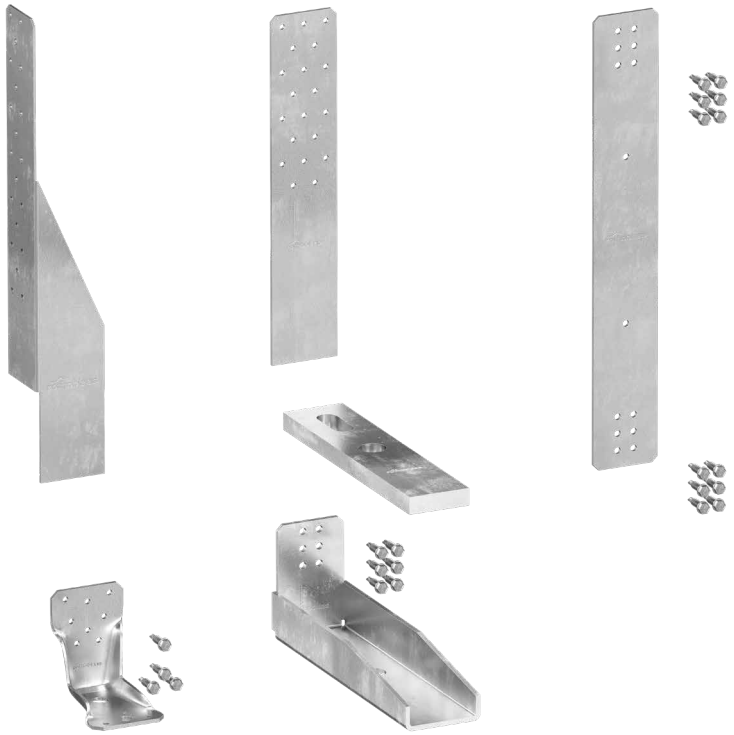
# WKR DOUBLE

## TENSILE ANGLE BRACKET FOR PREFABRICATED WALLS

### PREFABRICATION
The wall plate allows for pre-assembly in the factory, with the possibility of finishes prefabrication. Fastening on site is carried out using the base angle bracket or inter-storey plate and self-drilling metal screws.

### TOLERANCES
On-site management is quick and easy. The numerous models of the base angle bracket allow the wall to be installed on a grout, on a base plate or on a reinforced concrete kerb.

### PRE-INSTALLATION
The base angle brackets can be pre-installed on the reinforced concrete foundation. Slotted holes for installing the anchors allow management of installation tolerances.



VIDEO

CE
ETA-22/0089

**SERVICE CLASS** SC1 SC2

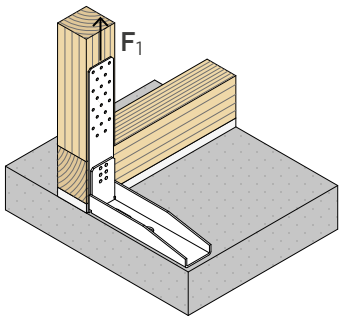
**MATERIAL**

S355 Fe/Zn12c — **WKRD100C**: S355 + Fe/Zn12c carbon steel

S350 Z275 — **VERTICAL PLATES**: S350GD + Z275 carbon steel

S235 Fe/Zn12c — **WKRDW6020**: S235 + Fe/Zn12c carbon steel

**EXTERNAL LOADS**




VIDEO
Scan the QR Code and watch the video on our YouTube channel

## FIELDS OF USE

Tension joints for prefabricated walls.
Optimised for fastening frame walls.
Timber-to-timber and timber-to-concrete configurations.

Can be applied to:
- solid timber and glulam
- timber frame
- CLT and LVL panels

## TIMBER-TO-CONCRETE TOLERANCE

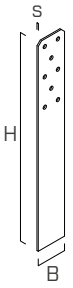
Thanks to the slotted hole for installing the anchor, it is possible to pre-install the bottom plate and subsequently install the walls. The slot allows tolerance management.

## TIMBER-TO-TIMBER

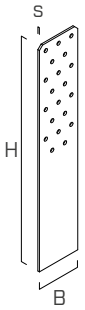
The inter-storey plate allows to create the wall-to-wall connection between one storey and the next.

