pull' Prop/Brace.

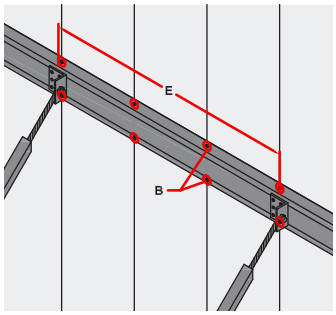
D - Position waler at 1/3rd of wall height from top of wall, or as otherwise specified by engineer. Where the wall is taller than 4m, a secondary waler with braces should be provided at the wall's mid-height.

E - Spacing between braces as specified by engineer. See below for minimum requirements.

NOTE: The following is provided for illustration and guidance purposes only. Bracing of formwork must be designed by the engineer to suit site conditions. Any wind loading and/or backfill loading has not been considered in the below.

WALL HEIGHT	SPACING BETWEEN BRACES
Up to 3.6m	Maximum 1.66m (every 5-6 panels)
3.6m to 5.0m	Maximum 1.33m (every 4-5 panels)



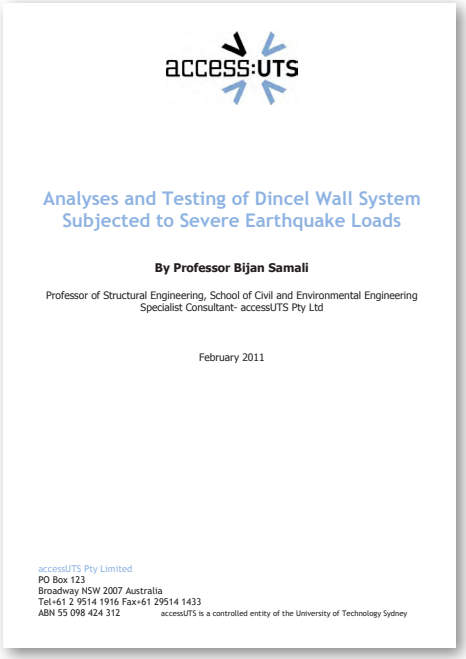


E.7. EARTHQUAKE RESISTANCE

Dincel Structural Walling has been subject to an extensive testing and assessment regime with the University of Technology Sydney (UTS) to determine the adequacy of the system in seismic regions. The tests include:

- Shake table simulations
- In-plane horizontal shear push over tests

The test results and accompanying analysis confirms the suitability of Dincel system to resist large lateral forces and resulting displacement caused by major ground motions measuring up to 9.0 on the Richter scale. The permanent polymer shell achieves this by working in conjunction with concrete and steel reinforcement to provide ductile composite action to the wall. It was also determined that the lateral stiffness of a Dincel wall is equivalent of a comparable conventional plain concrete wall.
For further information, it is recommended that the full report by the University of Technology Sydney (UTS) is downloaded by scanning on the QR Code below:


access:UTS

Analyses and Testing of Dincel Wall System Subjected to Severe Earthquake Loads

By Professor Bijan Samali

Professor of Structural Engineering, School of Civil and Environmental Engineering
Specialist Consultant- accessUTS Pty Ltd

February 2011

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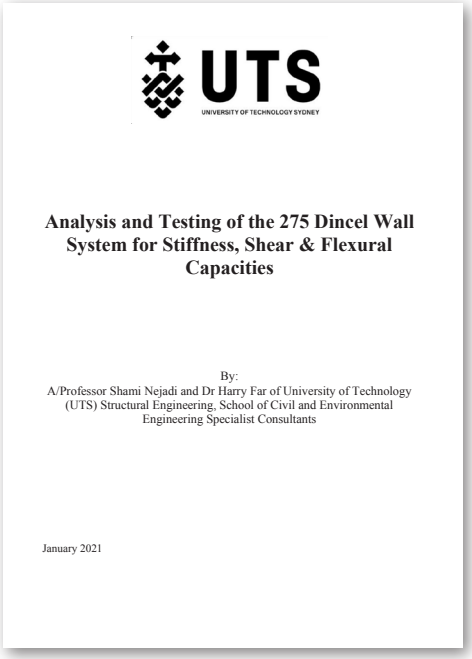
ABN 55 098 424 312 accessUTS is a controlled entity of the University of Technology Sydney


UTS
UNIVERSITY OF TECHNOLOGY SYDNEY

Analysis and Testing of the 275 Dincel Wall System for Stiffness, Shear & Flexural Capacities

By:
A/Professor Shami Nejadi and Dr Harry Far of University of Technology (UTS) Structural Engineering, School of Civil and Environmental Engineering Specialist Consultants

January 2021

Furthermore, the in-plane stiffness and ductility of Dincel 275 was tested by the University of Technology Sydney (UTS). It was found that higher ductility factors can be utilised within Dincel walling due to the composite action and confinement provided by the polymer shell. All methodologies for determining ductility factors confirm that Dincel 275, even when left unreinforced, will qualify as at least 'limited ductile' up to 'fully ductile', allowing for Dincel 275 walls to be safely used within existing design practices.

E.8. JOINTS

E.8.1. CONSTRUCTION JOINTS

Construction joints should not be confused with crack control joints. Crack control joints are not required within Dincel walling (refer to Section E.9.3). Construction joints within Dincel walls are required where the slab/footing below or above the wall contains a construction joint or at shrinkage strip locations. Such joints must be carried vertically through the wall due to the high amount of movement expected between the building elements.

E.8.1. 'STOP-START' CONSTRUCTION JOINT

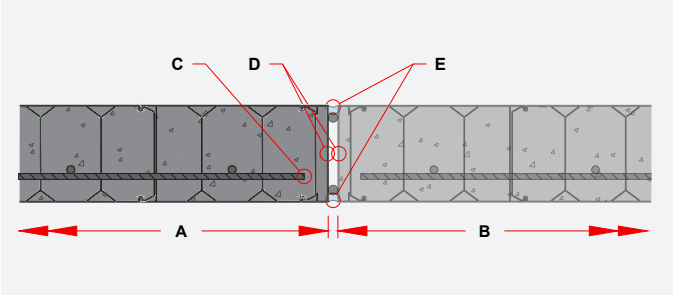
A - Extent of first concrete pour.

B - Dincel panels installed at a later stage.

C - Terminate horizontal reinforcement (if any) at wall end.

D - Termination of walls through either Clip-On End Cap (P-EC), Screw-On Cap (P-TC) or Stop End (P-EC) accessories.

E - Nominal 20mm gap (or as otherwise required) provided between walls. Gap must be treated for waterproofing, acoustic and fire purposes as required. Caulking can be considered for non-submerged conditions.



E.8.2.WHERE CONTINUITY REQUIRED

A - Extent of first concrete pour.

B - Extent of Dincel panels installed for first concrete pour. Two additional panels are installed and left empty (not concreted) in order to house the cast-in horizontal lapping bars.

C - Remainder of Dincel panels installed at later stage.

D - Slide down barrier to allow for pour break. Barrier can consist of the following options:

- Dincel Stop End accessory (P-SE) or Screw-On Cap accessory (P-TC) with neat holes drilled to accommodate horizontal bars. If P-TC used the width is required to be cut to size (to fit inside profile).
- Rigid expanded metal mesh (rib mesh) cut to size. Note: rib mesh is not suitable when SCC is used.

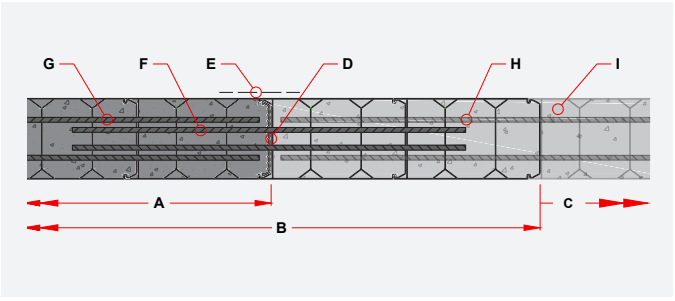
E - If wall is used for waterproof application, provide waterproof membrane (bandage) to joint.

F - Reinforcement used to lap with horizontal bars within wall, inserted through neat holes.

G - Horizontal reinforcement within wall for first pour, as required by Structural Engineer.

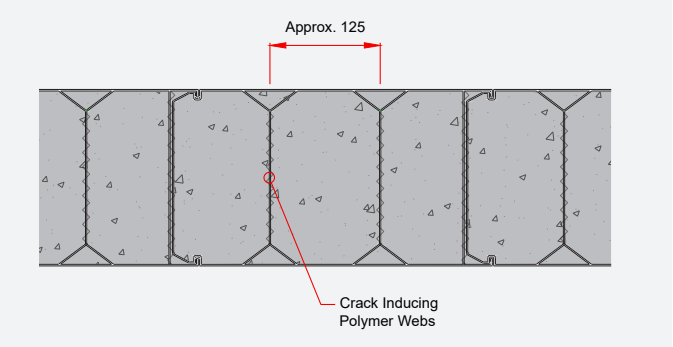
H - Horizontal reinforcement installed at later stage.

I - Concrete poured within next segment of Dincel profiles at later stage.



E.9. CRACK CONTROL MECHANISM

Dincel profiles feature polymer webs which are provided in plan at approximately 125mm centres (exact spacing differs depending on the profile). These webs reduce the cross-sectional area of the vertical plane which induces controlled cracks along the 'weakened' locations.



In conventional concrete design, crack control expansion joints are typically provided in order to combat volumetric changes from shrinkage and thermal fluctuations. These items have been explained below for Dincel walling.

Shrinkage

The most extreme design shrinkage strain after 30 years as specified in AS 3600-2018 Table 3.1.7.2 is 810 microstrain. This is assuming the worst conditions such as an f'c of 25MPa, thickness of 50mm and an arid environment. Even taking into account these worst conditions as a conservative approach, the crack size can be calculated as follows:

Shrinkage = Strain multiplied by the distance between crack inducers

Shrinkage = 810 x 10-6 x 125mm = 0.1mm

This indicates that the maximum crack width will not exceed 0.1mm on either side of a web, or 0.2mm in total at a web location. It should be noted that due to the polymer encapsulation provided by Dincel panels leading to ongoing hydration, this is a conservative calculation.

Thermal Expansion

When considering thermal effects (i.e. thermal expansion and contraction) for Australian conditions it would be reasonable to consider a total thermal variation of 40°C (i.e. ± 20°C). In accordance with AS 3600-2018 3.2.4, the coefficient of thermal expansion for concrete is 12 x 10-6/°C. Over a length of 125mm between polymer webs, the maximum total thermal expansion can be calculated as follows:

Thermal expansion = Coefficient of thermal expansion x temperature variation x length

Thermal expansion = (12 x 10-6 / °C) x 40°C x 125 = 0.06mm

Combined Effects

Considering the worst case scenario of combined shrinkage and thermal expansion (the smallest possible shrinkage with the largest possible thermal expansion) using a design shrinkage strain after 30 years for a tropical environment, 200mm concrete thickness, f'c=25MPa, the design shrinkage strain would be taken as 440 (in accordance with AS 3600-2018,Table 3.1.7.2). The shrinkage can be calculated as follows:

Shrinkage = Strain multiplied by the distance between crack inducers

Shrinkage = 440 x 10-6 x 125mm = 0.055

Therefore, the combined worst-case effects for combined shrinkage and thermal expansion can be calculated as follows:

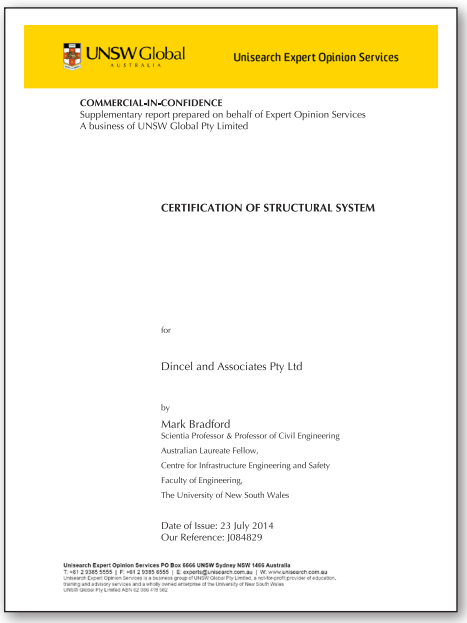
Total relative movement = Shrinkage - Expansion = 0.06mm – 0.055mm = 0.005

It can be seen from the above shrinkage and thermal expansion calculations that for the worst possible case of combined shrinkage and thermal effects, there is no resultant expansion and therefore no need for any special expansion joint provisions.

This type of design methodology is not typically considered with conventional concrete walls as cracks at regular centres would be unsightly. However, with Dincel walling, the concrete is encapsulated and protected by the polymer skin and therefore these controlled cracks are not visible at the surface. Furthermore, the polymer skin retains the moisture within concrete which enables ideal curing conditions. This minimises shrinkage in comparison to conventionally formed walls.

E.9.1. INDUSTRY REVIEW

The crack control principles for Dincel walling have been reviewed by the University of New South Wales (UNSW). For a more detailed explanation, the certification can be downloaded by scanning or clicking on the QR Code below:


UNSW Global AUSTRALIA Unisearch Expert Opinion Services

COMMERCIAL-IN-CONFIDENCE
Supplementary report prepared on behalf of Expert Opinion Services
A business of UNSW Global Pty Limited

CERTIFICATION OF STRUCTURAL SYSTEM

for

Dincel and Associates Pty Ltd

by
Mark Bradford
Scientia Professor & Professor of Civil Engineering
Australian Laureate Fellow,
Centre for Infrastructure Engineering and Safety
Faculty of Engineering,
The University of New South Wales

Date of Issue: 23 July 2014
Our Reference: J084829

E.9.2. CRACK CONTROL STEEL

AS 3600:2018 Section 11.7 specifies the minimum steel reinforcement required for concrete walls. Section 11.7.1(b) states requirements for horizontal reinforcement:

> *"In the horizontal direction, of not less than 0.0025, except that for a wall designed for one-way buckling using Clause 11.4(a) and where there is no restrain against horizontal shrinkage or vertical movements, this may be reduced to zero if the wall is less than 2.5 m wide".*

The minimum reinforcement stated in Section 11.7 of AS 3600:2018 applies is for crack control due to concrete shrinkage and thermal actions. This minimum reinforcement is deemed necessary so that crack widths that may develop do not affect structural performance and serviceability of the wall in its final state.

From a theoretical stand point, a Dincel wall can be idealised as a series of approximately 125mm wide concrete members and therefore the wall width is significantly less than the AS 3600 limit of 2.5m. Crack control steel reinforcement can therefore be reduced to zero within Dincel walls when the simplified method of AS 3600 is used.

Where steel reinforcement is required for a structural purpose other than crack control (i.e. horizontal bars in a shear wall), this steel reinforcement must be retained.

It should be noted that other international codes allow for the design of concrete walls as plain concrete only (without any steel reinforcement). Such codes include:

- ACI 318 (American)
- EuroCode2 1992 (European)
- BS 8110 (English)
- CSA A23.3 (Canadian)
- DIN 1045-1 (German)

As stated above, the technology offered by Dincel panels allows for the elimination of crack control steel. Elimination of steel reinforcement where possible should be seriously considered by engineers, as steel production is widely known as one of the largest carbon emitters from the manufacturing industry.

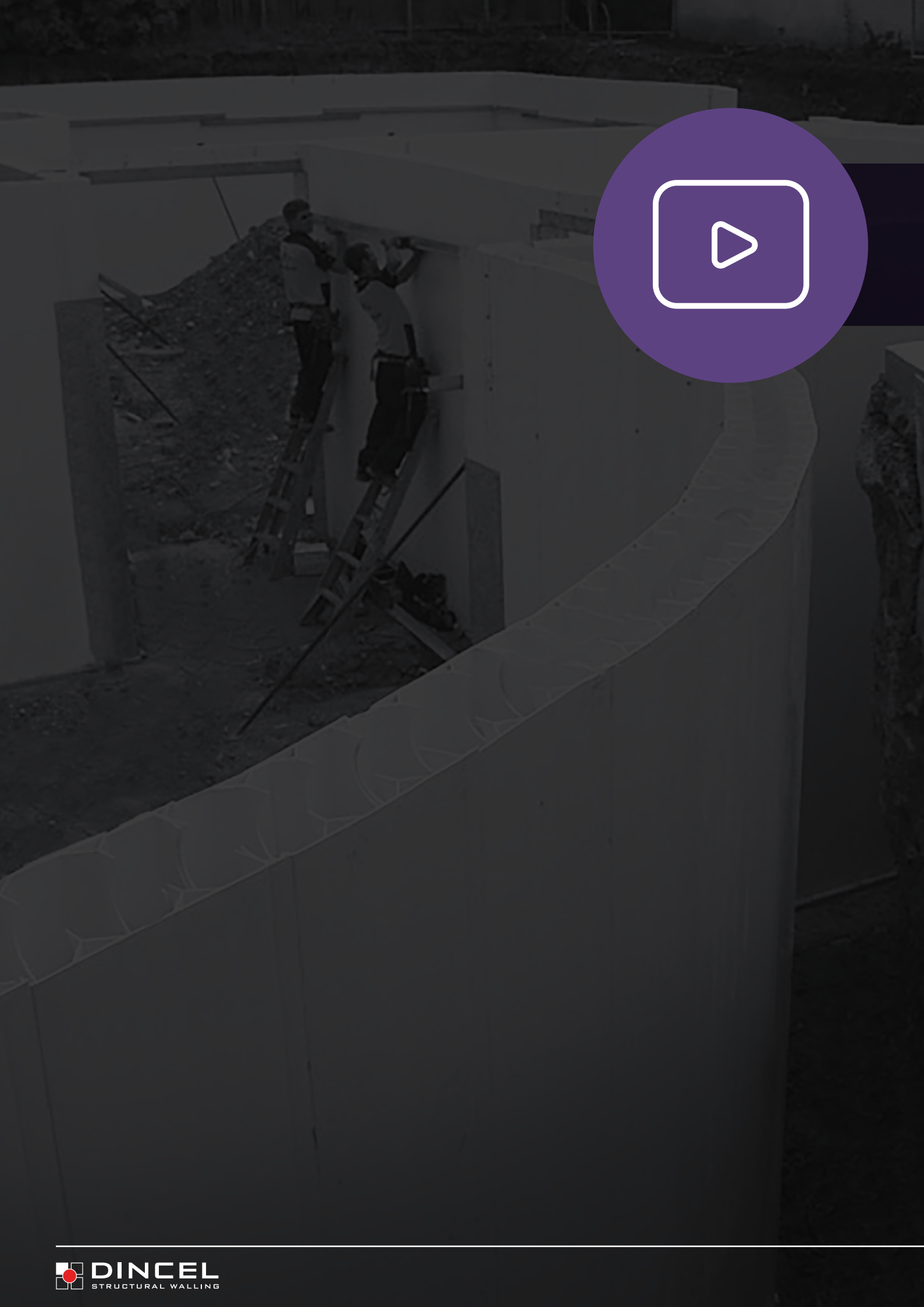
E.9.3. CRACK CONTROL JOINTS

Due to the inbuilt crack inducing technology, Dincel walls do not require joints for crack control purposes. Crack control joints are defined as those which are placed solely for the purpose of reducing cracking due to standard thermal fluctuations of expansion and contraction, creep, or concrete shrinkage. Crack control joints are sometimes referred to as contraction, shrinkage or control joints.

Crack control joints should not be confused with construction joints, which may be required within Dincel walling at locations where significant movement is expected (such as the continuation of a construction joint from a slab, refer to Section E.8.1).

It should also be noted that although the Dincel wall itself is not required to be provided with additional crack control joints, any finishes applied onto the walling system needs to be considered. For example, render applied onto the walling system will need to be provided with physical joints or grooves. Further information regarding crack control joints in finishes can be found in Section C.3.3.

Due to the controlled cracking which occurs in Dincel walling at approximately 125mm centres, the wall is able to handle the effects of thermal variations and shrinkage. This methodology would be no different to providing 'saw cuts' within a slab or concrete element, in order to induce a controlled crack and allow for movement. The controlled cracks within the wall act as contraction joints at close centres.



INSTALLATION

CONTENTS

F.1. ORDERING

F.1.1. DETERMINING WHAT TO ORDER

- Obtain the latest copy of the architectural and structural drawings. Make sure that drawings clearly identify which walls are specified as Dincel and the wall thicknesses are detailed.
- Upload plans to Dincel website. Our estimating team will make contact with you to discuss further.
- Dincel estimating team will send the components list and quote for your approval. Panel heights and other information may need to be confirmed during this process.

F.1.2. WAYS TO ORDER

To order with Dincel, simply use any of the below methods:

- **Call -** Call us on *1300 DINCEL* and get in touch with our Customer Service team who can guide you through the process.
- **Order Form -** Customer fills out an order form which includes details such as profile type, height and any associated accessories. Order forms can be downloaded from: *https://www.dincel.com.au/products.* The order form is then sent to *order@dincel.com.au.*
- **Dincel Shop -** Our Dincel online shop makes it easier than ever to place an order. Simply register for an account on our website, and once this is approved by our team you can browse our online catalogue and purchase at a time that suits you. The Dincel shop can be accessed at: *https://shop.dincel.com.au/*

F.2. TRANSPORT

F.2.1. TRANSPORT OPTIONS

- **Option 1: Delivery** – Delivery organised through Dincel directly to your site.
- **Option 2: Pickup** – Customer organises their own delivery. In such cases, please refer to our Transport Guidance Document. Dincel holding yards are located at:
  - NSW – Erskine Park
  - Victoria – Dandenong South
  - Queensland – Yatala

  Please note – orders must be placed prior to pick up.

