



# PHILIPP Power Box Installation Instruction



## 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 use 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 in plant, consult you during the installation of precast units and help to optimize the production process.
- ▲ **High application safety of our products** – close cooperation with federal institutes for material testing and – where required – German approvals of our products.
- ▲ **Software solutions** – design software for our sandwich anchor system.

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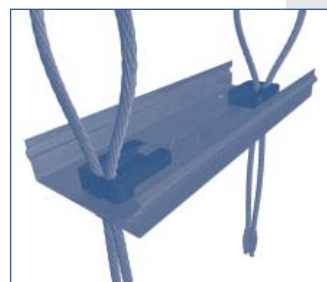
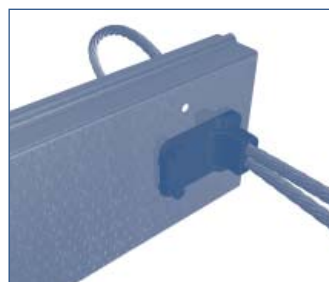
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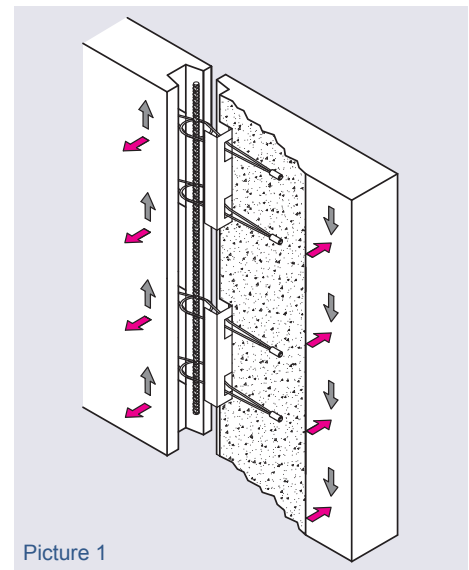
The **PHILIPP Power Box** is another product developed by **PHILIPP Group** which has a German approval. The **PHILIPP Power Box System** has not only a high load rating but can also transfer shear forces parallel and at right angles to the wall.

Hence, the **PHILIPP Power Box System** is the perfect solution for the connection of precast concrete units.



## Your Advantages in One View:

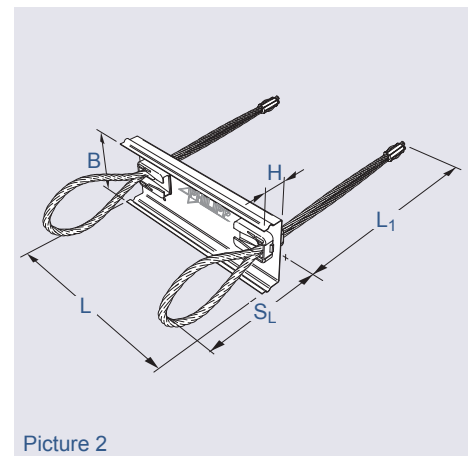
- Flexible connecting elements
- No complicated „reverse bending“ required
- High load bearing capacity
- Shear forces at right angle and parallel to the wall possible
- Simplified design due to shear force data per PHILIPP Power Box
- Cost-optimized due to stackable transport packaging
- Optimal utilization through variable number of PHILIPP Power Boxes per joint
- Stable, weatherproof box cover which is suitable for hot glueing
- Box cover can be recycled



Picture 1

## System Components

The **PHILIPP Box System** is used to connect precast concrete units where an approval is required. It is able to transfer shear forces parallel and at right angles to the wall safely into the concrete unit (Picture 1). Its simple installation with the aid of a timber board ensures practical application.