## CODES AND DIMENSIONS

### WALL PLATE




1

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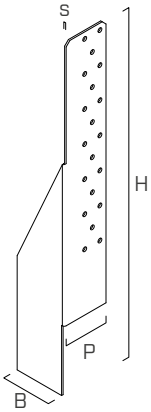


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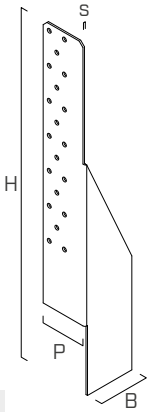



4

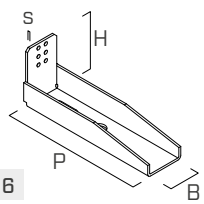
| | CODE | B [mm] | P [mm] | H [mm] | s [mm] | $n_v$ Ø5 [pcs] | | | pcs |
|---|---|---|---|---|---|---|---|---|---|
| 1 | **WKRD40** | 40 | - | 275 | 2 | 8 | ● | - | 10 |
| 2 | **WKRD60** | 60 | - | 305 | 2,5 | 20 | ● | - | 10 |
| 3 | **WKRD60L** | 62 | 55 | 403 | 2 | 20 | ● | - | 10 |
| 4 | **WKRD60R** | 62 | 55 | 403 | 2 | 20 | ● | - | 10 |

### INTER-STOREY PLATE


5

| | CODE | B [mm] | H [mm] | s [mm] | $n_v$ Ø6 [pcs] | pcs |
|---|---|---|---|---|---|---|
| 5 | **WKRD60T** | 60 | 410 | 2,5 | 12 | 10 |

### BASE ANGLE BRACKET




6

| | CODE | B [mm] | P [mm] | H [mm] | s [mm] | $n_v$ Ø6 [pcs] | $n_H$ Ø23 [pcs] | $n_H$ - Ø18 x 30 [pcs] | | | pcs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | **WKRD100C** | 68 | 255 | 100 | 4 | 6 | 1 | 1 | - | ● | 10 |



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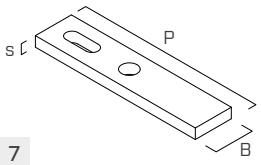
## WASHER

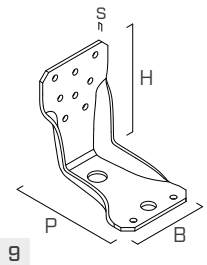



7

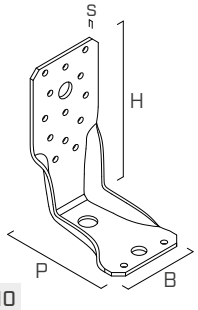

8

| | CODE | B [mm] | P [mm] | s [mm] | $n_H$ Ø18 | $n_H$ Ø22 | $n_H$ Ø23 [pcs] | $n_H$ - Ø18 x 30 [pcs] | | | pcs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | **WKRDW6020** | 54 | 240 | 20 | - | - | 1 | 1 | - | ● | 1 |
| 8 | **WHTW6016** | 50 | 56 | 6 | 1 | - | - | - | - | ● | 1 |
| | **WHTW6020** | 50 | 56 | 6 | - | 1 | - | - | - | ● | 1 |

## BASE ANGLE BRACKET




9

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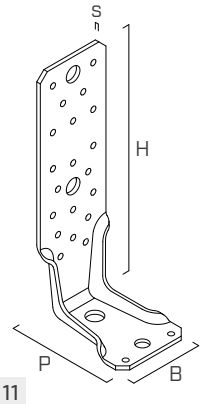
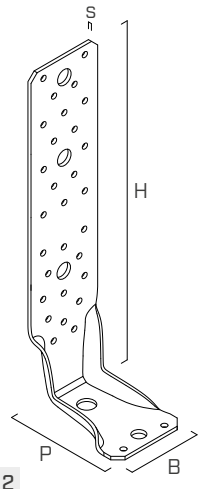



11

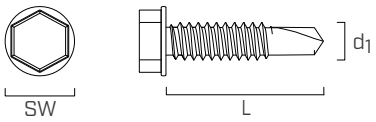



12

| | CODE | B [mm] | P [mm] | H [mm] | s [mm] | $n_v$ Ø5 [pcs] | $n_H$ Ø14 [pcs] | | | pcs |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | **WKR9530** | 65 | 85 | 95 | 3 | 8 | 1 | - | ● | 25 |
| 10 | **WKR13535** | 65 | 85 | 135 | 3,5 | 13 | 1 | - | ● | 25 |
| 11 | **WKR21535** | 65 | 85 | 215 | 3,5 | 20 | 1 | - | ● | 25 |
| 12 | **WKR28535** | 65 | 85 | 287 | 3,5 | 29 | 1 | - | ● | 25 |

## SELF-DRILLING SCREW FOR STEEL

| CODE | $d_1$ [mm] | SW [mm] | L [mm] | pcs |
|---|---|---|---|---|
| **MMS6325** | 6,3 | SW10 | 25 | 150 |