F.2.2. TIMEFRAMES

Stock Orders – Generally ready within two business days after payment has been received and cleared.

Custom Orders – Generally ready within 7-14 working days after payment has been received and cleared.

F3. UNLOADING & STORAGE

F.3.1. UNLOADING

All Dincel delivery trucks are equipped with a 'hiab' type crane to unload the Dincel product onto the site. From here, the panels can either be carried to their required position by hand, forklift, or the use of a mobile/tower crane.

F.3.2. LIFTING ON SITE

Suitable wide and flat lifting slings (not chains or round ropes) should be used to lift Dincel packs if cranes are used for unloading. These slings should be attached to a lifting/spreader bar where possible and not a 'choker' arrangement in order to prevent panel webs being bent and consequently damaged.

INCORRECT LIFTING *(No lifting/spreader bar used)*

CORRECT LIFTING DEVICE

The crane operator shall ensure that the packs are softly placed on the site's storage area without dropping the packs from a height.

F3.3. STORAGE

When daily temperatures are constantly over 30°C, the product should be kept under cover ensuring that air-flow is not restricted.

The product is delivered to site in packs with timber crates around them. Do not stack more than 3 packs on top of each other. The packs are required to be stored by the customer/installer on a clean flat area with timber sleepers placed at 1000mm maximum centres. The product will have a tendency to deform if they are stored with uneven or inappropriate support. The stored product may collect dust over a period of time in a construction site's condition. Refer to Section F.14 if cleaning of the snap-joints is required.

F.4. TOOLS

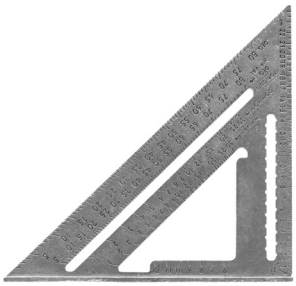
The tools normally associated with formworking and concreting trades can be used to construct Dincel walls. As a general guide, hand and power tools may include but are not limited to the following (products and/or brands shown below are indicative only):

GENERAL CONSTRUCTION

Chalk Line
For marking out wall footprint and any cuts to panels

Marking Pencil/Pen
For marking onto Dincel panels and slab as required

Tape Measure
For taking measurements as required



Squares
For ensuring wall corners and cuts are square

Spirit Level
Checking plumbness of panels

Laser Level
Checking vertical and horizontal panel alignment

Hammer
For general nailing purposes

Tin Snips
For general cutting purposes

Knips
For tying and fixing of steel reinforcement

CUTTING DINCEL PANELS

Angle Grinder
For making small cuts and adjustments to panels

Circular Saw
For cutting entire lengths of panels, or cutting the top of multiple panels

Reciprocating Saw
For cutting through entire cross section of Dincel panels or removing webbing if required

FIXING DINCEL PANELS

Actuated Charge Gun
For fixing angles and Guide Track to concrete slab

Cordless Drill
For use with the Hole Saw to form additional holes within Dincel profiles and accessories

Hole Saw
For creating T-Junctions or additional openings within Dincel panels

Cordless Impact Driver
For fixing screws to the Dincel profiles and accessories

Cordless Rotary Hammer
For placement of plug type anchors into slab for bracing purposes

Cordless Impact Wrench
For placement of screw type concrete anchors into slab for bracing purposes

CONCRETING

Wheelbarrow, Shovel & Trowel
For handling any concrete spills and finishing top/openings of Dincel walls

Vibrator
Required where SCC is not used. Refer to Section F.12.4 for specific details

Concrete Hose + Pump
For placement of concrete into Dincel walls (2.5inch max). Refer to Section F.12.3 for specific details

CLEANING

Garden Hose
For washing off uncured concrete slurry from walls

Pressure Washer
For cleaning hardened/cured concrete slurry, dust and other reminants from walls

Cleaning Spray and Cloth
To scrub off any remaining markings (for bare Dincel finishes)

F.5. SAFETY

F.5.1. PERSONAL PROTECTIVE EQUIPMENT (PPE)

The installer must adhere to all safety procedures/requirements which would normally be required with formwork and concreting trades. The Personal Protective Equipment (PPE) required will vary depending on the site conditions and it is important that before any work is carried out the risks and hazards are firstly assessed.

Where a Dincel panel is required to be cut on site, Personal Protective Equipment (PPE) such as a dust-proof respirator, safety gloves, hearing protection and protective eyewear must be worn. Always ensure that when cutting, the work area is appropriately ventilated. When concreting, a hard hat and steel cap boots and safety gloves should be worn.

F.5.2. ACCESS

Access to the walls on-site must always be provided in a safe manner and is the responsibility of the installer and builder. It is essential that all scaffolding, EWPs, platforms and edge protection provided comply with the relevant Safe Work practices, laws, standards, regulations and specific site requirements.

F.5.3. SWMS

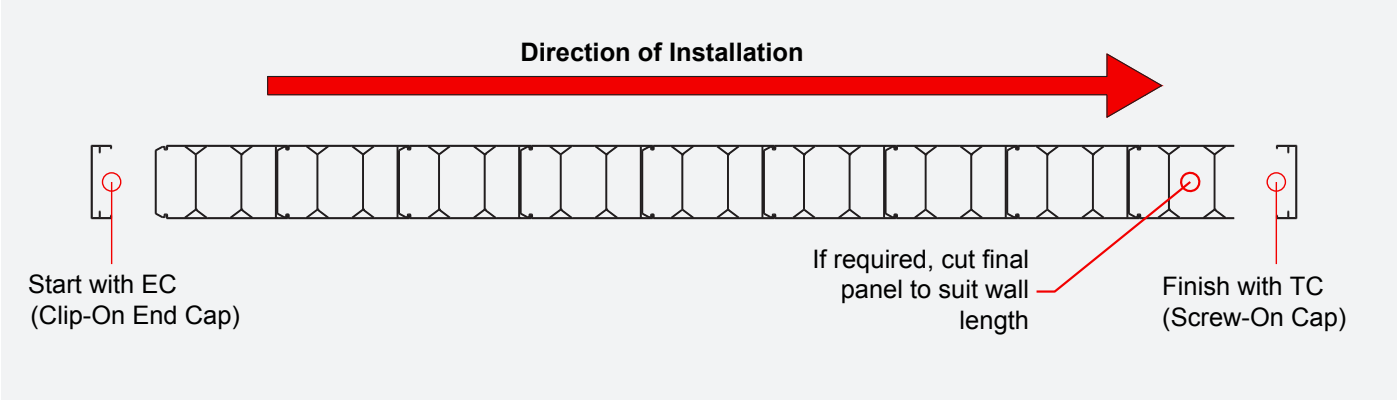
Prior to any installation, a Safe Work Method Statement (SWMS) should be developed by the builder and/or installer and adhered to at all times. The SWMS at a minimum should take into account safety considerations such as PPE required, safe access and safe lifting procedures.

F.6. PRE-PLANNING

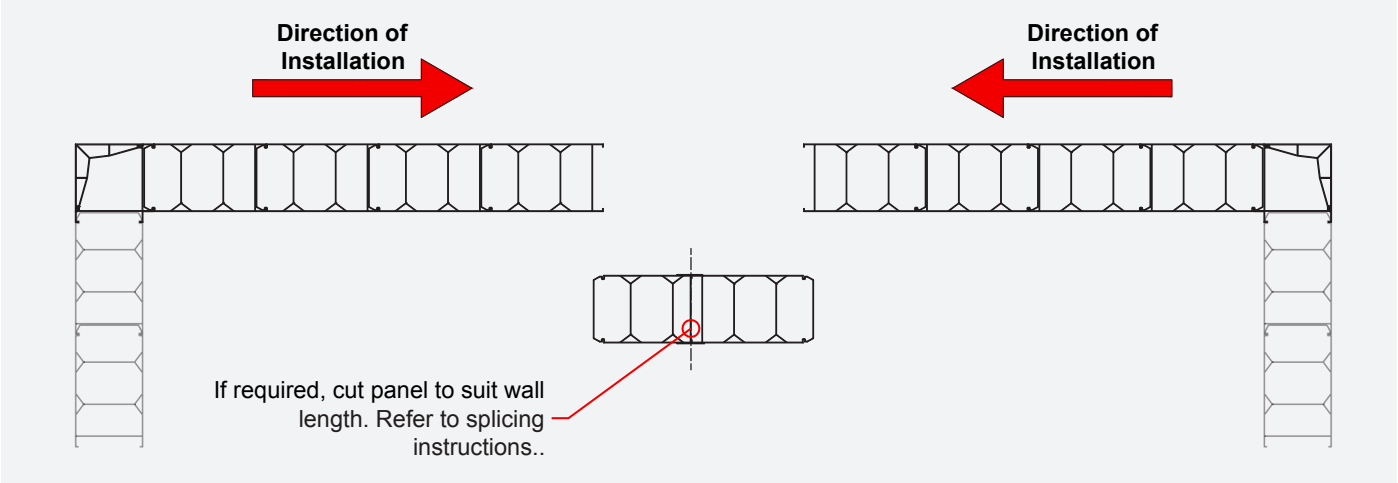
F.6.1 STARTING POINTS

Plan out the most suitable starting point for panel installation.

Option 1 – Use this option when constructing a straight wall



Option 2 – Use this option when constructing along a perimeter such as a basement or tank

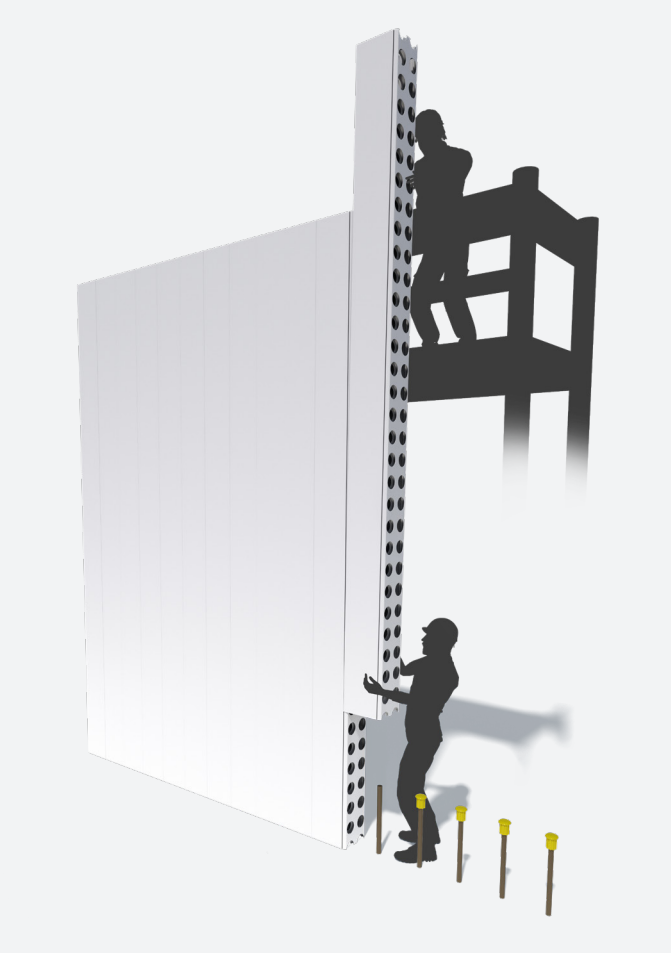


Dincel polymer profiles may be subjected to temperature elongation depending on the length, height and daily temperature. Installers should allow a nominal 10mm of movement for every 15m of wall length for each 10°c temperature variation above 20°c.

On top of temperature movement, installers should allow a construction tolerance of 1mm to each main profile.

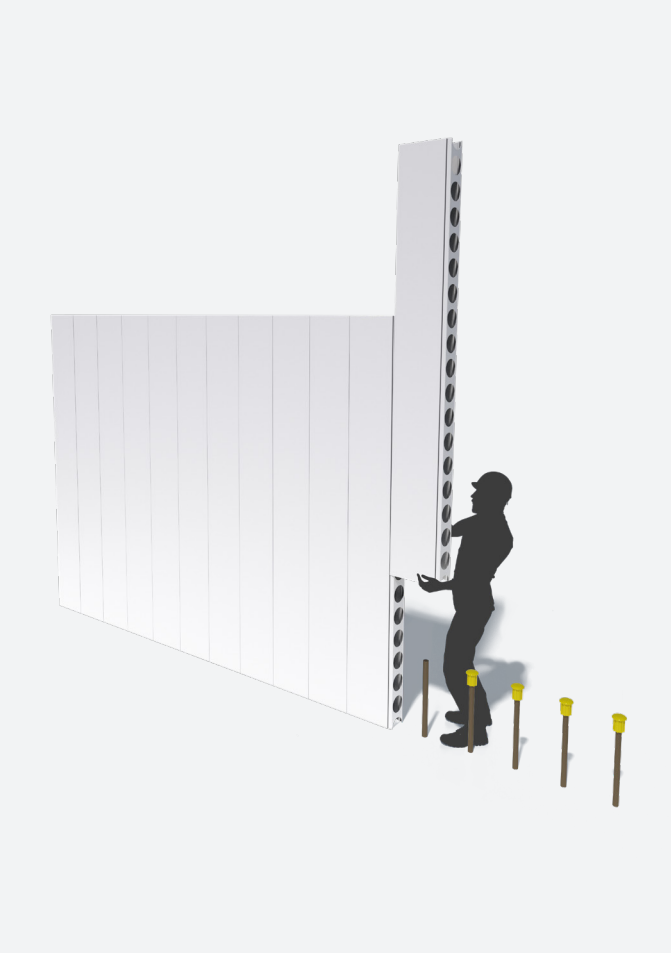
F.6.2 INSTALLATION METHODS

Select the most suitable installation method depending on the site conditions:



Top Down

'Top Down' installation is where panels are clicked into place from the formwork deck above and slid down into position.



Bottom Up

"Bottom Up' installation is where panels are clicked into place from the existing floor slab or ground level work area. This installation method is typically carried out when there is no formwork deck above.

F.6.3. WATERPROOFING

For any wall that is required to be waterproof (e.g. basement walls or tank walls), the method of waterproofing should be planned before installation. Waterproofing detailing should be designed by the project consultants or a qualified waterproofing contractor.

Although the Dincel wall itself is deemed waterproof by CSIRO, it is important to adequately waterproof all wall junctions and any Dincel walling connections that do not utilise the 'snap-lock' joint (such as where panels are cut and joined together).

A - Wall to slab junction at base

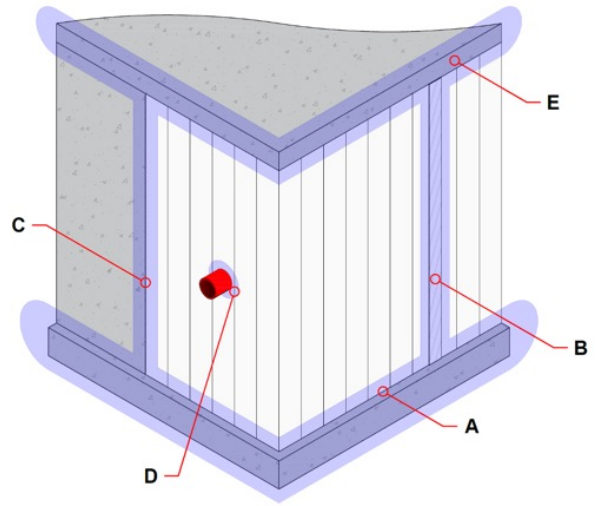
B - Any panel/accessory joints that do not utilise the 'snap-lock' connection (such as where a panel is cut and a P-WS accessory is used). Please refer to Section B.1.1. Option 2.

C - Junctions with other walling types

D - Any wall opening or penetration

E - Junctions with concrete slab above wall.
Note: an exposed slab edge is not recommended, please refer to Section B.3 for detailing.

AREAS HIGHLIGHTED MUST BE ADDITIONALLY WATERPROOFED



When waterproofing the above locations, best results will be achieved when the waterproofing is applied to the positive (exterior/wet) face. This way, water is prevented from entering into the system in the first instance.

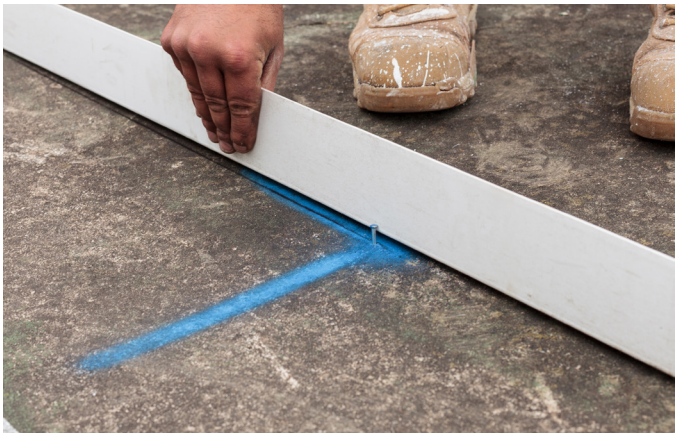
One of the most important aspects in achieving a waterproof wall is compacted concrete. Large air voids within the wall will result in leakages. The installer must ensure that there are no air voids within the wall in order to ensure sufficient protection from water. Self-Compacting Concrete (SCC) should be used where waterproofing is critical in order to ensure no air voids.

F.7. TYPICAL INSTALLATION PROCESS

F.7.1. WALL TRACK

1: Clean substrate ready for set out.

2: Use chalk line to mark out wall base location in accordance with the consultant drawings. Work off gridlines or surveyor marks for accurate placement.



3: Place D-ANG50 PVC Angle along the chalk line mark. Place angles on one side only for conventional concrete or on both sides for self-compacting concrete.

For basement waterproofing, a different detail may have been used by the designer (such as installing along a hob edge or cast in PVC waterstop). Consult with the designer and follow the necessary detail.

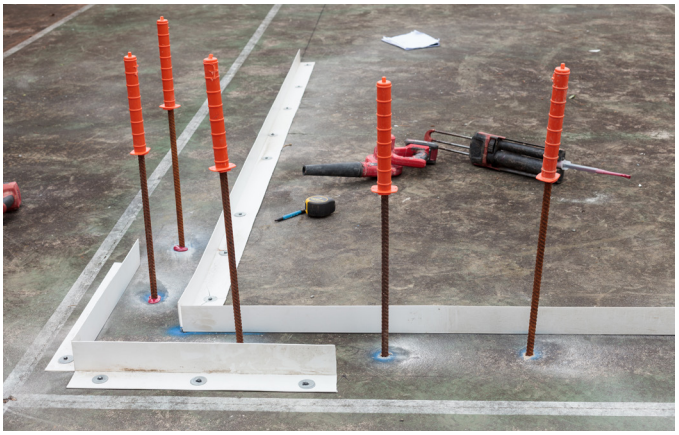
4: Place angles on at least one face of the corner, where:

- On one face the angle is continuous, or
- On the other face the angle extends 600mm each way

5: Fix angles to concrete slab through any of the following methods:

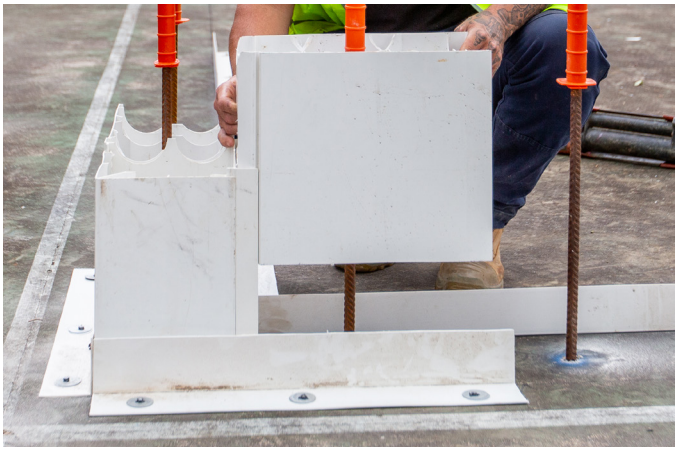
- Concrete nails w/actuator charge gun
- Plug and screw
- Drill and bolt

F.7.2. STARTER BARS



IF starter bars are cast in:
Check they are placed at the correct locations nominated on the engineer's drawings

IF starter bars are post-fixed:
Install starters bars by drill & epoxy at the locations and specifications nominated on the engineer's drawings.



TIP:
A template (sample 300mm tall panel) can be used to assist with starter bar placement.

F.7.3. WALL ASSEMBLY

6: Check quantity of panels before use and distribute evenly to required work zones, including reinforcement and bracing. Remove timber framing from packs.

7: If any dirt/dust has accumulated within panel joints, spray joints with detergent (Windex or similar) to work as a lubricant.

For waterproof walls:
Waterproofing contractor to apply any additional waterproofing (e.g. membrane, hydrophilic material or injection tubes) as detailed within the project design drawings.

