



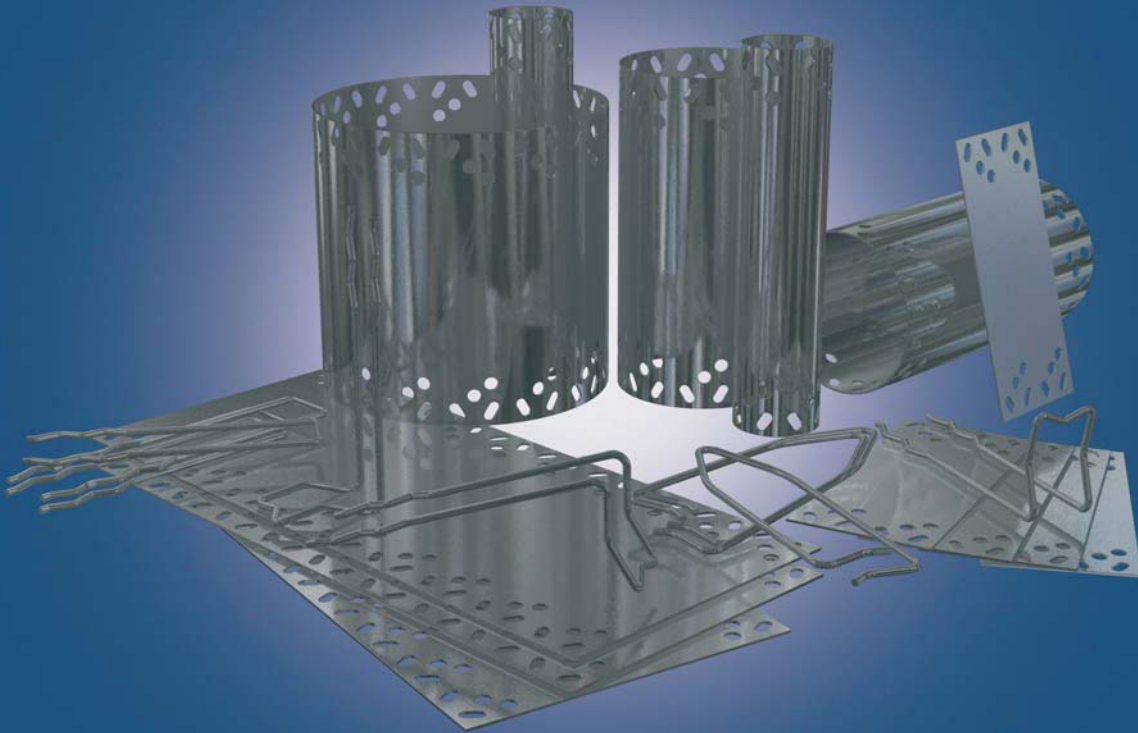
# PHILIPP Sandwich Panel Anchor System

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## Installation Instruction



Permissible values according to DIN 1045-1



## Transport and Mounting Systems for Precast Units

- ▲ **Technical department** – our staff would be happy to support you during your design process with suggestions for installation and of our transport and mounting systems for precast units.
- ▲ **Special constructions** – individual for your special application.
- ▲ **Practical tests in plant** – we ensure that our concepts are customized.
- ▲ **Test reports** – for documentation and your safety.
- ▲ **Service** – our engineers would be happy to train your technicians and staff at plant, consult during installation of precast units and help to optimize the production process.
- ▲ **High application safety of our products** – close cooperation with federal institute for material testing and – where required – German approvals of our products.
- ▲ **Software solutions** – design software for our sandwich anchor system.

### ▲ **Technical Department:**

Phone: +49 (0) 6021 / 40 27-318  
Fax: +49 (0) 6021 / 40 27-329  
Email: [technik@philipp-gruppe.de](mailto:technik@philipp-gruppe.de)

### ▲ **Sales Department:**

Phone: +49 (0) 6021 / 40 27-300  
Fax: +49 (0) 6021 / 40 27-440  
Email: [export@philipp-gruppe.de](mailto:export@philipp-gruppe.de)



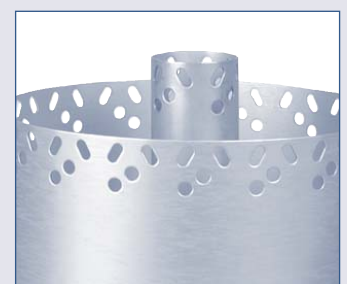
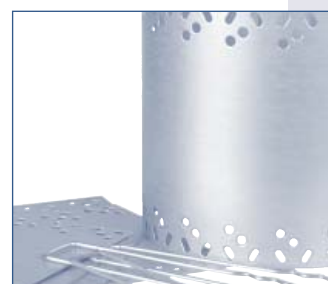
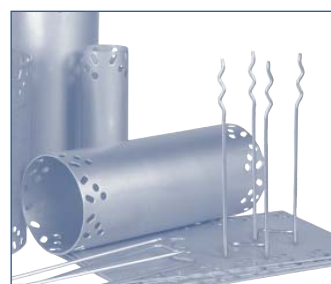
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## PHILIPP Calculation Software for Sandwich Panel Anchors

Our new calculation software is for free and available at:  
[www.philipp-gruppe.de](http://www.philipp-gruppe.de)



**Benefits in Overview:**

- Reduction of mounting and planning effort
- Technical developments accounted for though structural standards based on new DIN 1045-1
- Minimal thermal bridge through the fastening system
- Use of high quality stainless steel in anchor for lasting corrosion resistance
- System is widely in use, making design planning easier
- Uniform load transfer in thin-walled elements through load balancing between several support anchors
- Simple system adjustment even for geometrically complicated elements
- Insulating layer thickness up to **20cm** possible
- Connector pins can be used without further calculation under observation of the default boundary conditions
- Structural standard accounts for wind load as well as stress from temperature changes and shrinkage
- Both negative and positive production possible, since the system is rated for both load types
- The inspected system does not restrict the progress of the construction work
- Facing layer weight as benchmark sizing criteria for anchor selection
- Comprehensible and simple installation of anchors and pins
- Calculation software for simple anchor sizing

## GENERAL PLANNING NOTES FOR CONCRETE ELEMENTS IN SANDWICH CONSTRUCTION

The planning and manufacturing of concrete elements in sandwich panel construction requires consideration of fundamental design facts. These must be accounted for during the planning design, since various influences like **stress from transport, temperature changes or shrinkage** arise during an object's production and use phase. Sandwich elements can appear as so-called **three-layer slabs**, consisting of a **load bearing layer**, an **insulating layer**, and a **facing layer**. There are also **four-layer slab** versions as well. These are characterised by the rear ventilation of the facing layer. The different variations in three or four layers serve the physical construction needs on hand, to be determined by the design planner. The concrete that is used must demonstrate a **concrete quality of at least C30/37** ( $f_{ck, cyl} = 30 \text{ N/mm}^2$ ,  $f_{ck, cube} = 37 \text{ N/mm}^2$ ), independent of the slab version that is used. The concrete quality of the facing layer is restricted to C50/60 ( $f_{ck, cyl} = 50 \text{ N/mm}^2$ ,  $f_{ck, cube} = 60 \text{ N/mm}^2$ ).

Within the framework of the structural standard, the **PHILIPP Sandwich Panel Anchor System** already accounts for wind stresses **for structural heights of up to 100m**, as well as influences from temperature stresses. This effects anchor rating insofar as a rating of the limit load based on the thickness of the insulating layer, the weight of the facing layer, and the implemented load bearing system must be conducted. The weight of elements that might potentially be affixed (advertising signs, sun protection, etc) must be accounted for in the rating.

All elements of the **PHILIPP Sandwich Panel Anchor System** guarantee local load distribution from the facing layer into the load bearing layer. Continued distribution of the load is accounted for through corresponding rating by the structural planner.

For lasting, secure transmission of forces from wind, thermal expansion, etc, various anchoring elements are required. These are **inspected as a system on a structural standard basis** and are subject to **permanent quality control**. Cylindrical sleeve anchors (Page 6) serve as the primary load bearing element, connecting the load bearing layer to the facing layer. To **avoid unwanted torsion stress**, so-called **flat anchors** (Page 11) or, depending on the load, crossed connector pins (Page 20) may be used. Other potential connection elements can include connector pins, clip-on pins or connector stirrups (Page 18).

## General Manufacturing Notes:

- Use of low-shrinkage concrete (attention to water/cement value and grading curve)
- Avoidance of contact points between load bearing layer and facing layer through use of two-layer insulation or single layer insulating material in connection with a separating foil.
- Recommendation of a max. facing layer length of 6.0m or division into several elements to avoid cracks.
- Free moving offacing layer and load bearing layer by the use of installation with plane surface or by the use of a separating foil between installation layer and bearing layer.
- Affixing of installation components like windows, door frames, etc. into the load bearing layer.
- Allowance for individual rigidities for facing layer and load bearing layer, particularly during form removal process depending on the production process (positive or negative production).
- Positive production (facing layer up) is preferred to reduce the stress during form removal and to compensate for shrinking strain in the opposite direction.
- Uncrowded design of the overall construction, to allow for the expansion of components against one another.
- Construction design of building components set around corners must guarantee a non-squeezing construction (joints must be equipped with soft fill material or left free).
- Installation and application of thermal insulation materials with low water absorption properties and low thermal transmission, to optimise the insulation layer thickness (e.g. Styrofoam or Styrodur®).
- The concrete cover and corresponding exposure class comply with DIN 1045-1.
- Thermal insulation must be made of fire-resistant materials (DIN 4102-1).
- Model joints on the insulating materials as rabbet edges or pack with tape.
- Dose the use of concrete vibrator to prevent the decomposition of the concrete.
- Accounting for light colour design for the facing layer to minimise the stress through temperature changes.
- The center of anchorage should ideally be in the middle of the slab to prevent crack formation and torsion stress (as a result of shrinking, eccentricities, etc).
- Free moving offacing layer and load bearing layer by the use of installation with plane surface or by the use of a separating foil between installation layer and bearing layer.

## Transportation and Storage Notes:

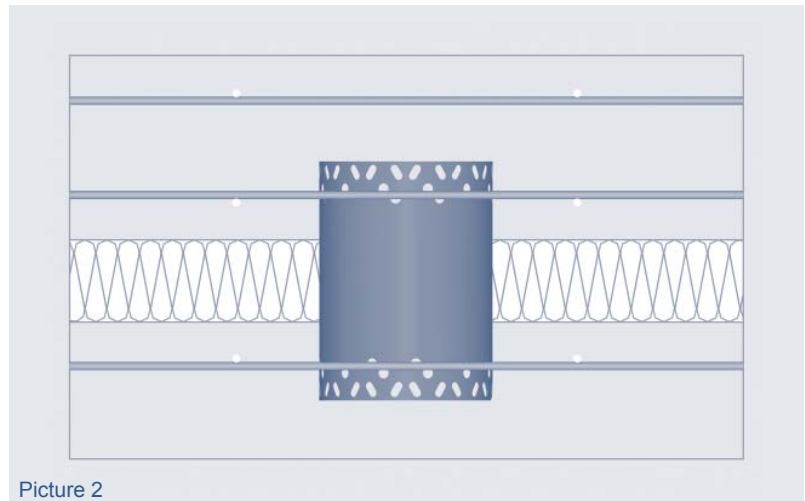
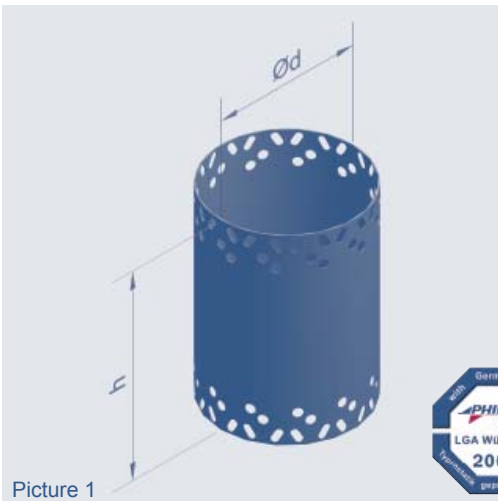
- Pay close attention to the entire transportation chain from manufacturer up to final assembly.
- Plan for an appropriate storage of elements .
- Selection of appropriate transportation anchor system.
- Indication of required transportation conditions to avoid damages e.g. through interim storage or handling
- Storage with consideration of sun and wind for evenly distributed drying of the load bearing layer and facing layer (storage away from sunlight, cover through plastic, etc).
- Post-treatment of concrete elements where required.
- The time to lift the unit out of the formwork depends on the surface structure, the adesion and the concrete strength.

**PHILIPP Sleeve Anchors** are part of the **PHILIPP Sandwich Panel Anchor System**. They can be used for three- or four-layer slabs. Their **cylindrical form** insures uniform stress in all load directions and **hence guarantees error-free mounting**. The sleeve anchors can be only used in connection with **PHILIPP Connector Pins** and **PHILIPP Flat Anchors**. In this way, they serve as support anchors and assure safe load division of the facing layer weight. The area around the anchor's edges possesses oval and round holes. The round holes are intended for the introduction of concrete reinforcing bars, while the oval holes created a secure bond with the concrete.

The **PHILIPP Sleeve Anchors** are made of stainless steel and ensure lasting anchorage of loads from the facing layer into the load bearing layer. The sleeve anchors are labelled with diameter and anchor height.

### Arrangement of PHILIPP Sleeve Anchors:

- The sleeve anchor should generally be arranged in the element's centre of gravity. To assure proper positioning and to avoid torsion of the element, an additional flat anchor or crossed connector pins must be installed.
- It is possible to install the sleeve anchor outside the element's centre of gravity. In this case it is placed offset from the axis of the centre of gravity in combination with a flat anchor carrying jointly. To avoid symptoms of fatigue in the flat anchor on the basis of thermal expansion of the facing layer, the maximal distance intervals from the sleeve anchors as indicated in table 19 must be observed.