# FASTENERS

| type | description | | d [mm] | support |
|---|---|---|---|---|
| **LBA** | high bond nail | | 4 | |
| **LBS** | round head screw | | 5 | |
| **AB1** | CE1 expansion anchor | | 12-16 | |
| **SKR** | screw-in anchor | | M12-M16 | |
| **VIN-FIX** | vinyl ester chemical anchor | | M12-M16-M20 | |
| **HYB-FIX** | epoxy chemical anchor | | M12-M16-M20 | |
| **EPO-FIX** | hybrid chemical anchor | | M12-M16-M20 | |
| **ULS13373** | washer | | M12 | |

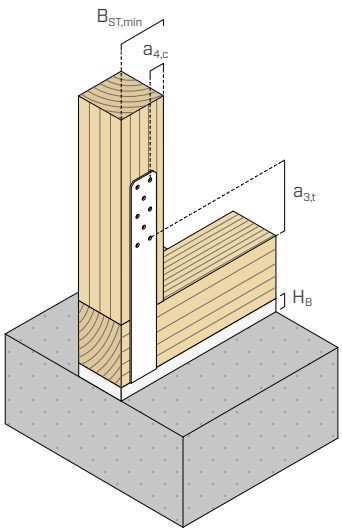
# INSTALLATION

## MINIMUM DISTANCES

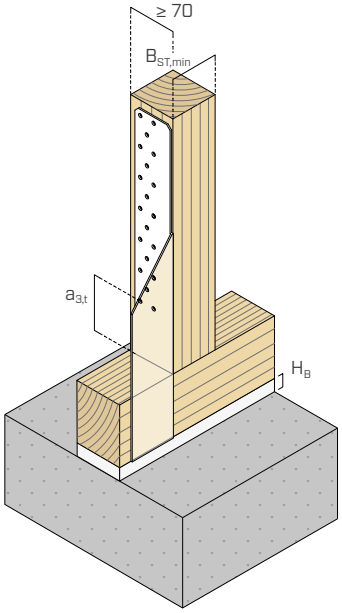
| TIMBER | | | nails LBA Ø4 | screws LBS Ø5 |
|---|---|---|---|---|
| C/GL | $a_{4,c}$ | [mm] | ≥ 12,5 | ≥ 12,5 |
| | $a_{3,t}$ | [mm] | ≥ 60 | ≥ 75 |

C/GL: minimum distances for solid timber or glulam. The distance $a_{4,c}$ is reduced in accordance with ETA-22/0089 based on laboratory test results.

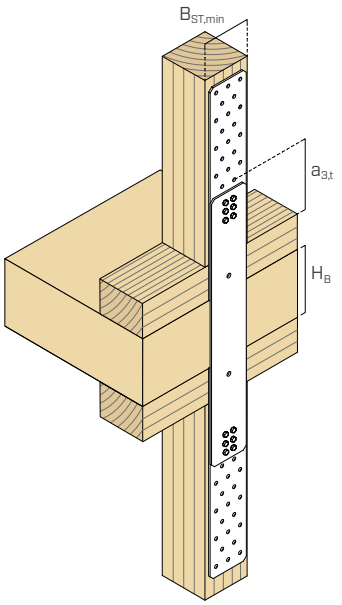
WKRD40/WKRD60




WKRD60L/R




WKRD60T




| wall plate | basic angle bracket | fasteners LBA Ø4 LBS Ø5 [pcs] | fasteners MMS6325 Ø6,3 [pcs] | $B_{ST,min}$ [mm] | $H_B$ min [mm] | $H_B$ max [mm] |
|---|---|---|---|---|---|---|
| WKRD40 | WKR9530 | 8 | 4 | 45 | 0 | 40 |
| | WKR13535 | 8 | 4 | | 0 | 74 |
| | WKR21535 | 8 | 4 | | 40 | 114 |
| | WKR28535 | 8 | 4 | | 112 | 210 |
| | WKRD100C | 8 | 4 | | 0 | 67 |
| | WKRD100C + WHTW6020 | 8 | 4 | | 0 | 67 |
| | WKRD60T | 8 + 8 | 4 + 4 | | 50 | 320 |
| WKRD60 | WKR9530 | 20 | 4 | 65 | 0 | 40 |
| | WKR13535 | 20 | 4 | | 0 | 74 |
| | WKR21535 | 20 | 4 | | 70 | 170 |
| | WKR28535 | 20 | 4 | | 142 | 230 |
| | WKRD100C + WHTW6016 | 20 | 4 | | 0 | 52 |
| | WKRD100C + WKRDW6020 | 20 | 6 | | 0 | 52 |
| | WKRD60T | 20 + 20 | 6 + 6 | | 110 | 300 |
| WKRD60L WKRD60R | WKR9530 | 20 | 4 | 38 | 0 | 40 |
| | WKR13535 | 20 | 4 | | 0 | 74 |
| | WKR21535 | 20 | 4 | | 70 | 170 |
| | WKR28535 | 20 | 4 | | 120 | 230 |
| | WKRD100C + WHTW6016 | 20 | 4 | | 0 | 52 |
| | WKRD100C + WKRDW6020 | 20 | 4 | | 0 | 52 |
| | WKRD60T | 20 + 20 | 4 + 4 | | 120 | 320 |

