HALFEN HSD-LD Lockable Dowels.

For temporary movement joints in posttensioned slabs.

The Lockable Dowel accommodates initial concrete shrinkage and is then locked in position with a mechanical plate and epoxy resin.

Traditional "pour strips"

- Additional formwork
- Trip hazard
- Restricted access
- Slabs propped for several weeks

HALFEN HSD-LD Lockable Dowel

- Minimal formwork
- Improved site access
- Reduced propping time

Many advantages with one result: HALFEN provides safety, reliability and efficiency for you and your customers.

Read more about the advantages of the HALFEN HSD-LD Lockable Dowels on the pages 18 to 25.

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HALFEN HSD SHEAR DOWEL SYSTEMS

Product Range

HALFEN Shear Dowels

The HALFEN range of shear dowels provides solutions for a wide range of applications, loads, slab depths and joint thicknesses. Each connector is a two-part assembly comprising a sleeve and a dowel component. The sleeve is nailed to the formwork ensuring subsequent alignment with the dowel. This alignment is essential for effective movement. The complete installation procedure is shown on page 14. HALFEN Shear Dowels are manufactured from stainless steel to ensure a high degree of corrosion resistance with no requirements for additional protection.

HALFEN HSD-ULTRA
The HALFEN HSD-ULTRA is a two-part, high capacity, shear dowel. The dowel component moves longitudinally within the sleeve to accommodate movement. The connector is available in seven sizes with design capacities from 5.5 kip to over 120 kip. The load tables on page 12-13 include slab depths from 6 1/2” to 20” and joints up to 2” wide. The dowel bar is Duplex stainless steel and all other components are manufactured from grade 1.4301 (304) stainless steel.

HALFEN HSD-ULTRA-V
The HALFEN HSD-ULTRA-V, high load Shear Dowel uses the same dowel component as the HALFEN HSD-ULTRA, but the cylindrical sleeve is contained within a rectangular box section. This sleeve allows lateral movement or rotation in addition to longitudinal movement. Available sizes, performance data and material specifications are the same as for the HSD-ULTRA.

HALFEN HSD
The HALFEN HSD Shear Dowel is used where loads are small, but where alignment is critical. It is available in four sizes. The dowel component is Duplex stainless steel.

HALFEN HSD-V
The HALFEN HSD-V Shear Dowel uses the same dowel as the HSD, but the cylindrical sleeve is contained within a rectangular box section to allow lateral movement or rotation in addition to longitudinal movement.
HALFEN HSD SHEAR DOWEL SYSTEMS

Product Range

HALFEN HSD-LD Lockable Dowel*
The dowel component is manufactured from 1\(\frac{1}{4}\)" diameter stainless steel; one end is threaded with a fixed nut and washer, and the other features a series of grooves to accept a Locking Plate. The cylindrical sleeve which accepts the dowel component is contained within a box-section to allow lateral, longitudinal, and rotational movement. The epoxy resin is poured into the L-shaped void former. This product has a maximum design shear strength of over 15 kip. See pages 18-25 for full technical details.

HALFEN HSD-LD-ULTRA Lockable Dowel*
The HSD-LD-ULTRA is a high capacity Lockable Dowel with a design shear strength of up to 30.6 kip. See pages 18-25 for full technical details.

HALFEN HSD-LD-W Lockable Dowel*
The dowel component is manufactured from 1\(\frac{1}{4}\)" diameter stainless steel, but is shorter than the HSD-LD dowel. One end of the dowel is designed to fit into the stainless steel Threaded Anchor cast into the face of the concrete and the other end features a series of grooves to accept a Locking Plate. The sleeve component is the same as used in the HSD-LD. See pages 18-25 for full technical details.

HALFEN HSD-AD Acoustic Dowels
The HALFEN HSD-AD Acoustic Dowels are designed to transfer shear loads and limit sound transmission across joints in concrete. The sleeve has Elastomer sound absorbing material between two stainless steel tubes and a nail plate for fixing to formwork. The sound transmission properties are generally unaffected by either joint width or service load. Tests in the frequency range of 100 - 3150 Hz have shown a reduction in sound transmission of 20 dB. When the standard solid dowel (HSD-AD Type B) was replaced by an anti-vibration dowel (HSD-AD Type A) a reduction of 25 dB was recorded. See pages 26-27 for more technical details.