Picture 2

The **PHILIPP Power Box System** is optimally harmonised and consists of:

- The galvanised **PHILIPP Power Box** including a highly capable steel rope
- High-strength grouting mortar



Picture 3

**Table 1: Dimensions of the PHILIPP Power Box**

Article-No.	$V_{Rd,  }$ per Box [kN]	Dimensions [mm]					L <sub>1</sub>	Package Unit [pcs]	Weight [kg/PU]
		S <sub>L</sub>	B	H	L				
54PB120	35,0	120	80	25	220	190	100	42.0	

Order Suggestion

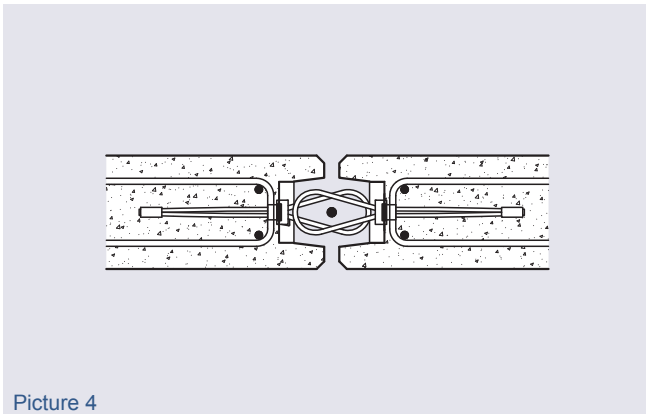
e.g. **PHILIPP Power Box** for the **Power Box System** → Art. No.: 54PB120

## Instructions for Installation and Use

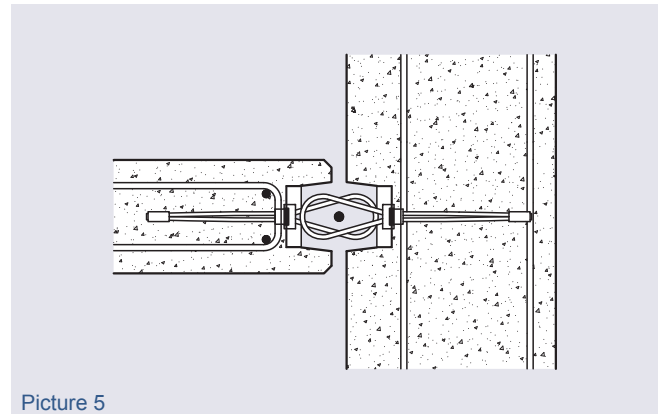
### Field of Application and Examples

The **PHILIPP Power Box System** can be used for the connection of reinforced precast concrete units. It transfers shear forces into the joint (parallel or at right angles to the wall) caused by primarily static shear load. Planned tensile forces in the joint (along the wall) are excluded or avoided through appropriate design.

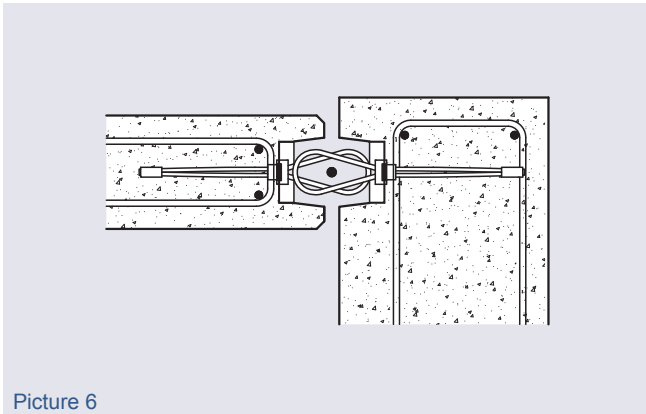
The **PHILIPP Power Box System** can be used, if it is proofed that the requirements for the crack width in the joint is fulfilled according to German Standard (DIN 1045:2001-07, Table 18) or the corrosion protection is ensured through other measure.