**Table 1: Dimensions PHILIPP Sleeve Anchor**

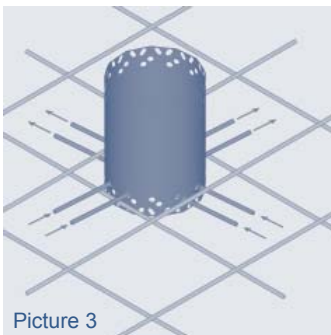
| Art.-No.     | Diameter<br>dia.d<br>[mm] | Material<br>Thickness t<br>[mm] | Height<br>h<br>[mm] |     |     |     |     |     | Weight per<br>100 mm Height<br>[kg] |
|--------------|---------------------------|---------------------------------|---------------------|-----|-----|-----|-----|-----|-------------------------------------|
|              |                           |                                 | 150                 | 175 | 200 | 225 | 260 | 300 |                                     |
| 77MA15XXX051 | 51                        | 1.5                             | 150                 | 175 | 200 | 225 | 260 | 300 | 0.11                                |
| 77MA15XXX076 | 76                        | 1.5                             | 150                 | 175 | 200 | 225 | 260 | 300 | 0.18                                |
| 77MA15XXX102 | 102                       | 1.5                             | 150                 | 175 | 200 | 225 | 260 | 300 | 0.22                                |
| 77MA15XXX127 | 127                       | 1.5                             | 150                 | 175 | 200 | 225 | 260 | 300 | 0.28                                |
| 77MA15XXX153 | 153                       | 1.5                             | 150                 | 175 | 200 | 225 | 260 | 300 | 0.33                                |
| 77MA15XXX178 | 178                       | 1.5                             | 150                 | 175 | 200 | 225 | 260 | 300 | 0.41                                |
| 77MA15XXX204 | 204                       | 1.5                             | 150                 | 175 | 200 | 225 | 260 | 300 | 0.46                                |
| 77MA15XXX229 | 229                       | 1.5                             | 150                 | 175 | 200 | 225 | 260 | 300 | 0.51                                |
| 77MA15XXX255 | 255                       | 1.5                             | 150                 | 175 | 200 | 225 | 260 | 300 | 0.57                                |
| 77MA15XXX280 | 280                       | 1.5                             | 150                 | 175 | 200 | 225 | 260 | 300 | 0.65                                |

The article number must be supplemented with the desired height h  
 e.g. sleeve anchor dia.d=204mm, height h=225mm, material thickness t=1,5mm  
 → Article-No.: 77MA15225204

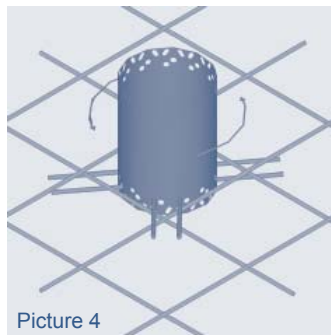
**PHILIPP Sleeve Anchors** can be installed in two different ways. The user can manufacture them either via positive production (facing layer up) or negative production (facing layer down). The installation of the sleeve anchor described below refers to positive production. The same steps are followed for negative production but in reversed order.

The **PHILIPP Sleeve Anchor** is inserted into the wire mesh reinforcement of the load bearing layer. Concrete reinforcing bars are then run through both of the rows of round holes (Table 3). The bars should lie at right angles to one another (Picture 3). The placement of rows of holes at staggered heights insures that additional bars will be positioned above and/or below the wire mesh reinforcement in the load bearing layer. Once brought into position, the anchor and all additional reinforcement are then turned by 45° (Picture 4). Cut-out surface reinforcement potentially may need to be supplemented with corresponding support rods into the sides of the **PHILIPP Sleeve Anchor**, whereby the overlap lengths should conform to DIN 1045-1 (Table 3). Once the accompanying concrete pouring process is finished, the required insulation can be put into place. In doing so, the anchors can either be stuck through the insulation material, or for large diameters, a spherical pocket must be specially cut. The insulation notch must be laid into the spherical anchor once the insulation has been laid to prevent a cold bridge, as well as a sticking together of the facing layer and the load bearing layer. It is particularly important to mind that installation is performed without leaving hollow spaces, as they would otherwise fill up during the concrete pouring. Offset alignment of the cross joints for two-layer insulation material is always preferred, for the stated reasons. Careful installation of the **PHILIPP Sleeve Anchors** ensures a lasting connection accentuated by gravity of the facing layer and the load bearing layer.

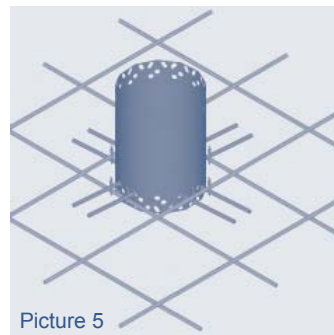
The use of thinner facing layer requires a different variant. To do so, the anchor is laid onto the reinforcement mesh of the facing layer using pre-installed support rods, and is wired tied (Picture 5).



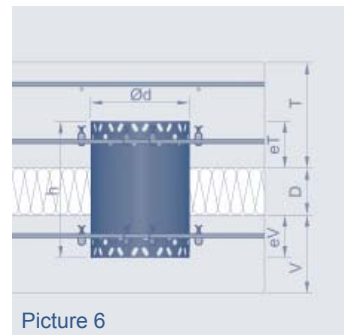
Picture 3



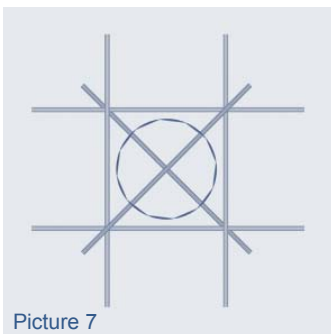
Picture 4



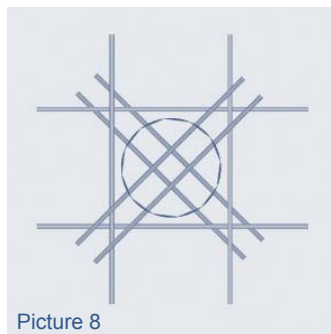
Picture 5



Picture 6



Picture 7



Picture 8

| Indicies/Legend                     |  |
|-------------------------------------|--|
| T = thickness of load bearing layer | L <sub>x</sub> = grid interval on X axis           |
| D = thickness of insulating layer   | L <sub>y</sub> = grid interval on Y axis           |
| V = thickness of facing layer       | t = material thickness                             |
| d = diameter of connector pins      | Q <sub>RD</sub> = rated value of shear             |
| dia. d = diameter sleeve anchors    | b = width of connector pin                         |
| l = length flat anchor              | e <sub>V</sub> = embedded depth facing layer       |
| h = height of anchoring element     | e <sub>T</sub> = embedded depth load bearing layer |
| f = distance flat anchor to fulcrum | n = distance connector pin to fulcrum              |

### Embedded Depth

The insulation thickness “D” and the facing layer thickness “V” are the predominant factors for determining the embedded depth “e<sub>V</sub>” for the facing layer. The fundamental rule applies that the embedded depth “e<sub>V</sub>” in the facing layer must be at least the minimum of the embedded depth “e<sub>T</sub>” in the load bearing layer. The calculation of the related anchor lengths is produced from the following formula:

$$h \geq e_T + D + e_V$$

$$e_T \geq e_V \quad (\text{Tables 2a and 2b on Page 8})$$

**Table 2a:** Anchor Heights Based on Facing Layer and Minimal Embedded Depth

| Thickness Facing Layer V [mm] | Insulation Thickness |    |     |    |    |    |     |     |     |     |     |     |     |  |
|-------------------------------|----------------------|----|-----|----|----|----|-----|-----|-----|-----|-----|-----|-----|--|
|                               | 30                   | 40 | 50  | 60 | 70 | 80 | 90  | 100 | 110 | 120 | 130 | 140 | 150 |  |
| 70                            | 150                  |    | 200 |    |    |    | 260 |     |     |     |     |     | 300 |  |
| 80                            | 150                  |    | 200 |    |    |    | 260 |     |     |     |     |     | 300 |  |
| 90                            | 150                  |    | 200 |    |    |    | 260 |     |     |     |     |     | 300 |  |
| 100                           | 150                  |    | 200 |    |    |    | 260 |     |     |     |     |     | 300 |  |
| 110                           | 150                  |    | 200 |    |    |    | 260 |     |     |     |     |     | 300 |  |
| 120                           | 150                  |    | 200 |    |    |    | 260 |     |     |     |     |     | 300 |  |

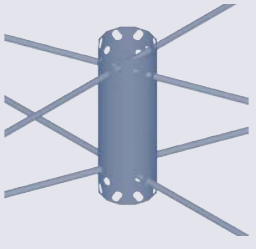
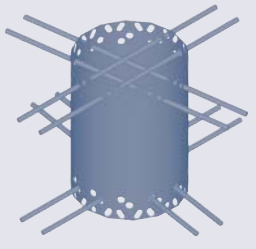
**Table 2b:** Minimal Embedded Depth of the Sleeve Anchor

| Thickness Facing Layer V [mm] | Required Minimum Embedded Depth $e_v$ bzw. $e_T$ [mm] |                         |
|-------------------------------|---|-------------------------|
|                               | Insulation 30-90 [mm]                                 | Insulation 100-150 [mm] |
| 70                            | 55  | 60                      |
| 80                            | 60  | 70                      |
| 90                            | 60  | 70                      |
| 100                           | 60  | 70                      |
| 110                           | 60  | 70                      |
| 120                           | 60  | 70                      |

### Required Reinforcement for PHILIPP Sleeve Anchor

To insure the load transfer from the facing to the load bearing layer, both a minimal reinforcement of the concrete element and the **PHILIPP Sleeve Anchors** are required. These required data are provided in the following table 3.

**Table 3:** Min. Reinforcement of Sleeve Anchors, Load Bearing Layer and Facing Layer

| Installation Position Anchor  | Diameter dia.d [mm] | Anchoring Bars BSt 500S  | Minimum Reinforcement of the Load Bearing Layer and Facing Layer  |
|---|---------------------|--|---|
|  | 51                  | 2 × 2 dia.6mm<br>L = 500mm   | <u>Facing layer:</u><br>1,88 cm <sup>2</sup> /m<br>(dia. 6mm-150mm squared in each direction) central             |
|   | 76                  |  |   |
|   | 102                 |  |   |
|  | 127                 | 2 × 4 dia.6mm<br>L = 700mm<br><br>Add-on 4 × dia.8mm<br>L = 700mm<br>in cut-out area | <u>Load bearing layer:</u><br>1,88 cm <sup>2</sup> /m<br>(dia. 6mm-150mm squared in each direction) on both sides |
|   | 153                 |  |   |
|   | 178                 |  |   |
|   | 204                 |  |   |
|   | 229                 |  |   |
|   | 255                 |  |   |
|   | 280                 |  |   |

The added reinforcement of 4 dia.8 L = 700 are only required for anchors whose diameter „dia.d” is larger than the mesh grid. The localised tearing of the welded wire mesh is compensated through this extra reinforcement. This should be built in on the same level as the torn mesh bar.

The surface reinforcement for the facing layer must correspond at least to a Q188A (mesh reinforcement dia. 6mm-150mm squared in each direction). A facing layer thickness of 100mm or more requires a two-layer wire mesh reinforcement. The reinforcement of the load bearing layer follows from the dimensioning required by the static. It must however be realised with a Q188A (mesh reinforcement dia. 6mm-150mm squared in each direction) reinforcement on both sides.



Notes on determination of the maximum permissible shear force  $Q_{zul}$  (as per DIN 1045-1) from the rated value of the shear force  $Q_{Rd}$  from **PHILIPP Sleeve Anchors** for all facing layer thicknesses:

$$Q_{zul} = \frac{Q_{Rd}}{\gamma_M} = \frac{Q_{Rd}}{1,35}$$

All rating values for shear force  $Q_{Rd}$  [kN] presented here for **PHILIPP Sleeve Anchors** apply to buildings of heights  $\leq 100$  m and a minimal concrete quality of C30/37 ( $f_{ck, cyl} = 30\text{N/mm}^2$ ;  $f_{ck, cube} = 37\text{N/mm}^2$ ) based on DIN 1045-1.

