

ANGLE BRACKET FOR TENSILE LOADS

COMPLETE RANGE

Available in 5 sizes to be combined with 5 washers to meet all static performance requirements.

SPECIAL STEEL

S355 steel ensures high tensile strength.

HOLE DIAMETER

The hole for "big size" rods is proportioned to the system dimensions.



CHARACTERISTICS

| | |
|-----------|----------------------------|
| FOCUS | tensile joints |
| HEIGHT | from 340 to 740 mm |
| THICKNESS | 3,0 mm |
| FASTENERS | LBA, LBS, VIN-FIX, HYB-FIX |



MATERIAL

Bright zinc plated carbon steel, three dimensional perforated plate.

FIELDS OF USE

Timber-to-concrete and timber-to-timber tensile joints for panels and timber beams

- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)
- timber based panels



CLT, TIMBER FRAME

High strength thanks to S355 steel, side reinforcement flanges and larger diameter hole at the base.

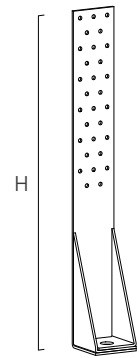
SEISMIC AND STIFFNESS

Within the SEISMIC-REV research project framework, the product and the related fastening elements were tested under static and cyclic loading, providing stiffness parameters (K_{ser}) and ductility levels.

CODES AND DIMENSIONS

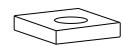
WHT ANGLE BRACKET

| CODE | H [mm] | hole [mm] | $n_v \text{ } \varnothing 5$ [pcs] | s [mm] | pcs |
|--------|-----------|--------------|---------------------------------------|-----------|-----|
| WHT340 | 340 | Ø18 | 20 | 3 | 10 |
| WHT440 | 440 | Ø18 | 30 | 3 | 10 |
| WHT540 | 540 | Ø22 | 45 | 3 | 10 |
| WHT620 | 620 | Ø26 | 55 | 3 | 10 |
| WHT740 | 740 | Ø29 | 75 | 3 | 1 |



WHTW WASHER

| CODE | hole [mm] | s [mm] | WHT340 | WHT440 | WHT540 | WHT620 | WHT740 | pcs |
|---------|--------------|-----------|--------|--------|--------|--------|--------|-----|
| WHTW50 | Ø18 | 10 | ● | ● | ● | - | - | 1 |
| WHTW50L | Ø22 | 10 | - | - | ● | - | - | 1 |
| WHTW70 | Ø22 | 20 | - | - | - | ● | - | 1 |
| WHTW70L | Ø26 | 20 | - | - | - | ● | - | 1 |
| WHTW130 | Ø29 | 40 | - | - | - | - | ● | 1 |



XYLOFON WASHER RESILIENT PROFILE

| CODE | hole [mm] | P [mm] | B [mm] | s [mm] | pcs |
|-------------|-----------------------------------|-----------|-----------|-----------|-----|
| XYLW806060 | WHT340 WHT440 WHT540 Ø23 | 60 | 60 | 6,0 | 10 |
| XYLW808080 | WHT620 Ø27 | 80 | 80 | 6,0 | 10 |
| XYLW8080140 | WHT740 Ø30 | 80 | 140 | 6,0 | 1 |



MATERIAL AND DURABILITY

WHT: S355 bright zinc plated carbon steel.

WHTW WASHER: S235 bright zinc plated carbon steel.

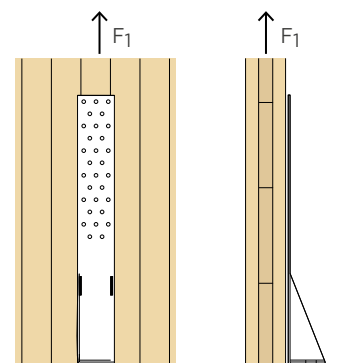
To be used in service classes 1 and 2 (EN 1995-1-1).

XYLOFON WASHER: Monolithic polyurethane compound.



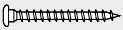

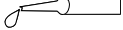



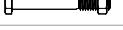

FIELD OF USE

- Timber to concrete joints
- OSB to concrete joints
- Timber-to-timber joints
- Timber to OSB joints
- Timber-to-steel joints

EXTERNAL LOADS



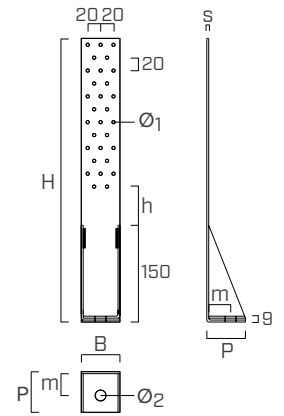
ADDITIONAL PRODUCTS - FASTENING

| type | description | | d [mm] | support |
|------------------------|------------------|-------------------------------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------|
| LBA | Anker nail |  | 4 |  |
| LBS | screw for plates |  | 5 |  |
| VIN-FIX ^(*) | chemical anchor |  | M16 - M20 - M24 - M27 |  |
| HYB-FIX | chemical anchor |  | M16 - M20 - M24 - M27 |  |
| KOS | bolt |  | M16 - M20 |  |

