CI/SfB	(29)	Et6	
March 2011			

Lockable Dowels

For Temporary Movement Joints

Ancon®
BUILDING PRODUCTS

Ancon Lockable Dowels

THE 'LOCKABLE DOWEL'

Ancon Lockable Dowels have been designed for use at temporary movement joints, most commonly found in post-tensioned concrete frames. These dowels allow initial shrinkage of the concrete to take place and are then locked in position with a mechanical plate and a controlled amount of epoxy resin. The locked dowels continue to transfer shear, but prevent further movement taking place.

The use of Lockable Dowels over other construction methods can save a significant amount of time and materials. Concrete shrinkage has traditionally been accommodated by leaving one metre-wide gaps in the slab called 'pour strips' or 'closure strips'. These strips are filled once movement has stabilised, however until they are filled the slabs must be propped, restricting site access and delaying site progress. Gaps in the slab also create a trip hazard for site workers, use additional formwork and can leave the soffit face marked.

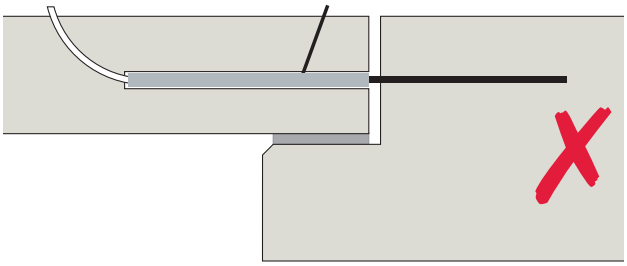
Lockable Dowels improve site access, minimise formwork requirements and accelerate the rate of construction. With a Lockable Dowel, there is no requirement for the slabs to be propped or a support corbel to be constructed, as shear load is transferred by the dowel. The time saved by removing the need to prop a slab can be significant.

A Lockable Dowel also provides many advantages over the site-assembled arrangement of carbon steel reinforcing bar, galvanised or plastic ducting, vent tubes and a non-specific grout, which is sometimes used by contractors. The design capacities shown on page 4 are backed by independent test data and the unique void former allows inspection of the dowel before the joint is locked.

Contents

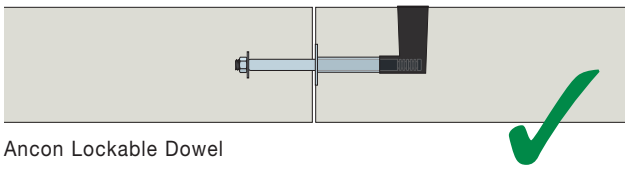
Standard Ancon systems are available for use at slab joints and retaining / core walls

Slab-to-Slab



Various site-assembled components

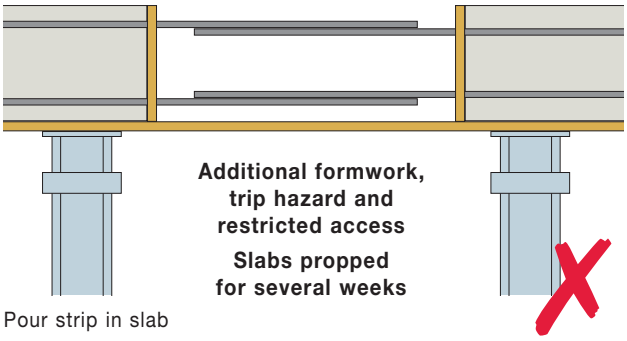
Unreliable performance, additional construction materials used and support corbel or prop required