**Table 4:** Rated Value of Shear Force  $Q_{Rd}$  [kN] for Sleeve Anchors for Facing Layer Thicknesses of  $V = 70$  mm

| Description<br>MA-dia. | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |
|------------------------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|                        | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 110  | 120  | 130  | 140  | 150  |
| MA-051                 | 15.3                        | 14.1 | 12.8 | 11.6 | 10.8 | 10.0 | 9.3  | 8.5  | 7.7  | 7.4  | 7.1  | 6.8  | 6.5  |
| MA-076                 | 19.6                        | 19.2 | 18.1 | 17.1 | 16.7 | 15.9 | 15.0 | 14.3 | 13.6 | 12.4 | 11.5 | 10.1 | 8.7  |
| MA-102                 | 27.0                        | 25.1 | 24.6 | 24.2 | 23.7 | 21.1 | 18.4 | 15.8 | 13.2 | 12.6 | 12.0 | 11.5 | 10.9 |
| MA-127                 | 39.4                        | 36.4 | 33.4 | 30.5 | 27.5 | 26.0 | 24.5 | 23.0 | 21.5 | 20.7 | 19.9 | 18.9 | 17.9 |
| MA-153                 | 48.4                        | 46.1 | 41.6 | 38.9 | 37.7 | 35.7 | 33.6 | 31.6 | 29.6 | 28.7 | 27.7 | 26.8 | 25.9 |
| MA-178                 | 55.9                        | 54.8 | 51.2 | 47.7 | 44.1 | 43.5 | 42.9 | 40.6 | 38.4 | 36.0 | 35.2 | 33.2 | 30.5 |
| MA-204                 | 65.3                        | 62.1 | 59.0 | 53.4 | 50.3 | 48.0 | 45.9 | 43.0 | 42.0 | 39.0 | 36.8 | 34.5 | 32.3 |
| MA-229                 | 71.8                        | 71.1 | 70.3 | 60.5 | 59.8 | 57.0 | 54.0 | 51.7 | 47.6 | 44.0 | 43.5 | 43.0 | 39.0 |
| MA-255                 | 72.0                        | 71.2 | 70.4 | 68.2 | 67.4 | 63.1 | 58.4 | 58.9 | 54.9 | 53.4 | 50.5 | 49.3 | 45.0 |
| MA-280                 | 76.2                        | 76.1 | 76.0 | 75.9 | 74.3 | 69.2 | 63.7 | 64.0 | 61.8 | 58.2 | 56.8 | 53.8 | 49.5 |

**Table 5:** Rated Value of Shear Force  $Q_{Rd}$  [kN] for Sleeve Anchors for Facing Layer Thicknesses of  $V = 80$  mm

| Description<br>MA-dia. | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |
|------------------------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|                        | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 110  | 120  | 130  | 140  | 150  |
| MA-051                 | 15.3                        | 14.0 | 12.8 | 11.5 | 10.6 | 10.0 | 9.3  | 8.5  | 7.7  | 7.4  | 7.1  | 6.8  | 6.5  |
| MA-076                 | 18.5                        | 18.0 | 17.1 | 16.0 | 15.1 | 14.3 | 13.8 | 13.3 | 13.1 | 11.9 | 11.0 | 9.8  | 9.0  |
| MA-102                 | 29.5                        | 27.6 | 26.4 | 25.3 | 24.4 | 22.0 | 19.6 | 17.2 | 14.6 | 13.5 | 12.6 | 12.1 | 11.4 |
| MA-127                 | 40.0                        | 36.7 | 33.5 | 30.5 | 28.4 | 26.8 | 25.5 | 24.2 | 22.9 | 21.5 | 20.4 | 19.6 | 18.3 |
| MA-153                 | 47.0                        | 45.7 | 42.8 | 40.0 | 37.8 | 36.2 | 34.0 | 32.4 | 30.3 | 28.0 | 27.0 | 26.0 | 25.0 |
| MA-178                 | 55.0                        | 55.5 | 52.8 | 50.9 | 48.5 | 47.2 | 44.6 | 42.3 | 39.0 | 36.0 | 34.0 | 32.5 | 30.5 |
| MA-204                 | 64.6                        | 62.2 | 59.9 | 55.0 | 52.9 | 50.4 | 48.0 | 46.0 | 44.0 | 41.5 | 39.5 | 38.0 | 36.0 |
| MA-229                 | 72.8                        | 71.3 | 69.9 | 61.7 | 59.7 | 56.9 | 54.4 | 52.4 | 48.9 | 46.1 | 45.0 | 43.5 | 42.0 |
| MA-255                 | 73.4                        | 72.9 | 71.0 | 69.5 | 66.4 | 63.2 | 59.0 | 58.6 | 54.7 | 53.0 | 51.5 | 50.5 | 47.8 |
| MA-280                 | 76.8                        | 76.5 | 76.2 | 75.1 | 72.4 | 67.9 | 63.1 | 63.2 | 60.9 | 57.6 | 56.7 | 54.6 | 51.9 |

**Table 6:** Rated Value of Shear Force  $Q_{Rd}$  [kN] for Sleeve Anchors for Facing Layer Thicknesses of  $V = 90$  mm

| Description<br>MA-dia. | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |
|------------------------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|                        | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 110  | 120  | 130  | 140  | 150  |
| MA-051                 | 15.2                        | 14.0 | 12.7 | 11.5 | 10.4 | 10.0 | 9.3  | 8.5  | 7.7  | 7.4  | 7.1  | 6.8  | 6.5  |
| MA-076                 | 17.4                        | 16.8 | 16.2 | 14.8 | 13.6 | 12.8 | 12.6 | 12.4 | 12.7 | 11.5 | 10.4 | 9.5  | 9.3  |
| MA-102                 | 31.5                        | 29.5 | 27.9 | 26.4 | 25.0 | 22.7 | 20.4 | 18.1 | 15.7 | 14.3 | 13.1 | 12.5 | 11.8 |
| MA-127                 | 40.6                        | 36.9 | 33.5 | 30.5 | 29.1 | 27.7 | 26.5 | 25.2 | 24.0 | 22.1 | 20.8 | 20.3 | 18.7 |
| MA-153                 | 45.7                        | 45.3 | 42.9 | 41.1 | 38.0 | 36.8 | 34.3 | 33.2 | 31.0 | 29.1 | 27.7 | 26.8 | 26.0 |
| MA-178                 | 54.1                        | 56.1 | 54.4 | 52.0 | 49.6 | 48.1 | 45.8 | 43.7 | 40.3 | 37.7 | 35.6 | 34.5 | 32.6 |
| MA-204                 | 63.9                        | 62.3 | 60.7 | 56.4 | 54.9 | 52.2 | 49.8 | 47.9 | 46.3 | 44.7 | 42.3 | 40.5 | 38.4 |
| MA-229                 | 73.8                        | 71.6 | 69.5 | 62.9 | 59.6 | 57.9 | 55.7 | 54.1 | 51.0 | 48.1 | 47.5 | 46.3 | 45.0 |
| MA-255                 | 74.8                        | 74.6 | 71.6 | 70.8 | 65.4 | 63.4 | 59.6 | 58.2 | 54.6 | 52.5 | 52.1 | 51.6 | 50.2 |
| MA-280                 | 77.3                        | 76.8 | 76.4 | 74.4 | 70.4 | 66.5 | 62.4 | 62.3 | 60.1 | 57.0 | 56.6 | 55.5 | 54.0 |

**Table 7:** Rated Value of Shear Force  $Q_{Rd}$  [kN] for Sleeve Anchors for Facing Layer Thicknesses of  $V = 100$  mm

| Description<br>MA-dia. | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |
|------------------------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|                        | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 110  | 120  | 130  | 140  | 150  |
| MA-051                 | -                           | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| MA-076                 | -                           | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| MA-102                 | 33.4                        | 31.4 | 29.5 | 27.5 | 25.5 | 23.3 | 21.1 | 18.9 | 16.7 | 15.1 | 13.6 | 12.8 | 12.1 |
| MA-127                 | 41.0                        | 37.0 | 33.6 | 30.6 | 29.8 | 28.6 | 27.4 | 26.2 | 25.0 | 22.6 | 21.1 | 21.0 | 18.9 |
| MA-153                 | 47.1                        | 45.0 | 43.0 | 41.2 | 38.0 | 36.9 | 34.4 | 33.3 | 31.0 | 30.2 | 28.4 | 27.7 | 26.9 |
| MA-178                 | 54.3                        | 56.3 | 55.9 | 53.2 | 50.8 | 48.9 | 47.0 | 45.2 | 41.6 | 39.4 | 37.3 | 36.6 | 34.6 |
| MA-204                 | 63.4                        | 62.5 | 61.5 | 57.9 | 57.0 | 54.1 | 51.5 | 49.8 | 48.6 | 47.9 | 45.2 | 42.9 | 40.9 |
| MA-229                 | 74.7                        | 71.8 | 69.7 | 63.0 | 60.8 | 58.9 | 57.1 | 55.8 | 53.2 | 50.2 | 50.0 | 49.2 | 47.9 |
| MA-255                 | 75.7                        | 75.5 | 71.8 | 71.6 | 65.2 | 63.8 | 59.7 | 58.4 | 54.7 | 52.6 | 52.6 | 52.6 | 52.7 |
| MA-280                 | 77.5                        | 77.0 | 76.5 | 74.5 | 68.7 | 65.5 | 62.6 | 62.4 | 59.7 | 57.1 | 56.8 | 56.4 | 56.1 |

**Table 8:** Rated Value of Shear Force  $Q_{Rd}$  [kN] for Sleeve Anchors for Facing Layer Thicknesses of  $V = 110$  mm

| Description<br>MA-dia. | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |
|------------------------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|                        | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 110  | 120  | 130  | 140  | 150  |
| MA-051                 | -                           | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| MA-076                 | -                           | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| MA-102                 | 33.0                        | 31.3 | 29.9 | 28.5 | 26.4 | 23.2 | 21.1 | 18.5 | 16.2 | 14.6 | 13.3 | 12.5 | 11.9 |
| MA-127                 | 39.7                        | 35.9 | 32.6 | 29.8 | 29.2 | 28.0 | 26.9 | 25.7 | 24.5 | 22.1 | 20.6 | 20.3 | 18.3 |
| MA-153                 | 40.0                        | 42.4 | 40.1 | 36.6 | 32.7 | 32.7 | 31.5 | 31.5 | 30.3 | 29.6 | 27.9 | 27.2 | 26.5 |
| MA-178                 | 55.0                        | 56.6 | 55.1 | 52.8 | 50.6 | 48.5 | 47.0 | 44.6 | 41.8 | 39.7 | 37.7 | 36.3 | 34.3 |
| MA-204                 | 65.4                        | 63.8 | 61.6 | 58.0 | 56.5 | 53.7 | 51.2 | 50.2 | 48.4 | 47.7 | 46.0 | 44.6 | 41.6 |
| MA-229                 | 74.7                        | 71.1 | 67.5 | 61.2 | 59.2 | 58.4 | 56.4 | 55.8 | 53.1 | 50.5 | 50.0 | 49.1 | 48.0 |
| MA-255                 | 77.3                        | 76.6 | 72.2 | 71.5 | 64.6 | 63.5 | 59.9 | 58.9 | 55.6 | 53.3 | 53.2 | 53.1 | 53.0 |
| MA-280                 | 77.6                        | 77.1 | 76.6 | 74.6 | 68.7 | 65.5 | 62.5 | 62.3 | 59.5 | 57.0 | 56.7 | 56.4 | 56.1 |

**Table 9:** Rated Value of Shear Force  $Q_{Rd}$  [kN] for Sleeve Anchors for Facing Layer Thicknesses of  $V = 120$  mm

| Description<br>MA-dia. | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |
|------------------------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|                        | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 110  | 120  | 130  | 140  | 150  |
| MA-051                 | -                           | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| MA-076                 | -                           | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| MA-102                 | 32.6                        | 31.1 | 30.3 | 29.6 | 27.3 | 23.0 | 21.1 | 18.2 | 15.6 | 14.2 | 12.9 | 12.3 | 11.6 |
| MA-127                 | 38.3                        | 34.8 | 31.7 | 29.1 | 28.6 | 27.5 | 26.3 | 25.1 | 23.9 | 21.5 | 20.0 | 19.7 | 17.7 |
| MA-153                 | 38.7                        | 39.8 | 37.3 | 31.9 | 27.4 | 28.5 | 28.5 | 29.6 | 29.6 | 29.0 | 27.4 | 26.8 | 26.2 |
| MA-178                 | 55.7                        | 56.9 | 54.3 | 52.3 | 50.3 | 48.0 | 46.9 | 44.0 | 41.9 | 39.9 | 38.1 | 36.1 | 34.0 |
| MA-204                 | 67.4                        | 65.2 | 61.6 | 58.2 | 56.1 | 53.4 | 50.9 | 50.5 | 48.2 | 47.5 | 46.9 | 46.2 | 42.3 |
| MA-229                 | 74.8                        | 70.5 | 65.3 | 59.4 | 57.6 | 57.8 | 55.6 | 55.8 | 52.9 | 50.8 | 49.9 | 49.0 | 48.1 |
| MA-255                 | 79.0                        | 77.6 | 72.6 | 71.3 | 63.9 | 63.3 | 60.0 | 59.4 | 56.5 | 54.1 | 53.8 | 53.6 | 53.4 |
| MA-280                 | 77.8                        | 77.3 | 76.7 | 74.7 | 68.8 | 65.5 | 62.5 | 62.2 | 59.4 | 56.8 | 56.6 | 56.4 | 56.1 |

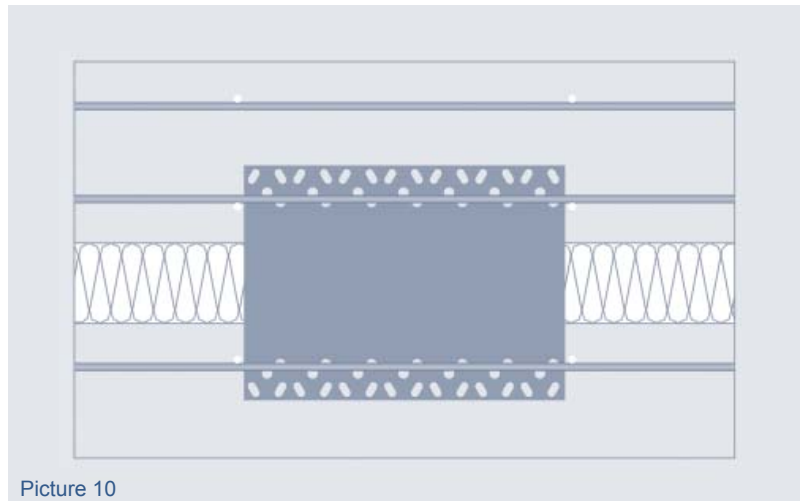
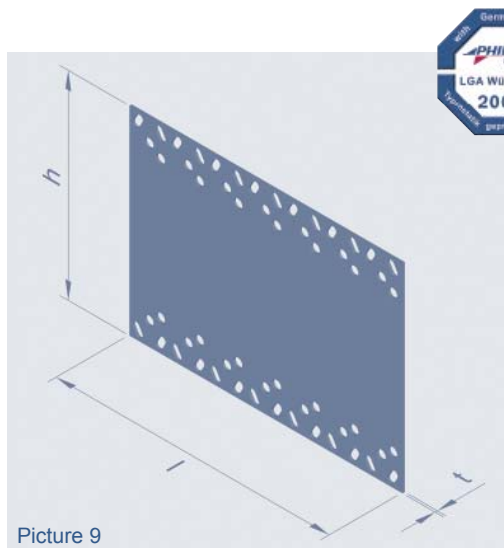


**PHILIPP Flat Anchors** are part of the **PHILIPP Sandwich Panel Anchor System**. They can be used for three- or four-layer slabs. They can be applied either in pairs with symmetrical installation in building components as a pure support anchor or as a torsion anchor in combination with the **PHILIPP Sleeve Anchor**. The flat anchor can only be installed in connection with **PHILIPP Connector Pins**. Where serving as a support anchor, the flat anchor provides safe load partitioning of the facing layer weight into the load bearing layer. Both areas around the anchor's edges possess oval and round holes. The round holes are intended for the introduction of concrete reinforcing bars, while the oval holes create a secure bond with the concrete.