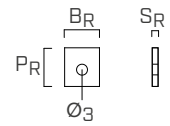
^(*) For more information, see the data sheet available at www.rothoblaas.com

GEOMETRY

| WHT | | WHT340 | WHT440 | WHT540 | WHT620 | WHT740 |
|---------------------------|----------------------|--------|--------|--------|--------|--------|
| Height | H [mm] | 340 | 440 | 540 | 620 | 740 |
| Base | B [mm] | 60 | 60 | 60 | 80 | 140 |
| Depth | P [mm] | 63 | 63 | 63 | 83 | 83 |
| Thickness | s [mm] | 3 | 3 | 3 | 3 | 3 |
| Hole position in timber | h [mm] | 40 | 60 | 40 | 40 | - |
| Hole position in concrete | m [mm] | 35 | 35 | 35 | 38 | 38 |
| Flange holes | \varnothing_1 [mm] | 5,0 | 5,0 | 5,0 | 5,0 | 5,0 |
| Base hole | \varnothing_2 [mm] | 18,0 | 18,0 | 22,0 | 26,0 | 29,0 |



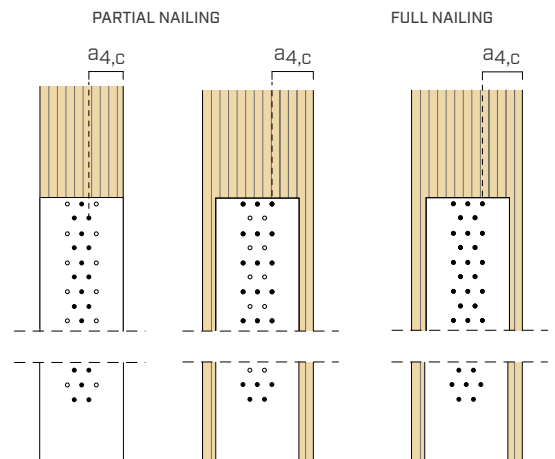
| WHTW WASHER | | WHTW50 | WHTW50L | WHTW70 | WHTW70L | WHTW130 |
|-------------|---------------------------|--------|---------|--------|---------|---------|
| Base | B_R [mm] | 50 | 50 | 70 | 70 | 130 |
| Depth | P_R [mm] | 56 | 56 | 77 | 77 | 77 |
| Thickness | s_R [mm] | 10 | 10 | 20 | 20 | 40 |
| Washer hole | \varnothing_3 [mm] | 18,0 | 22,0 | 22,0 | 26,0 | 29,0 |



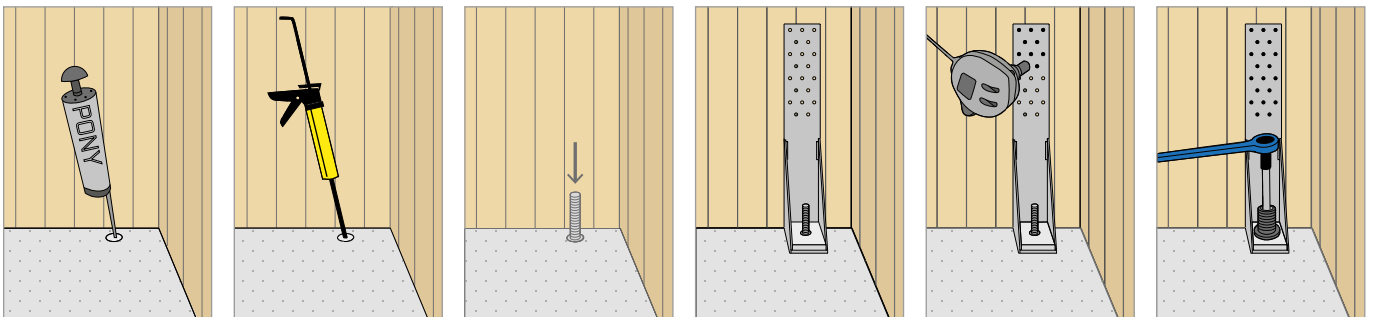
INSTALLATION

| TIMBER minimum distances | | nails | |
|-----------------------------|-----------------------------|--------|------------------|
| | | LBA Ø4 | screws LBS Ø5 |
| C/GL | a_{4,c} [mm] | ≥ 20 | ≥ 25 |
| CLT | a_{4,c} [mm] | ≥ 12 | ≥ 12,5 |