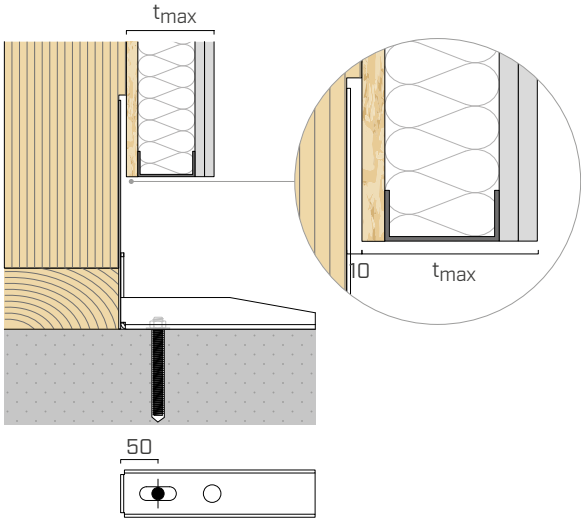
# INSTALLATION

## INSTALLATION OF WKRD100C BASE ANGLE BRACKETS

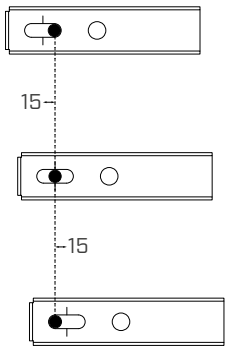
Frame walls can be supplied with different levels of prefabrication. Depending on the presence and thickness of the internal finish, the WKRD100C angle bracket can be installed in different ways. The bracket is provided with one slotted hole Ø18 and one circular hole Ø23.

## INSTALLATION OF BASE ANGLE BRACKETS PRIOR TO WALL INSTALLATION

The angle brackets can be pre-installed on the foundation in order to speed up the installation and fastening of the walls. In this configuration, it is advisable to install the anchor in the slotted hole, which then allows any installation tolerances to be compensated for.




Example: pre-installed M16 anchor in central position for wall with prefabricated internal finish (without thickness limitation).

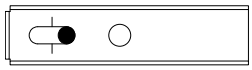



The presence of the slotted hole makes it possible to compensate for an installation tolerance of ± 15 mm after wall installation. After installation, simply apply the tightening torque required to fully anchor the connection to the ground.

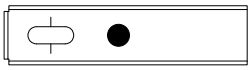
## INSTALLATION OF BASE ANGLE BRACKETS AFTER WALL INSTALLATION

The angle brackets can be installed after the walls have been installed. In this case, there are two possible ways of fastening them to the ground:

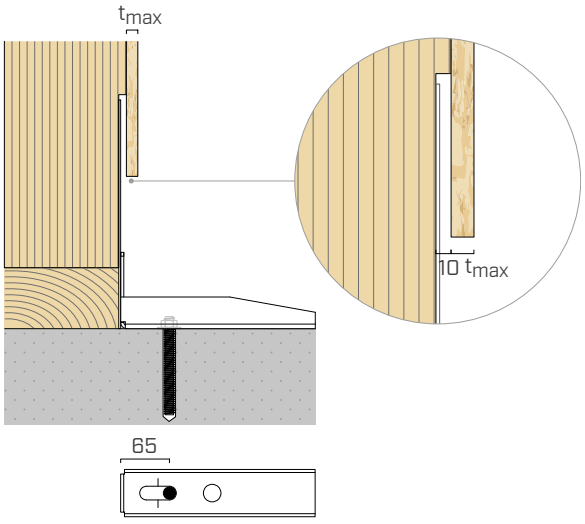
| | anchor choice | |
|---|---|---|
| $t_{max}$ [mm] | IN | OUT |
| 20 | M16 | - |
| 80 | - | M20 |