The flat anchors are made of stainless steel and ensure lasting anchorage of loads from the facing layer into the load bearing layer. The flat anchors are labelled with anchor width and anchor height.

### Arrangement of the PHILIPP Flat Anchors:

Where flat anchors are used alone, at least three flat anchors are required for load transfer. Two of the three anchors transfer the vertical load and should hence be selected for optimal utilisation in such a way that their share of their own dead weight is distributed evenly between the two anchors. A third anchor is installed horizontally and as such forms the fulcrum for the facing layer (Picture 32). The maximum interval between fulcrum (horizontally installed flat anchor or sleeve anchor) and the most external anchor point (flat anchor) are to be drawn from table 19. The rated load limits are laid out in the following tables 13 through 18, depending on the respective facing layer thickness, heat insulation thickness and anchor length. Within the framework of determining the loads on the individual anchors, the eccentricities and potential uneven loading must be taken into account.



**Table 10: Dimensions PHILIPP Flat Anchors**

| Art.-No.     | Length<br>l<br>[mm] | Material<br>Thickness<br>t<br>[mm] | Height<br>h<br>[mm] |     |     |     |     |     |     | Weight per<br>100 mm Height<br>[kg] |
|--------------|---------------------|------------------------------------|---------------------|-----|-----|-----|-----|-----|-----|-------------------------------------|
|              |                     |                                    | 150                 | 175 | 200 | 225 | 260 | -   | -   |                                     |
| 77FA20XXX080 | 80                  | 2.0                                | 150                 | 175 | 200 | 225 | 260 | -   | -   | 0.13                                |
| 77FA30XXX080 |                     | 3.0                                | -                   | -   | -   | -   | 260 | 280 | 300 | 0.19                                |
| 77FA20XXX120 | 120                 | 2.0                                | 150                 | 175 | 200 | 225 | 260 | -   | -   | 0.21                                |
| 77FA30XXX120 |                     | 3.0                                | -                   | -   | -   | -   | 260 | 280 | 300 | 0.28                                |
| 77FA20XXX160 | 160                 | 2.0                                | 150                 | 175 | 200 | 225 | 260 | -   | -   | 0.26                                |
| 77FA30XXX160 |                     | 3.0                                | -                   | -   | -   | -   | 260 | 280 | 300 | 0.37                                |
| 77FA20XXX200 | 200                 | 2.0                                | 150                 | 175 | 200 | 225 | 260 | -   | -   | 0.40                                |
| 77FA30XXX200 |                     | 3.0                                | -                   | -   | -   | -   | 260 | 280 | 300 | 0.47                                |
| 77FA20XXX240 | 240                 | 2.0                                | 150                 | 175 | 200 | 225 | 260 | -   | -   | 0.38                                |
| 77FA30XXX240 |                     | 3.0                                | -                   | -   | -   | -   | 260 | 280 | 300 | 0.57                                |

Continued next page

**Table 10:** Dimensions PHILIPP Flat Anchors

| Art.-No.     | Length<br>l<br>[mm] | Material<br>Thickness<br>t<br>[mm] | Height<br>h<br>[mm] |     |     |     |     |     |     | Weight per<br>100 mm Height<br>[kg] |
|--------------|---------------------|------------------------------------|---------------------|-----|-----|-----|-----|-----|-----|-------------------------------------|
|              |                     |                                    | 150                 | 175 | 200 | 225 | 260 | 280 | 300 |                                     |
| 77FA20XXX320 | 320                 | 2.0                                | 150                 | 175 | 200 | 225 | 260 | -   | -   | 0.51                                |
| 77FA30XXX320 |                     | 3.0                                | -                   | -   | -   | -   | 260 | 280 | 300 | 0.75                                |
| 77FA20XXX360 | 360                 | 2.0                                | 150                 | 175 | 200 | 225 | 260 | -   | -   | 0.58                                |
| 77FA30XXX360 |                     | 3.0                                | -                   | -   | -   | -   | 260 | 280 | 300 | 0.85                                |
| 77FA20XXX400 | 400                 | 2.0                                | 150                 | 175 | 200 | 225 | 260 | -   | -   | 0.64                                |
| 77FA30XXX400 |                     | 3.0                                | -                   | -   | -   | -   | 260 | 280 | 300 | 0.94                                |

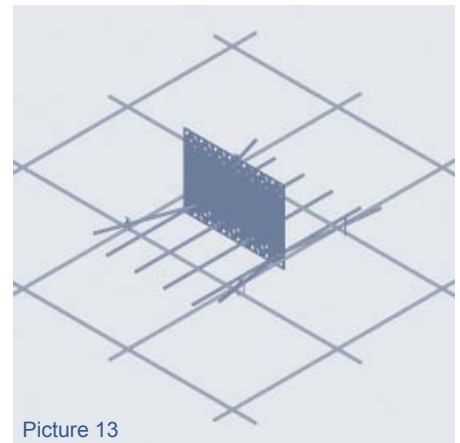
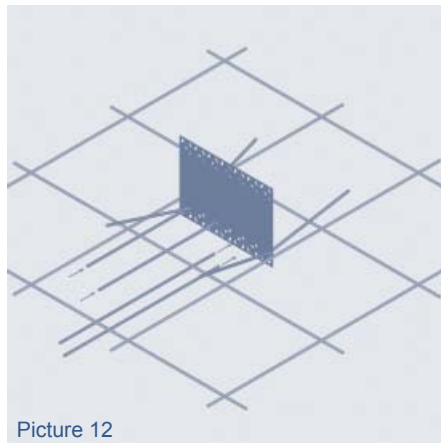
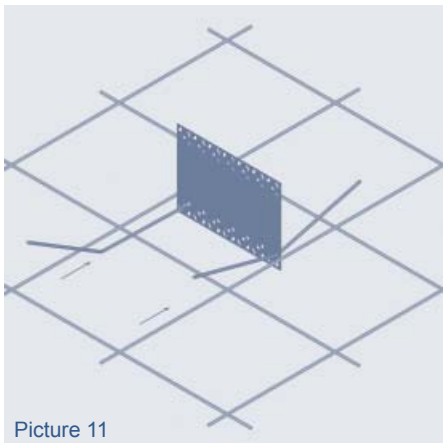
The article number must be supplemented with the desired height h.

e.g. flat anchor L=320mm, height h=280mm, material thickness t=3.0mm

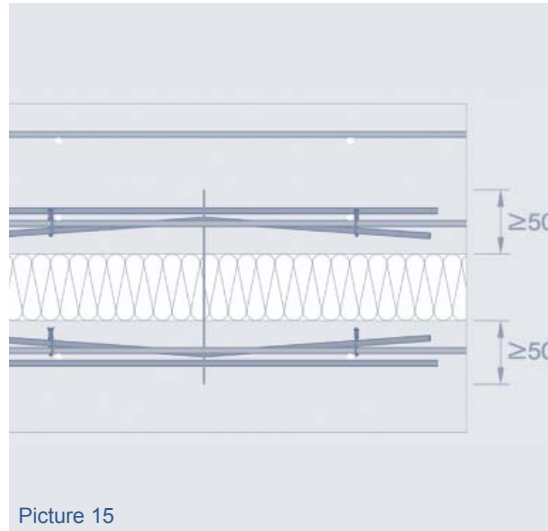
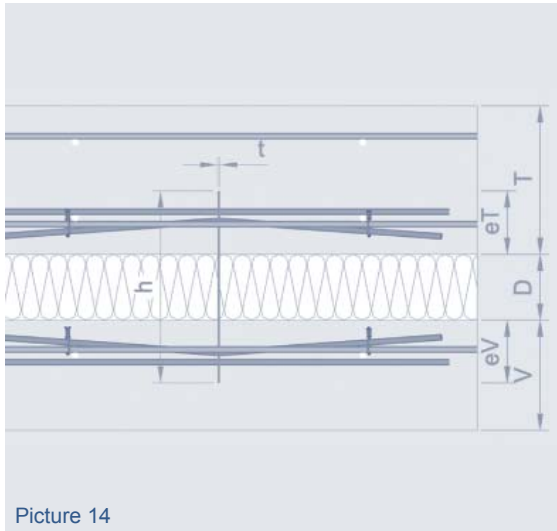
→ Article-No.: 77FA30280320

## Installation

We recommend the following steps for the installation of **PHILIPP Flat Anchors**: Two light, 30 degrees offset concrete reinforcing bars are stuck through the anchor's upper series of round holes (Picture 11). The positioning of the anchor on the installation point is conducted next, with the required number of concrete reinforcing bars (Table 11) run through the lower series of round holes at the same time. Particular attention must be accorded to the positioning of the concrete reinforcing bars, since these must lie beneath the lower welded wire mesh level (Picture 12). In the last installation step, the 30 degrees offset concrete reinforcing bars stuck into the upper series of round holes are shifted to the side and tie-bound to the welded wire mesh (Picture 13). The required heat insulation is installed after the pouring of the first layer (depending in positive or negative production) around the anchor. The required building component reinforcement with the required anchor reinforcement are then installed in a similar manner.



Pictures 14 and 15 show the ideal installation of the PHILIPP Flat Anchor.



**Table 11:** Min. Reinforcement of Flat Anchor, Load Bearing Layer and Facing Layer

| Installation Position Anchor | Length L [mm] | Anchoring Bars BSt 500S    | Minimum Reinforcement of the Load Bearing Layer and Facing Layer  |
|------------------------------|---------------|----------------------------|---|
|                              | 80            | 2 × 4 dia.6mm<br>L = 400mm | <p><u>Facing layer:</u><br/>1,88 cm<sup>2</sup>/m<br/>(dia. 6mm-150mm squared in each direction) central</p> <p><u>Load bearing layer:</u><br/>1,88 cm<sup>2</sup>/m<br/>(dia. 6mm-150mm squared in each direction) on both sides</p> |
|                              | 120           | 2 × 5 dia.6mm<br>L = 400mm |   |
|                              | 160 bis 280   | 2 × 6 dia.6mm<br>L = 400mm |   |
|                              | 320 bis 400   | 2 × 7 dia.6mm<br>L = 400mm |   |

The surface reinforcement for the facing layer must correspond at least to a Q188A (mesh reinforcement dia. 6mm-150mm squared in each direction). A facing layer thickness of 100mm or more requires a two-layer wire mesh reinforcement. The reinforcement of the load bearing layer follows from the dimensioning required by the static. It must however be realised with a Q188A (mesh reinforcement dia. 6mm-150mm squared in each direction) reinforcement on both sides.

### Embedded Depth

The heat insulation thickness “D” and the minimum embedded depth of 50 mm are the predominant factors for the determination of anchor height “h”. As part of this, embedded depth “e<sub>T</sub>” of the load bearing layer must be at least the minimum of the embedded depth “e<sub>V</sub>” of the facing layer. The minimum embedded depth is set at 50 mm, independent of the load bearing and facing layer (Picture 15). The calculation of the related anchor lengths is produced from the following formula:

$$e_T = e_V = (h - D) \times 0,5 \quad \text{min. } e \geq 50\text{mm} \quad (\text{Picture 15 and Table 12})$$

**Table 12:** Anchor height flat anchor depending on insulation layer thickness

| Anchor height h [mm] | Insulation thickness D [mm] |    |    |    |     |    |            |     |     |            |     |     |            |  |
|----------------------|-----------------------------|----|----|----|-----|----|------------|-----|-----|------------|-----|-----|------------|--|
|                      | 30                          | 40 | 50 | 60 | 70  | 80 | 90         | 100 | 120 | 140        | 160 | 180 | 200        |  |
|                      | <b>150</b>                  |    |    |    | 175 |    | <b>200</b> |     | 225 | <b>260</b> |     | 280 | <b>300</b> |  |

Notes on determination of the maximum permissible shear force  $Q_{zul}$  (as per DIN 1045-1) from the rated value of the radial stress  $Q_{Rd}$  from **PHILIPP Flat Anchors** for all facing layer thicknesses:  $Q_{zul} = \frac{Q_{Rd}}{\gamma_M} = \frac{Q_{Rd}}{1,35}$

All rating values for shear force  $Q_{Rd}$  [kN] presented here for **PHILIPP Flat Anchors** apply to buildings of heights  $\geq 100$  m and a minimal concrete quality of C30/37 ( $f_{ck, cyl} = 30$  N/mm<sup>2</sup>,  $f_{ck, cube} = 37$  N/mm<sup>2</sup>) based on DIN 1045-1