*US Patent No. 8209933
Dowels are used to transfer shear across construction and movement joints in concrete. They are often either cast or drilled into the concrete. A single row of short thick dowels provides reasonable shear transfer but demands additional accuracy during construction. Skewed installation of dowels can lead to stress concentrations, resulting in subsequent spalling of the concrete. Where dowels are used across expansion and contraction joints, half the length of the bar is debonded to allow movement to take place. Dowelled joints either require formwork to be drilled for the dowels to pass through, or concrete to be drilled for dowels to be resin fixed in one side. At movement joints, dowels will need to be accurately aligned in both directions to ensure movement can actually take place, otherwise cracking is likely to occur. Plain dowels are not very effective when used across joints wider than 3/8".

Keyed joints require complicated formwork to create the tongue and groove. If the joint is not formed correctly, differential movement can take place. Load is transferred through the locally reduced section of the joint which can at times result in cracking.
HALFEN HSD SHEAR DOWEL SYSTEMS

Applications

HALFEN Solutions to Joints

In most cases conventional dowelled or keyed joints can be replaced by joints incorporating HALFEN Shear Dowels. These connectors are more effective at transferring load and allowing movement to take place, easier to fix on site, and can prove to be a more cost-effective solution.

HALFEN connectors can be used for movement joints in floor slabs, suspended slabs, and for replacing double columns and beams at structural movement joints. Applications in civil engineering include joints in bridge parapets, bridge abutments and diaphragm wall constructions.

Traditional solution
Floor-to-floor connection with columns

HALFEN solution

Double Columns

Single Column with HALFEN HSD-ULTRA

Floor Slab

Dowel Bar

HALFEN HSD-ULTRA

Wall

Keyed Joint

HALFEN HSD-ULTRA

Slab/wall connection

Corbel Support

HALFEN HSD-ULTRA

There are many applications for HALFEN HSD Shear Dowels in all types of reinforced concrete constructions – both building and civil engineering projects.

**Building Applications**

**Ground Floor Slabs**
Movement joints are usually required to divide a reinforced concrete ground slab into bays. HALFEN HSD Shear Dowels are used to transfer shear load from slab to slab and to prevent differential settlement. Where adjoining bays are different sizes, movement in two directions will occur, HALFEN HSD-V Shear Dowels should be used in this situation.

**Suspended Floor Slabs**
In suspended slabs, connectors should be placed at points of contraflecure where there is little or no bending moment and maximum shear force.

**Structural Movement Joints in Frames**
A common requirement in framed buildings is a structural movement joint to isolate one part of the building from another. Traditional practice is to provide a line of double columns. The use of HALFEN Shear Dowels reduces costs, speeds construction, and increases the useable floor area.

**Beam to Wall or Slab Connections**
Corbel and half lap joints are a problem to design and difficult and expensive to construct. The use of HALFEN HSD Shear Dowels simplifies design and construction, producing a better detail.

**Post-Tensioned Building Frames**
The HALFEN range includes Lockable Dowels which replace pour strips in post-tensioned concrete frames. See page 18 to 25 for more information.
HALFEN HSD SHEAR DOWEL SYSTEMS

Applications

Civil Engineering Applications

Movement Joints in Carriageways
HALFEN HSD Shear Dowels are used in carriageway joints to transfer high shear loads caused by traffic loading and for eliminating differential settlement.

Bridge Abutments
HALFEN HSD Shear Dowels are used vertically at bridge abutments to fix the bridge deck to the abutment. In addition to ease of installation, the use of HALFEN HSD Shear Dowels allows for the bridge deck to be jacked up for bearings to be replaced.