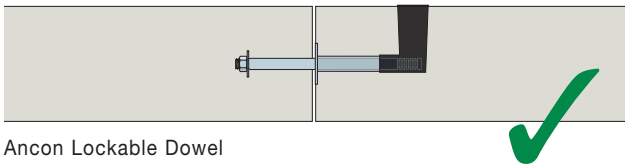
Ancon Lockable Dowel

Proven performance
Minimal material usage

Slab-to-Slab



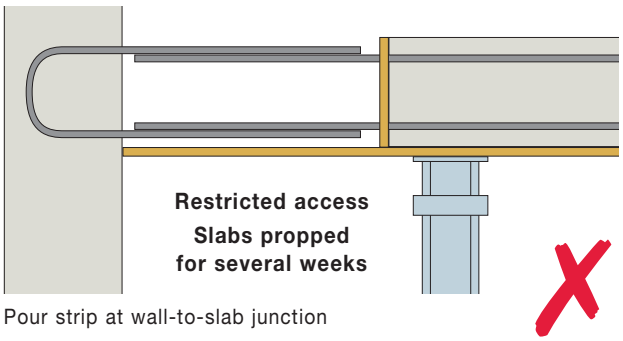
Pour strip in slab



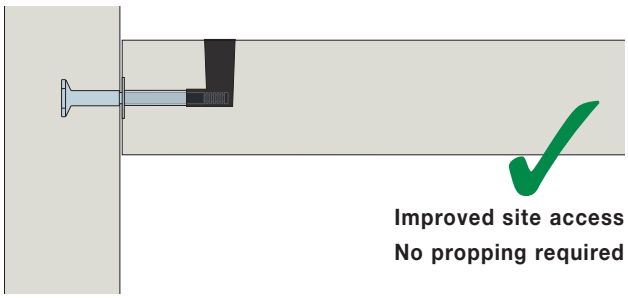
Ancon Lockable Dowel

Minimal formwork
Improved site access
No propping required

Slab-to-Wall



Pour strip at wall-to-slab junction



Ancon Lockable Dowel

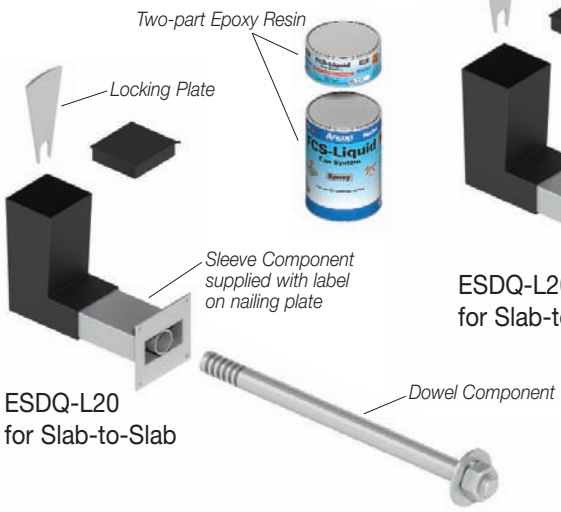
Improved site access
No propping required

A Lockable Dowel allows initial shrinkage of the concrete to take place and then, after a pre-determined time period (generally 60-120 days), is locked in position with a mechanical plate and a controlled amount of epoxy resin. The range comprises three products; ESDQ-L20, HLDQ-L30 and ESDQ-L20W.

SLAB-TO-SLAB LOCKABLE DOWELS

ESDQ-L20*

The dowel component is manufactured from 30mm diameter Duplex stainless steel; one end is threaded with a fixed nut and washer, and the other features a series of grooves to accept the Locking Plate. The cylindrical sleeve which accepts the dowel component is contained within a box-section to allow lateral, longitudinal and some rotational movement. The epoxy resin is poured into the L-shaped void former. This product has a design capacity of almost 70kN. See pages 4-7 for full technical details.



ESDQ-L20
for Slab-to-Slab

SLAB-TO-WALL LOCKABLE DOWEL

ESDQ-L20W*

The dowel component is manufactured from 30mm diameter Duplex stainless steel, but is shorter than the ESDQ-L20 dowel. One end of the dowel is designed to fix into the stainless steel Ancon SKS24 Threaded Anchor cast into the face of the concrete and the other end features a series of grooves to accept the Locking Plate. The sleeve component is the same as used in the ESDQ-L20. See pages 4-7 for full technical details.