**Table 13:** Rated Value of Shear Force  $Q_{Rd}$  [kN] for Flat Anchors for Facing Layer Thicknesses of V = 70 mm

| t [mm] | l [mm] | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |  |
|--------|--------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|--|
|        |        | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 120  | 140  | 160  | 180  | 200  |  |
| 2      | 80     | 8.9                         | 8.5  | 8.0  | 7.6  | 7.1  | 6.5  | 5.9  | 5.2  | 4.3  | 3.7  | 2.6  | -    | -    |  |
| 3      | 80     | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 5.6  | 5.2  | 4.7  | 3.9  |  |
| 2      | 120    | 15.8                        | 15.0 | 14.0 | 12.9 | 11.8 | 10.6 | 9.7  | 8.9  | 7.8  | 6.3  | 5.0  | -    | -    |  |
| 3      | 120    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.4  | 7.8  | 6.7  | 6.1  |  |
| -2     | 160    | 25.5                        | 24.7 | 23.0 | 21.3 | 19.6 | 17.7 | 16.0 | 14.8 | 13.0 | 9.8  | 8.2  | -    | -    |  |
| 3      | 160    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 12.6 | 11.0 | 10.0 | 8.9  |  |
| 2      | 200    | 34.0                        | 33.6 | 31.6 | 29.5 | 27.2 | 25.0 | 22.5 | 20.0 | 17.5 | 15.9 | 12.3 | -    | -    |  |
| 3      | 200    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 16.5 | 14.9 | 13.6 | 12.3 |  |
| 2      | 240    | 36.3                        | 35.2 | 34.1 | 33.0 | 32.0 | 30.7 | 29.2 | 27.8 | 25.0 | 20.8 | 17.2 | -    | -    |  |
| 3      | 240    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 23.2 | 20.7 | 18.6 | 16.5 |  |
| 2      | 280    | 47.1                        | 45.8 | 43.2 | 40.8 | 38.5 | 36.0 | 34.1 | 32.4 | 28.5 | 25.4 | 22.0 | -    | -    |  |
| 3      | 280    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 27.1 | 24.0 | 23.3 | 21.0 |  |
| 2      | 320    | 47.6                        | 46.6 | 45.6 | 44.6 | 41.7 | 41.3 | 38.9 | 37.4 | 33.5 | 30.1 | 26.9 | -    | -    |  |
| 3      | 320    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 32.5 | 29.5 | 25.5 | 21.7 |  |
| 2      | 360    | 46.0                        | 44.8 | 43.6 | 42.4 | 41.3 | 41.1 | 41.0 | 39.0 | 36.5 | 33.4 | 29.4 | -    | -    |  |
| 3      | 360    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 36.5 | 35.0 | 29.0 | 23.0 |  |
| 2      | 400    | 53.7                        | 52.7 | 51.8 | 50.8 | 49.9 | 49.6 | 47.5 | 44.9 | 40.5 | 35.8 | 31.1 | -    | -    |  |
| 3      | 400    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 41.4 | 37.5 | 33.0 | 28.5 |  |

**Table 14:** Rated Value of Shear Force  $Q_{Rd}$  [kN] for Flat Anchors for Facing Layer Thicknesses of V = 80mm

| t [mm] | l [mm] | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |  |
|--------|--------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|--|
|        |        | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 120  | 140  | 160  | 180  | 200  |  |
| 2      | 80     | 8.8                         | 8.4  | 8.0  | 7.6  | 7.2  | 6.5  | 5.8  | 5.0  | 4.0  | 3.3  | 2.2  | -    | -    |  |
| 3      | 80     | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 5.3  | 4.9  | 4.4  | 3.6  |  |
| 2      | 120    | 15.5                        | 14.6 | 13.7 | 12.9 | 11.8 | 10.6 | 9.7  | 8.9  | 7.7  | 5.9  | 4.6  | -    | -    |  |
| 3      | 120    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.3  | 7.7  | 6.5  | 5.9  |  |
| 2      | 160    | 25.6                        | 24.7 | 23.1 | 21.4 | 19.5 | 17.4 | 15.8 | 14.6 | 12.7 | 9.6  | 7.6  | -    | -    |  |
| 3      | 160    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 12.3 | 11.0 | 10.0 | 8.6  |  |
| 2      | 200    | 34.1                        | 33.4 | 31.5 | 29.5 | 27.4 | 25.8 | 23.3 | 20.8 | 18.1 | 15.5 | 11.4 | -    | -    |  |
| 3      | 200    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 17.5 | 15.1 | 14.0 | 12.8 |  |
| 2      | 240    | 36.3                        | 35.2 | 34.1 | 32.9 | 31.8 | 30.7 | 29.6 | 28.5 | 26.0 | 20.7 | 16.3 | -    | -    |  |
| 3      | 240    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 24.9 | 20.7 | 18.7 | 16.6 |  |
| 2      | 280    | 46.8                        | 45.6 | 44.4 | 43.2 | 42.0 | 40.5 | 37.5 | 34.0 | 30.1 | 27.5 | 21.1 | -    | -    |  |
| 3      | 280    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 29.0 | 25.5 | 23.3 | 21.1 |  |
| 2      | 320    | 47.1                        | 46.1 | 45.1 | 44.1 | 41.8 | 41.0 | 38.8 | 38.4 | 37.7 | 33.8 | 26.8 | -    | -    |  |
| 3      | 320    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 37.8 | 34.7 | 30.0 | 23.7 |  |
| 2      | 360    | 46.0                        | 44.8 | 43.6 | 42.4 | 41.2 | 41.0 | 40.8 | 40.5 | 40.1 | 37.7 | 29.4 | -    | -    |  |
| 3      | 360    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 42.7 | 39.9 | 34.4 | 28.8 |  |
| 2      | 400    | 53.7                        | 52.9 | 52.0 | 51.1 | 50.3 | 49.9 | 49.6 | 49.3 | 48.3 | 39.8 | 31.1 | -    | -    |  |
| 3      | 400    | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 49.1 | 45.2 | 38.8 | 33.6 |  |

**Table 15:** Rated Value of Shear Force  $Q_{Rd}$  [kN] for Flat Anchors for Facing Layer Thicknesses of  $V = 90\text{mm}$

| t<br>[mm] | l<br>[mm] | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |
|-----------|-----------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|           |           | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 120  | 140  | 160  | 180  | 200  |
| 2         | 80        | 8.7                         | 8.4  | 8.0  | 7.6  | 7.2  | 6.4  | 5.6  | 4.8  | 3.7  | 2.8  | 1.9  | -    | -    |
| 3         | 80        | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 5.0  | 4.5  | 4.0  | 3.3  |
| 2         | 120       | 15.2                        | 14.2 | 13.5 | 12.9 | 11.8 | 10.6 | 9.7  | 8.9  | 7.6  | 5.6  | 4.2  | -    | -    |
| 3         | 120       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.2  | 7.6  | 6.4  | 5.7  |
| 2         | 160       | 25.6                        | 24.8 | 23.2 | 21.5 | 19.4 | 17.0 | 15.5 | 14.4 | 12.4 | 9.4  | 6.9  | -    | -    |
| 3         | 160       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 12.1 | 11.0 | 10.1 | 8.4  |
| 2         | 200       | 34.1                        | 33.3 | 31.5 | 29.6 | 27.7 | 26.5 | 24.1 | 21.7 | 18.7 | 15.1 | 10.5 | -    | -    |
| 3         | 200       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 18.0 | 15.2 | 14.3 | 13.4 |
| 2         | 240       | 36.4                        | 35.2 | 34.0 | 32.8 | 31.6 | 30.6 | 29.6 | 27.7 | 26.2 | 20.6 | 15.3 | -    | -    |
| 3         | 240       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 24.5 | 20.8 | 18.7 | 16.7 |
| 2         | 280       | 46.4                        | 45.3 | 44.2 | 43.1 | 42.0 | 40.6 | 37.5 | 34.0 | 30.1 | 26.8 | 20.1 | -    | -    |
| 3         | 280       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 29.0 | 25.6 | 23.4 | 21.2 |
| 2         | 320       | 46.6                        | 45.6 | 44.6 | 43.5 | 41.9 | 40.8 | 38.7 | 38.3 | 37.6 | 33.0 | 26.6 | -    | -    |
| 3         | 320       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 38.1 | 35.5 | 31.3 | 25.8 |
| 2         | 360       | 46.0                        | 44.8 | 43.6 | 42.4 | 41.2 | 40.9 | 40.5 | 40.2 | 39.5 | 37.7 | 29.4 | -    | -    |
| 3         | 360       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 42.9 | 40.8 | 35.7 | 30.3 |
| 2         | 400       | 53.8                        | 53.0 | 52.2 | 51.5 | 50.7 | 50.3 | 49.8 | 49.4 | 48.3 | 39.8 | 31.1 | -    | -    |
| 3         | 400       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 49.4 | 46.0 | 40.2 | 35.5 |

**Table 16:** Rated Value of Shear Force  $Q_{Rd}$  [kN] for Flat Anchors for Facing Layer Thicknesses of  $V = 100\text{mm}$

| t<br>[mm] | l<br>[mm] | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |
|-----------|-----------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|           |           | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 120  | 140  | 160  | 180  | 200  |
| 2         | 80        | 8.6                         | 8.3  | 7.9  | 7.6  | 7.3  | 6.4  | 5.5  | 4.5  | 3.4  | 2.4  | 1.5  | -    | -    |
| 3         | 80        | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 4.7  | 4.2  | 3.6  | 3.0  |
| 2         | 120       | 14.8                        | 13.8 | 13.2 | 12.9 | 11.8 | 10.6 | 9.7  | 8.9  | 7.6  | 5.2  | 3.8  | -    | -    |
| 3         | 120       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.2  | 7.4  | 6.2  | 5.5  |
| 2         | 160       | 25.7                        | 24.9 | 23.2 | 21.5 | 19.3 | 16.6 | 15.3 | 14.2 | 12.0 | 9.2  | 6.3  | -    | -    |
| 3         | 160       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 11.8 | 11.0 | 10.1 | 8.1  |
| 2         | 200       | 34.2                        | 33.1 | 31.4 | 29.6 | 27.9 | 27.3 | 24.9 | 22.5 | 19.3 | 14.7 | 9.6  | -    | -    |
| 3         | 200       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 19.6 | 15.4 | 14.7 | 13.9 |
| 2         | 240       | 36.4                        | 35.2 | 33.9 | 32.7 | 31.4 | 30.6 | 29.7 | 28.8 | 26.3 | 20.5 | 14.4 | -    | -    |
| 3         | 240       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 24.2 | 20.8 | 18.8 | 16.8 |
| 2         | 280       | 46.1                        | 45.1 | 44.1 | 43.1 | 42.1 | 40.7 | 37.6 | 34.1 | 30.2 | 26.0 | 19.1 | -    | -    |
| 3         | 280       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 29.1 | 25.6 | 23.4 | 21.2 |
| 2         | 320       | 46.1                        | 45.1 | 44.0 | 43.0 | 42.0 | 40.5 | 38.5 | 38.1 | 37.4 | 32.1 | 26.4 | -    | -    |
| 3         | 320       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 38.5 | 36.2 | 32.6 | 27.8 |
| 2         | 360       | 46.0                        | 44.8 | 43.6 | 42.4 | 41.2 | 40.7 | 40.3 | 39.8 | 38.9 | 37.7 | 29.4 | -    | -    |
| 3         | 360       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 43.0 | 41.6 | 37.0 | 31.7 |
| 2         | 400       | 53.8                        | 53.1 | 52.5 | 51.8 | 51.1 | 50.6 | 50.1 | 49.6 | 48.3 | 39.8 | 31.1 | -    | -    |
| 3         | 400       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 49.8 | 46.9 | 41.6 | 37.3 |

**Table 17:** Rated Value of Shear Force  $Q_{Rd}$  [kN] for Flat Anchors for Facing Layer Thicknesses of  $V = 110\text{mm}$

| t<br>[mm] | l<br>[mm] | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |
|-----------|-----------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|           |           | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 120  | 140  | 160  | 180  | 200  |
| 2         | 80        | 8.6                         | 8.2  | 7.7  | 7.3  | 6.8  | 6.1  | 5.2  | 4.3  | 2.9  | 2.1  | 1.2  | -    | -    |
| 3         | 80        | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 4.0  | 3.6  | 3.2  | 2.7  |
| 2         | 120       | 14.8                        | 13.9 | 13.0 | 12.2 | 11.1 | 9.9  | 9.0  | 8.2  | 6.6  | 4.5  | 3.1  | -    | -    |
| 3         | 120       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 7.7  | 7.0  | 6.1  | 5.4  |
| 2         | 160       | 25.4                        | 23.9 | 22.0 | 20.1 | 17.9 | 15.5 | 14.4 | 13.3 | 11.3 | 8.1  | 5.4  | -    | -    |
| 3         | 160       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 11.2 | 10.4 | 9.3  | 8.0  |
| 2         | 200       | 33.9                        | 32.8 | 30.4 | 28.1 | 26.7 | 23.5 | 22.3 | 21.0 | 17.8 | 13.1 | 8.5  | -    | -    |
| 3         | 200       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 17.4 | 14.5 | 13.2 | 11.8 |
| 2         | 240       | 36.2                        | 35.1 | 34.0 | 33.0 | 31.9 | 31.0 | 29.4 | 27.8 | 24.2 | 19.1 | 12.7 | -    | -    |
| 3         | 240       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 24.1 | 20.7 | 18.1 | 15.4 |
| 2         | 280       | 46.4                        | 45.3 | 44.3 | 43.2 | 41.9 | 40.3 | 38.2 | 35.4 | 31.3 | 25.3 | 17.6 | -    | -    |
| 3         | 280       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 28.7 | 25.1 | 23.0 | 20.6 |
| 2         | 320       | 46.5                        | 45.2 | 44.0 | 42.8 | 41.6 | 40.1 | 38.7 | 38.1 | 36.8 | 31.2 | 25.3 | -    | -    |
| 3         | 320       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 37.3 | 34.5 | 30.6 | 26.5 |
| 2         | 360       | 46.4                        | 45.1 | 43.8 | 42.5 | 41.2 | 40.3 | 39.6 | 38.9 | 37.6 | 34.0 | 26.8 | -    | -    |
| 3         | 360       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 42.0 | 39.8 | 34.8 | 30.5 |
| 2         | 400       | 53.3                        | 52.5 | 51.7 | 51.0 | 50.3 | 49.7 | 49.0 | 48.4 | 46.9 | 38.9 | 30.8 | -    | -    |
| 3         | 400       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 47.7 | 43.9 | 39.8 | 35.7 |