Diaphragm Wall/Slab Connections
Connecting road slabs to diaphragm walls can be a difficult and expensive operation. Forming recesses or using post fixed dowels into site drilled holes presents many problems on site. HALFEN HSD Shear Dowels provide a cost effective solution. The sleeve components are nailed to plywood formwork which is rigidly fixed to the reinforcement cage. After excavation the plywood is removed to reveal the faces of the sleeves. The dowel components can now be inserted ready to support the slab.

Joints in Parapets
The use of HALFEN Shear Dowels in the vertical joints in parapets is a simple and cost effective way of connecting the sections. The HALFEN HSD-V facilitates significant rotation at the joint without reducing the horizontal shear capacity.
HALFEN HSD SHEAR DOWEL SYSTEMS

HALFEN HSD-ULTRA/HSD-ULTRA-V design capacities $F_{rd}$ [kip] for various joint widths at a maximum slab thickness in 4000 psi concrete.

HALFEN HSD/HSD-V design capacities $F_{rd}$ [kip] for various joint widths at a maximum slab thickness in 4000 psi concrete.
The HALFEN HSD-ULTRA is a shear dowel system for high loads. The steel plates in the area around the dowel and the sleeve distribute the load in the concrete and allow higher loads than conventional shear dowels.

The HALFEN HSD-ULTRA shear dowels come in two parts. The set always consists of the dowel (HSD-ULTRA-D) and the corresponding sleeve (HSD-ULTRA-S and HSD-ULTRA-SV, respectively). The HSD-ULTRA does not allow any movement perpendicular to the dowel. The HSD-ULTRA-V allows lateral movement in one direction. Both, HSD-ULTRA and HSD-ULTRA-V allow movement in longitudinal direction.

Dimensions of the dowels and sleeves can be found on this page. Additional information like design capacities and required reinforcement can be found on pages 12-13.

**Edge Distance and Spacing**

The minimum edge distance and spacing of the HALFEN HSD-ULTRA shear dowels is determined by the depth of slab and is illustrated in the adjacent drawing.
Local reinforcement is required around each connector 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 HALFEN HSD-ULTRA and HSD-ULTRA-V shear dowels attain their full capacity. The tables below show proposals for the type and spacing of the main reinforcement, together with details of reinforcement above and below the shear dowels.

### Reinforcement details

Local reinforcement is required around each connector 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 HALFEN HSD-ULTRA and HSD-ULTRA-V shear dowels attain their full capacity. The tables below show proposals for the type and spacing of the main reinforcement, together with details of reinforcement above and below the shear dowels.
Load bearing capacities

Design capacities $F_{Rd}$ [kip] for various joint widths [Inch] in 3000/4000 psi concrete

<table>
<thead>
<tr>
<th>Dowel</th>
<th>Slab thickness [Inch]</th>
<th>$\frac{1}{4}$</th>
<th>$\frac{1}{2}$</th>
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<td>HSD-ULTRA-30(-V)</td>
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<td>102.4</td>
</tr>
</tbody>
</table>

All values in the tables on page 12 and 13 are design load capacities (LRFD) and have to be compared to factored loads.

Reinforcement details

Local reinforcement around the dowels in 3000/4000 psi concrete

<table>
<thead>
<tr>
<th>Dowel</th>
<th>U-bars each side of the dowel</th>
<th>distance $e_1$ [Inches]</th>
<th>distance $e_2$ [Inches]</th>
<th>Longitudinal bars top and bottom</th>
</tr>
</thead>
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<tr>
<td>HSD-ULTRA-30(-V)</td>
<td>(5) No. 4</td>
<td>$1 \frac{1}{4}$</td>
<td>$1 \frac{1}{4}$</td>
<td>(3) No. 4</td>
</tr>
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<td>(6) No. 5</td>
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<td>(3) No. 5</td>
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<td>(8) No. 5</td>
<td>$1 \frac{1}{4}$</td>
<td>$1 \frac{1}{4}$</td>
<td>(4) No. 5</td>
</tr>
</tbody>
</table>

Minimum longitudinal bars are based on minimum dowel centres ($1.5 \times h_{min}$). If spacing greater than this is adopted, the longitudinal bars are to be designed assuming slab edge acts as a beam spanning between the dowels.
**HALFEN HSD-ULTRA SHEAR DOWEL SYSTEM**

**Installation Procedure**

The two-part assembly of all HALFEN Shear Dowels removes the need for drilling formwork on site, supporting dowel bars and fitting debonding sleeves and end caps. The installation is a fast and accurate process.