- C/GL: minimum distances for solid timber or glulam consistent with EN 1995-1-1 according to ETA considering a timber density $\rho_k \leq 420 \text{ kg/m}^3$
- CLT: minimum distances for Cross Laminated Timber according to ÖNORM EN 1995-1-1 (Annex K) for nails and ETA 11/0030 for screws



ASSEMBLY



Drilling of the concrete support and hole cleaning

Injection of the chemical anchor into the hole

Positioning of the threaded rod

Installation of WHT angle bracket (with washer if prescribed)

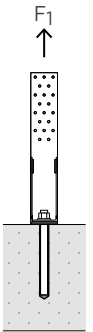
Nailing of the angle bracket

Positioning of the nut by adequate tightening

STRUCTURAL VALUES | TIMBER-TO-CONCRETE TENSILE JOINT

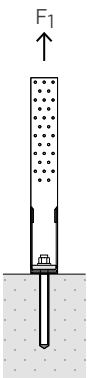
WHT340 - with or without WHTW50 washer

| configuration | R _{1,k} TIMBER | | | | R _{1,k} STEEL | | R _{1,d} CONCRETE | | | | | |
|-----------------------------------------------------------------------------------------------------------------|-------------------------|---------------|-------------------------|---------------------------------|------------------------|--------------------|------------------------------|------|------------------------------|------|------------------------------|--------------|
| | holes fastening Ø5 | | | R _{1,k} timber [kN] | R _{1,k} steel | | R _{1,d} uncracked | | R _{1,d} cracked | | R _{1,d} seismic | |
| | type | Ø x L [mm] | n _v [pcs] | | [kN] | Y _{steel} | VIN-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 8.8 Ø x L [mm] | [kN] |
| <ul style="list-style-type: none"> total fastening washer WHTW50 M16 anchor | LBA nails | Ø4,0 x 40 | 20 | 31,4 | 63,4 | Y _{M2} | M16 x 195 | 36,5 | M16 x 195 | 48,3 | M16 x 245 M16 x 195 | 24,3 18,4 |
| | | | Ø4,0 x 60 | 20 | | | | | | | | |
| <ul style="list-style-type: none"> partial fastening washer WHTW50 M16 anchor | LBA nails | Ø4,0 x 40 | 14 | 22,0 | 63,4 | Y _{M2} | M16 x 195 | 36,5 | M16 x 195 | 48,3 | M16 x 245 M16 x 195 | 24,3 18,4 |
| | | | Ø4,0x 60 | 14 | | | | | | | | |
| <ul style="list-style-type: none"> total fastening without washer M16 anchor | LBA nails | Ø4,0 x 40 | 20 | 31,4 | 42,0 | Y _{M0} | M16 x 160 | 30,7 | M16 x 160 | 38,9 | M16 x 245 M16 x 195 | 24,6 19,6 |
| | | | Ø4,0 x 60 | 20 | | | | | | | | |
| <ul style="list-style-type: none"> partial fastening without washer M16 anchor | LBA nails | Ø4,0 x 40 | 14 | 22,0 | 42,0 | Y _{M0} | M16 x 160 | 30,7 | M16 x 160 | 38,9 | M16 x 245 M16 x 195 | 24,6 19,6 |
| | | | Ø4,0x 60 | 14 | | | | | | | | |
| | | Ø5,0 x 40 | 14 | 22,0 | | | | | | | | |
| | | Ø5,0 x 50 | 14 | 27,0 | | | | | | | | |



WHT440 - with or without WHTW50 washer

| configuration | R _{1,k} TIMBER | | | | R _{1,k} STEEL | | R _{1,d} CONCRETE | | | | | |
|-----------------------------------------------------------------------------------------------------------------|-------------------------|---------------|-------------------------|---------------------------------|------------------------|--------------------|------------------------------|------|------------------------------|------|------------------------------|--------------|
| | holes fastening Ø5 | | | R _{1,k} timber [kN] | R _{1,k} steel | | R _{1,d} uncracked | | R _{1,d} cracked | | R _{1,d} seismic | |
| | type | Ø x L [mm] | n _v [pcs] | | [kN] | Y _{steel} | VIN-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 8.8 Ø x L [mm] | [kN] |
| <ul style="list-style-type: none"> total fastening washer WHTW50 M16 anchor | LBA nails | Ø4,0 x 40 | 30 | 47,1 | 63,4 | Y _{M2} | M16 x 245 | 46,4 | M16 x 245 | 51,9 | M16 x 330 M16 x 245 | 32,8 24,3 |
| | | | Ø4,0 x 60 | 30 | | | | | | | | |
| <ul style="list-style-type: none"> partial fastening washer WHTW50 M16 anchor | LBA nails | Ø4,0 x 40 | 20 | 31,4 | 63,4 | Y _{M2} | M16 x 245 | 46,4 | M16 x 245 | 51,9 | M16 x 330 M16 x 245 | 32,8 24,3 |
| | | | Ø4,0 x 60 | 20 | | | | | | | | |
| <ul style="list-style-type: none"> partial fastening without washer M16 anchor | LBA nails | Ø4,0 x 40 | 20 | 31,4 | 42,0 | Y _{M0} | M16 x 160 | 30,7 | M16 x 160 | 38,9 | M16 x 330 M16 x 245 | 34,0 24,6 |
| | | | Ø4,0x 60 | 20 | | | | | | | | |
| | | Ø5,0 x 40 | 20 | 31,4 | | | | | | | | |
| | | Ø5,0 x 50 | 20 | 38,6 | | | | | | | | |