Where applicable, start the wall installation with a corner profile (P-5).

10: Screw fix bottom of panels into angle, ensuring that the corner assembly is square.

8: Install 1 to 2 main profiles (P-1) on both sides of the corner.

- Click the profiles above the starter bars then slide down

11: Plumb assembled corner through the use of diagonal braces.

9: Ensure panel end with a 'half' web hole(s) are always positioned towards the bottom for web hole alignment.

12: Place corner horizontal reinforcement into wall:

Where hook bars are specified:

- Place hook bars into the corner from both sides, creating an eyelet for vertical reinforcement bar to be placed inside.
- Hook bar must consist of a return leg no less than 175mm to ensure the bar is seated onto the webbing and not turn.

Where u-bars are specified (200/275 Dincel):
Slide P5 corner cover up to insert u-bar (where this is not possible, remove webbing between the two circles to allow for insertion through the main profile by pre-feeding bars).

13: Continue to install Dincel main profiles (P-1) whilst also inserting the steel reinforcement as required. Ensure that horizontal web holes line up at all times.

Where vertical 200P-VRC/D-VRC accessories are used:
Use the exact concrete cover nominated on the engineers drawing. Bars can be held into place by fixing to the reo-clip with tie-wire. Place a minimum of three reo-clips onto vertical bars (at bottom, middle & top providing at least 50mm clearance from starter bars)

- 200P-VRC: Place vertical reinforcement first
- D-VRC: Place horizontal reinforcement first

If there is no horizontal steel required, tie D-VRC clips on alternate sides to ensure concrete cover on both faces.

Where vertical reo-clip accessories are not used:
Ensure that vertical bars are adequately secured into position. Bar chairs can be used for some applications.

14: If wall is continuing vertically at a later stage or tying to slab, vertical bars should protrude from top of wall (as nominated on engineer's drawings). Tie off vertical bars to a horizontal lace bar or support timber.

15: Ensure that horizontal bars are provided with the correct lap, as specified on engineer's drawings. Bar ends should be marked on the slab or wall. This mark can be used as a reference point for the next horizontal bar to appropriately lap with.

16: Fix horizontal waler into wall by screwing into every panel joint. Place screws in joint location as shown in Section F.11.3.

17: Fix diagonal braces to walers. Plumb the wall by adjusting the turnbuckle on the brace (if applicable). See section F.11 for further details on bracing. Spacing and type of braces as determined by engineer.

18: If the Dincel panel modules do not align with the required wall length then cut the Dincel panel to suit. As the snap lock joint is removed during the cutting process additional screwing is required (refer to Section F.8.1 for instructions).

19: Provide additional bracing to wall ends and corners as required. Refer to Section F.11.5 and F.11.6 for guidance.

F.7.4. WINDOW & DOOR OPENINGS

1: For any openings such as windows or doors, cut the surrounding panels to suit the required opening dimensions.

2: Assemble cut panels into place. Ensure that horizontal web holes line up.

3: Ensure that sill, head and jamb details are formed with any rebates or falls as required on the consultant drawings.

Note: Steel fire rated doors can also be cast into the wall. When cast in, place sealant on flanges of door jamb and fix to Dincel profiles using external grade self-tapping button head screws at 150mm centres.

Optional:
For very short headers, panels may be orientated horizontally. For this option, use a P-WS to join to adjacent panels and screw at min 150mm centres.

4: Prepare capping and bracing for opening as specified in Section F.11.4.

5: When concreting, temporarily remove capping and bracing to sill to allow for concrete hose and insertion of vibrator (for conventional concrete mixes). Port holes can also be created if suitable. Once compacted concrete has reached sill level, reinstate bracing & capping to opening.

F.7.5. CURVED WALLS

1: Remove notches from the base angle to allow the angle to follow the required curvature. Fix curved base angle to slab.

For 200 & 275 Dincel:
2A: Install the P4 and P1 panels along angle (as specified on the components list) to achieve the desired curvature.

For 110 & 155 Dincel:
2B: Cut a slit on one face of panels as required. Then, bend profiles to required curvature and stitch back together using screws at 150mm centres.

F.8. WALL SPLICING

F.8.1. VERTICAL WALL SPLICE

If the wall length does not match up with the Dincel panel modular sizes, a panel can be cut to achieve the exact dimension required. As the snap-lock joint is removed during the cutting process it is required to affix the panel to the rest of the wall through screws:

F.8.1.1. OPTION 1 – USE OF P-WS

A - Cut Dincel panel to suit required width.

B - No requirement to cut adjacent Dincel panel in most cases.

C - P-WS (Wall Splicer) accessory.

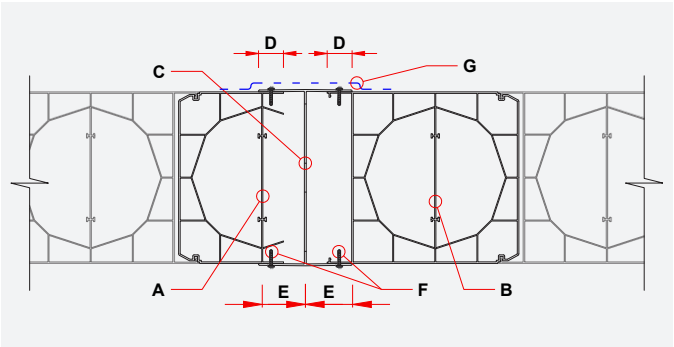
D - Min 40mm overlap between flange of P-WS and adjacent Dincel panels. Apply MS polymer sealant to areas where P-WS makes contact with panels.

E - Max 90mm between web of P-WS and closest web of adjacent Dincel panel, otherwise add additional bracing to prevent bulging.

F - Screws provided at max:
- 150mm centres for bottom 1/3 of wall
- 300mm centres for top 2/3 of wall

For an external or exposed wall, galvanised or stainless steel screws must be used to prevent corrosion.

G - For subterranean, submersed or tank walls, provide min 300mm wide membrane over cut joint on the positive (exposed to water) face. Membrane to be compatible with PVC as a substrate. Where there is no access to apply the membrane, the 2xP1 panels and P-WS can be preconstructed and slid down into place in one piece with the membrane already applied.



F.8.1.2. OPTION 2 – SLIDE TECHNIQUE

A - Cut Dincel panel to suit required width.

B - Remove barbs from panel 'B' to allow for panel to slide into panel 'A'.

C - Min 40mm overlap between panels. Apply white MS polymer sealant to areas where panels make contact with each other.

D - Min 40mm overlap between flange of P-WS and adjacent Dincel panels. Apply MS polymer sealant to areas where P-WS makes contact with panels.

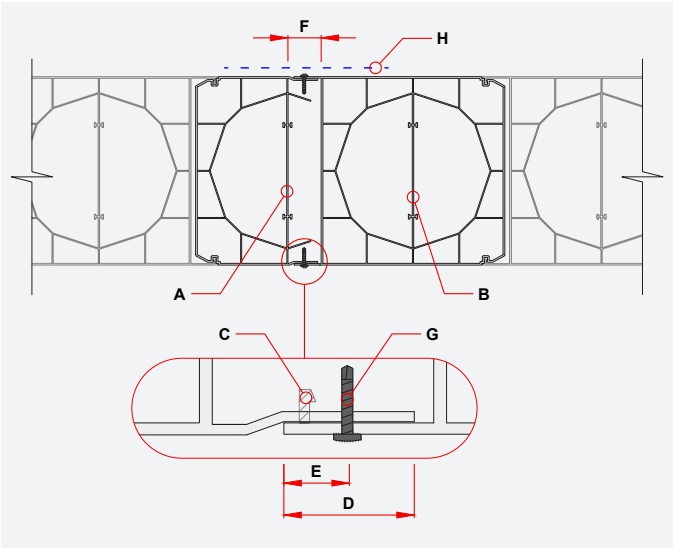
E - Min 15mm between screw fixing and lapped end.

F - Max 90mm between webbing of panels, otherwise add additional bracing to prevent bulging.

G - Screws provided at max:
- 150mm centres for bottom 1/3 of wall
- 300mm centres for top 2/3 of wall

For an external or exposed wall, galvanised or stainless steel screws must be used to prevent corrosion.

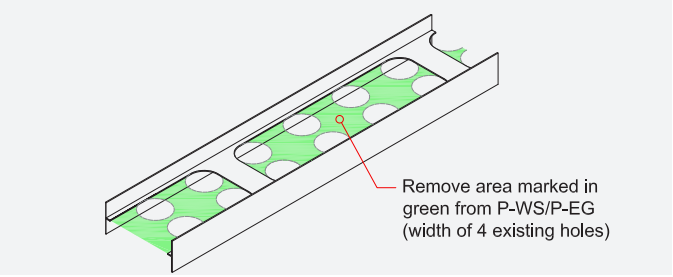
H - For subterranean, submersed or tank walls, provide min 300mm wide membrane over cut joint on the positive (exposed to water) face. Membrane to be compatible with PVC as a substrate. Where there is no access to apply the membrane, the 2xP1 panels can be preconstructed and slid down into place in one piece with the membrane already applied.



F.8.2. HORIZONTAL WALL SPLICE

F.8.2.1. OPTION 1 – USE OF P-WS

A - Join Dincel profiles together using P-WS accessory. Where P-WS is used, modify as per below in order to allow for cast-in vertical bars to pass through and provide a greater concrete-to-concrete interface. Similarly, use P-EG where there is a suspended slab.



B - Screws to be placed at each panel joint as shown (refer to F.11.3 for screw placement guidance).

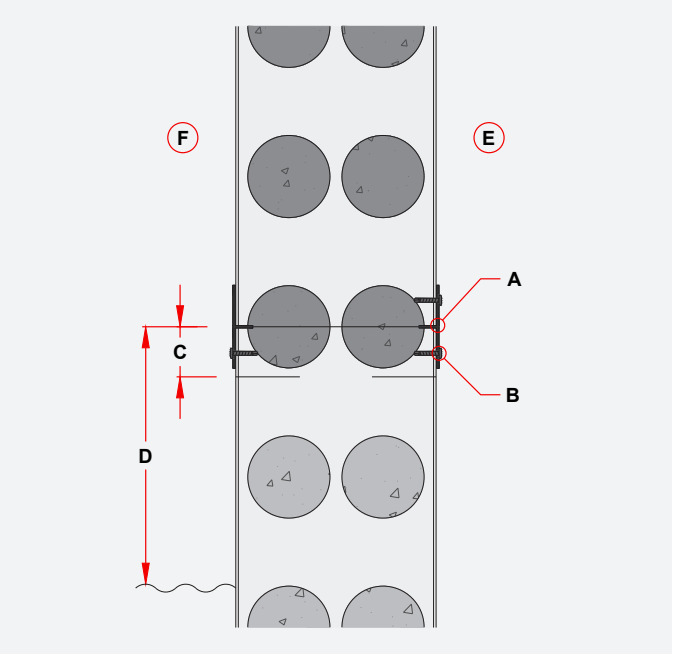
C - Concrete pour break as per consultant drawings or otherwise 50mm below horizontal wall joint (if applicable).

D - Horizontal splice must be minimum 500mm above water table location or permanent water immersion. Otherwise, a membrane must be applied to the positive face to protect the horizontal joint.

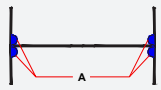
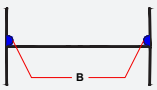
E - Accessible face.

F - Inaccessible face (after placement of profile over the splice joint). Screw for P-WS can be reversed if required..

Note: This detail is only suitable for above ground walls (non-submerged) and subject to Design Engineer approval.



Treatment to P-WS for Horizontal Wall Splices:

Below Ground (but at least 500mm above permanent water table)	**Above Ground** (General Application)	**Above Ground** (Critical aesthetics)
		
A – Provide MS polymer sealant to all 4 flanges	B – Provide MS polymer sealant to top flanges	C – After concrete has set, use angle grinder or multi-tool to remove flanges from P-WS D – Provide MS polymer sealant to remaining joint in wall

F.8.2.2. OPTION 2 – CONVENTIONAL FORMWORK

A - Provide min 300mm x 20mm plywood to both sides of wall.

B - Screws to be placed through the plywood and Dincel panels at minimum each panel joint (refer to F.11.3 for screw placement guidance).

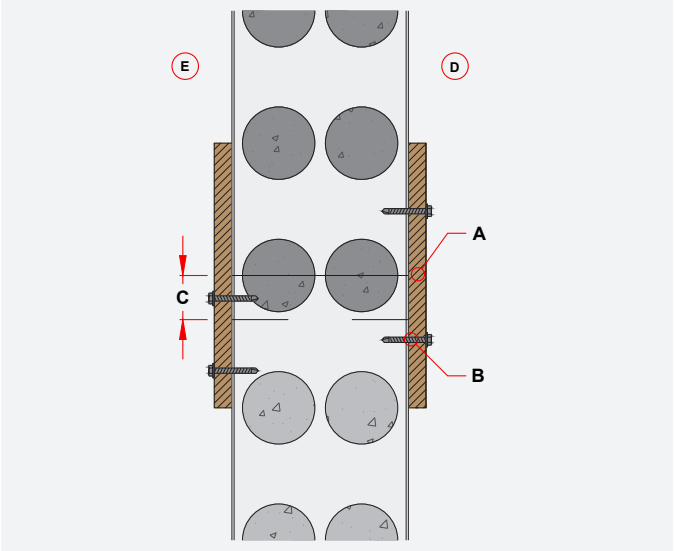
C - Concrete pour break as per consultant drawings or otherwise 50mm below horizontal wall joint (if applicable).

D - Accessible face.

E - Inaccessible face (after placement of profile over the splice joint). Screws to plywood can be reversed if required.

Note: Once plywood formwork is removed, provide horizontal joint with sealant if required for aesthetic or waterproofing purposes.

Note: This detail is only suitable for above ground walls (non-submerged). Otherwise, provide a suitable waterproofing membrane over the horizontal joint.



F.8.2.3. OPTION 3 – 'SAW-TOOTH' SPLICE

A - Install panels in a staggered formation to establish a 'saw tooth' profile.

B - Every second panel to extend up by min 750mm.

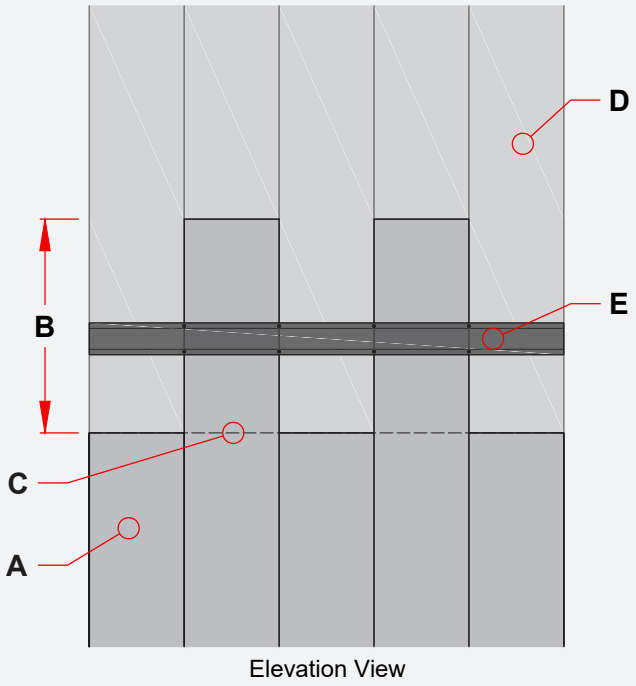
C - Concrete pour break location (if applicable).

D - Panels above to be installed at a later stage (after concrete in panels below has adequately cured). Ensure that horizontal web holes line up between all profiles.

E - For taller walls provide additional bracing at splice location, such as top hat with screws at every panel joint.

Note: Provide horizontal joints with sealant if required for aesthetic or waterproofing purposes.

Note: This detail is only suitable for above ground walls (non-submerged).

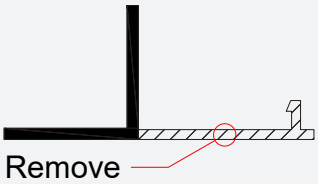


Elevation View

F.8.3.CONNECTION OF DIFFERENT PROFILES

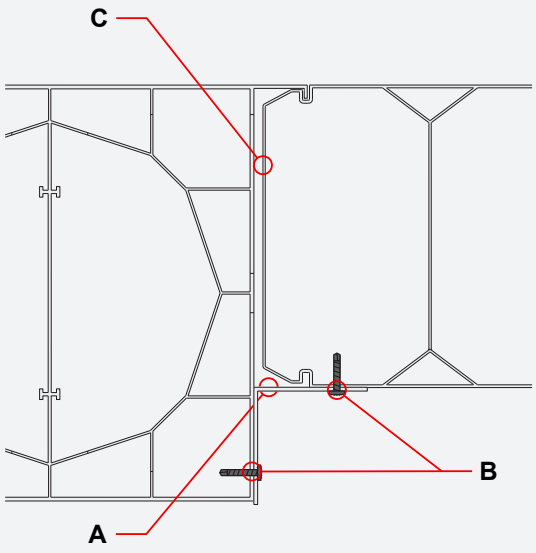
F.8.3.1. STRAIGHT WALLS

A - Provide temporary angle D-ANG50 between profiles on one side to block-out gap.
Note: a larger angle or plywood formwork will be required when connecting Dincel 275 to Dincel 110 or 155.
Remove protruding leg of panel if required:



B - Screw temporary angle at max:
- 150mm centres for bottom 1/3 of wall.
- 300mm centres for top 2/3 of wall.

C - Horizontal steel reinforcement can be fed through on one side if required. Place concrete hose on either side of junction to ensure adequate flow of concrete between the panels.

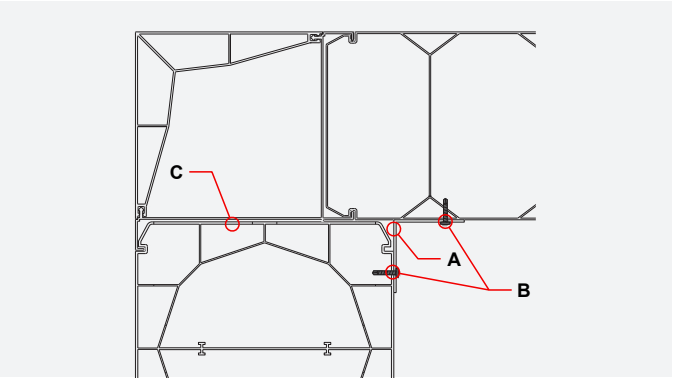


F.8.3.2. CORNERS

A - Provide temporary angle D-ANG50 at corner junction of profiles.

B - Screw temporary angle at max:
- 150mm centres for bottom 1/3 of wall.
- 300mm centres for top 2/3 of wall.

C - Horizontal steel reinforcement can be fed through one side if required. Place concrete hose on either side of junction to ensure adequate flow of concrete between the panels.



F.8.3.3. CORNER SPLICING

A - Un-cut Dincel profile.

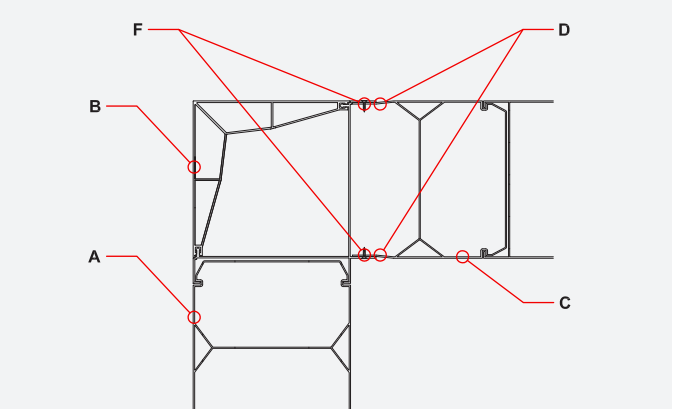
B - Dincel corner profile.

C - Cut Dincel panel to suit required width.

D - Remove barbs from corner B to allow profile D to slide under. Min. 40mm overlap between panels. Apply white MS polymer sealant to areas where panels make contact with each other.

E - Screws provided at max:
- 150mm centres for bottom 1/3 of wall.
- 300mm centres for top 2/3 of wall.

For an external or exposed wall, galvanised or stainless steel screws must be used to prevent corrosion.



F.8.4. SPLICING OFF-CUTS

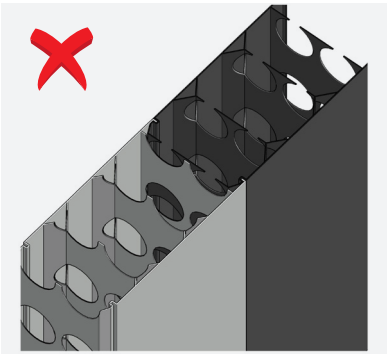
It should be noted that stacking/splicing off-cuts on top of each other to create the height of the wall should be avoided where possible. Stacking of off-cuts is not recommended due to the following:

- Can leads to decreased aesthetics.
- Not suitable for applications where the wall is required to be waterproof, as the protective PVC skin is compromised at the cut locations (unless suitably waterproofed with a membrane or similar).
- Provides less formwork stability and may require additional support/bracing.
- May lead to mis-aligned web holes - refer to Section F.8.5 for further details.