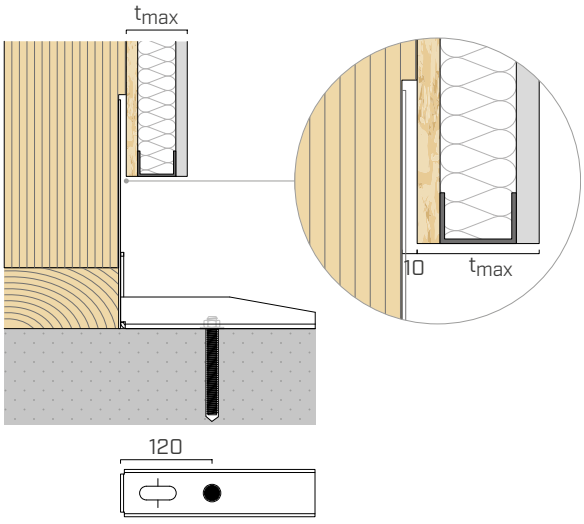
anchor positioned in the internal hole **(IN)**



anchor positioned in the outer hole **(OUT)**




Example: post-installed M16 anchor for prefabricated wall with single OSB panel.

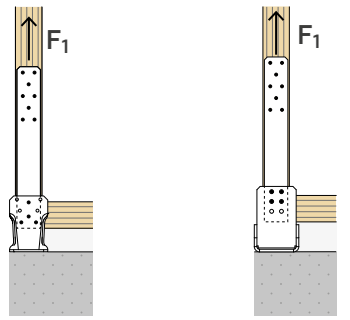



Example: post-installed M20 anchor for prefabricated wall with internal counter wall.

# STRUCTURAL VALUES | TIMBER-TO-CONCRETE | $F_1$

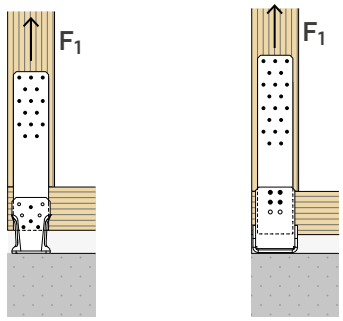
## WALL-ANGLE BRACKET BASE PLATE COUPLING

WKRD40



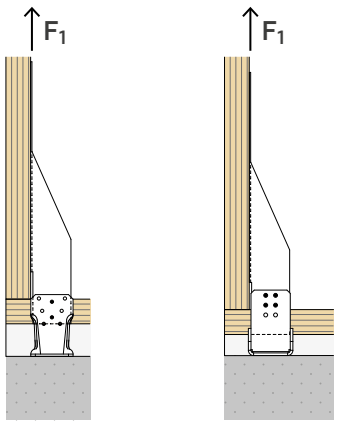

WKR WKRD100C

WKRD60




WKR WKRD100C

WKRD60L/R




WKR WKRD100C

## TIMBER STRENGTH

| wall plate | basic angle bracket | fasteners | | | $R_{1,k,timber}$ | | $R_{1,k,steel}$ | |
|---|---|---|---|---|---|---|---|---|
| | | steel-to-timber LBA Ø4 LBS Ø5 | steel-to-steel MMS6325 Ø6,3 | concrete | LBA460 | LBS570 | | |
| | | [pcs] | [pcs] | [Ø] | [kN] | [kN] | [kN] | $\gamma_{steel}$ |
| WKRD40[1] | WKR9530 | 8 | 4 | M12 | 22,6 | 21,7 | 22,7 | $\gamma_{M2}$ |
| | WKR13535 | 8 | 4 | M12 | 22,6 | 21,7 | 22,7 | |
| | WKR21535 | 8 | 4 | M12 | 22,6 | 21,7 | 22,7 | |
| | WKR28535 | 8 | 4 | M12 | 22,6 | 21,7 | 22,7 | |
| | WKRD100C | 8 | 4 | M16 | 22,6 | 21,7 | 17,6 | |
| | WKRD100C + WHTW6020 | 8 | 4 | M20 | 22,6 | 21,7 | 18,8 | |
| WKRD60[2] | WKR9530 | 20 | 4 | M12 | 36,1 | 34,6 | 24,8 | |
| | WKR13535 | 20 | 4 | M12 | 36,1 | 34,6 | 24,8 | |
| | WKR21535 | 20 | 4 | M12 | 36,1 | 34,6 | 24,8 | |
| | WKR28535 | 20 | 4 | M12 | 36,1 | 34,6 | 24,8 | |
| | WKRD100C + WHTW6016 | 20 | 4 | M16 | 36,1 | 34,6 | 24,8 | |
| | WKRD100C + WKRDW6020 | 20 | 6 | M16 | 36,1 | 34,6 | 37,2 | |
| | WKRD100C + WKRDW6020 | 20 | 6 | M20 | 36,1 | 34,6 | 27,2 | |