NOTES FOR SEISMIC DESIGN

Particular attention has to be paid to the "capacity design" applied at different scale levels: the global structure and the connection system. Experimentally the ultimate strength of the LBA nail (and of the LBS screw) is notably larger than the characteristic strength evaluated according to EN 1995.

E.g. LBA nail Ø4 x 60 mm: R_{v,k} ≈ 2,8 - 3,6 kN by experimental tests (variable according to the type of timber and plate thickness).

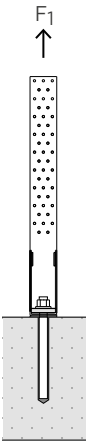
Experimental data derive from tests carried out within the Seismic-Rev research project and are reported in the scientific report: "Connection systems for timber buildings: experimental campaign to characterize stiffness, strength and ductility" (DICAM - Department of Civil, Environmental and Mechanical Engineering - UniTN).



STRUCTURAL VALUES | TIMBER-TO-CONCRETE TENSILE JOINT

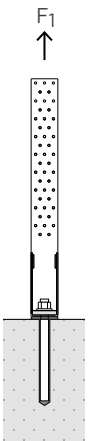
WHT540 - with WHTW50 washer (M16)

| configuration | R _{1,k} TIMBER | | | | R _{1,k} STEEL | | R _{1,d} CONCRETE | | | | | | | | | | | |
|----------------------------------------------------------------------------------------------------------------|-------------------------|---------------|-------------------------|---------------------------------|------------------------|-----------------|----------------------------|------------------------------|--------------------------|------------------------------|--------------------------|------------------------------|-----------|-------------|-----------|-------------|-----------|-------------|
| | holes fastening Ø5 | | | R _{1,k} timber [kN] | R _{1,k} steel | | R _{1,d} uncracked | | R _{1,d} cracked | | R _{1,d} seismic | | | | | | | |
| | type | Ø x L [mm] | n _v [pcs] | | [kN] | [kN] | Y _{steel} | VIN-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 8.8 Ø x L [mm] | [kN] | | | | | |
| <ul style="list-style-type: none"> total fastening washer WHTW50 M16 anchor | LBA nails | Ø4,0 x 40 | 45 | 70,7 | 63,4 | Y _{M2} | M16 x 245 | 46,4 | M16 x 245 | 52,0 | M16 x 330 | 32,8 | | | | | | |
| | | Ø4,0 x 60 | 45 | 86,9 | | | | | | | | | M16 x 195 | 36,5 | M16 x 195 | 48,3 | M16 x 245 | 23,5 |
| | screws LBS | Ø5,0 x 40 | 45 | 70,7 | | | | | | | | | M16 x 245 | 46,4 | M16 x 245 | 52,0 | M16 x 330 | 32,8 |
| | | Ø5,0 x 50 | 45 | 86,9 | | | | | | | | | M16 x 195 | 36,5 | M16 x 195 | 48,3 | M16 x 245 | 23,5 |
| <ul style="list-style-type: none"> partial fastening washer WHTW50 M16 anchor | LBA nails | Ø4,0 x 40 | 29 | 45,5 | 63,4 | Y _{M2} | M16 x 245 | 46,4 | M16 x 245 | 52,0 | M16 x 330 | 32,8 | | | | | | |
| | | Ø4,0 x 60 | 29 | 56,0 | | | | | | | | | M16 x 195 | 36,5 | M16 x 195 | 48,3 | M16 x 245 | 23,5 |
| | screws LBS | Ø5,0 x 40 | 29 | 45,5 | | | | | | | | | M16 x 245 | 46,4 | M16 x 245 | 52,0 | M16 x 330 | 32,8 |
| | | Ø5,0 x 50 | 29 | 56,0 | | | | | | | | | M16 x 195 | 36,5 | M16 x 195 | 48,3 | M16 x 245 | 23,5 |