Nail the sleeve component to the formwork ensuring that the sleeve is correctly orientated for the direction of the load. Check that the minimum spacing and edge distances are not exceeded. The label prevents debris from entering into the sleeve aperture and should not be removed at this stage.

When the concrete has achieved sufficient strength, strike the shuttering. Peel off or puncture the label to reveal the hole for the dowel. Where HSD-V or HSD-ULTRA-V are being used, the label should only be punctured enough to allow the dowel into the cylindrical sleeve.

Push the dowel component through the joint filler (if applicable) until it is fully located in the sleeve component. It may be necessary to tap the dowel component to overcome the dimple which pinch holds the dowel in the sleeve and prevents dislocation when the concrete is vibrated.

Fix the local reinforcement in position around the dowel component together with any other reinforcement that is required, ensuring that the correct cover to the reinforcement is maintained. Pour the concrete to complete the installation of the shear connector.

Notes:

(i) Although installation is shown for HALFEN HSD-ULTRA, the procedure is the same for all HALFEN HSD Shear Dowels.

(ii) 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 pouring of the concrete.
The HALFEN HSD is a shear dowel system for applications with smaller loads where the alignment of the dowels is critical. HALFEN HSD Shear Dowels come in two parts. The set always consists of the dowel (HSD-D) and the corresponding sleeve (HSD-S and HSD-SV) respectively. The HSD does not allow any movement perpendicular to the dowel. The HSD-V allows lateral movement in one direction. Both, HSD and HSD-V allow movement in longitudinal direction. Dimensions of the dowels and sleeves can be found on this page. Additional information such as design capacities and required reinforcement can be found on page 16 and 17.

### HSD-D Dowel Component

<table>
<thead>
<tr>
<th>Diameter [Inch]</th>
<th>Length [Inch]</th>
<th>Height [Inch]</th>
<th>Width [Inch]</th>
<th>Lat. movement [Inch]</th>
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<td>3/4</td>
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<tr>
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<td>13 1/4</td>
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### HSD-S Sleeve Component

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<td>6 1/4</td>
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### HSD-SV Sleeve Component

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<td>3 3/8</td>
<td>1 5/8</td>
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* Different dowel length are available on request.
## Load bearing capacities

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</table>

All values in the table above are design load capacities (LRFD) and have to be compared to factored loads.

### Edge Distances and Spacing

The minimum edge distance and spacing of the HALFEN HSD shear dowels is determined by the depth of the slab and illustrated in the adjacent drawing.
Reinforcement details

Local reinforcement is required around each connector 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 HALFEN HSD and HSD-V shear dowels attain their full capacity. The tables below show proposals for the type and spacing of the main reinforcement, together with details of reinforcement above and below the shear dowels.

Design capacities \( F_{rd} \) [kip] for various joint widths [Inch] in 3000/4000 psi concrete

<table>
<thead>
<tr>
<th>Dowel</th>
<th>U-bars each side of the dowel</th>
<th>( e_1 ) [Inches]</th>
<th>( e_2 ) [Inches]</th>
<th>Longitudinal bars top and bottom</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSD-20(-V)</td>
<td>(2) No. 3</td>
<td>1 ( \frac{3}{4} )</td>
<td>1 ( \frac{3}{4} )</td>
<td>(2) No. 3</td>
</tr>
<tr>
<td>HSD-22(-V)</td>
<td>(2) No. 4</td>
<td>2</td>
<td>2</td>
<td>(2) No. 3</td>
</tr>
<tr>
<td>HSD-25(-V)</td>
<td>(2) No. 4</td>
<td>1 ( \frac{1}{2} )</td>
<td>1 ( \frac{1}{2} )</td>
<td>(2) No. 3</td>
</tr>
<tr>
<td>HSD-30(-V)</td>
<td>(2) No. 5</td>
<td>2 ( \frac{3}{4} )</td>
<td>2 ( \frac{3}{4} )</td>
<td>(2) No. 3</td>
</tr>
</tbody>
</table>

The minimum longitudinal bars are based on a dowel distance of 1.5 times the slab thickness \( h \). If the spacing is greater than this, the longitudinal bars are to be designed assuming the slab edge acts as a beam spanning between the dowels.
Lockable Dowels
HALFEN HSD-LD 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.