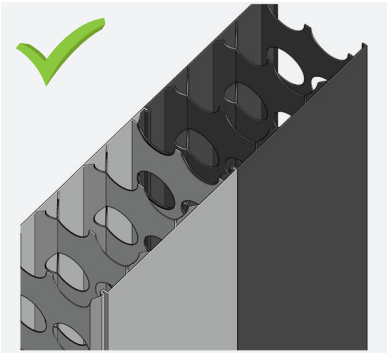
Instead, it is recommended to use full-height panels where possible. In some scenarios, it may not be possible to use a panel for the entire height of the wall (such as for corners/ accessories for tall walls). In these instances, it is critical the above points are adequately addressed at the splice location.

F.8.5. ALIGNMENT OF WEB-HOLES

Web holes within panels must be aligned at all times. Failure to do so will result in decreased concrete flow and the potential for inadequate concrete compaction (air-voids). The half web hole should always be orientated towards the ground and matching with the adjacent panels. Special attention must be provided where panels have been spliced horizontally and not cut at a 'half web-hole' location.



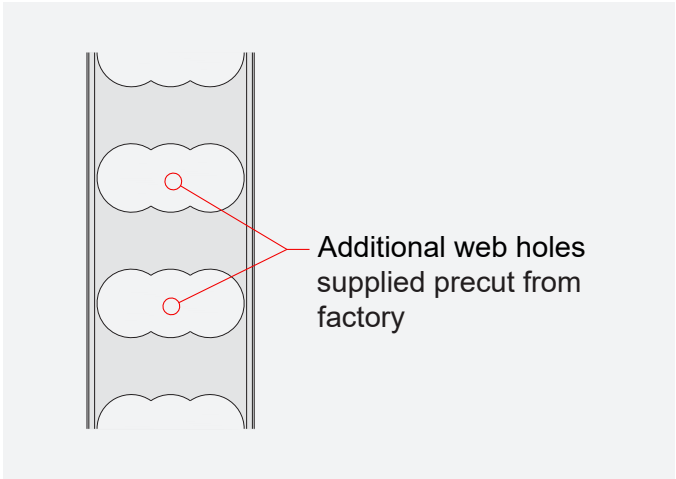
Incorrect – web holes do not align



Correct – web holes align

F.9. INSERTING TIES OR U-BARS

P-1C MAIN PROFILES (AVAILABLE FOR DINCEL 200P-1C AND 275P-1C):



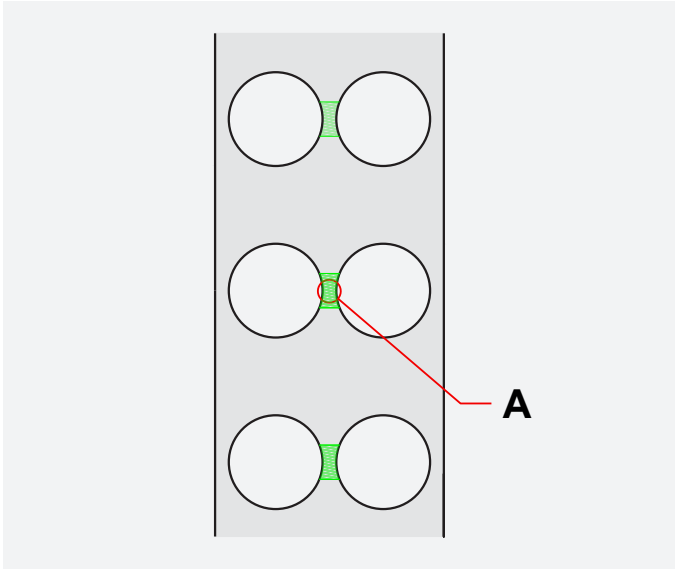
Note: Order 200P-1C or 275P-1C when ties or U-Bars are required. The P1C main profile panels are pre-cut in the factory to include an additional central web hole which elimantes cutting on site. The additional hole allows for easy insertion of horizontal closed ties and U-Bars for difficult access areas. Otherwise, the below detail can be used if the custom panels were not ordered.

WHERE P-1C NOT ORDERED:

Inserting Closed Ties

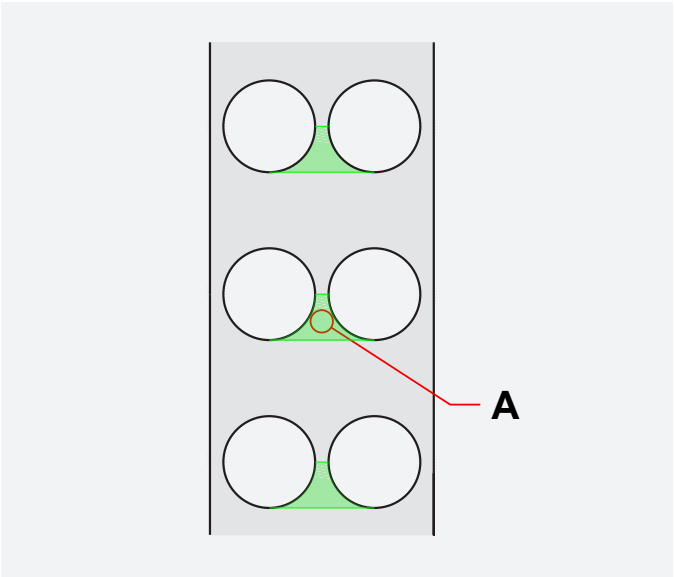
A - Remove the portion of webbing shown in green as required. An angle grinder or reciprocating saw can be used to remove the webbing.

- For U-bars: Only the first web of the profile requires to be cut where the reinforcement is inserted.
- For Closed-Ties: All webs within the profile must be cut where the reinforcement is inserted.



Inserting U-Bars

Note: Care should be taken to ensure that remaining webbing is not damaged or cracked during process. Cracked or damaged webs will lead to bulging following concrete pour.



F.10. CONNECTION TO SLAB OR LANDING

It is important that the structural engineering drawings are followed for all connection details to slabs or stair landings, including reinforcement arrangements, spacings, and any necessary waterproofing details. The details below have been provided as a generic installation guideline for preparing the Dincel panels to receive connection reinforcement specified by the engineer (such as 'L' bars).

F.10.1. PANELS SPANNING ABOVE SLAB

A - Holes removed from face of Dincel panels by using a hole saw. Typically, 100ø or as specified by engineer.

B - If larger opening is required, additional core holes can be taken adjacent (and above or below) to the first hole.

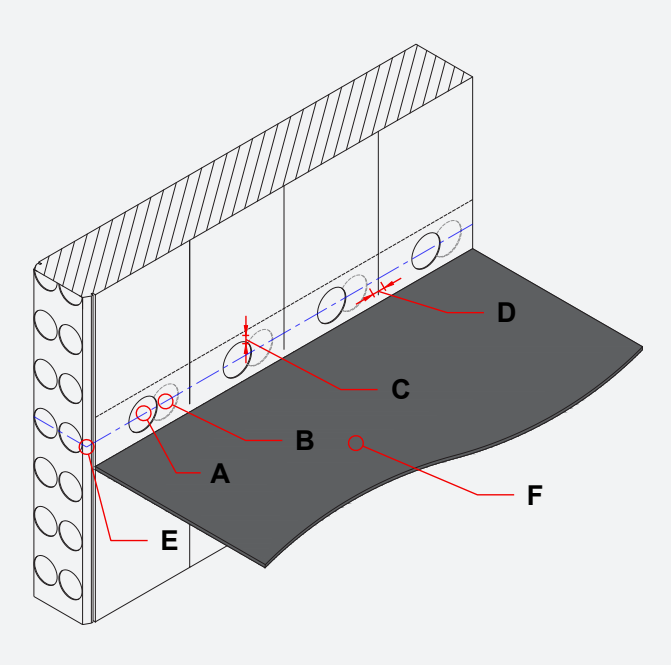
C - 25mm min clearance between top of cored holes and SSL.

D - 50mm min clearance between cored hole and panel joint.

E - Where possible, line up core hole locations with panel web holes. Otherwise, provide bracing to opposite face to prevent bulging if webbing has been removed.

F - Formwork Deck.

Note: Once holes have been prepared, insert steel reinforcement as specified by engineer.



F.10.2. PANELS TERMINATING AT SLAB

A - Remove inner skin from panels and parts of webbing using an angle grinder, reciprocating saw, or similar.

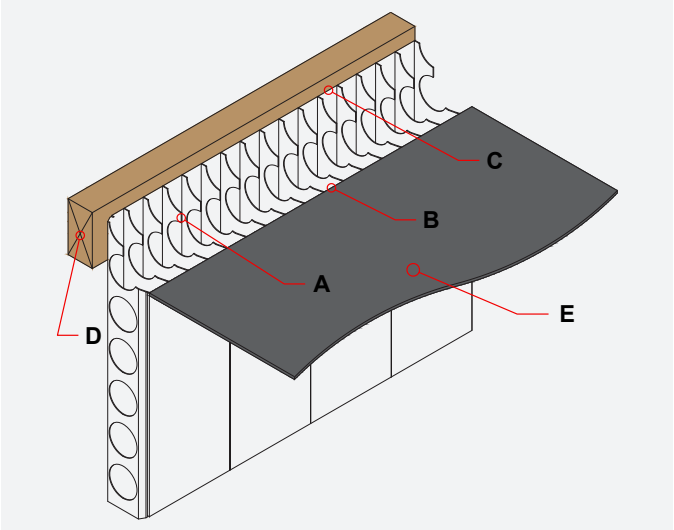
B - Bottom of cut to line up with slab soffit, or as otherwise nominated on engineer's drawings.

C - Top of cut to line up with slab SSL, or as otherwise nominated on engineer's drawings.

D - For slab thicknesses of 200mm or greater, provide support timber prevent bulging. Timber to extend 50mm above Dincel panels and adequately braced.

E - Formwork Deck.

Note: Once Dincel panels have been prepared, insert steel reinforcement as specified by engineer.



F.11. BRACING

It is a safety requirement that any bracing is suitably designed and certified by the project's structural or temporary works engineer in order to provide lateral stability to the wall during installation. This will need to take into account site specific factors such as wind loading, brace capacities, brace spacing, brace fixings, wall height and the loading applied from the concrete pour.

F.11.1. DIAGONAL BRACES

Diagonal bracing is required if the Dincel panels are freestanding and there is no formwork deck to secure the top of the wall onto. If there is a formwork deck above, refer to the next Section.

A - Continuous horizontal waler, constructed from steel (top hat) or timber.

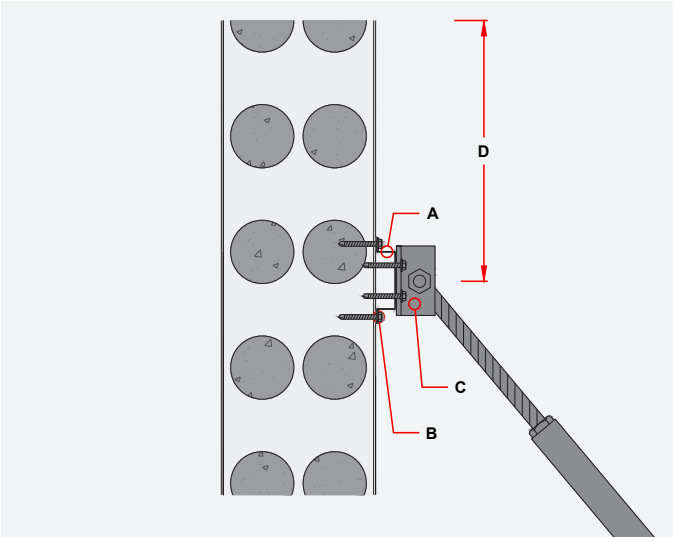
B - Min 2 x 12g hex head screws at each panel joint location (refer to F.11.3 for placement guidance). Screws to be removed after concrete pour, and holes remaining provided with sealant if required.

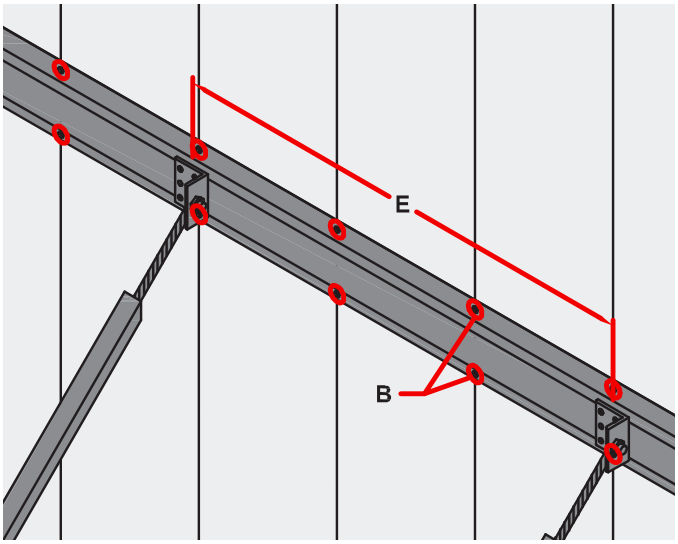
C - Adjustable 'Push-Pull' Prop/Brace.

D - Position waler at 500mm from top of wall, or as otherwise specified by engineer. Where the wall is taller than 4m, a secondary waler with braces should be provided at the wall's mid-height.

E - Spacing between braces as specified by engineer. See below for minimum requirements.

NOTE: The following is provided for illustration and guidance purposes only. Bracing of formwork must be designed by the engineer to suit site conditions. Any wind loading and/or backfill loading has not been considered.





DINCEL PROFILES	WALL HEIGHT	HORIZONTAL SPACING OF WALERS	SPACING BETWEEN BRACES
110, 155, 200	Up to 4.0m	1 row	Maximum 1.66m (every 5-6 panels)
	Above 4.0m, and up to 5.5m	2 rows	Maximum 1.33m (every 4-5 panels)
275	Up to 4.5m	1 row	Maximum 1.38m (every 5-6 panels)
	Above 4.5m, and up to 6.5m	2 rows	Maximum 1.1m (every 4-5 panels)

F.11.2. SECURING TO FORMWORK DECK

Where the Dincel wall height is under 3.6m, panels can be secured to the formwork deck rather than using diagonal bracing. This restraint technique will ensure faster installation and easier access for trades on the level below.

A - Dincel profile, filled with concrete on completion of bracing. Panels must be under 3.6m tall, otherwise supplement with conventional bracing and walers.

B - Formwork decking system, suitably propped and braced as required.

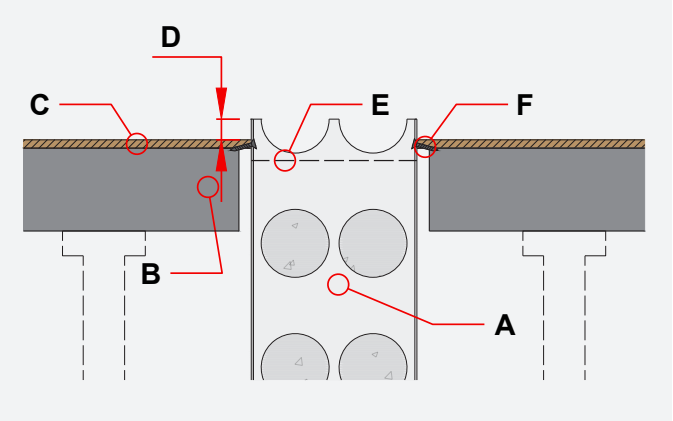
C - Plywood deck surface (min 20mm thick). Plywood to be installed snug surrounding Dincel wall.

D - 25mm lip to enable suitable edge for screw fixings. Lip also prevents deck water run-off & debris entering Dincel panels before pour.

E - Typical pour break location.

F - Screw fixings into plywood deck on one side of wall profile (typically minimum 50mm chipboard screws or minimum 50mm timber hex head screws). Screws should be placed at every panel joint location (refer to F.11.3 for screw placement guidance).

NOTE: The following is provided for illustration and guidance purposes only. Bracing of formwork must be designed by the engineer to suit site conditions.

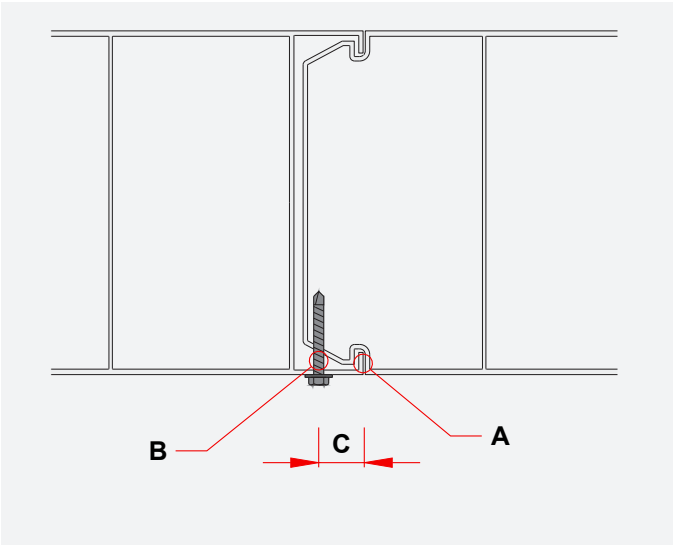


F.11.3. SCREW PLACEMENT

A - Vertical panel joint (simplified illustration without 'barbs' shown).

B - Screw fixings into plywood deck on one side of wall profile (typically minimum 50mm chipboard screws or minimum 50mm timber hex head screws). Screws should be placed at every panel joint location.

C - Screw located 20mm from panel vertical joint in order to provide maximum fixing capacity.



F.11.4. BRACING OF OPENINGS

The below detail is intended for where Self-Compacting Concrete (SCC) is used. If conventional concrete + vibration is selected, the formwork bracing must be installed so that the sill is accessible for pouring/vibration and a pour break occurs at the sill level.

A - Dincel Wall. Profiles are to be cut in order to suit the required opening size.

B - Shutters to cast shape of opening.
For flat openings: use P-TC accessory screwed to profiles at max 150mm centres. If required, these can be removed after concrete set.
For profiled shape openings (i.e. for some windows or doors), either:
• Cast-in metal frame and provide screws at 150mm centres.
• Use combination of plywood and timber formwork to form rebate as required. Fix assembly to Dincel panels at max 150mm centres.

C - Continuous timber bracing to opening sides/jambs. Timber width must closely match wall thickness (by at least 75%).

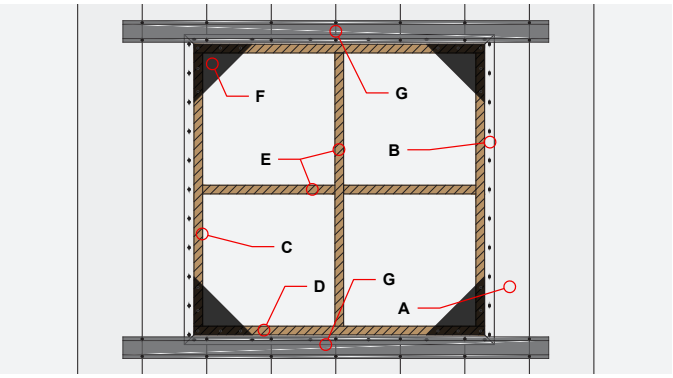
D - Continuous timber bracing to opening header and bottom/sill. Timber width must closely match wall thickness (by at least 75%).

E - Intermediary supports required where timber formwork frame is used. Supports positioned to ensure external timber does not span more than 750mm at any given location.

F - Plywood gussets to maintain squareness of formwork frame.

G - Temporary horizontal waler provided directly above and below opening on both sides of the wall in order to maintain alignment. Waler to be constructed from steel (top hat) or timber and may be required to be braced with push-pull props for larger spans.

Note: Once Dincel panels have been prepared, insert steel reinforcement as specified by engineer.



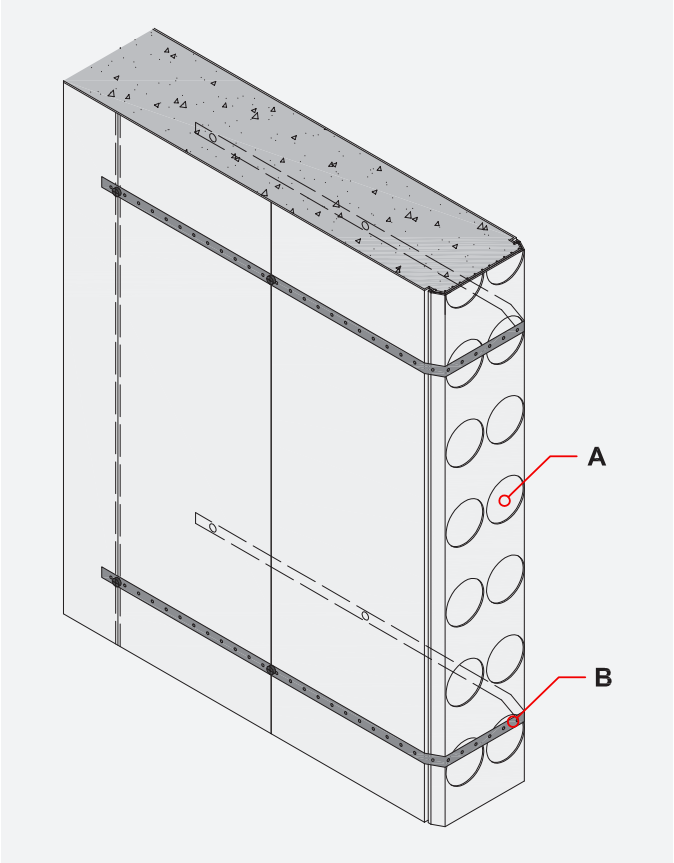
F.11.5. WALL ENDS

F.11.5.1. Non-Critical Aesthetics

WALL HEIGHT	SUGGESTED WALL END BRACING
Up to 3.0m	Use of Stop End accessory. Perforated straps are not required for 155 Dincel. If tolerances do not allow for minimal deflection, use straps for 200 Dincel.
3.0m to 3.6m	Use of Stop End accessory and perforated metal straps @ max 750mm centres for bottom 1/3rd of wall (minimum).
Above 3.6m	Must increase bracing to suit or provide separate pours/lifts.