[1]For WKRD40 on LVL studs with width $B_{st}$ < 60mm, $R_{1,k,timber}$ for LBA nails shall be reduced by applying the coefficient $0,8 \cdot \sqrt{350 / \rho_k}$

[2]For WKRD60 on LVL studs with width $B_{st}$ < 80mm, $R_{1,k,timber}$ for LBA nails shall be reduced by applying the coefficient $0,8 \cdot \sqrt{350 / \rho_k}$

| wall plate | basic angle bracket | fasteners | | | $R_{1,k,timber}$ | | $R_{1,k,steel}$ | |
|---|---|---|---|---|---|---|---|---|
| | | steel-to-timber LBA Ø4 LBS Ø5 | steel-to-steel MMS6325 Ø6,3 | concrete | LBA440 | LBS540 | | |
| | | [pcs] | [pcs] | [Ø] | [kN] | [kN] | [kN] | $\gamma_{steel}$ |
| WKRD60L WKRD60R | WKR9530 | 20 | 4 | M12 | 16,6 | 17,2 | 24,8 | $\gamma_{M2}$ |
| | WKR13535 | 20 | 4 | M12 | 16,6 | 17,2 | 24,8 | |
| | WKR21535 | 20 | 4 | M12 | 16,6 | 17,2 | 24,8 | |
| | WKR28535 | 20 | 4 | M12 | 16,6 | 17,2 | 24,8 | |
| | WKRD100C + WHTW6016 | 20 | 4 | M16 | 16,6 | 17,2 | 24,8 | |
| | WKRD100C + WKRDW6020 | 20 | 4 | M20 | 16,6 | 17,2 | 24,8 | |

## CONCRETE STRENGTH

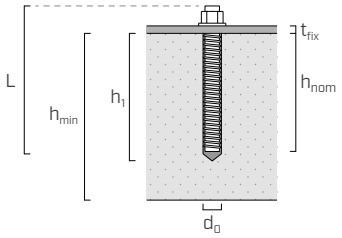
Strength values of some of the possible fastening solutions. For additional solutions, different from those indicated in the table, it is possible to use the My Project software available at www.rothoblaas.com.
The values shown in the table have been determined taking into account the contribution of the coefficient $k_{t//}$ in the calculations.

| | configuration on concrete | fasteners | | $R_{1,d\ concrete}$ |
|---|---|---|---|---|
| | | type | Ø x L | |
| | | | [pcs] | [kN] |
| **WKR9530 WKR13535** | **uncracked** | VIN-FIX 5.8 | M12 X 195 | **26,6** |
| | **cracked** | VIN-FIX 5.8 | M12 X 195 | **19,5** |
| | | HYB-FIX 5.8 | M12 X 195 | **26,7** |
| | **seismic** | HYB-FIX 8.8 | M12 X 245 | **18,1** |
| | | EPO-FIX 8.8 | M12 X 195 | **23,6** |
| **WKR21535 WKR28535** | **uncracked** | VIN-FIX 5.8 | M12 X 195 | **25,4** |
| | **cracked** | VIN-FIX 5.8 | M12 X 195 | **18,6** |
| | | HYB-FIX 5.8 | M12 X 195 | **25,5** |
| | **seismic** | HYB-FIX 8.8 | M12 X 245 | **17,3** |
| | | EPO-FIX 8.8 | M12 X 195 | **22,5** |
| **WKRD100C** | **uncracked** | VIN-FIX 5.8 | M16 X 195 | **30,0** |
| | **cracked** | HYB-FIX 5.8 | M16 X 195 | **39,7** |
| | **seismic** | EPO-FIX 8.8 | M16 X 195 | **20,8** |
| **WKRD100C + WHTW6016** | **uncracked** | VIN-FIX 5.8 | M16 X 195 | **26,7** |
| | **cracked** | HYB-FIX 5.8 | M16 X 195 | **35,3** |
| | **seismic** | EPO-FIX 8.8 | M16 X 195 | **18,4** |
| | | HYB-FIX 8.8 | M16 X 245 | **23,8** |
| **WKRD100C + WHTW6020** | **uncracked** | VIN-FIX 5.8 | M20 X 245 | **34,1** |
| | **cracked** | HYB-FIX 5.8 | M20 X 245 | **42,3** |
| | **seismic** | EPO-FIX 8.8 | M20 X 245 | **24,6** |
| **WKRD100C + WKRDW6020 (M16)** | **uncracked** | VIN-FIX 5.8 | M16 X 195 | **26,7** |
| | | HYB-FIX 5.8 | M16 X 195 | **38,4** |
| | **cracked** | HYB-FIX 5.8 | M16 X 195 | **35,2** |
| | | | M16 X 245 | **38,4** |
| | **seismic** | EPO-FIX 8.8 | M16 X 245 | **23,2** |
| | | | M16 X 330 | **33,2** |
| **WKRD100C + WKRDW6020 (M20)** | **uncracked** | VIN-FIX 5.8 | M20 X 245 | **28,3** |
| | **cracked** | HYB-FIX 5.8 | M20 X 245 | **36,7** |
| | **seismic** | EPO-FIX 8.8 | M20 X 245 | **21,5** |
| | | | M20 X 330 | **30,8** |