Advantages
The use of HALFEN HSD Lockable Dowels can save a significant amount of time and materials over other construction methods. Concrete shrinkage has traditionally been accommodated by leaving gaps in the slabs called ‘pour strips’ or ‘closure strips’. These strips are filled once movement has stabilized, 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, require additional formwork and can leave the soffit face marked. Lockable Dowels improve site access, minimize formwork requirements, and accelerate the rate of construction. With a Lockable Dowel, there is less 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 early removal of slab props can be significant.

In addition, engineers have found the HALFEN HSD Lockable Dowel to be the preferred design solution for pin-ended joints. Although it is customary for practical reasons to use U-bars or other rebar continuity systems at these connections, these options do not truly act as hinges and so rotation of the slab under load can induce cracking at the wall-to-slab interface with potential integrity issues.

Pour Strips restrict site access, cause a trip hazard and delay progress on site

The Lockable Dowel is closer to a true pin-ended joint and, being manufactured from stainless steel, provides additional corrosion protection over systems using carbon steel reinforcement. The design capacities shown on page 24 are backed by independent test data and the unique void former allows inspection of the dowel before the joint is locked. Standard HALFEN systems are available for use at slab joints and retaining/core walls, requiring permanent movement.
Applications

In most cases, HALFEN Lockable Dowels can be used to replace pour strips at temporary movement joints in post-tensioned concrete structures. Standard HALFEN systems are available for use at slab joints and retaining/core walls, requiring permanent movement.

Slab-to-Slab
Traditional solution

- Additional formwork
- Trip hazard
- Restricted access
- Slabs propped for several weeks

HALFEN solution

- Minimal formwork
- Improved site access
- Reduced propping time

Slab-to-Wall
Traditional solution

- Restricted access
- Slabs propped for several weeks

HALFEN solution

- Improved site access
- Reduced propping time

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HALFEN HSD-LD LOCKABLE DOWEL SYSTEM

Product Range

Range of Lockable Dowels

HALFEN HSD-LD Lockable Dowels allow initial shrinkage of the concrete to take place and then, after a pre-determined time period (generally 28-120 days), the dowels are locked in position with a mechanical plate and a controlled amount of epoxy resin. The range comprises three products; HSD-LD 30 Lockable Dowel, HSD-LD-ULTRA 30 Lockable High Capacity Dowel, and HSD-LD-W Lockable Wall Dowel.

Slab-to-Slab Lockable Dowels

HSD-LD 30* Lockable Dowel
The dowel component is manufactured from 1 3/16” diameter 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 rotational movement. The epoxy resin is poured into the L-shaped void former. This product has a maximum design strength of over 15 kip. See pages 22 to 24 for full technical details.

Example Specification Clause

Delete/Amend blue text as appropriate

<HALFEN HSD-LD 30 or HALFEN HSD-LD-ULTRA 30> lockable shear load connector comprising dowel, sleeve and locking components to be installed at the temporary movement joint between two slabs. Product to be positioned at <insert centers> inch horizontal centers at <the center line of the slab or XXX inch from the top of the slab>. The dowel is to be locked in position after <insert time period> using the locking plate and resin supplied. System should be installed in accordance with HALFEN’s instructions and engineer’s drawings.

HSD-LD-ULTRA 30* Lockable High Capacity Dowel
The HSD-LD-ULTRA 30 is a high load Lockable Dowel with a design capacity of up to 30.6 kip.