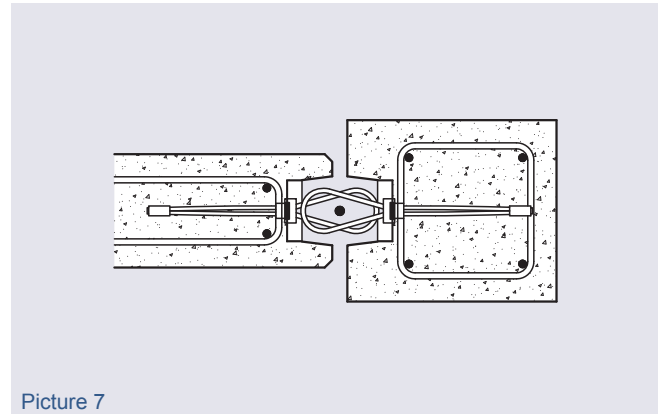
Picture 4



Picture 5



Picture 6

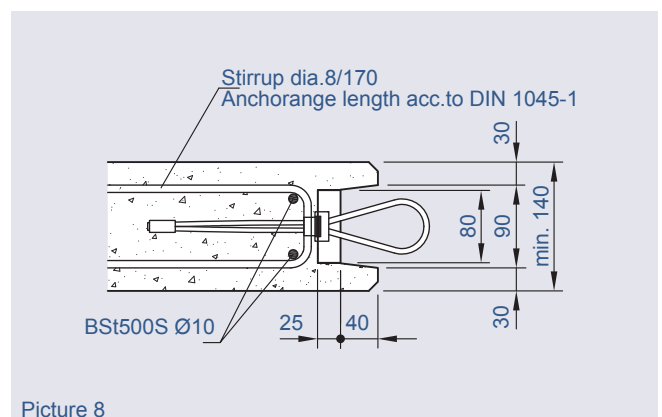


Picture 7

### Geometry of Precast Units

The reinforced concrete units must have a minimum wall thickness of 14cm. If there are shear forces at right angles to the wall the thickness must be increased to a minimum of 18cm.

In general a maximum joint height of 3.5m is allowed. Higher joints are possible if the subsequent grouting of the joint is undertaken in a batch-bulk processing in combination with a grouting hose



Picture 8

## Dimensioning and Design

The precast concrete units to be connected must correspond to DIN 1045-1:2001-07. The precast units are made of normal concrete with a mechanical strength class of at least C30/37 based on German Standard (DIN 1045-2:2001-07). The structural engineer is responsible to design the units and prove the joint connections according to the German approval.

The shear force parallel to the wall on the resistance side is:

**Table 2: Design Value of the Shear Force Capacity Parallel to the Wall**

Wall Thickness h [cm]	Design Value of the Shear Force Capacity $V_{Rd,  }$ [kN/Power Box]			
	C 30/37	C 35/45	C40/50	C 45/55
≥ 14	35			

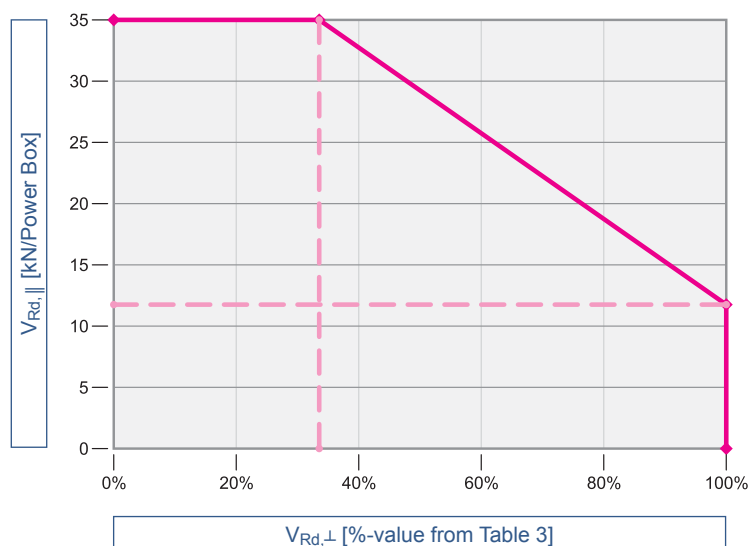
**Table 3: Design Value of the Shear Force Capacity at Right Angles to the Wall**

Wall Thickness h [cm]	Design Value of the Shear Force Capacity $V_{Rd,\perp}$ [kN/m]			
	C 30/37	C 35/45	C40/50	C 45/55
18	11.9	13.5	14.5	15.4
20	15.0	17.1	18.4	19.6
22	18.4	21.0	22.5	24.0
24	22.0	25.0	26.9	28.6

If shear forces parallel and at right angles to the wall occur at the same time, the shear force at right angles to the wall has to be reduced. To calculate the reduced value of  $V_{Rd,\perp}$  it must be multiplied with a reduction factor.