**Table 18:** Rated Value of Shear Force  $Q_{Rd}$  [kN] for Flat Anchors for Facing Layer Thicknesses of  $V = 120\text{mm}$

| t<br>[mm] | l<br>[mm] | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |
|-----------|-----------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|           |           | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 120  | 140  | 160  | 180  | 200  |
| 2         | 80        | 8.5                         | 8.0  | 7.5  | 6.9  | 6.4  | 5.8  | 4.9  | 4.1  | 2.3  | 1.7  | 0.9  | -    | -    |
| 3         | 80        | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 3.3  | 3.1  | 2.7  | 2.3  |
| 2         | 120       | 14.8                        | 14.0 | 12.8 | 11.6 | 10.4 | 9.2  | 8.3  | 7.4  | 5.6  | 3.8  | 2.3  | -    | -    |
| 3         | 120       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 7.2  | 6.6  | 5.9  | 5.3  |
| 2         | 160       | 25.2                        | 23.0 | 20.8 | 18.7 | 16.5 | 14.3 | 13.4 | 12.5 | 10.6 | 7.0  | 4.5  | -    | -    |
| 3         | 160       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 10.6 | 9.7  | 8.8  | 7.9  |
| 2         | 200       | 33.6                        | 32.4 | 30.9 | 28.1 | 25.5 | 22.5 | 21.0 | 19.4 | 16.3 | 11.4 | 7.4  | -    | -    |
| 3         | 200       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 18.3 | 13.5 | 11.7 | 9.7  |
| 2         | 240       | 35.9                        | 35.1 | 34.2 | 33.3 | 32.4 | 31.5 | 29.1 | 26.7 | 22.0 | 17.6 | 11.4 | -    | -    |
| 3         | 240       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 23.9 | 20.6 | 17.3 | 14.0 |
| 2         | 280       | 46.7                        | 45.6 | 44.4 | 43.3 | 41.6 | 40.0 | 38.9 | 36.8 | 32.5 | 24.5 | 16.0 | -    | -    |
| 3         | 280       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 28.3 | 24.5 | 22.6 | 20.0 |
| 2         | 320       | 46.8                        | 45.4 | 44.0 | 42.6 | 41.2 | 39.8 | 38.9 | 38.0 | 36.2 | 30.2 | 21.5 | -    | -    |
| 3         | 320       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 36.0 | 32.8 | 28.5 | 25.3 |
| 2         | 360       | 46.8                        | 45.4 | 44.0 | 42.6 | 41.2 | 39.8 | 38.9 | 38.0 | 36.2 | 30.2 | 24.2 | -    | -    |
| 3         | 360       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 41.0 | 38.0 | 32.5 | 29.2 |
| 2         | 400       | 52.8                        | 51.8 | 51.0 | 50.3 | 49.5 | 48.8 | 48.0 | 47.2 | 45.6 | 38.1 | 30.6 | -    | -    |
| 3         | 400       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 45.5 | 41.0 | 37.9 | 34.0 |

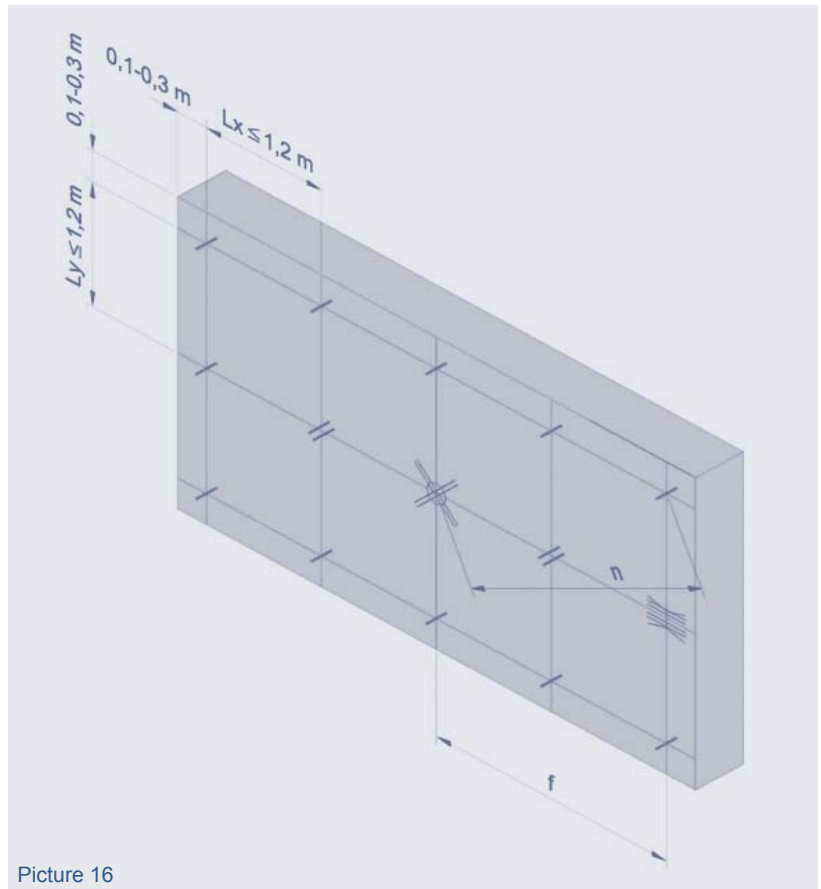


## Edge Distances and Intervals for the PHILIPP Sandwich Panel Anchor System

A distance interval of max. 1.20m is to be observed between the individual anchor elements (Picture 16). These individual elements may be flat anchors, connector pins, or sleeve anchors. In manufacturing building components with a strongly structured surface, we recommend reducing the pin interval  $L_x$  and  $L_y$  to 0.9m.

A square or rectangular grid division is particularly helpful. Specifically, a height-width ration for the grid of  $0.67 \leq L_x / L_y \leq 1,5$  should be followed to insure an equal load transfer. The interval "f" for the flat anchors from the center of anchorage to the most external anchor element is correspondingly accounted for in table 19. Furthermore the size "n" must also not exceed the values for connector pins as provided in tables 21 and 22.

For connector pins, the interval distances may amount to maximally 1.20m and the edge distances must be in between 0.1-0.3m.



Picture 16

**Table 19:** Maximum Flat Anchor Interval "f" [m] from Fulcrum

| t<br>[mm] | l<br>[mm] | Insulation Thickness D [mm] |      |      |      |      |      |      |      |      |      |      |      |      |
|-----------|-----------|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|           |           | 30                          | 40   | 50   | 60   | 70   | 80   | 90   | 100  | 120  | 140  | 160  | 180  | 200  |
| 2         | 80        | 0.60                        | 1.10 | 1.60 | 2.30 | 3.00 | 4.00 | 5.00 | 6.10 | 8.60 | 9.90 | 9.90 | -    | -    |
| 3         | 80        | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.00 | 9.90 | 9.90 | 9.90 |
| 2         | 120       | 0.60                        | 1.10 | 1.60 | 2.30 | 3.00 | 4.00 | 5.00 | 6.10 | 8.60 | 9.90 | 9.90 | -    | -    |
| 3         | 120       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.00 | 9.90 | 9.90 | 9.90 |
| 2         | 160       | 0.60                        | 1.10 | 1.60 | 2.30 | 3.00 | 4.00 | 5.00 | 6.10 | 8.60 | 9.90 | 9.90 | -    | -    |
| 3         | 160       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.00 | 9.90 | 9.90 | 9.90 |
| 2         | 200       | 0.60                        | 1.10 | 1.60 | 2.30 | 3.00 | 4.00 | 5.00 | 6.10 | 8.60 | 9.90 | 9.90 | -    | -    |
| 3         | 200       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.00 | 9.90 | 9.90 | 9.90 |
| 2         | 240       | 0.60                        | 1.10 | 1.60 | 2.30 | 3.00 | 4.00 | 5.00 | 6.10 | 8.60 | 9.90 | 9.90 | -    | -    |
| 3         | 240       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.00 | 9.90 | 9.90 | 9.90 |
| 2         | 280       | 0.60                        | 1.10 | 1.60 | 2.30 | 3.00 | 4.00 | 5.00 | 6.10 | 8.60 | 9.90 | 9.90 | -    | -    |
| 3         | 280       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.00 | 9.90 | 9.90 | 9.90 |
| 2         | 320       | 0.60                        | 1.10 | 1.60 | 2.30 | 3.00 | 4.00 | 5.00 | 6.10 | 8.60 | 9.90 | 9.90 | -    | -    |
| 3         | 320       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.00 | 9.90 | 9.90 | 9.90 |
| 2         | 360       | 0.60                        | 1.10 | 1.60 | 2.30 | 3.00 | 4.00 | 5.00 | 6.10 | 8.60 | 9.90 | 9.90 | -    | -    |
| 3         | 360       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.00 | 9.90 | 9.90 | 9.90 |
| 2         | 400       | 0.60                        | 1.10 | 1.60 | 2.30 | 3.00 | 4.00 | 5.00 | 6.10 | 8.60 | 9.90 | 9.90 | -    | -    |
| 3         | 400       | -                           | -    | -    | -    | -    | -    | -    | -    | -    | 8.00 | 9.90 | 9.90 | 9.90 |

The **PHILIPP Connection Anchor Pins** are part of the **PHILIPP Sandwich Panel Anchor System**. They can be used for three- or four-layer slabs.

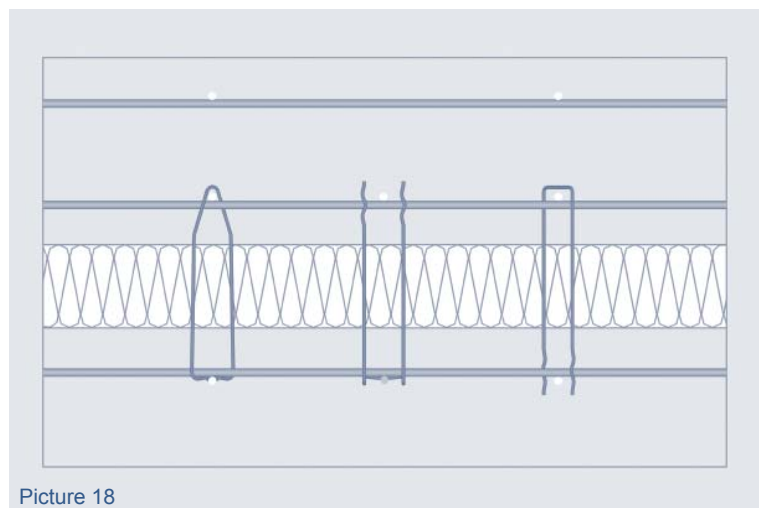
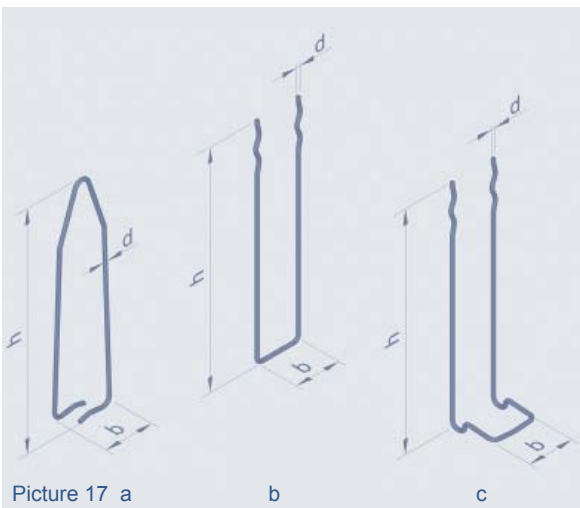
They can be used in pairs as torsion anchors (Picture 30) or individually as a retaining anchor. The connection anchor pins may only be used in connection with **PHILIPP Flat Anchors** or **PHILIPP Sleeve Anchors**. This provides for safe, load lasting distribution.

Connection anchor pins are made of stainless steel. There are available in three different versions (Picture 17) to be used in accordance with the type of production. The most common version is for use as **PHILIPP Connector Pin** (Picture 17b), since it can be use in both positive and negative production. Other versions are the **PHILIPP Clip-On Pin** (Picture 17c) and the **PHILIPP Connector Stirrup** (Picture 17a), which are primarily used with positive production however.

Both the connector pin as well as of the clip-on pin are characterised by a wavy area on their extremities that guarantees a secure bond with the concrete. The U-form of the opposite end is identical for both versions. The clip-on pin features an addition 90° bend, to allow for fastening onto the existing reinforcement mesh. The connector stirrup, by contrast, must be secured by an encompassing anchor around the installed mesh reinforcement. It is placed with its legs offset at 90° onto the reinforcement and then bent around the reinforcement (Pictures 26-29).

The various connector pins are available in diameters of 4.0, 5.0, and 6.0mm for each type.

When using connection anchor pins as a retaining anchor, no further sizing is required, since all testing is provided within the framework of the structural standards. Moreover, wind stresses up to a building height of 100m as well as temperature influences are accounted for.