* US Patent No. 8209933
**Slab-to-Wall Lockable Dowel**

**HSD-LD-W-D 30° Lockable Wall Dowel**
The HSD-LD-W-D 30 dowel component is also manufactured from 1 3/16" diameter stainless steel, but is shorter than the HSD-HS-LD-D 30 dowel. One end of the dowel is designed to screw into the stainless steel HALFEN HSD-LD-W Anchor 40 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 HALFEN HSD-LD 30. See pages 22 to 24 for full technical details.

**Example Specification Clause**
delete/amend blue text as appropriate
HALFEN HSD-LD-W 30 Lockable Wall Dowel comprising dowel, sleeve, threaded anchor and locking components to be installed at the temporary movement joint between slab and wall. Product to be positioned at <insert centers> inch horizontal centers at <the center line of the slab or XXX inch from the top of the slab>. The dowel is to be locked in position after <insert time period> using the locking plate and resin supplied. System should be installed in accordance with HALFEN’s instructions and engineer’s drawings.

* US Patent No. 8209933

**Epoxy Resin**
Each dowel is locked after a pre-determined time period (generally 28-120 days) with a high quality, two-part epoxy resin. The resin is mixed and poured into the L-shaped void former. Each dowel requires 1.5 liters of resin which is supplied in a single can for each dowel to control the quantity.
### Performance Data

#### HSD-LD 30 Lockable Dowel [slab-to-slab]

<table>
<thead>
<tr>
<th>Slab Thickness</th>
<th>Design Strength Longitudinal Load [kip]</th>
<th>Vertical Design Strength [kip] for Various Design Joint Widths in 4000 psi Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>¼&quot;</td>
<td>½&quot;</td>
</tr>
<tr>
<td>6 ¼&quot;</td>
<td>10.0</td>
<td>3.4</td>
</tr>
<tr>
<td>6 ½&quot;</td>
<td>10.0</td>
<td>5.1</td>
</tr>
<tr>
<td>7&quot;</td>
<td>14.6</td>
<td>5.6</td>
</tr>
<tr>
<td>8&quot;</td>
<td>18.0</td>
<td>9.0</td>
</tr>
<tr>
<td>8 ¼&quot;</td>
<td>22.5</td>
<td>12.0</td>
</tr>
<tr>
<td>9&quot;</td>
<td>22.5</td>
<td>13.0</td>
</tr>
<tr>
<td>10&quot;</td>
<td>22.5</td>
<td>14.0</td>
</tr>
<tr>
<td>11&quot; and above</td>
<td>22.5</td>
<td>15.7</td>
</tr>
</tbody>
</table>

#### HSD-LD:ULTRA 30 Lockable Dowel [slab-to-slab]

<table>
<thead>
<tr>
<th>Slab Thickness</th>
<th>Design Strength Longitudinal Load [kip]</th>
<th>Vertical Design Strength [kip] for Various Design Joint Widths in 4000 psi Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>¼&quot;</td>
<td>½&quot;</td>
</tr>
<tr>
<td>9 ½&quot; and above</td>
<td>22.5</td>
<td>30.6</td>
</tr>
</tbody>
</table>

#### HSD-LD-W 30 Lockable Dowel [slab-to-wall]

<table>
<thead>
<tr>
<th>Slab Thickness</th>
<th>Design Strength Longitudinal Load [kip]</th>
<th>Vertical Design Strength [kip] for Various Design Joint Widths in 4000 psi Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>¼&quot;</td>
<td>½&quot;</td>
</tr>
<tr>
<td>6 ¼&quot;</td>
<td>10.0</td>
<td>2.7</td>
</tr>
<tr>
<td>6 ½&quot;</td>
<td>10.0</td>
<td>3.4</td>
</tr>
<tr>
<td>7&quot;</td>
<td>14.6</td>
<td>5.1</td>
</tr>
<tr>
<td>7 ½&quot;</td>
<td>14.6</td>
<td>5.6</td>
</tr>
<tr>
<td>8&quot;</td>
<td>18.0</td>
<td>9.0</td>
</tr>
<tr>
<td>8 ¼&quot;</td>
<td>18.0</td>
<td>12.0</td>
</tr>
<tr>
<td>9&quot;</td>
<td>18.0</td>
<td>13.0</td>
</tr>
<tr>
<td>10&quot;</td>
<td>18.0</td>
<td>14.0</td>
</tr>
<tr>
<td>11&quot; and above</td>
<td>18.0</td>
<td>15.7</td>
</tr>
</tbody>
</table>