Diagram 1 shows the interaction between the shear forces.

**Diagram 1: Interaction Diagram of Shear Forces at Right Angle with and Parallel to the Joint**



The percentage of the shear force at right angles to the wall can be taken from Diagram 1 or calculated as follows:

If  $V_{Rd,||} \leq 13$  kN,  $V_{Rd,\perp}$  can be implemented fully!

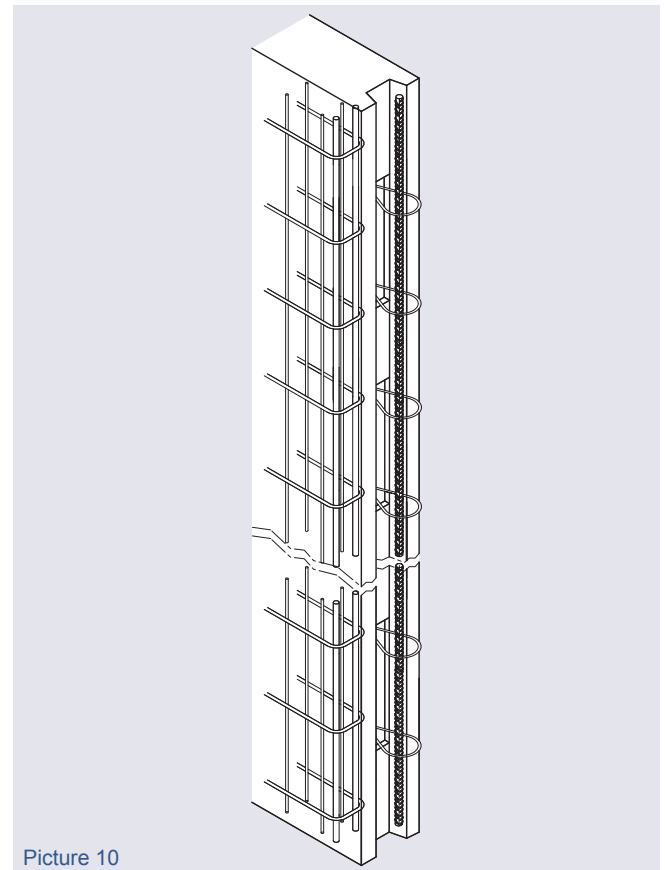
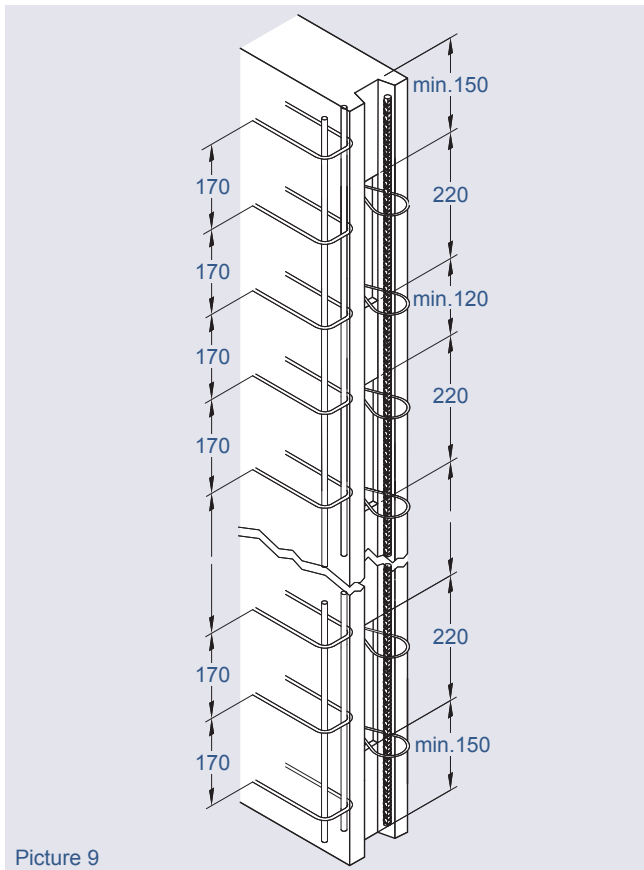
If  $V_{Rd,||} > 13$  kN,  $V_{Rd,\perp}$  must be multiplied with the following reduction factor:

$$\text{Reduction factor} = 1/3 + 0,0286 \times (35 - V_{Rd,||})$$

$$V_{Rd,\perp} = \text{reduction factor} \times \text{table value}$$

## Reinforcement

The **PHILIPP Power Box** is installed in combination with a timber board. The minimum distance in between the **PHILIPP Power Boxes** must be 12cm and the minimum distance to the edge must be 15cm (Picture 9).



In the area of the **PHILIPP Power Boxes** the precast elements must be provided with minimum reinforcement. This reinforcement should be stirrups dia.8/17 (means: dia.8 mm every 17 cm) and 2 longitudinal bars dia.10 mm (see alignment in Picture 8+9).

**The stirrups may alternatively be replaced by comparable mesh reinforcement (see Picture 10).**

The requirement is e.g. fulfilled by mesh reinforcement Type Q 257 A (means: dia.7 mm every 15 cm). If requirements exist in terms of fire resistance durability for the overall construction, the rules based on German standard DIN V ENV-1992-1-2 apply.

## Manufacture of Precast Concrete Units

The **PHILIPP Power Box System** works on the principle of overlap connections. It is therefore essential that the loops are located across from each other at the same height (Picture 14).

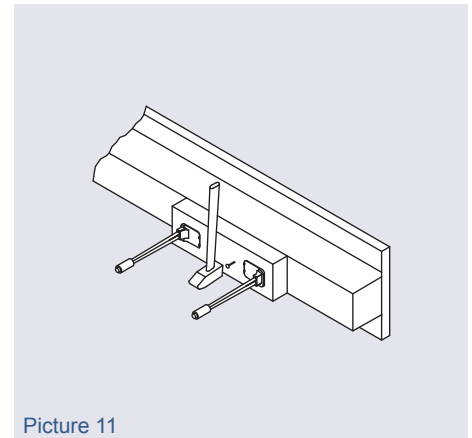
The **PHILIPP Power Box** can be fixed to the mould by nailing or hot gluing (Picture 11 and 12).

The anchorage of the connecting loops should be aligned rectangular to the **PHILIPP Power Box** in the precast unit. If an installation in the vertical formwork is preferred the alignment of the wire loop ends in the precast unit should be ensured by tying the loops onto the reinforcement with wire.

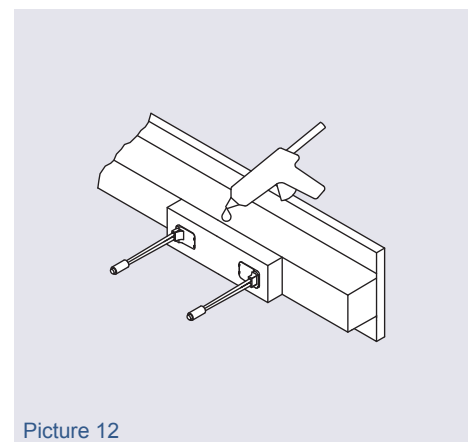
## Mounting and Grouting

For preparation of grouting, the cover is removed and the connecting loops are folded in a way that they are rectangular to the **PHILIPP Power Boxes**. When properly aligned the connecting loops will overlap horizontally within the nominal dimension of 90 mm (Picture 13) and will lie directly above one another (Picture 14).