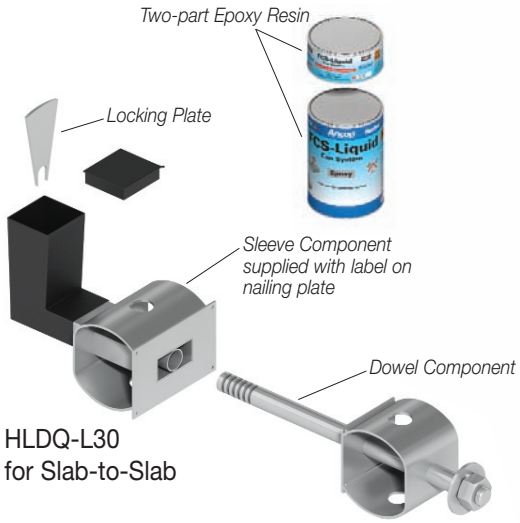
ESDQ-L20W
for Slab-to-Wall

Epoxy Resin

Each dowel is locked after a pre-determined time period (generally 60-120 days) with a high quality, two-part epoxy resin. The resin is mixed and poured into the L-shaped void former. One 1.5 litre can is supplied per dowel.

HLDQ-L30*

The HLDQ-L30 is a high load Lockable Dowel with a design capacity of up to 136kN. See pages 4-7 for full technical details.

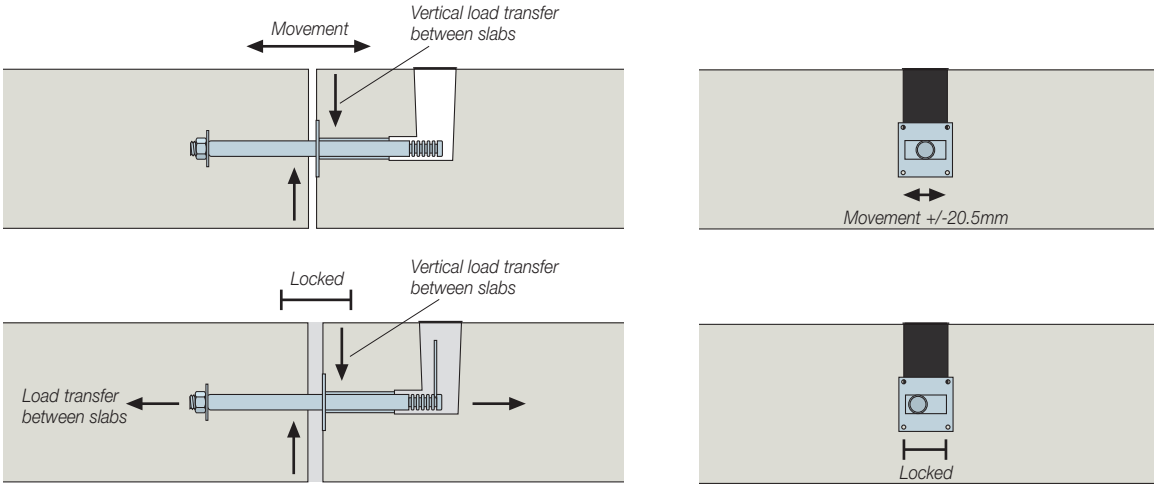


HLDQ-L30
for Slab-to-Slab

** Patent pending*

Ancon Lockable Dowels

PERFORMANCE DATA



ESDQ-L20 Lockable Dowels (slab-to-slab)

Slab Thickness (mm)	Tension along line of dowel (kN)	Vertical Design Resistance (kN) for Various Design Joint Widths (mm) in 32MPa Concrete							
		5	10	15	20	25	30	35	40
160	45	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
180	65	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
200	80	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
220	100	53.6	53.6	53.6	53.6	53.6	53.6	53.6	52.7
240	100	62.2	62.2	62.2	62.2	60.6	57.8	55.2	52.7
260 and above	100	71.4	69.9	66.6	63.5	60.6	57.8	55.2	52.7

ESDQ-L20W Lockable Dowels (slab-to-wall)