A - Dincel Stop End Accessory, slid down into slot of main profile.
Note: for 110 and 275 Dincel, a Stop End accessory is not available. Instead, cut a 155-Stop End (155P-SE) to size and slide down panel. For 275 Dincel, use 'critical aesthetics' detail or alternatively, use minimum 3mm thick metal "C" channels.

B - Wrap reusable perforated metal straps around wall end, if required. Straps are to be min 1800mm long and screwed back to first and second panel joints, and positioned at max 300mm from the top and bottom of the wall. Refer to Section F.11.3 for exact screw location.



F.11.5.2. Where Aesthetics Critical

WALL HEIGHT	SUGGESTED WALL END BRACING
Up to 3.0m	Use of Screw-On Cap Accessory screwed @ max 200mm centres, supported by full width timber as shown. Perforated metal straps @ max 750mm centres
3.0m to 3.6m	Use of Screw-On Cap Accessory screwed @ max 150mm centres, supported by full width timber as shown. Perforated metal straps @ max 500mm centres
Above 3.6m	Provide separate pours/lifts, or Increase bracing and supports to suit

A - Dincel Stop End Accessory, slid down into slot of main profile.

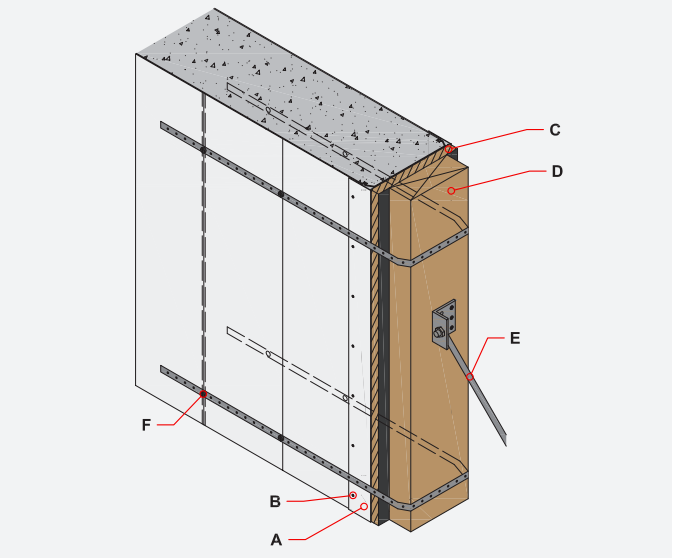
B - Connect Screw-On Cap to main profile by screwing at the required centres.

C - For Dincel 275: Min 20mm x 275mm plywood, provided along full height of wall end.

D - Min 75 x 200mm timber support bearer, provided along full height of wall end. Width of timber support bearer can be reduced to suit for Dincel 110 & 155 Dincel.

E - Push-pull prop screwed to support timber, as specified by engineer. Multiple braces along height of wall are likely required at wall end.

F - Wrap reusable perforated metal straps around wall end, if required. Straps are to be min 1600mm long and screwed back to first and second panel joints, and positioned at max 300mm from the top and bottom of the wall. Refer to Section F.11.3 for exact screw location.

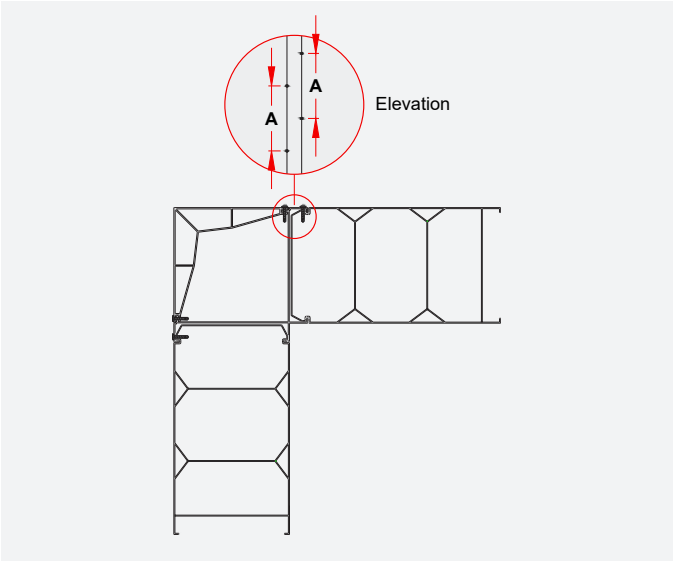


F.11.6. CORNERS

F.11.6.1. Non-Critical Aesthetics

A - Provide screws @ max 300mm centres to joint locations for bottom 1/3rd of corner (minimum). For P5 corners, screws are to be provided to both joints in an alternating arrangement (see figure below).

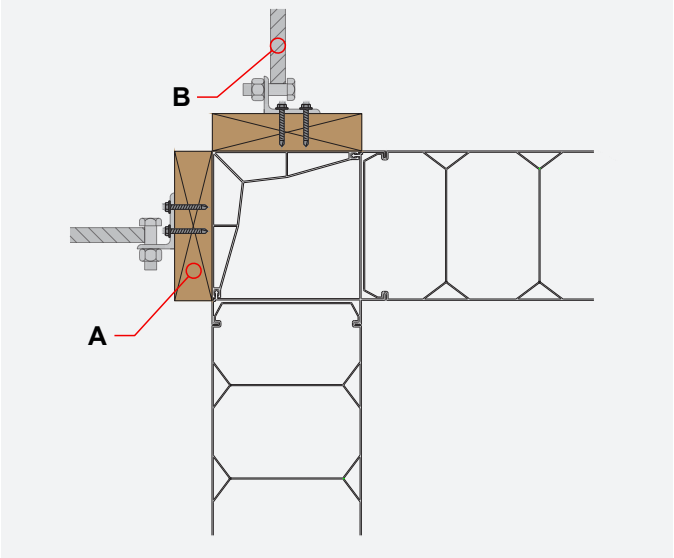
Note: The use of screws to the external face is not suitable for submerged basement walls unless additional waterproofing is provided. Refer to below detail instead.



F.11.6.2. Where Aesthetics Critical

A - Timber support bearer provided along full height and width of corner.

B - Push-pull prop or similar screwed to support timber. Provide min 2 braces (at top and bottom) of timber. For basement or in-ground walls, timber packers can be used between the excavation face and timber supports.



F.11.7. T-JUNCTIONS

F.11.7.1. Option 1

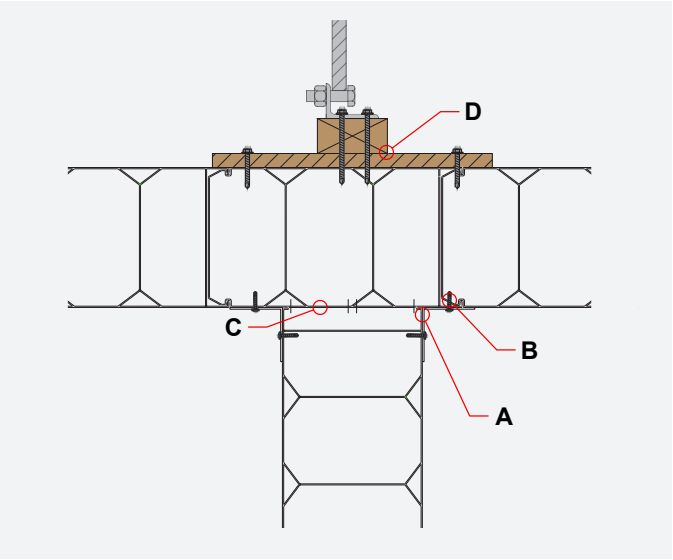
A - Provide temporary angles D-ANG50 to either side of the wall.

B - Screw temporary angles at max:
- 150mm centres for bottom 1/3 of wall
- 300mm centres for top 2/3 of wall

C - If required by engineer, use hole-saw to provide cores at 150mm centres and at diameter to match the main profiles. A Guide Track accessory can be used as a template for marking hole locations.

D - Provide full width plywood and timber prop to prevent bulging on the opposite face. Alternatively, pour each part of the T-Junction at different times.

Note: Only provide screws to external plywood/timber for interior T-Junctions. For basement walls, no screws are to be used on this face.



F.11.7.2. Option 2

A - Provide temporary angles D-ANG50 to either side of the wall.

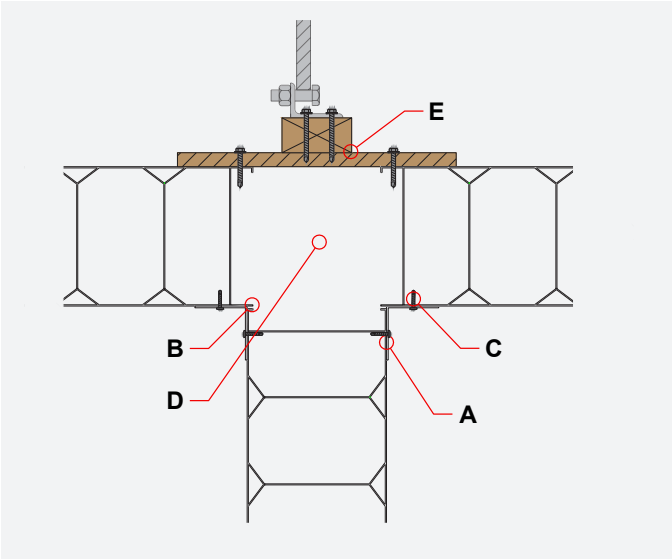
B - Orientate rear of panels (side with barbs) towards T-Junction.

C - Screw temporary angles at max:
- 150mm centres for bottom 1/3 of wall
- 300mm centres for top 2/3 of wall.

D - No Dincel panels or accessories required within T-Junction.

E - Provide full width plywood and vertical timber, suitably propped, to the opposite face. Plywood to be adequately screw fixed to the Dincel panels.

Note: If detail used for wall which requires to be waterproof, exposed concrete surface and angles must be adequately waterproofed with membrane extending min 200mm onto the Dincel panels on either side.



F.12. CONCRETING

F.12.1. CONCRETE ORDERING

Ensure that the concrete mix is ordered in accordance with the specification provided by the consulting design engineer. Recommendations by Dincel for concrete mix design can be found in section B.20. In order to ensure adequate concrete compaction within the formwork, the mix should be either of the following:

	SELF-COMPACTING CONCRETE	HIGH-SLUMP CONCRETE
AGGREGATE SIZE	Maximum 10mm	Maximum 10mm
CONCRETE SLUMP/ SPREAD	Nominal 700mm spread	Nominal 220mm (180mm at the point of discharge)
SLUMP/SPREAD TOLERANCE	-50mm / +30mm	± 40mm
COMPACTION METHOD	No vibration needed on single pours. Refer to F.12.4 of DCM for details	Must vibrate. Refer to F12.4. for details.

The concrete pour should not take place when the ambient daily temperature is over 35°C or under 5°C, or in notable wet weather conditions, unless given specific approval by the project's consulting structural engineer. Consideration should also be given to the distance that the concrete must travel in the pump hose. For example, where concrete requires to be pumped over 15 storeys, the site team should agree on the methodology and suitability of concrete mix with the concrete manufacturer.

F.12.1.1. Net Concrete Quantity (Guidance)

DINCEL PROFILE	PER M2 OF WALL	PER M3 OF CONCRETE
110MM DINCEL	0.105 m^3 of concrete	9.5 m^2 of wall area
155MM DINCEL	0.15 m^3 of concrete	6.7 m^2 of wall area
200MM DINCEL	0.195 m^3 of concrete	5.1 m^2 of wall area
275MM DINCEL	0.27 m^3 of concrete	3.7 m^2 of wall area

Note: The above excludes wastage from concrete pump, hopper & agitator.

Note: Concrete quantity calculations can vary depending on reinforcement to concrete ratio and compaction of concrete.

F.12.2. POUR RATES

The following pour rate table (SCC and Conventional) should be followed in order to prevent bulging or rippling of the formwork face. This is particularly an important consideration when Dincel is not rendered or cladded for aesthetic purposes.

Pouring conditions also need to be considered as the concrete mix and ambient temperature of the time of pouring may vary from project to project. These variations should be taken into account to determine the minimum pouring wait times. Continuation of concrete pouring should only take place after the concrete has reached initial setting.

Please note, the table is applicable as a general guide for all Dincel profiles. The engineer can consider pouring higher walls/higher concrete lifts when aesthetics is not critical. Please consult Dincel team regarding any project specific pour rate recommendations.

F.12.2.1.Self-Compacting Concrete (SCC 680mm ±50 spread)

Where SCC is used, ensure good attention to detail is placed when bracing and sealing formwork. The pressure exerted by SCC is similar to pouring conventional high slump concrete and performing extensive vibration. Due to this higher concrete pressure, taller walls may result in a "wavy" finish unless multiple concrete lifts are considered.

Please note, vibration is not required to compact concrete when using SCC. However, it is recommended to agitate/shuffle the top 400mm of concrete between layers/concrete lifts. Refer to F.12.4.

F.12.2.2. Conventional Concrete (Min 180mm Slump at Truck Discharge) with Vibration

Vibration is required when using conventional concrete in Dincel walls. Where horizontal reinforcement exists in the wall design, the horizontal bars must be vibrated to disperse surrounding concrete and to help eliminate any voids.

VERTICAL POUR RATE TABLE (WHERE AESTHETICS CRITICAL) - SCC & CONVENTIONAL CONCRETE						
DINCEL PROFILE	WALL HEIGHT	1ST CONCRETE LIFT (METRES)	MIN. WAITING TIME (HOURS)**	2ND CONCRETE LIFT (METRES	MIN. WAITING TIME (HOURS)**	3RD CONCRETE LIFT (METRES)
110*	UP TO 3.0M	3.0m	-	-	-	-
	4.0M	2.5m	1.0hr	1.5m	-	-
155* 200*	UP TO 3.0M	1.8m	1.0hr	1.2m	-	-
	3.6M	2.0m	1.0hr	1.6m	-	-
	4.0M	2.0m	1.0hr	2.0m	-	-
	4.5M	2.0m	1.0hr	1.5m	1.0hr	1.0m
	5.0M	2.0m	1.0hr	2.0m	1.0hr	1.0m
	5.5M	2.0m	1.0hr	2.0m	1.0hr	1.5m
	6.0M AND ABOVE	2.0m	1.0hr	2.0m	1.0hr	2.0m*
275*	UP TO 3.0M	3.0m	-	-	-	-
	3.6M	2.0m	1.0hr	1.6m	-	-
	4.0M	2.5m	1.0hr	1.5m	-	-
	5.0M	2.5m	1.0hr	2.5m	-	-
	6.0M AND ABOVE	2.5m	1.0hr	2.0m	1.0hr	1.5m*

* Please consult Engineer and Dincel Construction team for project specific advice.

** The time between each concrete lift is based upon when the concrete achieves initial set. Consult with the selected concrete manufacturer for confirmation of initial setting times. The initial setting time for SCC is generally 2-3 hours from time of dispatch. The design engineer needs to account for any possible cold joints that may occur at pour breaks. Particularly if the cold joint is below permanent water table.

Note: Dincel 275 profiles are available in standard lengths of up to 6.525m. For taller walls, longer profiles can be specially ordered or alternatively use multiple profiles spliced together.

Note: For Conventional concrete pours, vibrating is required. Refer to section 12.4

Note: For Self-Compacting Concrete (SCC), no vibration is required besides shuffling between layers/concrete lifts. Refer to section F.12.4

F.12.2.3. Horizontally Placed Dincel Panels

Where panels have been installed horizontally (such as for factory/warehouse walls or retaining walls) the recommended concrete placement is:

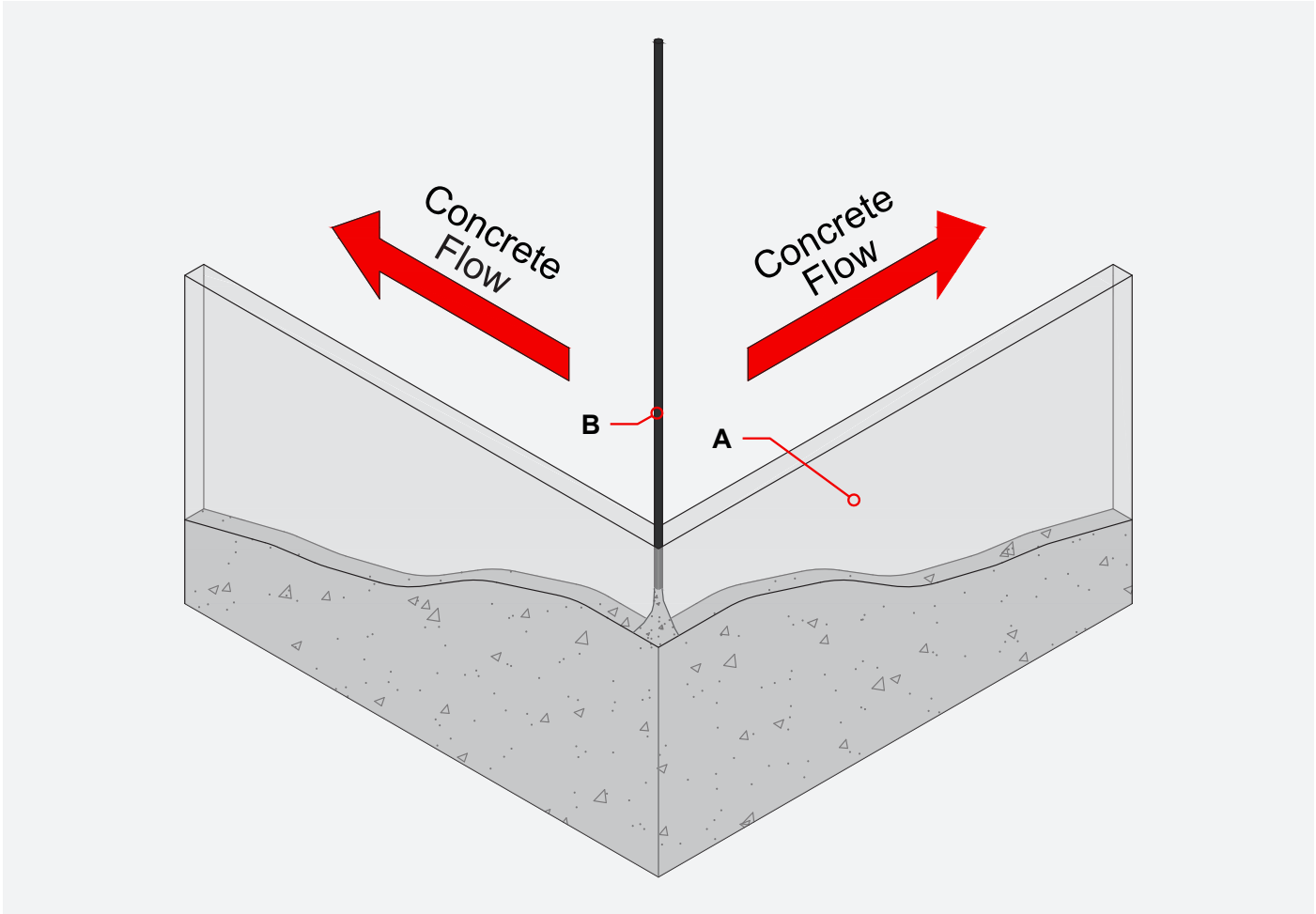
- Dincel 110, 155 & 200: a maximum of 1.0m vertical lifts per hour or until initial concrete set.
- Dincel 275: a maximum of 2.0m vertical lifts per hour or until initial concrete set.

F.12.3. PLACEMENT

It is common for aggregate to segregate when pouring concrete walls due to two main reasons:

1. concrete fall from heights (the below hose positioning options A & B address this issue)
2. build up at the bottom of the concrete hose where the kink created by the hose clamp lies. If dispersed within the wall formwork, this will result in segregated concrete at the base cold joint leading to poor liquid tightness. Due to this event, installers must discharge/dispose this segregated concrete outside of the wall form work (0.1m³) before beginning the placement of concrete.

F.12.3.1. Hose Positioning



A - Dincel Walls (panel joints not shown for clarity).

B - Pour location should always start at corners or T-junctions where possible. This will ensure that the concrete will flow away from the corner or junction and subsequently divert the pressure from these locations. The pour location may be moved to the centre of the wall once concrete has reached the required lift height at the corner or junction.