**Table 20:** Dimensions **PHILIPP Connection Anchor Pins**

| Art.-No.  | Description                        | Art      | d<br>[mm] | b<br>[mm] | h<br>[mm] |     |     |     |     |     |     |     |
|-----------|------------------------------------|----------|-----------|-----------|-----------|-----|-----|-----|-----|-----|-----|-----|
|           |                                    |          |           |           | 160       | 200 | 250 | 280 | -   | 320 | -   | -   |
| 77VB40XXX | Connector stirrup<br>(Picture 17a) | VB-4.0-h | 4         | 60        | 160       | 200 | 250 | 280 | -   | 320 | -   | -   |
| 77VB50XXX |                                    | VB-5.0-h | 5         | 60        | 160       | 200 | 250 | 280 | -   | 320 | -   | -   |
| 77VN40XXX | Connector pin<br>(Picture 17b)     | VN-4.0-h | 4         | 34        | 160       | 180 | 200 | 220 | 240 | 260 | -   | -   |
| 77VN50XXX |                                    | VN-5.0-h | 5         | 35        | 240       | 260 | 280 | 300 | 320 | 340 | 360 | 380 |
| 77VN60XXX |                                    | VN-6.0-h | 6         | 46        | 320       | 340 | 360 | 380 | 400 | -   | -   | -   |
| 77AN40XXX | Clip-on pin<br>(Picture 17c)       | AN-4.0-h | 4         | 34        | 160       | 200 | 250 | 280 | -   | 320 | -   | -   |
| 77AN50XXX |                                    | AN-5.0-h | 5         | 38        | 160       | 200 | 250 | 280 | -   | 320 | -   | -   |

The article number must be supplemented with the desired height h.

e.g. connector pin height h=280mm, diameter dia.d=5.0mm

→ Article-No.: 77VN50280

## Installation

### PHILIPP Connector pins:

The open ends of the connector pins are stuck through the reinforcement cross in the load bearing layer and through the heat insulation into the facing layer up to the bottom of the formwork (Picture 19). To prevent the ends of the pins from being visible later, they are retracted slightly (approx. 1cm) from the bottom of the formwork. The necessary embedded depth for the wavy ends in the load bearing layer is thereby guaranteed. The building component must thereafter be compressed. At minimum, the embedded depth into the facing layer must be at least  $e_V \geq 60\text{mm}$  (Picture 20).

### PHILIPP Clip-on Pins and PHILIPP Connector Stirrup:

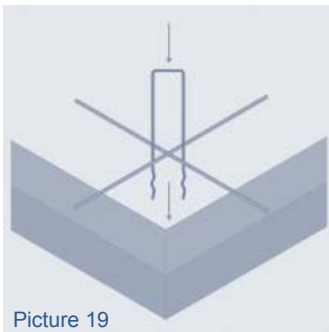
In affixing the clip-on pins and connector stirrup onto the welded wire mesh, the correct embedded depth is assured. Please pay attentions to the necessary coverage according DIN 1045-1. The embedded depth in the bearing layer  $e_T$  must total at least 60mm. The clip-on pin is hooked into the welded mesh reinforcement (Picture 23 and 24) and thereafter connected through the turning of the reinforcement cross (Picture 25). Installation can also be performed with the aid of a pin (Picture 21 and 22).

### Crossed Connector Pins:

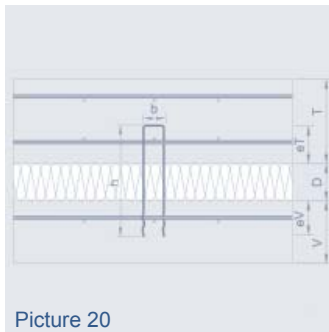
The **PHILIPP Connector Pins** can also be installed as torsion anchors. This is only possible in connection with a **PHILIPP Sleeve Anchor**. Installation follows as with the tradition application as a connector pin with an installation angle below approx.  $45^\circ$  (Picture 30).

### Arrangement, Edge Distances and Intervals

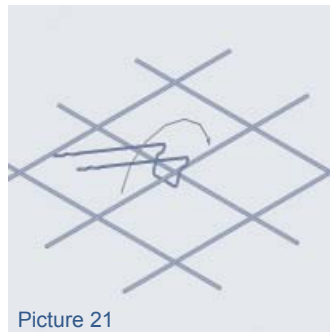
The edge distances of the outer **PHILIPP Connection Anchor Pins** must amount to at least 10cm to assure safe anchoring. Double pins are required where the facing layer projects more than 200mm. The interval distance for the pins may amount to max. 1.2m and may not exceed 0.9m where heightened adhesion through structural shells is present. For diagonals, insofar as no flat anchors are in place, the first pin is to be executed as a double pin. Adherence of distance "n" (based on Tables 21 and 22) and "f" (based on Table 19) must be constantly inspected (Picture 16.)



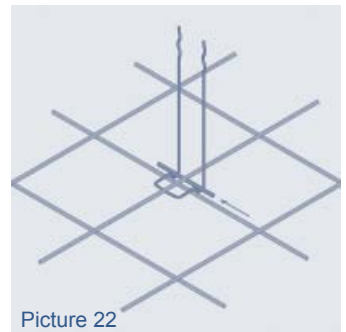
Picture 19



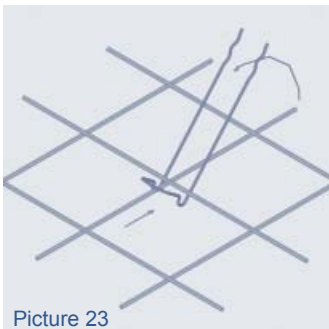
Picture 20



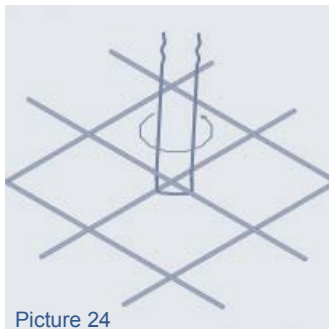
Picture 21



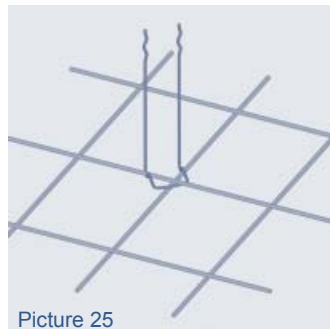
Picture 22



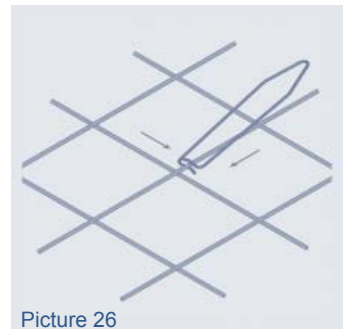
Picture 23



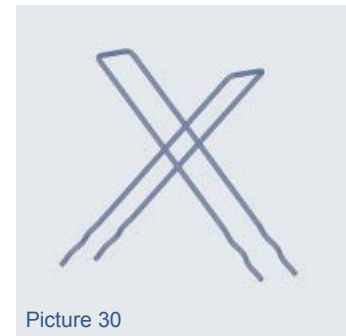
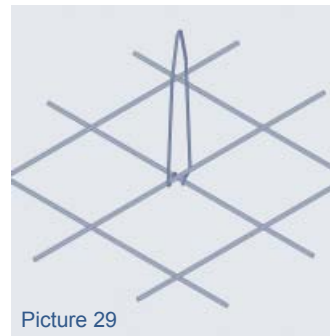
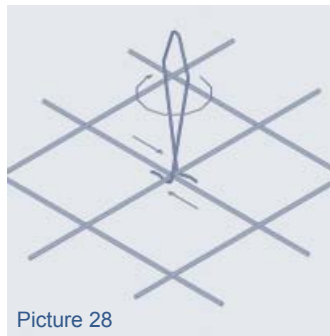
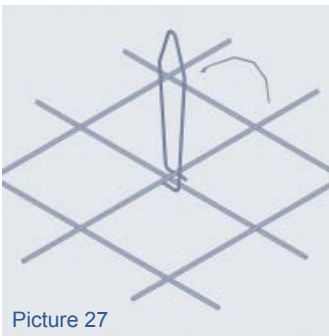
Picture 24



Picture 25



Picture 26



**Table 21:** Diameter, Length and Maximal Distances to the Fulcrum

**PHILIPP Connector Pins**

| V [mm] |           | Insulation Thickness D [mm] |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|--------|-----------|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|        |           | 30                          | 40  | 50  | 60  | 70  | 80  | 90  | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 |     |
| 70     | dia. [mm] | 4.0                         |     | 4.0 |     | 4.0 |     | 4.0 |     | 4.0 |     | 4.0 |     | 5.0 |     | 5.0 |     | 5.0 |     |     |
|        | h [mm]    | 160                         |     | 180 |     | 200 |     | 220 |     | 240 |     | 260 |     | 280 |     | 300 |     | 320 |     |     |
|        | max.n [m] | 1.5                         | 2.5 | 3.5 | 4.5 | 6.0 | 7.5 | 9.0 |     |     |     |     |     |     |     |     |     |     |     |     |
| 80     | dia. [mm] | 4.0                         |     | 4.0 |     | 4.0 |     | 4.0 | 5.0 | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 |     |     |
|        | h [mm]    | 180                         |     | 200 |     | 220 |     | 240 | 240 | 260 |     | 280 |     | 300 |     | 320 |     | 340 |     |     |
|        | max.n [m] | 1.5                         | 2.5 | 3.5 | 4.5 | 6.0 | 7.5 | 9.0 |     |     |     |     |     |     |     |     |     |     |     |     |
| 90     | dia. [mm] | 4.0                         |     | 4.0 |     | 4.0 | 5.0 | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 |     |     |
|        | h [mm]    | 200                         |     | 220 |     | 240 | 240 | 260 |     | 280 |     | 300 |     | 320 |     | 340 |     | 360 |     |     |
|        | max.n [m] | 1.5                         | 2.5 | 3.5 | 4.5 | 6.0 | 7.5 | 9.0 |     |     |     |     |     |     |     |     |     |     |     |     |
| 100    | dia. [mm] | 4.0                         |     | 4.0 |     | 4.0 |     | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 | 6.0 |     |
|        | h [mm]    | 200                         |     | 220 |     | 240 |     | 260 |     | 280 |     | 300 |     | 320 |     | 340 |     | 360 | 380 |     |
|        | max.n [m] | 1.5                         | 2.5 | 3.5 | 4.5 | 6.0 | 7.5 | 9.0 |     |     |     |     |     |     |     |     |     |     |     |     |
| 110    | dia. [mm] | 5.0                         |     | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 | 6.0 | 6.0 |
|        | h [mm]    | 220                         |     | 240 |     | 260 |     | 280 |     | 300 |     | 320 |     | 340 |     | 360 |     | 380 | 380 | 400 |
|        | max.n [m] | 1.5                         | 2.5 | 3.5 | 4.5 | 6.0 | 7.5 | 9.0 |     |     |     |     |     |     |     |     |     |     |     |     |
| 120    | dia. [mm] | 5.0                         |     | 5.0 |     | 5.0 |     | 5.0 |     | 5.0 | 6.0 | 6.0 |     | 6.0 |     | 6.0 |     | 6.0 | 6.0 | 6.0 |
|        | h [mm]    | 240                         |     | 260 |     | 280 |     | 300 |     | 320 | 320 | 340 |     | 360 |     | 380 |     | 400 |     | 400 |
|        | max.n [m] | 1.5                         | 2.5 | 3.5 | 4.5 | 5.5 | 6.5 | 7.5 | 9.0 |     |     |     |     |     |     |     |     |     |     |     |

**Table 22:** Diameter, Length, and Maximal Distances to the Fulcrum

**PHILIPP Connector Stirrup/  
PHILIPP Clip-on Pins**

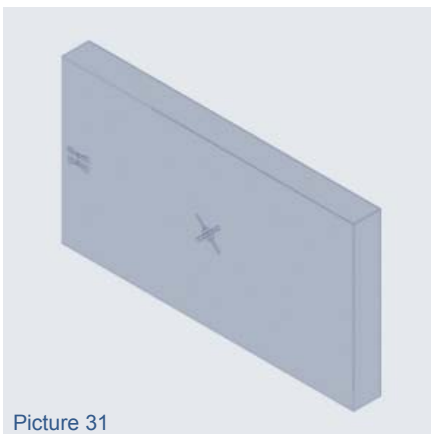
| V [mm] |           | Insulation Thickness D [mm] |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|--------|-----------|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|        |           | 30                          | 40  | 50  | 60  | 70  | 80  | 90  | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 |
| 70     | dia. [mm] |                             | 4.0 |     |     |     | 4.0 |     |     | 4.0 |     | 5.0 |     |     | 5.0 |     |     | 5.0 |     |
|        | h [mm]    |                             | 160 |     |     |     | 200 |     |     | 250 |     | 250 |     |     | 280 |     |     | 320 |     |
|        | max.n [m] | 1.5                         | 2.5 | 3.5 | 4.5 | 6.0 | 7.5 | 9.0 |     |     |     |     |     |     |     |     |     |     |     |
| 80     | dia. [mm] |                             | 4.0 |     |     | 4.0 |     |     |     | 5.0 |     |     |     | 5.0 |     |     | 5.0 |     |     |
|        | h [mm]    |                             | 160 |     |     | 200 |     |     |     | 250 |     |     |     | 280 |     |     | 320 |     |     |
|        | max.n [m] | 1.5                         | 2.5 | 3.5 | 4.5 | 6.0 | 7.5 | 9.0 |     |     |     |     |     |     |     |     |     |     |     |
| 90     | dia. [mm] |                             | 4.0 |     | 4.0 |     | 5.0 |     |     | 5.0 |     |     | 5.0 |     |     | 5.0 |     |     |     |
|        | h [mm]    |                             | 160 |     | 200 |     | 200 |     |     | 250 |     |     | 280 |     |     | 320 |     |     |     |
|        | max.n [m] | 1.5                         | 2.5 | 3.5 | 4.5 | 6.0 | 7.5 | 9.0 |     |     |     |     |     |     |     |     |     |     |     |
| 100    | dia. [mm] | 4.0                         |     | 4.0 |     |     |     | 5.0 |     |     |     | 5.0 |     |     | 5.0 |     |     | 6.0 |     |
|        | h [mm]    | 160                         |     | 200 |     |     |     | 250 |     |     |     | 280 |     |     | 320 |     |     | 360 |     |
|        | max.n [m] | 1.5                         | 2.5 | 3.5 | 4.5 | 6.0 | 7.5 | 9.0 |     |     |     |     |     |     |     |     |     |     |     |
| 110    | dia. [mm] |                             | 5.0 |     |     |     | 5.0 |     |     | 5.0 |     |     | 5.0 |     |     | 6.0 |     |     |     |
|        | h [mm]    |                             | 200 |     |     |     | 250 |     |     | 280 |     |     | 320 |     |     | 360 |     |     |     |
|        | max.n [m] | 1.5                         | 2.5 | 3.5 | 4.5 | 6.0 | 7.5 | 9.0 |     |     |     |     |     |     |     |     |     |     |     |
| 120    | dia. [mm] |                             | 5.0 |     |     | 5.0 |     |     | 5.0 | 6.0 |     |     | 6.0 |     |     | 6.0 |     |     |     |
|        | h [mm]    |                             | 200 |     |     | 250 |     |     | 280 | 280 |     |     | 320 |     |     | 360 |     |     |     |
|        | max.n [m] | 1.5                         | 2.5 | 3.5 | 4.5 | 5.5 | 6.5 | 7.5 | 9.0 |     |     |     |     |     |     |     |     |     |     |

## Applicable Supporting Systems

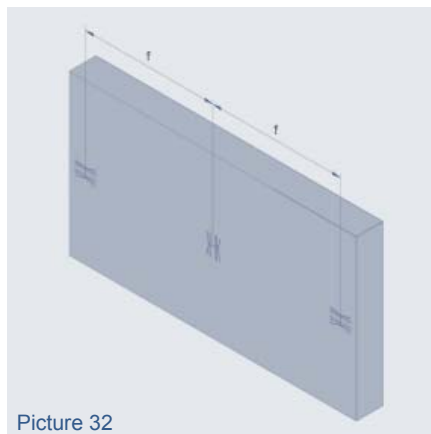
The **PHILIPP Sandwich Panel Anchor System** offers the use various possibilities for load transfer. A combination of **PHILIPP Sleeve Anchors** with **PHILIPP Flat Anchors**, or a version that uses solely flat anchors depending on building component geometry is possible. The following explanations represent a selected of the combination possibilities for the various anchor systems.