## ANCHORS INSTALLATION PARAMETERS

| type | type of washer | type of rod Ø x L [mm] | | $t_{fix}$ [mm] | $h_{nom} = h_{ef}$ [mm] | $h_1$ [mm] | $d_0$ [mm] | $h_{min}$ [mm] |
|---|---|---|---|---|---|---|---|---|
| **WKR** | - | M12 | 195 | 3 | 155 | 160 | 14 | 200 |
| | | | 245 | 3 | 210 | 215 | 14 | 250 |
| **WKRD100D** | **no washer** | M16 | 195 | 4 | 155 | 160 | 18 | 200 |
| | **WHTW6016** | M16 | 195 | 10 | 155 | 160 | 18 | 200 |
| | | | 245 | 10 | 200 | 205 | 18 | 250 |
| | **WHTW6020** | M20 | 245 | 10 | 200 | 205 | 22 | 250 |
| | **WKRDW6020** | M16 | 195 | 24 | 155 | 160 | 18 | 200 |
| | | | 245 | 24 | 195 | 200 | 18 | 250 |
| | | M20 | 245 | 24 | 195 | 200 | 22 | 250 |
| | | | 330 | 24 | 280 | 285 | 22 | 250 |

Precut INA threaded rod, with nut and washer
MGS threaded rod to be cut to size: for more information, see the "**PLATES AND CONNECTORS FOR TIMBER**" catalogue, available in the "Catalogues" section of the website www.rothoblaas.com




| | |
|---|---|
| $t_{fix}$ | fastened plate thickness |
| $h_{nom}$ | nominal anchoring depth |
| $h_{ef}$ | effective anchoring depth |
| $h_1$ | minimum hole depth |
| $d_0$ | hole diameter in the concrete support |
| $h_{min}$ | concrete minimum thickness |

## ANCHORS VERIFICATION FOR STRESS LOADING $F_1$

Fastening elements to the concrete through anchors not listed in the table, shall be verified according to the load acting on the anchors, which can be evaluated through the $k_{t//}$ coefficients. The axial load acting on the anchor can be obtained as follows:

$$F_{bolt//,d} = k_{t//} \cdot F_{1,d}$$

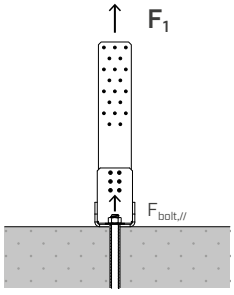
$k_{t//}$ coefficient of eccentricity
$F_{1,d}$ axial load on the WKR angle bracket

The anchor check is satisfied if the design tensile strength, obtained considering the boundary effects, is greater than the design external load: $R_{bolt//,d} \geq F_{bolt//,d}$.

The resistances shown in the table on the previous page have been determined taking into account the contribution of the coefficient $k_{t//}$.

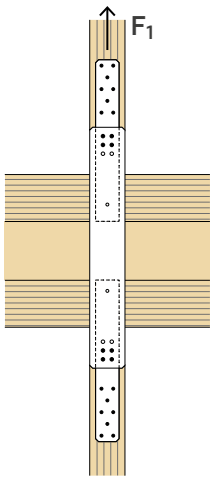
| configuration | rod | $k_{t//}$ |
|---|---|---|
| **WKR9530 - WKR13535** | **M12** | 1,05 |
| **WKR21535 - WKR28535** | **M12** | 1,10 |
| **WKRD100C** | **M16** | 1,20 |
| **WKRD100C + WHTW6016** | **M16** | 1,35 |
| **WKRD100C + WHTW6020** | **M20** | 1,70 |
| **WKRD100C + WKRDW6020** | **M16** | 1,35(*) |
| **WKRD100C + WKRDW6020** | **M20** | 1,90 |

(*) Value calculated considering the anchor installed in the most unfavourable position within the slotted hole.