F.12.3.2. Option A – Point hose towards webbing

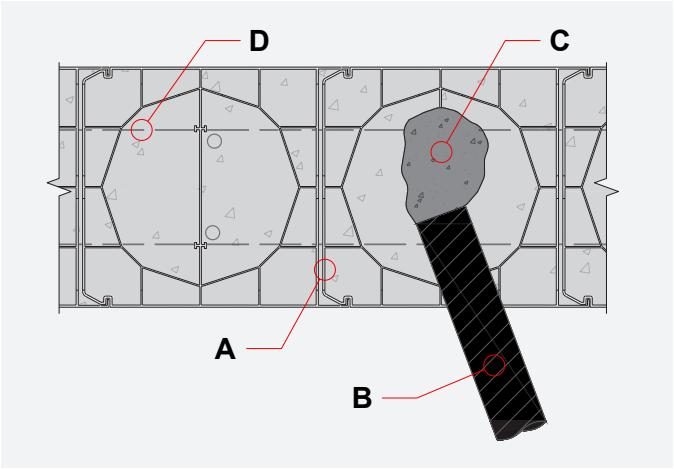
A - Dincel panels.

B - Max 2.5 inch concrete pump hose, lowered into wall. Note: Placement at wall corners or T-Junctions is preferred where possible.

C - Point hose towards Dincel panel webbing to prevent free fall of concrete.

D - Reinforcement as required by engineer.

Note: Option A is suited to walls less than 3.6m in height.



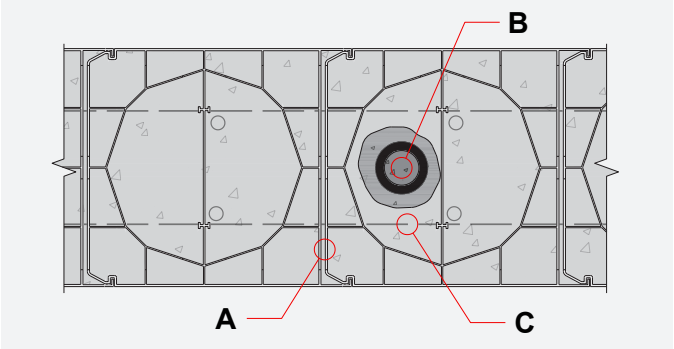
F.12.3.3.Option B – Lower hose or tremie/drop chute into panel

A - Dincel panels.

B - Max 2.5 inch concrete pump hose, lowered into wall. Alternatively, a flexible tremie/drop chute can be used. Note: Placement at wall corners or T-Junctions is preferred where possible.

C - Reinforcement as required by engineer. Hose or chute to be positioned in between reinforcement bars where possible.

Note: Option B is suited to walls greater than 3.6m in height and for Dincel 200 & 275 only. It is an optional approach in order to minimise any chance of segregation.



F.12.4. VIBRATION

F.12.4.1. Requirements

- If conventional concrete is used, vibration must be used.
- If Self-Compacting Concrete (SCC) is used, vibration should not be used. Vibration of SCC to consolidate concrete may lead to segregation. However, it is recommended to use the vibrator to lightly agitate ('shuffle') the top 400mm of concrete between layers/ lifts.

Vibration for conventional concrete is required in order to achieve the following:

- Prevention of air-voids
- Ensure slurry from the concrete mix invades the panel joints in order to create a waterproof seal

F.12.4.2. Specifications

HEAD DIAMETER	TYPE	SHAFT	HOSE LENGTH
25mm	Pocket Vibrator	Flexible	Use of extension hose if required to match wall height.

F.12.4.3. Technique

For guidance on how to vibrate a concrete wall, please refer to the Cement Concrete & Aggregates Australia (CCAA) guide to concrete for housing, Figure 4.3. The CCAA document can be downloaded by scanning the QR Code to the right.

Generally speaking, for each concrete pour/lift, the vibrator should be placed at the bottom of the pour and moved up slowly until it is clear of the concrete. This should be carried out at regular intervals of the wall (i.e. typically at every Dincel panel location). Care should be taken not to over vibrate the concrete in order to prevent segregation of the concrete mix.

As Dincel formwork is a non-porous material, it does not absorb water from the concrete mix during pouring (unlike masonry block walls, fibre cement or plywood forms). This is an automatic measure which will increase flowability of concrete within the formwork.

Care should be taken when using a vibrator as they can damage the webs within Dincel formwork which may cause bulging. The likelihood of damaging webs with a vibrator increases with a large vibrator head size, for this reason vibrators with a head size large than 25mm should not be used. The slim 25mm profile would also ensure that the head can slide past horizontal reinforcement within Dincel formwork. Pay special attention to the sides of all openings, bulkheads and any areas that have a higher than normal concentration of steel.

F.13. PATCHING

In the event that the Dincel polymer surface is damaged, the surface can be patched and repaired. The type of patch will depend on the application:

F.13.1 Patching for aesthetics

For the patching of small holes (such as from screws), a suitable white silicon can simply be applied and made flush with the surface.

For other surface damage:

- The damaged area should be cut and removed from the wall.
- If any concrete repair is required to rectify damaged concrete within the wall, concrete patching can be completed by conventional means.
- The surface is then filled with resin of not less than 2mm in thickness (to match with the adjacent Dincel wall module).
- Sand and level the dried resin surface.
- Apply a colour-matched paint. Note: Dulux produces a 'Dincel White' colour. Before painting, apply a primer base coat designed for PVC substrates.
- Depending on walling application, additional waterproofing treatment may be required over/at the damaged area.

F.13.2. Patching for waterproofing

For any surface which may potentially be exposed to water pressure (i.e. retaining wall, basement wall, or water tank), the surface damage must be repaired through the application of a suitable waterproof membrane over the affected area.

F.14. CLEANING

During concreting, concrete slurry may splatter onto Dincel walls. The removal of hardened concrete slurry could damage the walls' surface which may not be aesthetically pleasing for walls without a paint, render or cladding finish. Therefore, it is always preferable to remove the slurry before it hardens.

F.14.1 Removal of Wet Concrete

- Wash slurry with high-pressure water within 30 minutes of occurring (before the concrete slurry hardens). Care should be taken as to not wet inside the Dincel panels, which would affect the concrete's water-to-cement ratio.

F.14.2. Patching for waterproofing

- Ensure the concrete slurry is at least two weeks old.
- Apply hydrochloric-acid diluted to 1-in-10 or less onto the concrete slurry with a brush. The soft brushing will allow the concrete slurry to absorb the diluted acid.
- Apply high water pressure to remove the concrete slurry five minutes (or ten minutes maximum) after application of the diluted acid.

F.14.3. General Cleaning

- Any household detergent can be used on the Dincel polymer skin for general cleaning purposes.
- A high-pressure washer is recommended for removing general dirt and dust from the surface

F.15. INSTALLATION CHECKLIST

The installation checklist ensures that most of the critical items regarding installation of a Dincel wall have been carried out by the installer. The checklist can be incorporated into the site Inspection & Test Plan (ITP) in order to capture all site-specific elements and scope of works which may vary from project to project.

To download a copy of the most current Installation Checklist, scan the following QR Code.

DINCEL
STRUCTURAL WALLING

CONSTRUCTION MANUAL WATERPROOF ADDENDUM

CONTENTS

G.1. OVERVIEW

This document is to be used where the Dincel Waterproofing Warranty is required. This document makes reference to the latest Dincel Structural Walling – Construction Manual (DCM). This can be sourced from www.dincel.com.au at the time of design and construction. This document takes precedence over the DCM when Dincel Waterproofing Warranty is applicable.

Following the DCM, the Design Engineer/Architect must:

1. Include the DWS profile, injection system and must include a dish drain to DCM specifications and appropriately designed drainage pit and pump out capability.
2. Ensure that all footings other than those directly bearing on rock or hard shale are required to have pile/piers founding on rock/hard shale to avoid or minimize long term foundation settlement or differential settlement due to ground movement. In cases where footings do not bear directly on rock or hard shale or do not have piles/piers founding on hard rock or shale; a site and photographic survey at the slab/footing to wall junction at 5m (maximum) intervals should be undertaken by a registered surveyor within 5 days after Occupation Certificate. This will be used as a base line against which future settlement (if any) could be compared.
3. Ensure construction details are consistent with the details shown in the DCM if they are not present in this Construction Manual Addendum.

Additionally, the design of the wall must meet the requirements of the following:

- The Structural Design Engineer shall provide certification that the design of the Dincel Wall (155mm thick, 200mm thick, or 275mm thick) is adequately reinforced for the applied loading (i.e., earth, surcharge, traffic load, water pressures).
- The Structural Design Engineer shall also certify that the maximum deflection under the applicable loads (i.e., water, soil, traffic surcharge loading) at the mid-span of the basement wall does not exceed the basement wall height (mm)*/750 by assuming that the concrete thicknesses are 150mm (for 155 Dincel), 195mm (for 200 Dincel) and 270mm (for 275 Dincel) for the respective Dincel Wall specified.
- The Structural Design Engineer shall inspect and provide certification that the reinforcement placed using Dincel reo-clips complies with his/her design intent.

The Dincel Waterproof Warranty only covers the cases defined in the following tables G.1.1 and G.1.2 and is based on the:

- Nominated ground water table position.
- Earth loading.
- Max. 10KPa traffic/backfilling compaction surcharge loading (excludes surcharge loadings from neighbouring buildings if any).

G.1.1. ONE WAY SPANNING WALLS BETWEEN BASEMENT SLABS

WALL THICKNESS	MAXIMUM STRUCTURAL HEIGHT BETWEEN SUPPORTS (M)*	MAXIMUM ALLOWABLE GROUND WATER HEIGHT (M) # ABOVE THE WALL-FOOTING JUNCTION
155 DINCEL	3.0 and lower	0.4
200 DINCEL	4.0	NIL
	3.6	0.4
	3.3	0.8
	3.0 and lower	1.0
275 DINCEL	4.5	1.5
	4.0	2.5
	3.5 and lower	3.5

G.1.2. TWO WAY SPANNING WALLS BETWEEN BASEMENT SLABS AND BUTTRESSES

WALL THICKNESS	MAXIMUM STRUCTURAL HEIGHT BETWEEN SUPPORTS (M)*	MAXIMUM ALLOWABLE GROUND WATER HEIGHT (M) # ABOVE THE WALL-FOOTING JUNCTION
275 DINCEL	5.0	2.0**
	4.5	3.5**
	4.0	4.0**

* **NOTE:** Represents the structural height for the basement wall between the lateral supports provided by the footing-slab and suspended slabs over.

** **NOTE:** Maximum space between buttresses supporting two way spanning basement wall is 3.0m. This is to suit any carparking spaced between 2.4m and up to 3m. The length, height, thickness of the buttress walls is to be determined by the Structural Design Engineer. Buttresses can only be placed at the inside face of the basement wall which is opposite to the earth and/or water. The connection between the perimeter basement wall and buttress walls shall only be a single galvanized dowel bar to the center of the buttress wall and away from any Dincel panel joint.

NOTE: Ground Water Table Position (water table ▼) means the highest potential ground water position which includes permanent (purged water table), tidal water position due to sea/river level movement and storm water movement above each relevant wall-footing slab junction for the period of warranty.

G.2. BASEMENT SLABS WITH FALLS

Basement slabs on sloping sites can be designed with various falls provided the permanent ground water table is below the concrete footing level. The Dincel system can allow for the DWS to be stepped down at 300mm heights along with the footings to suit sloping basement surface levels. The DWS and footing steps must be continuous behind the Dincel walls.

The Dincel Waterproofing Warranty must be coordinated with the provided shop drawings and shall show the below information.

G.2.1. TYPICAL SECTION VIEW OF STEPPED WALL

A - Basement slab profile provided by Project's Architect

B - 300mm footing steps where required

C - Dincel corner profile

D - Top of Dincel profiles

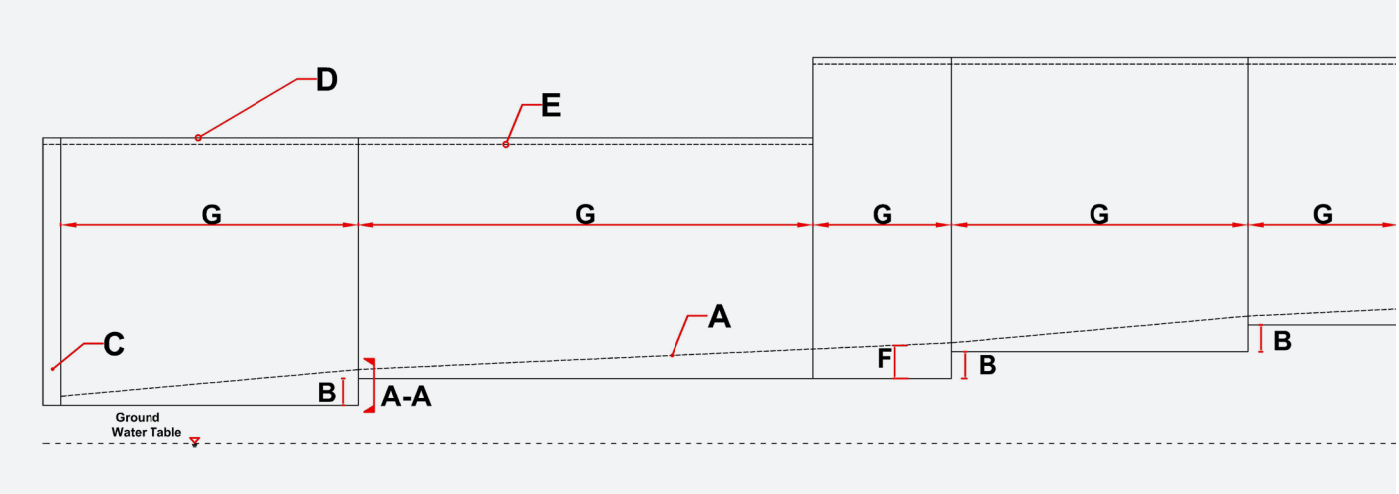
E - Soffit level for slabs/beams over

F - Max. 700mm from footing to slab level

G - Pack sizes to suit wall section heights/lengths.

A-A - Refer to section G.2.3.

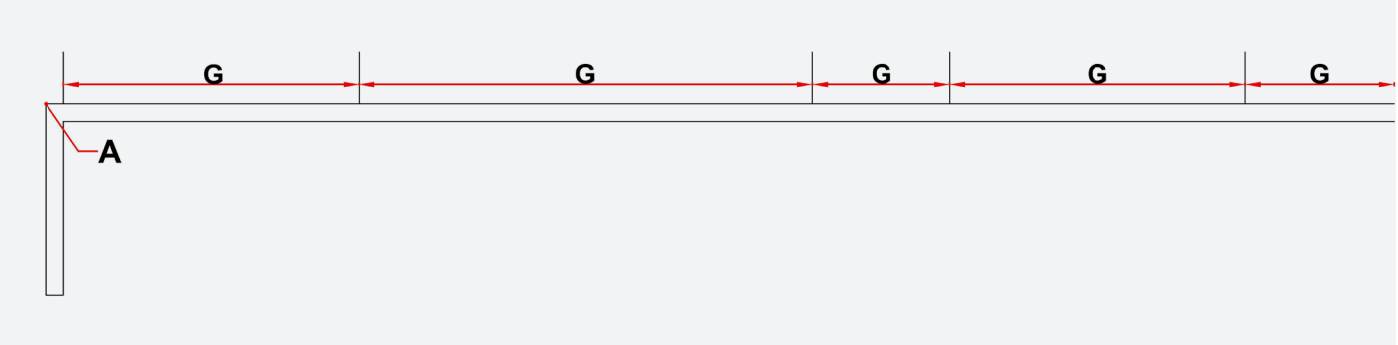
NOTE: Ideal pack size spans include multiples of 10 x 200P-1 or 12 x 275P-1 main profiles.



G.2.2. PLAN VIEW OF STEPPED WALL

A - Set-out point by surveyor starting at corner profile.

G - Pack sizes to suit wall section heights/lengths.



G.2.3. STEPPED FOOTING – PLAN VIEW SECTION A-A (G.2.1)

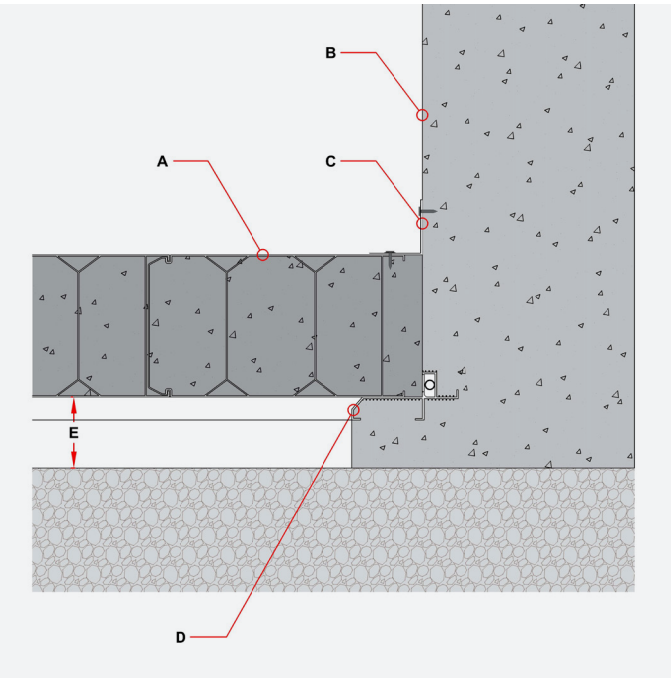
A - Dincel profile. Female end facing footing step.

B - Face of footing step to be formed with profile lengths (0-25mm construction tolerance).

C - Screw temporary D-ANG50 Angles at max:
- 150mm centres.

D - Dincel Water Stop (DWS) used as cast-in shutter to form hob.

E - Min. 100mm (width of DWS hob).



G.2.4. SECTION AT BOTTOM OF DINCEL WALL - GROUND WATER TABLE BELOW FOOTING LEVEL

A - Concrete footing to engineer's details.

B - Concrete floor slab to engineer's details.

C - Concrete pour break where required. Min. 200mm wide. Concrete footing to slab connection to engineer's details.

D - Min. 300mm.

E - Min. 100mm.

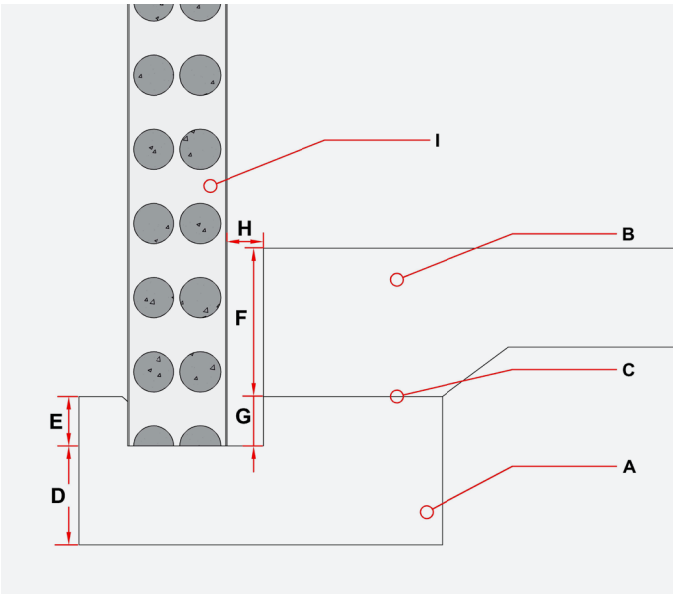
F - Max. 600mm.

G - Min. 100mm.

H - Rebate to allow for dish drain.
Refer to project's engineers specifications.

I - Dincel Profile.

NOTE: DWS not shown.



G.3. BASEMENT WALLS WITH MULTIPLE BASEMENT FLOORS - BELOW FINISHED GROUND LEVEL

Dincel Profile Lengths

- Dincel 275 profiles are generally extruded up to 6525mm long (special orders of up to 7950mm can be achieved)
- Dincel 155 & 200 profiles can be extruded up to 7950mm

G.3.1. TYPICAL DINCEL BASEMENT WALL ACCOMMODATING MULTIPLE LEVEL BASEMENT FLOORS

A - Dincel profile.

B - Concrete Footing or Slab to engineer's details.

C - Footing/Slab to engineer's details. Refer to Section G.6 for variations.

D - When required to connect to an external basement wall. Only dowel connections to the inside face of external basement walls and away from panel joints (drill and epoxy or in-situ bars).

E - Continuous length of Dincel profile. Max 7950mm for Dincel profiles.

F - Drip groove.

G - Ground water table (if any) min. 500mm below any horizontal panel joints.

H - Space to satisfy building authority requirements to install waterproof bandage. Backfill space to engineer's details (only required when a horizontal joint is applied). Refer to section G.4.