The most common solution is depicted in picture 31. This involves the installation of **PHILIPP Sleeve Anchors** in the facing layer's centre of gravity as a support anchor. It forms the fulcrum through its central position, from which all lateral movements of the facing layer proceed. Additional load transfer, in particular in order to transfer torsion stress that arises (through eccentricities, etc) is delivered through **PHILIPP Flat Anchors** or a crossed connector pin arranged laterally. An anchor arrangement of this kind is particularly appropriate for rectangular slabs. Other variations in the arrangement of support anchors are shown in picture 32 and picture 33. The bearing elements shown there are either flat anchors alone (Picture 32) or a combination of flat anchor and sleeve anchors (Picture 33).

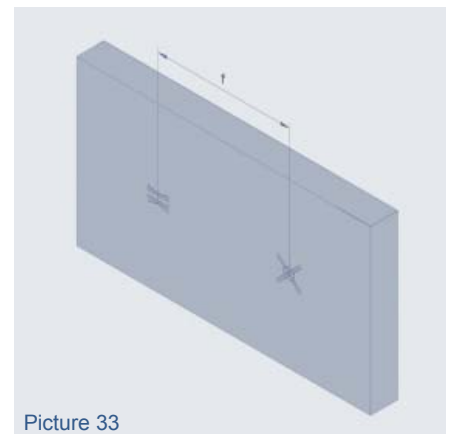
The variation in picture 32 require two load-bearing flat anchors, as well as a flat anchor turned by 90°, serving as a bracing element along the length. The cross of the axes of the three **PHILIPP Flat Anchors** represent the so-called fulcrum. In the version shown in picture 33, the load is divided equally on both anchors. The condition for this, however, is that both anchors lie at the same distance to the facing layer's centre of gravity. The sleeve anchors automatically forms the fulcrum.



Picture 31

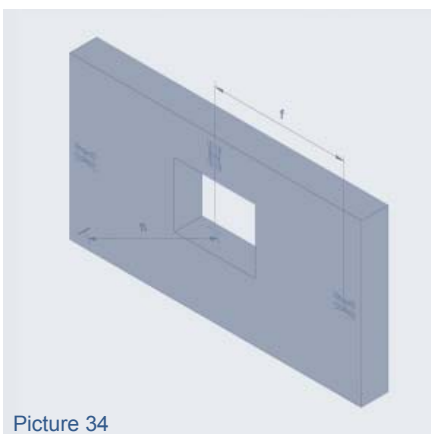


Picture 32

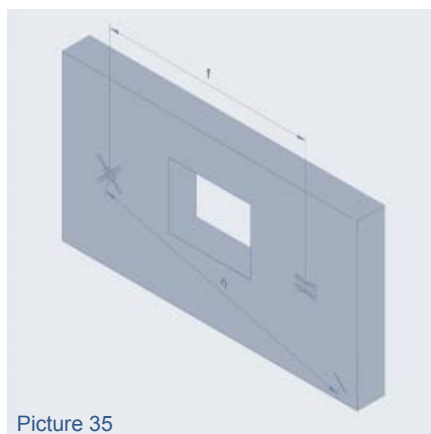


Picture 33

The depicted window cavity in picture 34 and picture 35 necessitates the installation of the anchor outside the centre of gravity. It should be hence be guaranteed that the respective support anchors are equally loaded. The variation in picture 34 require two load bearing **PHILIPP Flat Anchors**, as well as a flat anchor turned by 90°, serving as a bracing element along the length. The cross of the axes of the three **PHILIPP Flat Anchors** represent the so-called fulcrum. The variation in picture 35 consists of two supporting members, the flat and sleeve anchors. The **PHILIPP Sleeve Anchors** automatically form the fulcrum in that case, with all movements of the facing layer proceeding from it.



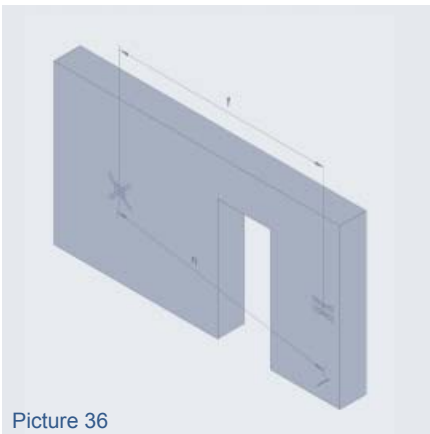
Picture 34



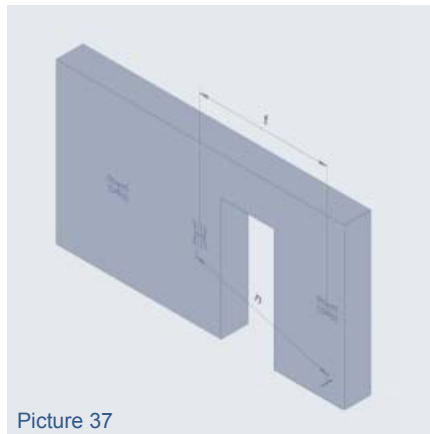
Picture 35

Larger openings as depicted in picture 36 and picture 37 require an analogue anchor arrangement as shown in the previous paragraph. It must be assured in doing so, however, that the support anchors (**PHILIPP Sleeve Anchors** and/or vertical **PHILIPP Flat Anchors**) always transfer the main loads. The sleeve anchors (picture 36) and the cross of the axes of the three **PHILIPP Flat Anchors** represent the fulcrum.

The torsion load that emerges through the asymmetrical building component shape are absorbed through a **further PHILIPP Flat Anchor**.



Picture 36

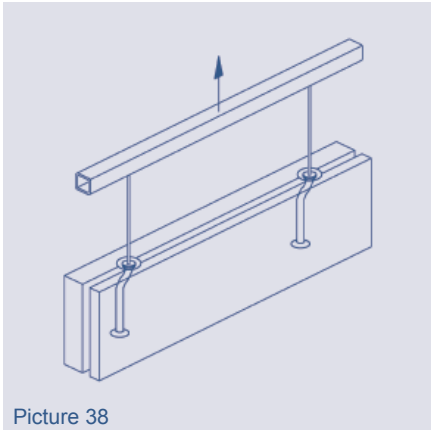


Picture 37

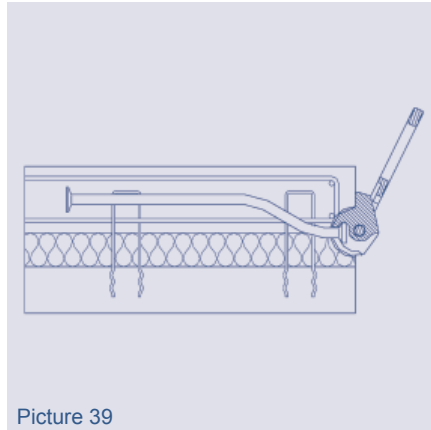
Every planning of anchoring must fundamentally adhere to the “n” and “f” dimensions. The maximum distances are indicated in table 19 on page 17 and in tables 21 + 22 on page 20.

## PHILIPP Offset Spherical Head Lifting Anchor

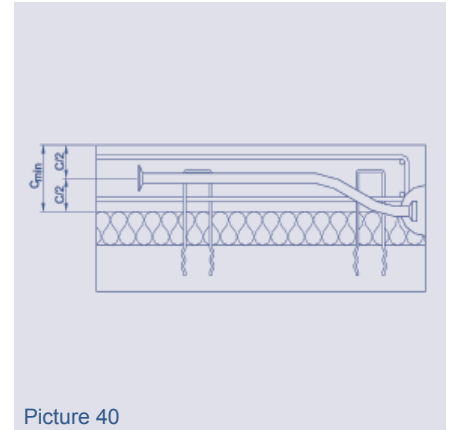
When transporting sandwich slab elements, **PHILIPP Offset Spherical Head Lifting Anchors** have proven their value. Its bent form secures a load point in the axis of the centre of gravity, thereby assuring that the building component will hang nearly vertically. To avoid damages, the form removal process should follow as shown below (load bearing layer up). A production of a load bearing layer downward requires the use of a tilting table. The installation of additional **PHILIPP Connector Pins** (Picture 39 and 40) in the anchorage area has shown that a stretching of the slab during the lifting process can be avoided.



Picture 38



Picture 39

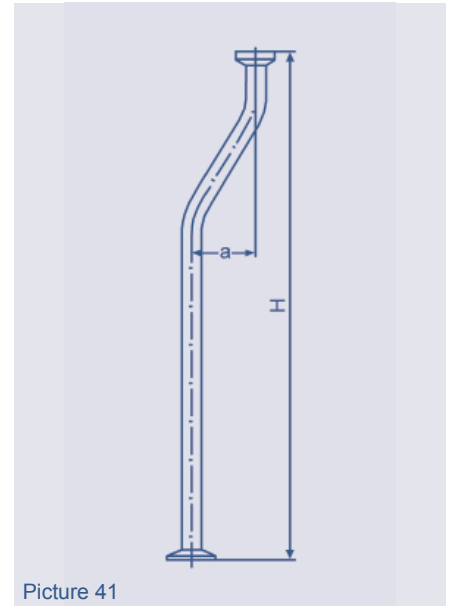


Picture 40

**Table 23: PHILIPP Offset Spherical Head Lifting Anchor**

| Art.-No.     | Height<br>H<br>[mm] | Offset<br>a<br>[mm] | Admiss. Load<br>F<br>[kN] | Load Bearing<br>Layer<br>Thickness c<br>[mm] |
|--------------|---------------------|---------------------|---------------------------|--|
| 81-013-227GK | 227                 | 50                  | 13                        | 80   |
| 81-025-268GK | 268                 | 50                  | 25                        | 100  |
| 81-040-406GK | 406                 | 60                  | 40                        | 100  |
| 81-050-466GK | 466                 | 60                  | 50                        | 120  |
| 81-075-664GK | 664                 | 70                  | 75                        | 160  |
| 81-100-664GK | 664                 | 70                  | 100                       | 160  |
| 81-150-825GK | 825                 | 70                  | 150                       | 200  |
| 81-200-986GK | 986                 | 90                  | 200                       | 240  |

When using **PHILIPP Offset Spherical Head Lifting Anchors**, the accompanying installation and application guidelines must be observed! The anchors are to be loaded in axial direction (Picture 38).



Picture 41

## Ropes

- wire rope slings
- crane and forest ropes
- wire, hemp and polyamide ropes
- hoisting and special ropes
- polypropylene ropes
- rope connections



## Lifting, attachment and lashing equipment

- load restraint systems
- RUD sling chains
- load suspension devices
- round slings, sling bands and lifting equipment
- rope and chain accessories
- lifting beams



## Transport and mounting systems for prefabricated units

- transport anchors
- spherical-head anchor system
- fixing sockets
- connecting technique



## Hydraulic, pneumatics and conveyor technique

- hydraulic units and components
- pneumatic, connector systems and accessories
- Hoses, fittings and accessories
- machines, tools, machinery systems and accessories

**PHILIPP GmbH**  
Lilienthalstrasse 7-9  
D-63741 Aschaffenburg  
Tel: + 49 (0) 6021 / 40 27-0  
Fax: + 49 (0) 6021 / 40 27-440  
info@philipp-group.de  
www.philipp-group.de

**PHILIPP GmbH**  
Roßlauer Strasse 70  
D-06869 Coswig/Anhalt  
Tel: + 49 (0) 34903 / 6 94-0  
Fax: + 49 (0) 34903 / 6 94-20  
info@philipp-group.de  
www.philipp-group.de

**PHILIPP GmbH**  
Sperberweg 37  
D-41468 Neuss  
Tel: + 49 (0) 2131 / 3 59 18-0  
Fax: + 49 (0) 2131 / 3 59 18-10  
info@philipp-group.de  
www.philipp-group.de

**Our Technical support: [technik@philipp-gruppe.de](mailto:technik@philipp-gruppe.de)**