Slab Thickness (mm)	Tension along line of dowel (kN)	Vertical Design Resistance (kN) for Various Design Joint Widths (mm) in 32MPa Concrete							
		5	10	15	20	25	30	35	40
160	45	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
180	65	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
200	80	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
220	80	53.6	53.6	53.6	53.6	53.6	53.6	53.6	52.7
240	80	62.2	62.2	62.2	62.2	60.6	57.8	55.2	52.7
260 and above	80	71.4	69.9	66.6	63.5	60.6	57.8	55.2	52.7

HLDQ-L30 Lockable Dowels (slab-to-slab)

Slab Thickness (mm)	Tension along line of dowel (kN)	Vertical Design Resistance (kN) for Various Design Joint Widths (mm) in 32MPa Concrete							
		5	10	15	20	25	30	35	40
240 and above	100	136.0	136.0	136.0	136.0	136.0	136.0	136.0	121.9

ESDQ-L20 Example

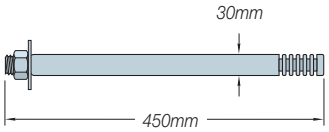
Slab thickness	= 240mm	
Joint width	= 20mm	
Concrete strength	= 32MPa	
Characteristic permanent action (dead load)	= 45kN/m	$\lambda_G = 1.2$
Characteristic variable action (imposed load)	= 50kN/m	$\lambda_Q = 1.5$
Design load	= 1.2 x 45 + 1.5 x 50 = 129kN/m	
Vertical design resistance	= 62.2kN (240mm slab 20mm joint)	
Therefore centres for vertical load	= 62.2 / 129 = 0.482m use 450mm centres	

The dowel in this application will provide a design resistance across the joint of 100kN, therefore the total design resistance in the direction of the dowel = 100 / 0.45 = 222kN/m.

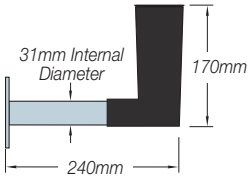
If this is insufficient, the dowel centres can be reduced to a minimum of 1.5 x slab thickness to increase the design resistance across the joint, in this example it would increase to 100 / 0.36 = 277kN/m.

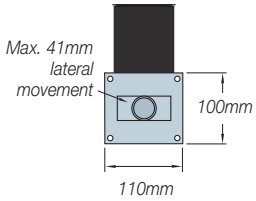
DIMENSIONS

ESDQ-L20 Components
Dowel Component

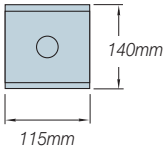


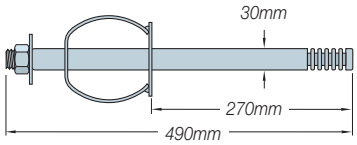
Sleeve Component



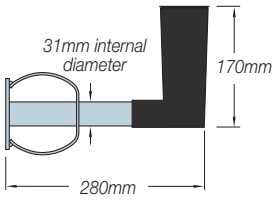


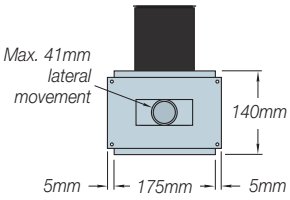
HLDQ-L30 Components
Dowel Component



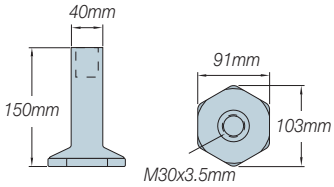


Sleeve Component

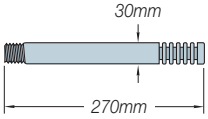




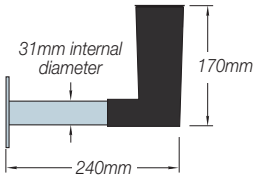
ESDQ-L20W Components
SKS24 Threaded Anchor