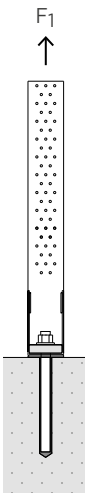
WHT540 - with washer WHTW50L (M20)

| configuration | R _{1,k} TIMBER | | | | R _{1,k} STEEL | | R _{1,d} CONCRETE | | | | | | | | | | | |
|-----------------------------------------------------------------------------------------------------------------|-------------------------|---------------|-------------------------|---------------------------------|------------------------|-----------------|----------------------------|------------------------------|--------------------------|------------------------------|--------------------------|------------------------------|-----------|-------------|-----------|--------------|-----------|-------------|
| | holes fastening Ø5 | | | R _{1,k} timber [kN] | R _{1,k} steel | | R _{1,d} uncracked | | R _{1,d} cracked | | R _{1,d} seismic | | | | | | | |
| | type | Ø x L [mm] | n _v [pcs] | | [kN] | [kN] | Y _{steel} | VIN-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 8.8 Ø x L [mm] | [kN] | | | | | |
| <ul style="list-style-type: none"> total fastening washer WHTW50L M20 anchor | LBA nails | Ø4,0 x 40 | 45 | 70,7 | 63,4 | Y _{M2} | M20 x 330 | 81,2 | M20 x 330 | 100,6 | M20 x 495 | 55,3 | | | | | | |
| | | Ø4,0 x 60 | 45 | 86,9 | | | | | | | | | M20 x 245 | 58,0 | M20 x 245 | 71,9 | M20 x 330 | 38,7 |
| | screws LBS | Ø5,0 x 40 | 45 | 70,7 | | | | | | | | | M20 x 330 | 81,2 | M20 x 330 | 100,6 | M20 x 495 | 55,3 |
| | | Ø5,0 x 50 | 45 | 86,9 | | | | | | | | | M20 x 245 | 58,0 | M20 x 245 | 71,9 | M20 x 330 | 38,7 |
| <ul style="list-style-type: none"> partial fastening washer WHTW50L M20 anchor | LBA nails | Ø4,0 x 40 | 29 | 45,5 | 63,4 | Y _{M2} | M20 x 330 | 81,2 | M20 x 330 | 100,6 | M20 x 495 | 55,3 | | | | | | |
| | | Ø4,0 x 60 | 29 | 56,0 | | | | | | | | | M20 x 245 | 58,0 | M20 x 245 | 71,9 | M20 x 330 | 38,7 |
| | screws LBS | Ø5,0 x 40 | 29 | 45,5 | | | | | | | | | M20 x 330 | 81,2 | M20 x 330 | 100,6 | M20 x 495 | 55,3 |
| | | Ø5,0 x 50 | 29 | 56,0 | | | | | | | | | M20 x 245 | 58,0 | M20 x 245 | 71,9 | M20 x 330 | 38,7 |



WHT620 - with WHTW70 washer (M20)

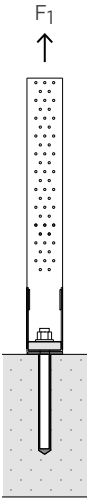
| configuration | R _{1,k} TIMBER | | | | R _{1,k} STEEL | | R _{1,d} CONCRETE | | | | | | | | | | | |
|----------------------------------------------------------------------------------------------------------------|-------------------------|---------------|-------------------------|---------------------------------|------------------------|-----------------|----------------------------|------------------------------|--------------------------|------------------------------|--------------------------|------------------------------|-----------|-------------|-----------|-------------|-----------|-------------|
| | holes fastening Ø5 | | | R _{1,k} timber [kN] | R _{1,k} steel | | R _{1,d} uncracked | | R _{1,d} cracked | | R _{1,d} seismic | | | | | | | |
| | type | Ø x L [mm] | n _v [pcs] | | [kN] | [kN] | Y _{steel} | VIN-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 8.8 Ø x L [mm] | [kN] | | | | | |
| <ul style="list-style-type: none"> total fastening washer WHTW70 M20 anchor | LBA nails | Ø4,0 x 40 | 55 | 86,4 | 85,2 | Y _{M2} | M20 x 330 | 78,4 | M20 x 330 | 81,3 | M20 x 495 | 55,3 | | | | | | |
| | | Ø4,0 x 60 | 55 | 106,2 | | | | | | | | | M20 x 245 | 56,6 | M20 x 245 | 69,8 | M20 x 330 | 37,3 |
| | screws LBS | Ø5,0 x 40 | 55 | 86,4 | | | | | | | | | M20 x 330 | 78,4 | M20 x 330 | 81,3 | M20 x 495 | 55,3 |
| | | Ø5,0 x 50 | 55 | 106,2 | | | | | | | | | M20 x 245 | 56,6 | M20 x 245 | 69,8 | M20 x 330 | 37,3 |
| <ul style="list-style-type: none"> partial fastening washer WHTW70 M20 anchor | LBA nails | Ø4,0 x 40 | 35 | 55,0 | 85,2 | Y _{M2} | M20 x 330 | 78,4 | M20 x 330 | 81,3 | M20 x 495 | 55,3 | | | | | | |
| | | Ø4,0 x 60 | 35 | 67,6 | | | | | | | | | M20 x 245 | 56,6 | M20 x 245 | 69,8 | M20 x 330 | 37,3 |
| | screws LBS | Ø5,0 x 40 | 35 | 55,0 | | | | | | | | | M20 x 330 | 78,4 | M20 x 330 | 81,3 | M20 x 495 | 55,3 |
| | | Ø5,0 x 50 | 35 | 67,6 | | | | | | | | | M20 x 245 | 56,6 | M20 x 245 | 69,8 | M20 x 330 | 37,3 |