All values in the table above are design load capacities (LRFD) and have to be compared to factored loads.
Dimensions

HSD-LD 30 Lockable Shear Dowel Components:
- HSD-LD-D 30 Dowel
- HSD-LD-ULTRA-D 30 Dowel
- HSD-LD-S 30 Sleeve
- HSD-LD-ULTRA-S 30 Sleeve
- HSD-LD-W 30 Sleeve
- HSD-LD-W-D 30 wall dowel

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 allowable 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.

HALFEN HSD-LD 30 Lockable Dowel sample calculation

Slab thickness = 10"
Joint width = 3/4"
Concrete strength = 4,000 psi
Characteristic permanent action (dead load) = 3.0 kip/ft factor = 1.2
Characteristic variable action (imposed load) = 3.5 kip/ft factor = 1.6
Factored load = 3.0 x 1.2 + 3.5 x 1.6 = 9.2 kip/ft
Design strength = 14 kip (10" slab 3/4" joint)
Therefore centers for vertical load = 14 / 9.2 = 1.52 ft use 18" centers

Once it is locked, this dowel will provide a design longitudinal capacity of 22.5 kip / 1.5 ft = 15 kip/ft.
Reinforcement Details

Local reinforcement is required around each HALFEN 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 main reinforcement required, 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.

### Main Reinforcement

<table>
<thead>
<tr>
<th>Dowel</th>
<th>Slab Thickness</th>
<th>Reinforcement on Each Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSD-LD 30</td>
<td>6 ½” and 6 ⅛”</td>
<td>(1) No. 4</td>
</tr>
<tr>
<td></td>
<td>7” and above</td>
<td>(2) No. 4</td>
</tr>
<tr>
<td>HSD-LD-Ultra 30</td>
<td>9 ½” and above</td>
<td>(3) No. 4</td>
</tr>
</tbody>
</table>

### Longitudinal Reinforcement

<table>
<thead>
<tr>
<th>Lockable Dowel</th>
<th>Longitudinal Bars Top and Bottom</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSD-LD 30</td>
<td>(2) No. 3</td>
</tr>
<tr>
<td>HSD-LD-Ultra 30</td>
<td>(3) No. 4</td>
</tr>
</tbody>
</table>

### Threaded Anchor

Reinforcement around the HALFEN Threaded Anchor should be a minimum #4, installed at maximum 8” vertical and horizontal centers.
Installation Procedure HSD-LD 30, HSD-LD-ULTRA 30 and HSD-LD-W 30

Installation HSD-LD 30 and HSD-LD-ULTRA 30 (slab-to-slab)

Although installation is shown for the HSD-LD 30, the procedure is the same for the HLD-LD-ULTRA 30.

1. Nail the sleeve to the formwork either central in the slab or for slab depths over 12” so the top of the void former 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. Place the local reinforcement, as specified on engineer’s drawings.

2. Pour the concrete, and when the required strength is attained, remove the formwork. Puncture the label to reveal the cylindrical sleeve only and insert the dowel until it is approximately 3/4” from the back of the void former.

3. Place the local reinforcement around the dowel component and pour the concrete.

4. After a predetermined time period (generally 28-120 days), when movement between the slabs has stabilized 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 center of the void former. 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 void former. It is essential the resin flows along the stainless steel box section towards the joint and reaches the notches on the locking plate, which indicate minimum resin depth. Joint must be filled before resin is installed.

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

After 24 hours the void former 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.

Installation HSD-LD 30 (slab-to-wall)

1. Nail the threaded anchor to the formwork so the dowel will be central in the adjoining slab or within 6” of the top of slabs over 12”. Place the local reinforcement as specified on engineer’s drawings and cast the concrete.