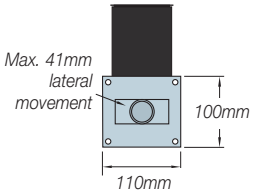


Dowel Component



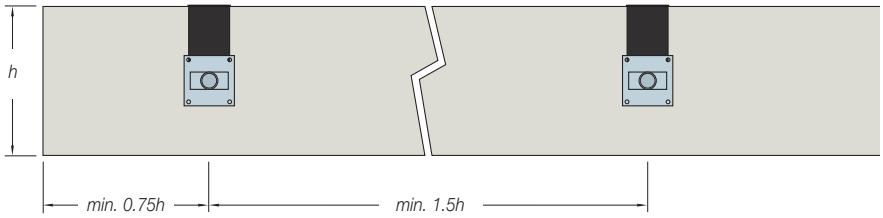
Sleeve Component





EDGE DISTANCE AND SPACINGS

For connectors working at or near their maximum capacity, the minimum spacing should be 1.5 times the slab thickness. Where the design load of the connector could be used in a thinner slab, a spacing of 1.5 times the thinner slab thickness can be used. The minimum end distance is always 0.5 times the spacing.



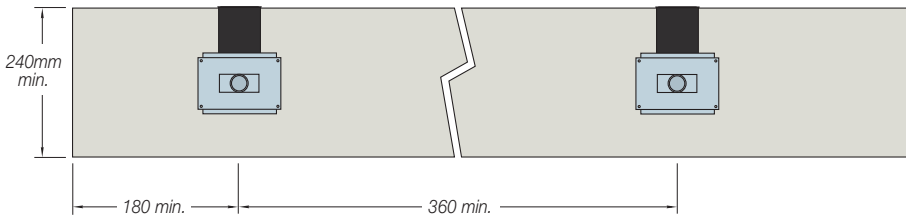
ESDQ-L20 Minimum Edge Distance and Spacings

ESDQ-L20 Example

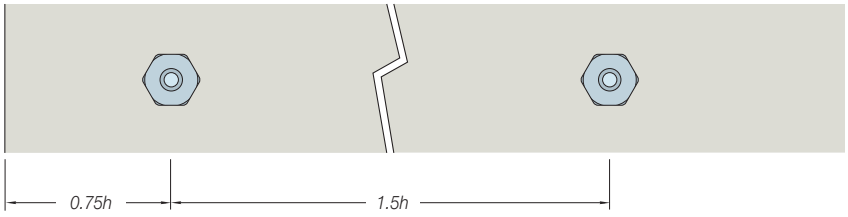
Slab thickness	= 300mm
Joint width	= 20mm
Concrete strength	= 32MPa
Design resistance/connector (based on slabs 260mm and above)	= 63.5kN
Spacing for max. load	300 x 1.5 = 450mm
End distance for max. load	450 x 0.5 = 225mm
Design resistance/metre	= 63.5 / 0.45 = 141.1kN/m

As an ESDQ-L20 can be used in a 220mm slab for a design resistance per connector of up to 53.6kN, the spacing can be based on a 220mm slab. Therefore:

Reduced spacing	220 x 1.5 = 330mm
Reduced end distance	330 x 0.5 = 165mm
Design resistance/metre	53.6 / 0.33 = 162.4kN/m



HLDQ-L30 Minimum Edge Distance and Spacings



ESDQ-L20W Minimum Edge Distance and Spacings. h = depth of adjoining slab

Ancon Lockable Dowels

REINFORCEMENT DETAILS

Local reinforcement is required around each Ancon Lockable Dowel to guarantee that the forces are transferred between the connectors and the concrete. Correct detailing in accordance with appropriate design codes and the recommendations provided here will ensure the dowels attain their full capacity. The tables show the type and spacing of the main reinforcement, together with details of reinforcement above and below the connectors. Although only the sleeve components are illustrated, the same reinforcement is required around the dowel component.