STRUCTURAL VALUES | TIMBER-TO-CONCRETE TENSILE JOINT

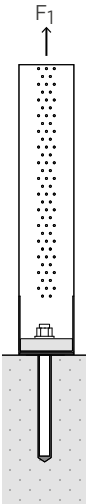
WHT620 - with WHTW70L washer (M24)

| configuration | R _{1,k} TIMBER | | | R _{1,k} STEEL | | R _{1,d} CONCRETE | | | | | | | | | | | | | |
|-----------------------------------------------------------------------------------------------------------------|-------------------------|---------------|-------------------------|---------------------------------|------------------------|---------------------------|------------------------------|-------------|------------------------------|-------------|------------------------------|-------------|-----------------|-----------|-------------|-----------|-------------|-----------|-------------|
| | holes fastening Ø5 | | | R _{1,k} timber [kN] | R _{1,k} steel | | R _{1,d} uncracked | | R _{1,d} cracked | | R _{1,d} seismic | | | | | | | | |
| | type | Ø x L [mm] | n _v [pcs] | | [kN] | Y _{steel} | VIN-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 8.8 Ø x L [mm] | [kN] | | | | | | | |
| <ul style="list-style-type: none"> total fastening washer WHTW70L M24 anchor | LBA nails | Ø4,0 x 40 | 55 | 86,4 | 85,2 | Y _{M2} | M24 x 330 | 94,0 | M24 x 330 | 95,9 | M24 x 495 | 46,2 | | | | | | | |
| | | Ø4,0 x 60 | 55 | 106,2 | | | | | | | M24 x 330 | | 31,2 | | | | | | |
| <ul style="list-style-type: none"> partial fastening washer WHTW70L M24 anchor | screws LBS | Ø5,0 x 40 | 55 | 86,4 | 85,2 | Y _{M2} | M24 x 330 | 94,0 | M24 x 330 | 95,9 | M24 x 495 | 46,2 | | | | | | | |
| | | Ø5,0 x 50 | 55 | 106,2 | | | | | | | M24 x 330 | | 31,2 | | | | | | |
| | LBA nails | Ø4,0 x 40 | 35 | 55,0 | | | | | | | 85,2 | | Y _{M2} | M24 x 330 | 94,0 | M24 x 330 | 95,9 | M24 x 495 | 46,2 |
| | | Ø4,0 x 60 | 35 | 67,6 | | | | | | | | | | | | | | M24 x 330 | |
| screws LBS | Ø5,0 x 40 | 35 | 55,0 | 85,2 | Y _{M2} | M24 x 330 | 94,0 | M24 x 330 | 95,9 | M24 x 495 | 46,2 | | | | | | | | |
| | Ø5,0 x 50 | 35 | 67,6 | | | | | | | M24 x 330 | | 31,2 | | | | | | | |



WHT740 - with WHTW130 washer (M27)

| configuration | R _{1,k} TIMBER | | | R _{1,k} STEEL | | R _{1,d} CONCRETE | | | | | | | | | | |
|-----------------------------------------------------------------------------------------------------------------|-------------------------|---------------|-------------------------|---------------------------------|------------------------|---------------------------|------------------------------|--------------|------------------------------|--------------|--------------|-----------------|-----------|--------------|-----------|--------------|
| | holes fastening Ø5 | | | R _{1,k} timber [kN] | R _{1,k} steel | | R _{1,d} uncracked | | R _{1,d} cracked | | | | | | | |
| | type | Ø x L [mm] | n _v [pcs] | | [kN] | Y _{steel} | HYB-FIX 5.8 Ø x L [mm] | [kN] | HYB-FIX 5.8 Ø x L [mm] | [kN] | | | | | | |
| <ul style="list-style-type: none"> total fastening M27 anchor washer WHTW130 | LBA nails | Ø4,0 x 40 | 75 | 117,8 | 158,6 | Y _{M2} | M27 x 495 | 153,3 | M27 x 495 | 153,3 | | | | | | |
| | | Ø4,0 x 60 | 75 | 144,8 | | | | | | | M27 x 330 | 100,9 | | | | |
| <ul style="list-style-type: none"> partial fastening M27 anchor washer WHTW130 | screws LBS | Ø5,0 x 40 | 75 | 117,8 | 158,6 | Y _{M2} | M27 x 330 | 144,9 | M27 x 330 | 100,9 | | | | | | |
| | | Ø5,0 x 50 | 75 | 144,8 | | | | | | | | | | | | |
| | LBA nails | Ø4,0 x 40 | 45 | 70,7 | | | | | | | 158,6 | Y _{M2} | M27 x 330 | 144,9 | M27 x 330 | 100,9 |
| | | Ø4,0 x 60 | 45 | 86,9 | | | | | | | | | | | | |
| screws LBS | Ø5,0 x 40 | 45 | 70,7 | 158,6 | Y _{M2} | M27 x 330 | 144,9 | M27 x 330 | 100,9 | | | | | | | |
| | Ø5,0 x 50 | 45 | 86,9 | | | | | | | | | | | | | |



GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-11/0086. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments. The connection design strength value is obtained from the values on the table as follows:

$$R_d = \min \left\{ \begin{array}{l} \frac{R_{k, \text{timber}} \cdot k_{\text{mod}}}{\gamma_M} \\ \frac{R_{k, \text{steel}}}{\gamma_{\text{steel}}} \\ R_{d, \text{concrete}} \end{array} \right.$$

The coefficients k_{mod} , γ_M and γ_{steel} should be taken according to the current regulations used for the calculation.

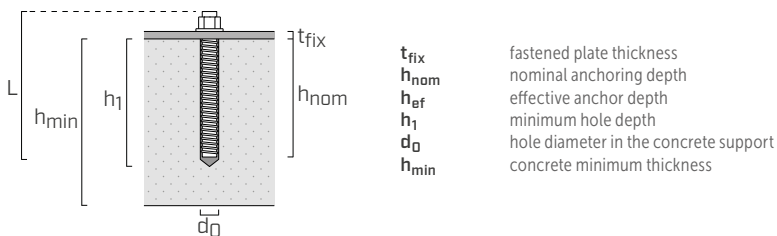
- The calculation process used a timber characteristic density of $\rho_k = 350 \text{ kg/m}^3$ and a C25/30 concrete strength class with a thin reinforcing layer, where there is no edge-distance and minimum thickness indicated in the installation parameters tables.

- Concrete design strength values are supplied for uncracked ($R_{1,d \text{ uncracked}}$), cracked ($R_{1,d \text{ cracked}}$) concrete and in case of seismic verification ($R_{1,d \text{ seismic}}$) for use of chemical anchor with threaded rod in steel class 5.8.
- Seismic design in performance category C2, without ductility requirements on anchors (option a2) elastic design according to EOTA TR045.
- Dimensioning and verification of timber and concrete elements must be carried out separately.
- For applications on CLT (Cross Laminated Timber) it is recommended to use nails/screws of adequate length to ensure that the fixing depth involves a sufficient timber thickness to prevent fragile failure for group effects.
- The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge), the anchors-to-concrete can be verified using MyProject calculation software according to the design requirements.

CHEMICAL ANCHORS INSTALLATION PARAMETERS⁽¹⁾

| type of rod Ø x L [mm] | WHT type | type of washer | t _{fix} | h _{nom} = h _{ef} [mm] | h ₁ [mm] | d ₀ [mm] | h _{min} [mm] |
|---------------------------|----------|--------------------------|------------------|--------------------------------------------|------------------------|------------------------|------------------------------|
| M16 | 160 | WHT340 / WHT440 | - | 9 | 132 | 140 | 18 |
| | 195 | WHT340 / WHT440 | - | 9 | 167 | 175 | |
| | | WHT340 / WHT440 / WHT540 | WHTW50 | 19 | 157 | 165 | |
| | 245 | WHT340 / WHT440 | - | 9 | 210 | 215 | |
| | | WHT340 / WHT440 | WHTW50 | 19 | 207 | 215 | |
| 330 | WHT540 | WHTW50 | 19 | 200 | 205 | | |
| M20 | 245 | WHT440 | - | 9 | 290 | 295 | 22 (HYB-FIX) 24 (VIN-FIX) |
| | | WHT540 | WHTW50 | 19 | 280 | 285 | |
| | 330 | WHT540 | WHTW50L | 19 | 280 | 285 | |
| | | WHT620 | WHTW70 | 29 | 270 | 275 | |
| | 495 | WHT540 | WHTW50L | 19 | 400 | 405 | |
| WHT620 | WHTW70 | 29 | 400 | 405 | | | |
| M24 | 330 | WHT620 | WHTW70L | 29 | 270 | 275 | 28 |
| | 495 | WHT620 | WHTW70L | 29 | 400 | 405 | |
| M27 | 330 | WHT740 | WHTW130 | 49 | 250 | 255 | 30 |
| | 495 | WHT740 | WHTW130 | 49 | 405 | 410 | |