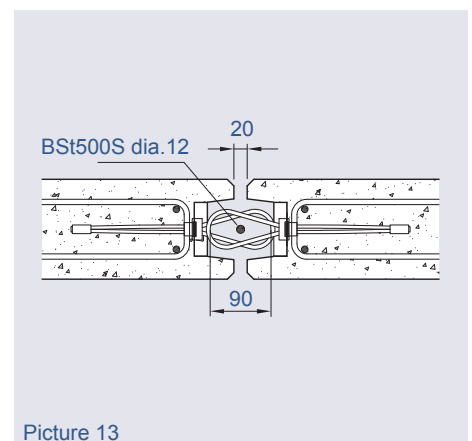
The loops are fixed by tying the loops together with wire or in another suitable way.



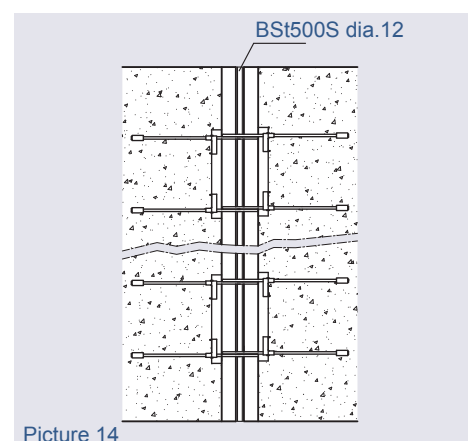
Picture 11



Picture 12



Picture 13



Picture 14



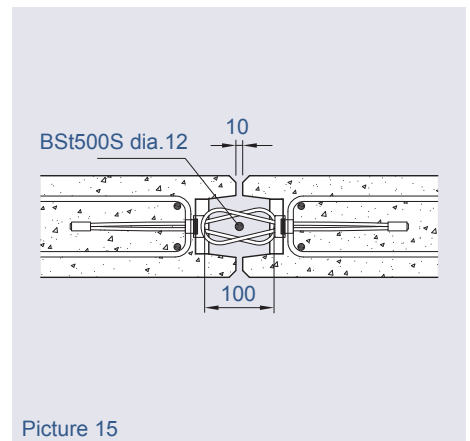
# PHILIPP POWER BOX INSTALLATION INSTRUCTIONS

The German approval of the **PHILIPP Power Box** already takes the horizontal and vertical mounting tolerances into account. The maximum allowable deviations are shown in Picture 15, 16 and 17.

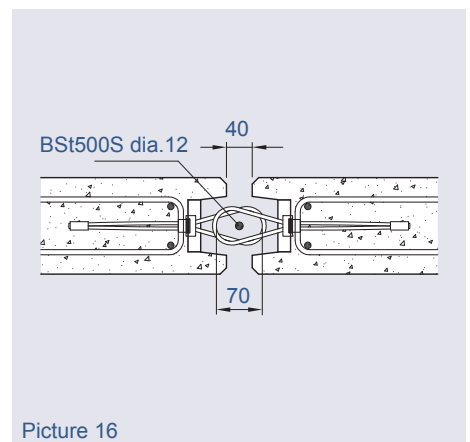
Prior to the setting of step ends of the grouting joints, a concrete reinforcing bar (dia.12 mm) should be positioned along the entire length of the joint (when using a joint tape be careful that it does not impede the grouting section or reduces the required concrete cover for the **PHILIPP Power Box**).

Proper installation should be observed visually. Step ends should thereafter be set on the sides of the joints before it is filled with **PHILIPP Grouting Mortar**. The use of a grouting hose with a hopper eases the process considerably. To reduce the pouring pressure, it is recommended that **PHILIPP Grouting Mortar** is filled in sections.