Options for Main Reinforcement

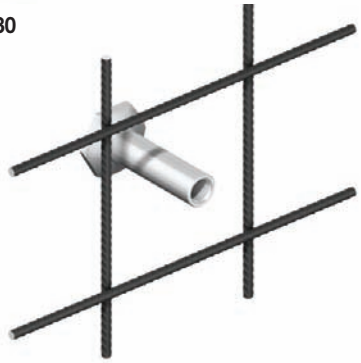
Lockable Dowel Ref.	No. of U-bars each side N12	N16	N20
ESDQ-L20	2	-	-
HLDQ-L30	4	3	2

Options for Longitudinal Reinforcement

Lockable Dowel Ref.	No. of bars top and bottom N12	N16	N20
ESDQ-L20	2	-	-
HLDQ-L30	2	2	-

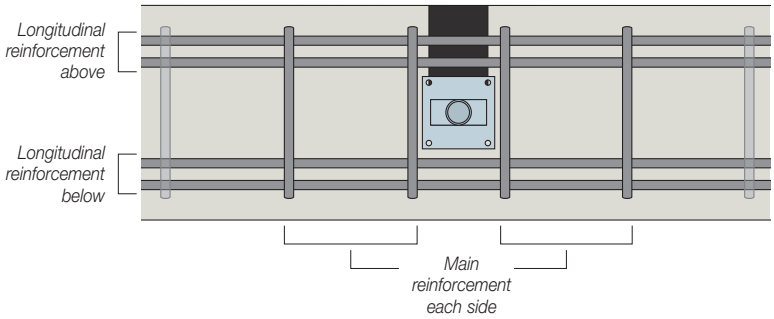
ESDQ-L20

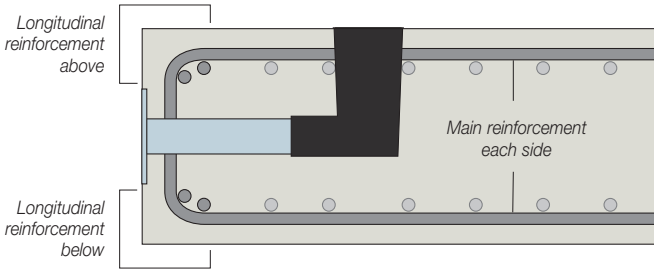
HLDQ-L30



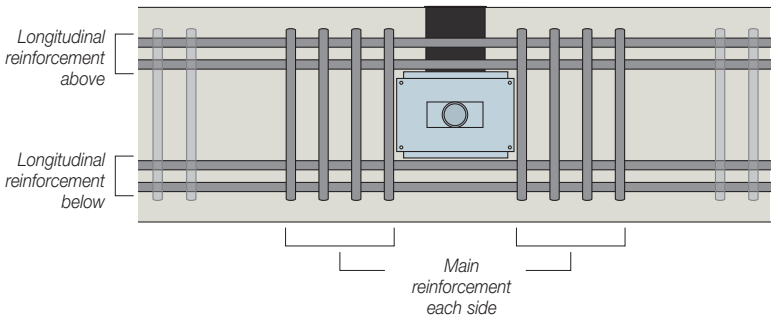
SKS24 Threaded Anchor, part of ESDQ-L20W

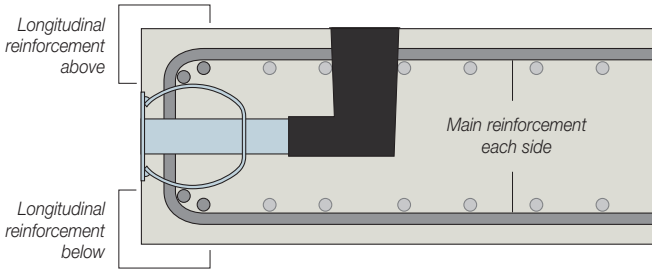
ESDQ-L20





HLDQ-L30





Threaded Anchor

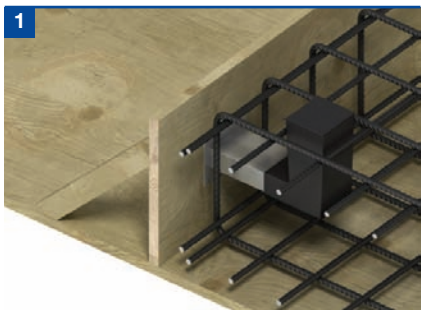
Reinforcement around the Ancon Threaded Anchor should be a minimum diameter of 12mm, installed at maximum 200mm vertical and horizontal centres.