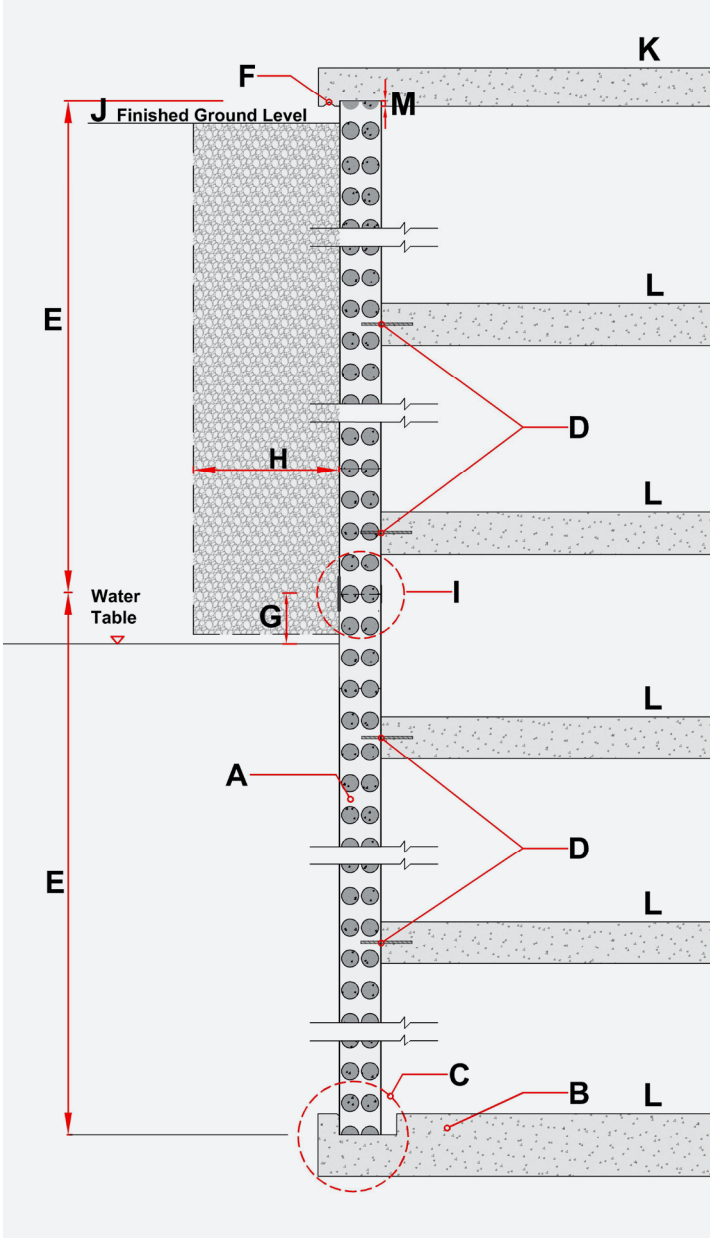
I - Horizontal splice joint. Refer to section G.4.

J - Finished Ground Level.

K - Top of ground floor slab.

L - Basement floor slabs 1, 2, 3, 4, 5 etc.

M -25mm soffit level to allow for slab or beam.



G.4. EXTENDING BASEMENT WALLS BELOW GROUND

Horizontal splicing of Dincel panels only allowed if continuous 7950mm long panels is not adequate to cover the total basement heights below the finished ground level.

If horizontal splicing of Dincel panels is to be adopted; the splicing must adopt the following:

- No horizontal splicing is to take place at wall to suspended basement slab joints.
- Splicing joint must be a minimum 500mm above the permanent/tidal water table (to be confirmed by a geotechnical report).

G.4.1. DINCEL WALL SPLICE DETAIL – JOINT BELOW GROUND

This detail is used when a horizontal joint is required below ground. The joint must be minimum 500mm above permanent/tidal water table.

A - Dincel profile.

B - Dincel Wall Splice (P-WS) accessory. Refer to F.8.2.1 of DCM

C - Cut and remove exterior part of Dincel Wall Splice (P-WS) accessory once wall is filled with concrete and structure is complete. 10mm groove cut into horizontal joint. Cleaned and prepped ready for sealant

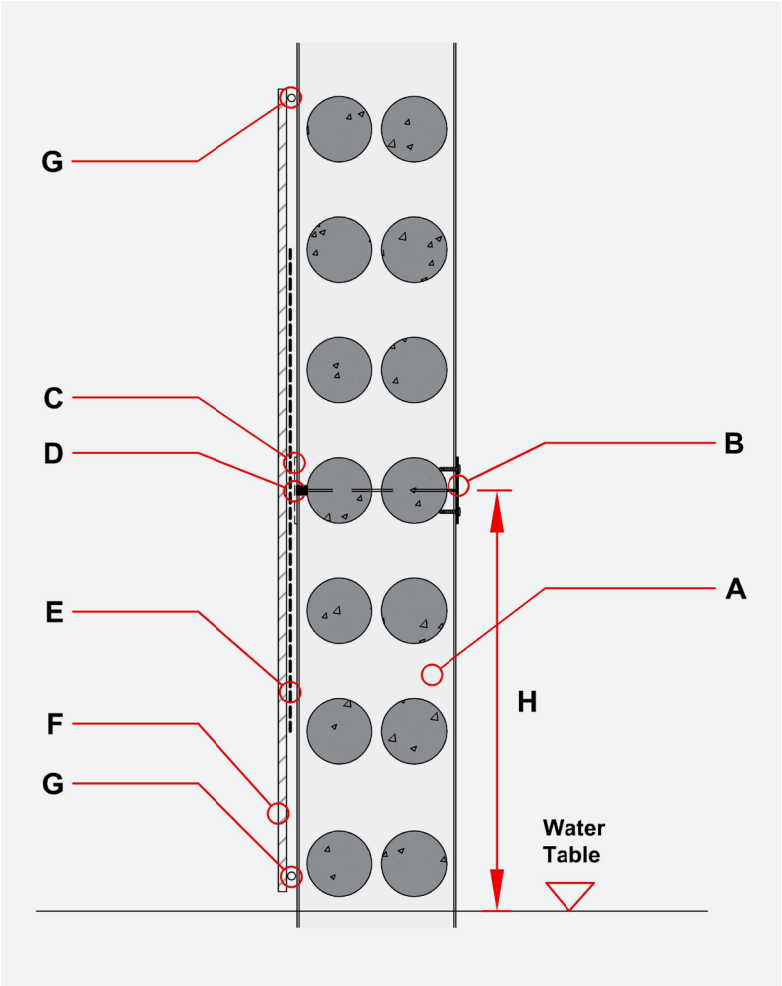
D - MS Polymer sealant or equivalent. Ensure continuous and without gaps.

E - Dincel nominated waterproofing bandage. Over sealant and 300mm above and below spliced joint.

F - Corflute positioned to protect waterproofing bandage and joint when backfilling. Min. 500mm above and below spliced horizontal joint.

G - PVC compatible adhesive to secure corflute in place before backfilling.

H - Horizontal joint minimum 500mm above permanent/tidal water table.



G.4.2. WALL JUNCTIONS

Where there are joints or junctions to exterior Dincel walls. No penetrations should occur at the earth face of the Dincel wall. Drilling into the interior side of the Dincel wall is permissible above wall-footing slab level and to engineer's details (drill & expoxy or in-situ bars) however should be minimised as much as possible.

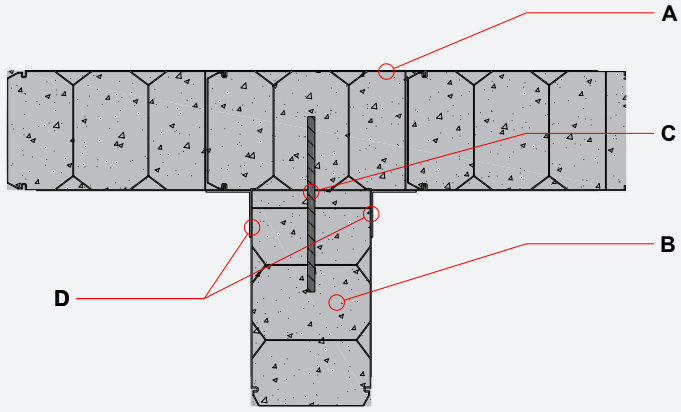
G.4.2.1. Typical Plan "T" Junction

A - Earth face of Dincel wall.

B - Internal Dincel wall.

C - Dowel connection only (no cut-out of Dincel skin permissible. Drill only).

D - Screw temporary D-ANG50 Angles at max:
- 150mm centres for bottom 1/3 of wall.
- 300mm centres for top 2/3 of wall.



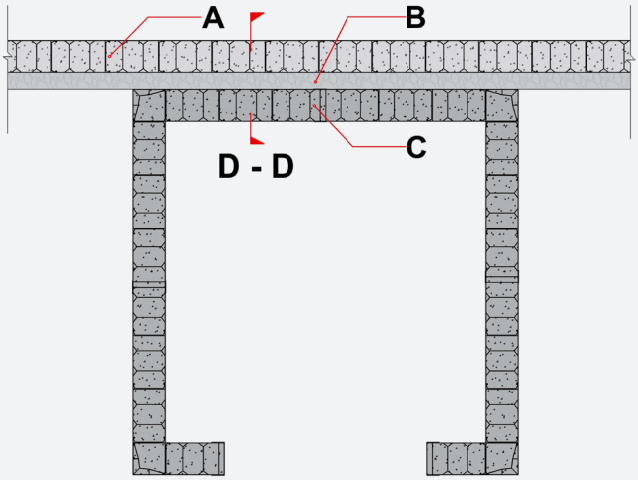
G.4.2.2. Typical Lift Shaft Wall for Waterproofing Purposes - Plan View

A - Continuous Dincel profile

B - Dish drain to engineer's details

C - Internal Dincel wall

D-D - Refer to section view G.4.2.3



G.4.2.3. Typical Lift Shaft Wall for Waterproofing Purposes - Section View

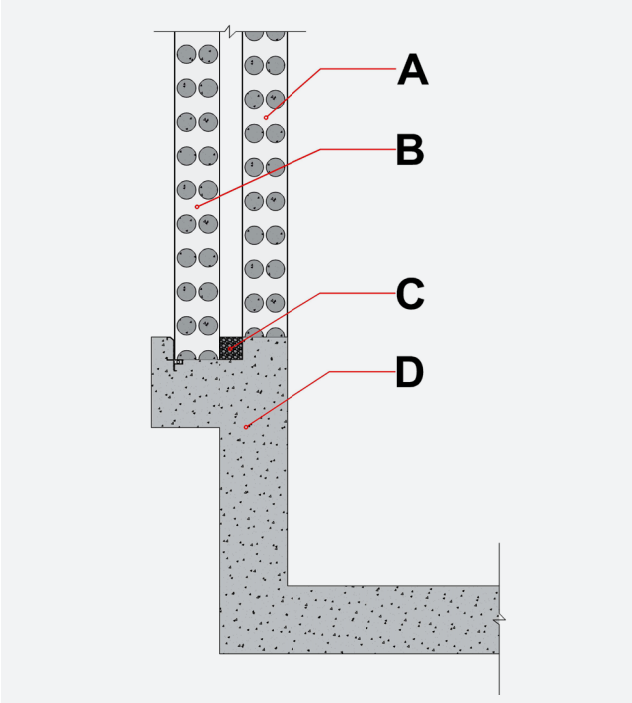
Industry standard is to pour in-situ monolithic concrete lift pits. Dincel wall construction above.

A - Dincel lift shaft wall.

B - Dincel external wall.

C - Dincel drain to project engineer's details.

D - Monolithic concrete lift pit to project engineer's details (Dincel Water Stop (DWS) cast in hob).



G.5. DINCEL WATERSTOP (DWS)

The DWS accessory is part of a waterproofing system. The system incorporates a re-injectable hose and is installed as part of the hob prior to Dincel wall construction. In the event of any water seepage during the period warranted at the base wall junction, injection material is pumped through the re-injectable hose to fill and seal any voids where water ingress has occurred.

G.5.1. INSTALLATION

The DWS is secured to formwork to act as a shutter to form a hob. The re-injectable hose is installed into the DWS cavity prior to Dincel wall installation. The following is an example on how the DWS accessory can be fixed in place to for up the footing slab.

The following details incorporate the Dincel Waterstop accessory (DWS) and re-injection hose system providing directions to ensure waterproofing around the Dincel wall and footing slab junction.

G.5.2. CONSTRUCTION OF SLAB REBATE WITH DINCEL WATER STOP (DWS)

A - Dincel Water Stop (DWS) used as cast-in shutter to form hob.

B - Timber batten held in place to stabilise the timbers used to form rebate using nails or screws. Preferably screws for ease of removal.

C - Steel reinforcement provided to hob design subject to engineer's details.

D - Plywood shutter (fixed/pinned appropriately to ground) or face of shoring/sheet piling.

E - Min. 100mm.

F - Total rebate width = Panel thickness + drainage cavity size.

G - Slab and slab reinforcement to engineer's details.

H - Timber positioned to suit required rebate.

I - Rebate distance to allow for dish drain (to project engineer's details).

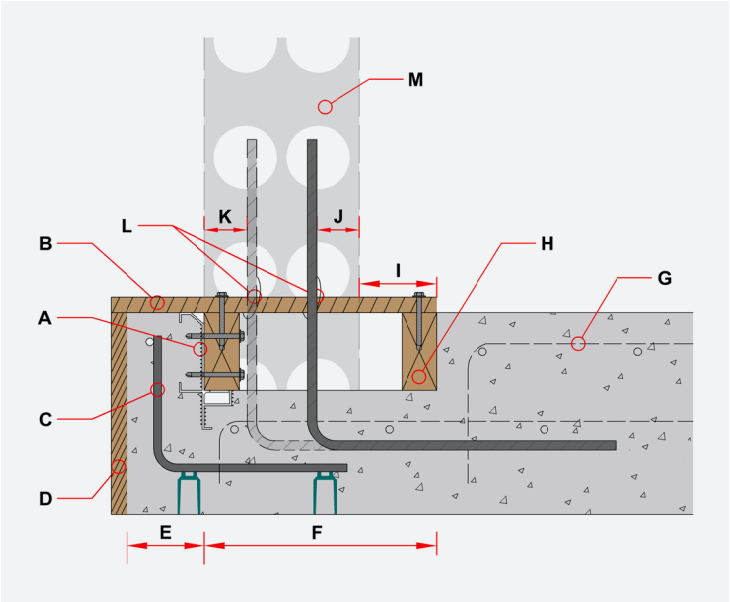
J - Min. 55mm concrete cover from face of Dincel to starter bar

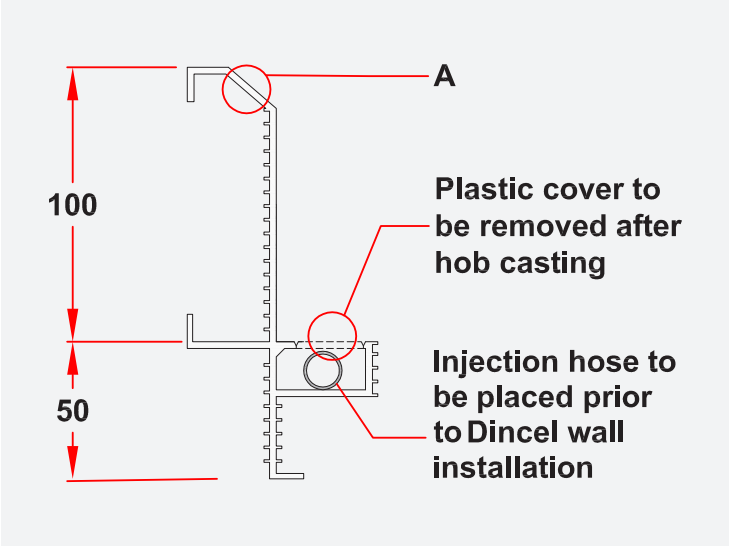
K - Min. 55mm concrete cover from face of Dincel to starter bar and to provide clearance to DWS

L - Option of one or two starter bars secured to timber batten using tie-wire as required by design engineer.

M -Dincel wall to be installed (shown for visual aid purposes)

NOTE: Maximum one layer of starter bars for Dincel 155 profiles to allow for sufficient concrete cover and clearance to DWS.





G.6. BASEMENT DETAILS

The following design details have been extracted from the DCM and should be included in basement designs to prevent water ingress through the cold joint located between the Dincel wall and footing slab.

The following designs incorporate three main waterproofing mechanisms;

1 - The waterproofing properties of the PVC membrane and patented 'snap' joints,

2 - The DWS/injection system to fill and seal any minor cracks at the wall-footing slab junctions in the event they have occurred and to prevent further additional water ingress (when required), and

3 - A free draining dish drain/pit/pump to remove any undesirable water that happens to travel into the basement. The dish drain may receive ground water prior to finalisation of injection procedure.

NOTE: Free draining dish drain means that the dish drain along the Dincel wall is free to drain and not subject to any blockage/ponding. Whilst the geotechnical report may confirm the site to be of non-submerged condition, if the drainage system fails, scenarios of submerged conditions can occur. Failure of the drainage system can cause hydrostatic pressure to lift the basement slab and joints, allowing water to penetrate through the floor slab and joints. Situations such as this are not covered by the Dincel Waterproof Warranty.

NOTE: Dish drains are required because of the following:

- To be able to drain out any water during the course of the structure's construction prior to application injection system.

- To be able to drain out any liquids overflowing from activities such as general and car cleaning and in the event of a sprinkler system being activated or failing.

NOTE: The waterproof warranty is only applicable once the injection of the resin inside the DWS has taken place. The injection of the waterproofing resin is to take place no earlier than the finalisation of the structural work of the entire building.

NOTE: In non-submerged conditions, ag-lines and drainage cells are required if the basement wall is not designed for hydrostatic pressure. Hydrostatic pressure must be designed for submerged conditions.

NOTE: The engineers working on the project must take into account the thickness of the slabs and their joints for the entire duration of the structure's service life, particularly in the event of malfunctioning ag-lines.

NOTE: The following details do not show site specific reinforcement requirements. Please consult and refer to the project's engineering drawings for details.

G.6.1. WALL-SLAB JOINT ABOVE GROUND WATER TABLE POSITION

G.6.1.1 Monolithic Footing with Rebate: This detail is applicable to basement slabs with negligible falls. The footing and basement slab is poured at the same time.

A - Dincel Wall (wall must be designed for hydrostatic water pressure if ag-line is not used or assumed to be non-functional in time).

B - Steel reinforcement to engineer's details.

C - Starter bars, tied to footing by either casting in or postfixing (drill & epoxy) as per engineer's detail.

D - Concrete floor slab to engineer's details.

E - Dincel Water Stop (DWS) used as cast-in shutter to form hob.

F - Re-injection hose system to provide waterproofing injection material.

G - Min 100mm.

H - Min 100mm set down. Timber can be used to form rebate and also as temporary restraint.

I - Min 300mm.

J - Dish drain to project engineer's details.

K - Drainage system by others.

L - Ag-line to project engineer's details.

M - Adhere drainage cell to Dincel face as required by Project Engineer when Dincel wall is not designed for hydrostatic pressure. Ensure no damage or ruptures of Dincel panels occur during backfilling.

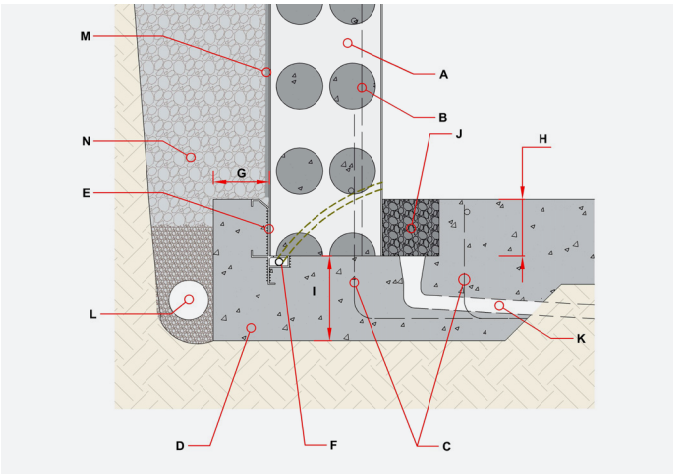
N - Free draining granular backfill to engineer's details.

NOTE: Use this detail over B3.2.1. of DCM when Dincel Waterproofing Warranty is required.

NOTE: Self Compacting Concrete (SCC) and injection material MUST be used with the following detail.

NOTE: No accessories (such as guide track P-G) to be used underneath Dincel wall.

NOTE: Waterproofing footing/slab by others.



G.6.1.2 Monolithic Footing Slab with Monolithic Hob: This detail is applicable to basement slabs with negligible falls. The footing slab and hob are poured at the same time.

A - Dincel Wall (wall must be designed for hydrostatic water pressure if ag-line is not used or assumed to be non-functional in time).

B - Steel reinforcement to engineer's details.

C - Starter bars, tied to footing by either casting in or postfixing (drill & epoxy) as per engineer's detail.

D - Concrete footing slab and hob to engineer's details.

E - Dincel Water Stop (DWS) used as cast-in shutter to form hob.

F - Re-injection hose system to provide waterproofing injection material.

G - Min 100mm.

H - Min 100mm hob. Timber can be used to form the hob and provide temporary wall restraint.

I - Min 300mm.

J - Dish drain to project engineer's details.

K - Drainage system by others.

L - Ag-line to project engineer's details.