2. When concrete reaches sufficient strength, remove 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 it is flush with the concrete. 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 anchoring of the sleeve and dowel components will be necessary, to avoid displacement during casting of the concrete.
HALFEN HSD-AD ACOUSTIC DOWEL SYSTEM

Introduction

HALFEN HSD-AD Acoustic Dowel
HALFEN HSD-AD is a high load capacity shear stainless steel shear connector: it enables acoustic as well as thermal insulation. Typical applications include shear load transfer at joints subjected to impact noises (stairway ramps, landings, corridors, loggias etc.).

HALFEN HSD-AD Acoustic Dowels replace standard corbels and bearings. They are easy to use and can be installed for cast-in-place concrete wall and landing construction as well as with pre-cast concrete elements and masonry walls.

HALFEN HSD-AD Acoustic Dowels are safe, provide optimum acoustic insulation properties, and long durability.

HALFEN HSD-AD-D-A
5/8” diameter B500B reinforcement sealed using Sika Grout 212 mortar within a V4A, 1 3/8” protection tube.
Suitable for joint widths up to 2”.

HALFEN HSD-AD-D-B
High ductility shear dowel. 1 3/8” diameter solid dowel, grade 1.4462
Suitable for joint widths up to 4”.

HALFEN HSD-AD-D-C Dowel Component
Solid stainless steel high load capacity shear dowel. 1 1/8” diameter, steel grade 1.4462 with elastomeric compound F8042 and V4A external shell.
Suitable for joint widths up to 4”.

HALFEN HSD-AD-S-C Sleeve Component
Sleeve in grade 1.4301 steel.

HALFEN HSD-AD Acoustic Dowels are available as Type A, which is a diameter 5/8” reinforcement bar sealed in grout with ASTM 316 protection tube around it and high ductility dowels Type B, which is a solid diameter 1 3/8” stainless steel dowel. Both dowels can be used in combination with the HALFEN HSD-AD Sleeve.
HALFEN HSD-AD Acoustic Dowels Type A, B and C

### HALFEN HSD-AD Acoustic Dowels Type A and B

**Dimensions [inch]**

<table>
<thead>
<tr>
<th>Dowel Component</th>
<th>Dowel Length</th>
<th>Dowel Diameter (∅)</th>
<th>Max. Embedment</th>
<th>Sleeve Component</th>
<th>Sleeve Length</th>
<th>Sleeve Diameter (∅)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSD-AD-A</td>
<td>15 ⅜&quot;</td>
<td>1 ⅜&quot;</td>
<td>4⅜&quot;</td>
<td>HSD-AD-S-AB*</td>
<td>5&quot;</td>
<td>2 ¼&quot;</td>
</tr>
<tr>
<td>HSD-AD-B</td>
<td>15 ¼&quot;</td>
<td>1 ⅝&quot;</td>
<td>4⅜&quot;</td>
<td>HSD-AD-S-AB*</td>
<td>5&quot;</td>
<td>2 ¼&quot;</td>
</tr>
</tbody>
</table>

* The HALFEN HSD-AD-A-SET and the HALFEN HSD-AD-B-SET contain the same sleeve; HSD-AD-S-AB

#### Edge Distances and Spacing

The edge distances and connector spacing required, as shown in the drawing on the left, are defined by the slab thickness.

### HALFEN HSD-AD Acoustic Dowel Type C

**Dimensions [inch]**

<table>
<thead>
<tr>
<th>Dowel Component</th>
<th>Dowel Length</th>
<th>Dowel Diameter (∅)</th>
<th>Max. Embedment</th>
<th>Sleeve Component</th>
<th>Sleeve Length</th>
<th>Sleeve Diameter (∅)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSD-AD-C</td>
<td>18 ⅛&quot;</td>
<td>1 ⅜&quot;</td>
<td>4⅜&quot;</td>
<td>HSD-AD-S-C</td>
<td>5&quot;</td>
<td>2 ¼&quot;</td>
</tr>
</tbody>
</table>

#### Edge Distances and Spacing

The edge distances and connector spacing required, as shown in the drawing on the left, are defined by the slab thickness.
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