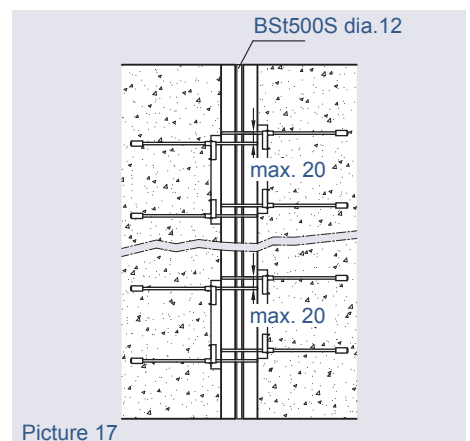
**PHILIPP Grouting Mortar** should be mixed, installed, and condensed based on the processing notes of page 10.



Picture 15



Picture 16



Picture 17

**Processing Instructions and Properties of PHILIPP Grouting Mortar**

**PHILIPP Grouting Mortar** is a ready-to-use dry mixture on a cement basis for grouting of precast concrete units. It is free of shrinkage and has a high strength and good flow ability.

**Properties**

**PHILIPP Grouting Mortar** is free of chlorides. It has a good bond with steel and concrete and allows no separation of the components. Furthermore it has a good pump ability and a good frost and de-icing salt resistance. **PHILIPP Grouting Mortar** is produced in reliably consistent quality and is easy to process. Due to its flowing consistency, the mortar is self-levelling and fills out all accessible, venting hollow spaces.

**PROCESSING**

**Preparation**

The subsurface must be free of dirt such as oils, greases, etc. Cement slurry leavings on the surface shall be removed. A seal formwork should be used. To improve grip, the joint surface should be pre-wetted thoroughly.

**Mixing**

Approximately 2/3 of the mixing water is put into the mixer; the **PHILIPP Grouting Mortar** is then completely stirred in. Afterwards the remaining water can be used to adjust the consistency. Mixing lasts 4 – 6 minutes depending on the type of mixing.

**Note**

During grouting, air must be able to escape. Careful compactions can prevent trapped air. The processing time is about 60 minutes at 20° C.

**Processing Temperature**

DIN 1045-2 and DIN EN 206-1 must be taken into account when working with **PHILIPP Grouting Mortar**. These standards give a processing temperature of at least +5° C.

**Post-treatment**

It should be prevented that **PHILIPP Grouting Mortar** dries up too fast for at least three days after application. Appropriate procedure includes covering with plastic sheets, wet tissues or irrigation.

**Consumption**

25 kg dry mortar results in 13 - 14 litres **PHILIPP Grouting Mortar**.

**Delivery form**

25 kg paper/PE bags

**Increase of Volume**

Bulking amounts to at least 0.1% after 24 hours.

**Table 4: Mechanical Strength Properties of PHILIPP Grouting Mortar**

Characteristic	1 day	3 days	7 days	28 days
	[N/mm <sup>2</sup> ]			
Compressive strength	44	55	70	80
Bending tensile strength	5.8	8.0	10.0	10.0

**PHILIPP Grouting Mortar** can be purchased from:

- **PHILIPP GmbH** Tel.: +49 (0) 6021 / 40 27-300

**Table 5: Site Check List**

Step	Working Process	Note
1	Open Box	Remove cover
2	Inspection of Box	Pay attention on clean surfaces
3	Fold out the connecting loops	Pay attention to the 90° position
4	Align concrete units	Pay attention to admissible tolerances
5	Install joint reinforcement	Along the entire length of the joint
6	Pre-wetting of grouting joints	Improvement of adhesion
7	Set step ends on sides	Use formwork, timber boards or joint tape
8	Joint grouting	Pay attention to the instructions regarding ambient temperature, compaction and processing time
9	After-treatment of grouting joint	According to processing instructions

**Table 6: Grout Consumption**

Unit Thickness	Joint Width	Grout Consumption per 1 m Joint and 2 Boxes/m	
		[l/m]	[kg/m]
[mm]	[mm]		
140	20	11.4	21.9
160	20	11.8	22.7
180	20	12.2	23.4
200	20	12.6	24.2

## 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

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