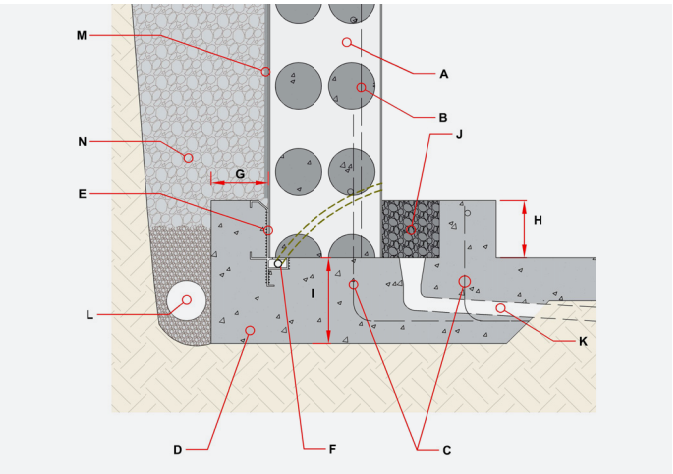
M -Adhere drainage cell to Dincel face as required by Project Engineer when Dincel wall is not designed for hydrostatic pressure. Ensure no damage or ruptures of Dincel panels occur during backfilling.

N - Free draining granular backfill to engineer's details.

NOTE: Self Compacting Concrete (SCC) and injection material MUST be used with the following detail.

NOTE: No accessories (such as guide track P-G) to be used underneath Dincel wall.

NOTE: Waterproofing footing/slab by others.



G.6.2. WALL-SLAB JOINT ABOVE GROUND WATER TABLE POSITION & FOOTING IS PLACED PRIOR TO BASEMENT SLAB

This detail is applicable to basement slab with significant falls. The footing is poured first. Basement slab after.

A - Dincel Wall.

B - Steel reinforcement to engineer's details.

C - Starter bars, tied to footing by either casting in or postfixing (drill & epoxy) as per engineer's detail.

D - Concrete floor slab to engineer's details.

E - Dincel Water Stop (DWS) used as cast-in shutter to form hob.

F - Re-injection hose system to provide waterproofing injection material.

G - Min 100mm.

H - Min 100mm set down to suit basement slab fall.

I - Min 300mm.

J - Dish drain to project engineer's details.

K - Drainage system by others.

L - Ag-line to project engineer's details.

M - Basement/ground floor slabs to engineer's details.

N - Footing steel reinforcement to engineer's details.

O - Waterproofing of this pour break joint and floor slab by others.

P - Steel reinforcement to engineer's details. Min 50mm from slab edge face.

Q - Min. 200mm.

R - Steel reinforcement to engineer's details.

S - Ensure no damage or ruptures of Dincel panels during backfilling.

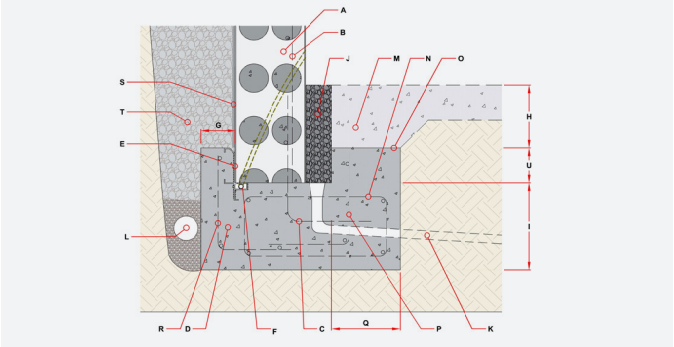
T - Free draining granular backfill to engineer's details.

U - Min. 100mm.

NOTE: Self Compacting Concrete (SCC) and injection material MUST be used with the following detail.

NOTE: No accessories (such as guide track P-G) to be used underneath Dincel wall.

NOTE: Waterproofing footing/slab by others.



G.6.3. WALL-SLAB JOINT BELOW GROUND WATER TABLE POSITION

G.6.3.1 Monolithic Footing Slab with Rebate.

A - Dincel Wall.

B - Steel reinforcement to engineers' details.

C - Starter bars, tied to footing by either casting in or postfixing (drill & epoxy) as per engineer's detail.

D - Concrete footing slab to engineer's details.

E - Dincel Water Stop (DWS) used as cast-in shutter to form hob.

F - Re-injection hose system to provide waterproofing injection material.

G - Min 100mm.

H - Min 100mm set down. Timber can be used to form rebate and also as temporary restraint

I - Min 300mm

J - Dish drain to project engineer's details.

K - Drainage system by others.

L - Concrete fines/sand to engineer's details.

M - Shoring.

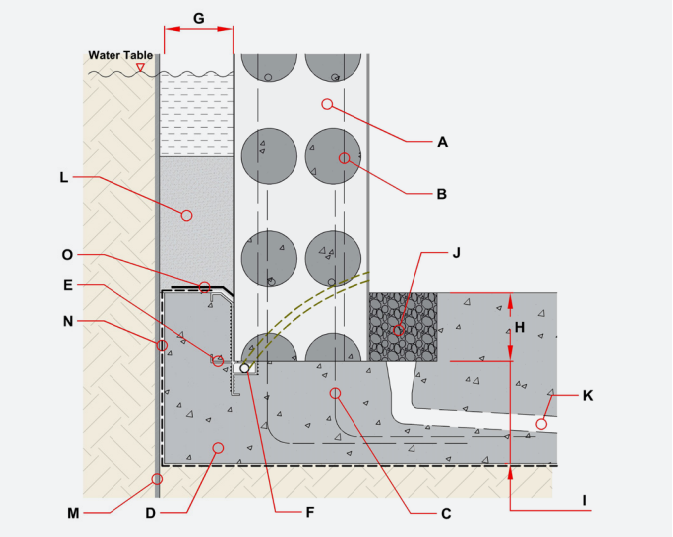
N - OPTIONAL nominated membrane or equivalent.

O - Dincel nominated waterproofing bandage over lapping nominated membrane on DWS if nominated membrane under slab is used.

NOTE: Self Compacting Concrete (SCC) and injection material MUST be used with the following detail.

NOTE: No accessories (such as guide track P-G) to be used underneath wall.

NOTE: Waterproofing footing/slab by others.



G.6.3.2 Monolithic Footing Slab with Monolithic Hob.

A - Dincel Wall.

B - Steel reinforcement to engineers' details.

C - Starter bars, tied to footing by either casting in or postfixing (drill & epoxy) as per engineer's detail.

D - Concrete footing slab and hob to engineer's details.

E - Dincel Water Stop (DWS) used as cast-in shutter to form hob.

F - Re-injection hose system to provide waterproofing injection material.

G - Min 100mm.

H - Min 100mm hob. Timber can be used to form the hob and provide temporary wall restraint.

I - Min 300mm

J - Dish drain to project engineer's details.

K - Drainage system by others.

L - Concrete fines/sand to Engineer's details.

M - Shoring.

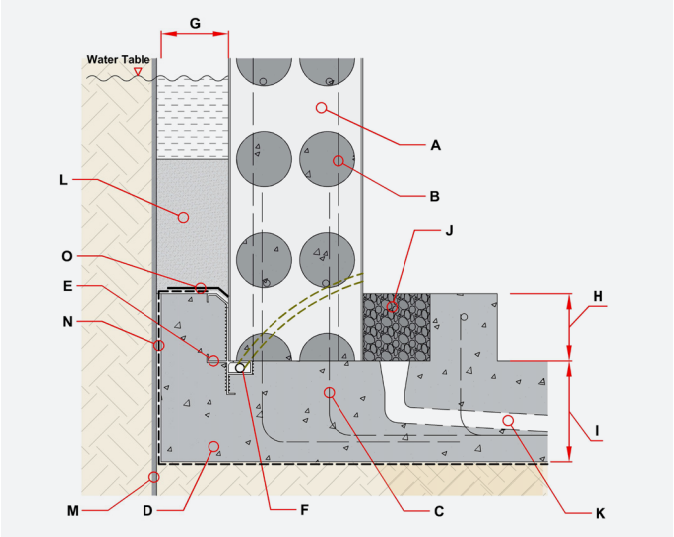
N - OPTIONAL nominated membrane or additives by others.

O - Dincel nominated waterproofing bandage over lapping nominated membrane on DWS if nominated membrane under slab is used.

NOTE: Self Compacting Concrete (SCC) and injection material MUST be used with the following detail.

NOTE: No accessories (such as guide track P-G) to be used underneath Dincel wall.

NOTE: Waterproofing footing/slab by others.



G.7. CONCRETE

Dincel designs that include a DWS and a re-injectable hose system must use Self-Compacting Concrete (SCC) provided by a supplier approved by Dincel.

	SELF-COMPACTING CONCRETE
AGGREGATE SIZE	Maximum 10mm
CONCRETE SLUMP/SPREAD	Nominal 680mm spread
SLUMP/SPREAD TOLERANCE	± 50mm
COMPACTION METHOD	No vibration needed on single pours. Refer to F12.4. of DCM for details

G.7.1. TESTING & ON-SITE ACCEPTANCE OF SCC

As a minimum, the first concrete load supplied on the project site each day shall be tested. Tests shall be repeated at least once every 25m³ of concrete thereafter.

Pre-pour Spread Test

- SCC is to be tested at the concrete suppliers batching plant and re-tested prior concrete use inside Dincel wall profiles. Variances greater than ± 50mm from what was tested at the suppliers batching plant will be deemed unstable and shall be refused/rejected for use inside Dincel wall profiles.
- A supplied concrete spread of 600mm or less will result in direct refusal/rejection of the supplied concrete.
- A supplied concrete spread of more than 600mm can have water added onsite (to the instructions of the supplier) in order to achieve the target 680mm to 730mm spread. The supplied concrete will be rejected if a minimum 670mm spread after adding water cannot be achieved before being placed into Dincel wall profiles.

G.7.2. POUR RATES

The following pour rate table should be followed in order to prevent bulging or rippling of the formwork face. This is particularly an important consideration for waterproofing or when Dincel is not rendered or cladded for aesthetic purposes.

Pouring conditions also need to be considered as the concrete mix and ambient temperature of the time of pouring may vary from project to project. These variations should be taken into account to determine the minimum pouring wait times. Continuation of concrete pouring should only take place after the concrete has reached initial setting.

Please note, the table is applicable as a general guide for all Dincel profiles. The engineer can consider pouring higher walls/ higher concrete lifts when aesthetics is not critical.

Please consult Dincel team regarding any project specific pour rate recommendations.

Where SCC is used, ensure good attention to detail is placed when bracing and sealing formwork. The pressure exerted by SCC is similar to pouring conventional high slump concrete and performing extensive vibration. Due to this higher concrete pressure, taller walls may result in a "wavy" finish unless multiple concrete lifts are considered.

Please note, vibration is not required to compact concrete when using SCC. However, it is recommended to agitate/shuffle the top 400mm of concrete between layers/concrete lifts. Refer to F.12.4 of the DCM.

VERTICAL POUR RATE TABLE (WHERE AESTHETICS CRITICAL) - SCC CONCRETE								
DINCEL PROFILE	WALL HEIGHT	1ST CONCRETE LIFT (METRES)	WAITING TIME (HOURS)**		2ND CONCRETE LIFT (METRES	WAITING TIME (HOURS)**		3RD CONCRETE LIFT (METRES)
			MIN.	MAX.		MIN.	MAX.	
155* 200*	UP TO 3.0M	1.8m	1.0hr	3.0hr	1.2m	-	-	-
	3.6M	2.0m	1.0hr	3.0hr	1.6m	-	-	-
	4.0M	2.0m	1.0hr	3.0hr	2.0m	-	-	-
	4.5M	2.0m	1.0hr	3.0hr	1.5m	1.0hr	3.0hr	1.0m
	5.0M	2.0m	1.0hr	3.0hr	2.0m	1.0hr	3.0hr	1.0m
	5.5M	2.0m	1.0hr	3.0hr	2.0m	1.0hr	3.0hr	1.5m
	6.0M & ABOVE	2.0m	1.0hr	3.0hr	2.0m	1.0hr	3.0hr	2.0m*
275*	UP TO 3.0M	3.0m	-	-	-	-	-	-
	3.6M	2.0m	1.0hr	3.0hr	1.6m	-	-	-
	4.0M	2.5m	1.0hr	3.0hr	1.5m	-	-	-
	5.0M	2.5m	1.0hr	3.0hr	2.5m	-	-	-
	6.0M & ABOVE	2.5m	1.0hr	3.0hr	2.0m	1.0hr	3.0hr	1.5m*

* **NOTE:** Please consult Engineer and Dincel Construction team for project specific advice.

** **NOTE:** The time between each concrete lift is based upon when the concrete achieves initial set. Consult with the selected concrete manufacturer/supplier for confirmation of initial setting times. The initial setting time for SCC is generally 2-3 hours from time of dispatch. The design engineer needs to account for any possible cold joints that may occur at pour breaks. Particularly if the cold joint is below ground water table position.

NOTE: Dincel 275 profiles are available in standard lengths of up to 6.525m. For taller walls, longer profiles can be specially ordered or alternatively use multiple profiles spliced together.

NOTE: For Self-Compacting Concrete (SCC), no vibration is required besides shuffling between layers/concrete lifts. Refer to section F.12.4 of DCM.

G.7.3. CONCRETE PLACEMENT

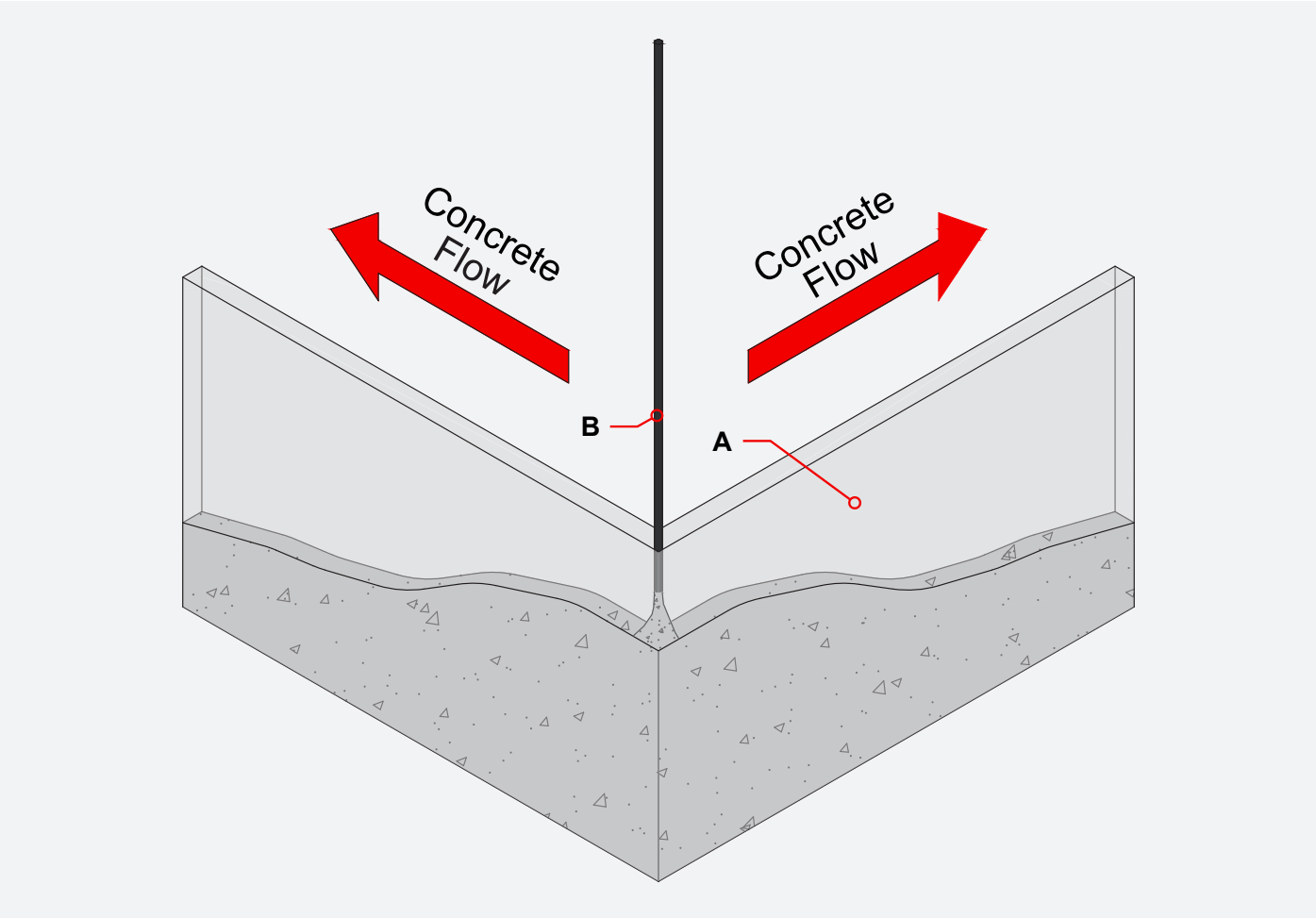
It is common for aggregate to segregate when pouring concrete walls due to two main reasons:

1 - Concrete fall from heights (the below hose positioning options A & B address this issue).

2 - Build up at the bottom of the concrete hose where the kink created by the hose clamp lies. If dispersed within the wall formwork, this will result in segregated concrete at the base cold joint leading to poor liquid tightness. Due to this event, installers must discharge/dispose this segregated concrete outside of the wall form work (0.1m³) before beginning the placement of concrete.

3 - Basement external walls must be poured first prior to any abutting internal walls including buttresses as referenced in table G.1.2.

G.7.3.1. Hose Positioning



A - Dincel Walls (panel joints not shown for clarity).

B - Pour location should always start at corners or braced wall ends where possible. This will ensure that the concrete will flow away from the corner or junction and subsequently divert the pressure from these locations. The pour location may be moved up to 4m intervals once concrete has reached the required lift height at the corner or junction.

NOTE: Concrete placement hose is to remain stationary when dispensing concrete at each interval.

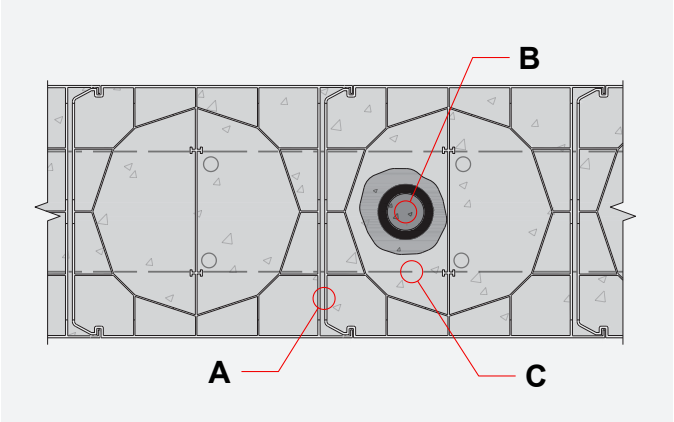
Option A – Lower hose or tremie/drop chute into panel

A - Dincel panels.

B - Max 2.5-inch concrete pump hose, lowered into wall. Alternatively, a flexible tremie/drop chute can be used. Note: Placement at wall corners or T-Junctions is preferred where possible.

C - Reinforcement as required by engineer. Hose or chute to be positioned in between reinforcement bars where possible.

Note: Option A is suited to walls greater than 3.6m in height and for Dincel 200 & 275 only. Reducing concrete falls below 2m is optimal and the preferred option to reduce the risk of concrete segregation.



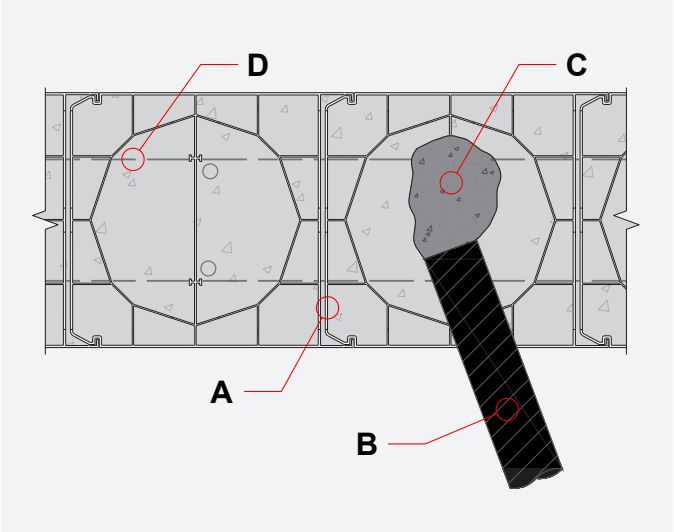
Option B – Point hose towards webbing

A - Dincel panels.

B - Max 2.5-inch concrete pump hose, lowered into wall. Note: Placement at wall corners or T-Junctions is preferred where possible.

C - Point hose towards Dincel panel webbing to prevent free fall of concrete.

D - Reinforcement as required by engineer.



G.8. PANEL SPLICE BANDAGING

In addition to the requirements shown in section F - Installation of the DCM, any cut/spliced panels and corners of angles different to 90°degree square faced corners need to be sealed with a Dincel nominated waterproofing bandage on the positive earth side of wall.

NOTES:

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