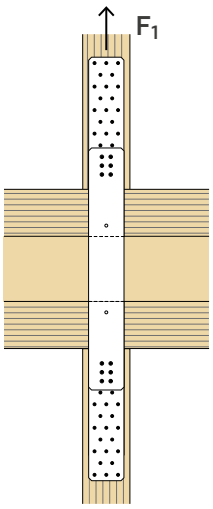


## PLATE COUPLING FOR INTER-STOREY WALL-PLATE

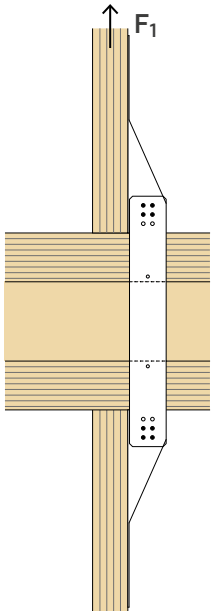
WKRD40 - WKRD60T




WKRD60 - WKRD60T




WKRD60L/R - WKRD60T




| wall plate | inter-storey plate | fasteners | | $R_{1,k,timber}$ | | $R_{1,k,steel}$ | |
|---|---|---|---|---|---|---|---|
| | | LBA Ø4-LBS Ø5 | MMS6325 Ø6,3 | LBA460 | LBS570 | | |
| | | [pcs] | [pcs] | [kN] | [kN] | [kN] | $\gamma_{steel}$ |
| **WKRD40**(1) | WKRD60T | 8 + 8 | 4 + 4 | **22,6** | **21,7** | **22,7** | $\gamma_{M2}$ |
| **WKRD60**(2) | | 20 + 20 | 6 + 6 | **36,1** | **34,6** | **37,2** | |

(1)For WKRD40 on LVL studs with width $B_{st}$ < 60mm, $R_{1,k,timber}$ for LBA nails shall be reduced by applying the coefficient $0,8 \cdot \sqrt{350 / \rho_k}$

(2)For WKRD60 on LVL studs with width $B_{st}$ < 80mm, $R_{1,k,timber}$ for LBA nails shall be reduced by applying the coefficient $0,8 \cdot \sqrt{350 / \rho_k}$

| wall plate | inter-storey plate | fasteners | | $R_{1,k,timber}$ | | $R_{1,k,steel}$ | |
|---|---|---|---|---|---|---|---|
| | | LBA Ø4-LBS Ø5 | MMS6325 Ø6,3 | LBA440 | LBS540 | | |
| | | [pcs] | [pcs] | [kN] | [kN] | [kN] | $\gamma_{steel}$ |
| **WKRD60L/R** | **WKRD60T** | 20 + 20 | 4 + 4 | **16,6** | **17,2** | **24,8** | $\gamma_{M2}$ |

### GENERAL PRINCIPLES

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-22/0089. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments.
- Design values can be obtained from values in the table as follows:

$$R_d = min \begin{cases} \frac{R_{k,\ timber} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{k\ bolt,\ head}}{\gamma_{M2}} \\ R_{d,\ concrete} \end{cases}$$

  The coefficients $k_{mod}$, $\gamma_M$ and $\gamma_{steel}$ should be taken according to the current regulations used for the calculation.
- It is possible to use nails or screws different to those proposed. Refer to ETA-22/0089 for the calculation of resistance with different connector lengths.
- Dimensioning and verification of timber and concrete elements must be carried out separately. Verify that there are no brittle failures before reaching the connection strength.
- Structural elements in timber, to which the connection devices are fastened, must be prevented from rotating.
- A timber density of $\rho_k$ = 350 kg/m$^3$ was considered for the calculation process.
- In the calculation phase, a strength class of C25/30 concrete with thin reinforcement was considered, in the absence of spacing and distances from the edge and minimum thickness indicated in the tables listing the installation parameters of the anchors used.
- The strength values are valid for the calculation hypothesis defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge or different concrete thickness), the concrete-side anchors can be verified using MyProject calculation software according to the design requirements.
- The anchors seismic design was carried out in performance category C2, without ductility requirements on anchors (option a2) elastic design according to EN 1992:2018, with $\alpha_{sus}$ = 0,6. For chemical anchors it is assumed that the annular space between the anchor and the plate hole is filled ($\alpha_{gap}$ = 1).
- The product ETAs for the anchors used in the concrete-side strength calculation are indicated below:
  - VIN-FIX chemical anchor according to ETA-20/0363;
  - HYB-FIX chemical anchor according to ETA-20/1285;
  - EPO-FIX chemical anchor according to ETA-23/0419;