INSTALLATION

Slab-to-Slab

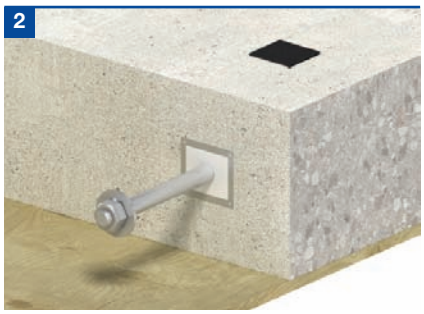
Although installation is shown for the ESDQ-L20, the procedure is the same for the HLDQ-L30.

1



Nail the sleeve to the formwork either central in the slab or for slab depths over 300mm so the top of the grout box is level with the top of the slab. Do not remove the label over the nailing plate as this prevents ingress of concrete into the sleeve. Fix the local reinforcement.

2

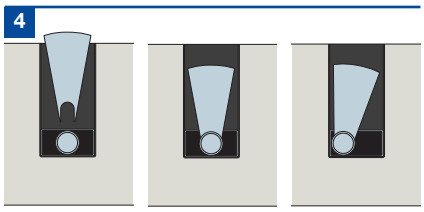


Pour the concrete, and when of sufficient strength, strike the formwork. Puncture the label to reveal the cylindrical sleeve only and insert the dowel until it is approximately 20mm from the back of the grout box.

3

Fix the local reinforcement around the dowel component and pour the concrete.

4



After a predetermined time period (generally 60-120 days), when movement between the slabs has stabilised and the joint between the slabs has been filled, the dowel is ready to be locked. Fit the Locking Plate on a groove in the centre of the grout box. The fan-shaped Locking Plate allows the dowel to be locked in any position.

5

Mix the two-part epoxy resin and pour into the grout box, ensuring it flows along the stainless steel box section towards the joint.

Joint must be filled before resin is installed.

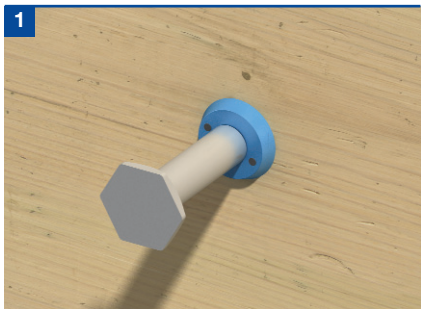
6

After 24 hours the grout box can be filled with cementitious material, level with the top of the slab, to complete the installation.

The locked dowel continues to transfer vertical load between the slabs, but movement can no longer take place.

Slab-to-Wall

1

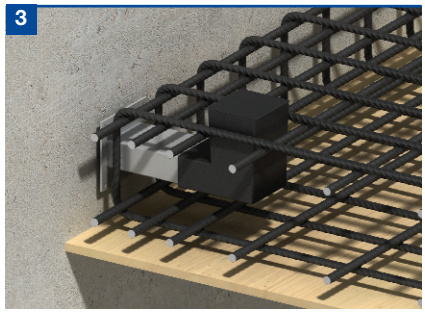


Nail the threaded anchor to the formwork so the dowel will be central in the adjoining slab or within 150mm of the top of slabs over 300mm. Fix the local reinforcement and cast the concrete.

2

When concrete reaches sufficient strength, strike the formwork and remove nailing plate. Screw the dowel into the anchor.

3



Puncture the label of the sleeve to reveal the cylindrical sleeve only. Push the sleeve over the dowel, until the dowel is approximately 20mm from the back of the grout box. Tie sleeve to reinforcement and pour concrete.

See Steps 4 to 6 above to complete installation.

Notes: *Where deep concrete pours are proposed, the installation will require further consideration. More robust fixing of the sleeve and dowel components will be necessary, to avoid displacement during casting of the concrete.*
Ensure joint has been filled before pouring resin.

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BUILDING PRODUCTS

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