INA precut INA threaded rod complete with nut and washer: see INA data sheet at www.rothoblaas.com



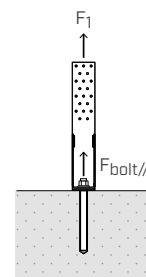
DIMENSIONING OF ALTERNATIVE ANCHORS

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 axial load on the WHT angle bracket

| | $k_{t//}$ |
|--------|-----------|
| WHT340 | 1,00 |
| WHT440 | 1,00 |
| WHT540 | 1,00 |
| WHT620 | 1,00 |
| WHT740 | 1,00 |



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

NOTES:

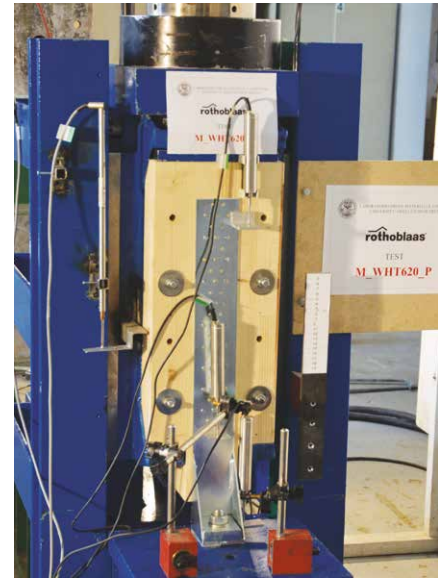
⁽¹⁾ Valid for the strength values shown in the table.

CONNECTION STIFFNESS

EVALUTATION OF SLIP MODULUS K_{ser}

- $K_{1,ser}$ experimental average value for WHT joints on GL24h Glulam and on CLT

| WHT type | configuration | fastening type $\varnothing \times L$ [mm] | n_v [pcs] | $K_{1,ser}$ [N/mm] | |
|----------|---------------------------------------|-----------------------------------------------|----------------|--------------------|--------------|
| | | | | GL24h | CLT |
| WHT340 | • total fastening • without washer | LBA nails $\varnothing 4,0 \times 60$ | 20 | - | 3440 |
| | • total fastening • with washer | LBA nails $\varnothing 4,0 \times 60$ | 20 | 5705 | 7160 |
| | • partial fastening • with washer | LBA nails $\varnothing 4,0 \times 60$ | 12 | - | 5260 |
| WHT440 | • total fastening • with washer | LBA nails $\varnothing 4,0 \times 60$ | 30 | 6609 | 10190 |
| | • partial fastening • with washer | LBA nails $\varnothing 4,0 \times 60$ | 20 | - | 8060 |
| WHT540 | • total fastening • with washer | LBA nails $\varnothing 4,0 \times 60$ | 45 | - | 11470 |
| | • partial fastening • with washer | LBA nails $\varnothing 4,0 \times 60$ | 29 | - | 9700 |
| WHT620 | • total fastening • with washer | LBA nails $\varnothing 4,0 \times 60$ | 52/55 | 13247 | 13540 |
| | • partial fastening • with washer | LBA nails $\varnothing 4,0 \times 60$ | 30/35 | 9967 | 10310 |



Seismic-REV experimental campaign on GL24h glulam (DICAM-University of Trento and CNR-IVALSA San Michele All'Adige, 2015).

- K_{ser} according to EN 1995-1-1 for timber-to-timber joint nails* GL24h/C24

Nails (without pre-drilling hole) $\frac{\rho_m^{1,5} \cdot d^{0,8}}{30}$ (EN 1995 § 7.1)

| WHT type | fastening type $\varnothing \times L$ [mm] | n_v [pcs] | K_{ser} [N/mm] |
|----------|-----------------------------------------------|----------------|---------------------|
| WHT340 | LBA nails $\varnothing 4,0 \times 60$ | 14 | 12177 |
| | | 20 | 17395 |
| WHT440 | LBA nails $\varnothing 4,0 \times 60$ | 20 | 17395 |
| | | 30 | 26093 |
| WHT540 | LBA nails $\varnothing 4,0 \times 60$ | 29 | 25223 |
| | | 45 | 39139 |
| WHT620 | LBA nails $\varnothing 4,0 \times 60$ | 35 | 30442 |
| | | 55 | 47837 |

* For steel-to-timber connections the reference standard indicates the possibility of doubling the value of K_{ser} listed in the table (7.1 (3)).



Experimental campaign on CLT panels (C24) (CNR-IBE San Michele All'Adige, 2020).