1/2019

Connecting systems

for modern prefabricated walls

Certainly a great connection.

CE ETA

KNAPP®
connectors.com

Welcome to the World of KNAPP®!

As a manufacturer of patented connecting systems, we develop and produce high-quality products that are distributed worldwide. Not only our connecting systems convince, they also inspire you with the wide range of applications. The comprehensive service offers the possibility to find the best, most efficient and innovative solution for the realization of your projects. On the following pages, you will find our connecting systems for modern prefabricated walls. Every connector allows high level of prefabrication and possesses the CE- and Ü-Marking in accordance with European and German certification of standards. Regular external inspections guarantee maximum security for planners, architects, manufacturers and owners.

Friedrich Knapp
Company founder

Our Service

The KNAPP®-Team provides competent advice and excellent service for your projects.

We offer a full coverage service by representatives in Germany and Austria. You will find the right contact person easily and quickly.
www.knapp-connectors.com

You can reach our internal consultants in Germany and Austria, Monday – Tuesday 8 a.m. to 4.30 p.m. and on Friday 8 a.m. to 12 p.m.
www.knapp-connectors.com/contact

Our Planner Service

Planner service

We offer comprehensive planning and structural-engineering calculations for architects, planners and structural engineers. Contact us for your next project! We also offer statics pre-dimensioning and help you find the right connector from KNAPP®. Take advantage of our engineers' consulting, our "know-how", and many years of experience. You can also use the pre-measurement tool from our website.
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KNAPP® offers the right connection for the areas of:

Timber construction | Post-beam wood-glass-facade | Prefab walls | Timber construction engineering | Door- and window construction | Furniture and interior design | Glued glass elements for timber and metal construction

More information
www.knapp-connectors.com/downloads

WALCO® V | The connector for prefab wall up to 7 kN*

Features:

- Universal connection to wood, steel and concrete
- For timber width from 80 mm upwards
- No milling is necessary for thicknesses 13 /15 mm necessary
- Fast and accurate on-site assembly without screws are assembled without screw on-site
- Particularly easy retraction of the locking screw by generously shaped receiving hopper (V system)
- Screw collar and collar bolts are screwed directly in the component with or without interlayer
- Hang on end walls and connected subsequently to partitioning
- Setting joint intervals e.g. for seals and readjustment of building tolerances
- Stable from the first wall corner on
- ETA inkludes hardwood components and BauBuche

WALCO® V60

WALCO® V80

made in Germany

ETA

CE

The clip lock, made from stainless spring steel, locks the connection against slide-in direction and supports the starting power Z_A from one wall unit to the other.

The V-shape fork catches the holding screw and lines them in exact position.

The WALCO® V holding screw is the counter part to the connector. It comes in four different versions.

3-5 pcs. WALCO® V hex-head wood screws 6x50 mm.

WALCO® V is made of premium quality steel, hot-dip galvanized and produced in Germany.

Installation example:
Mounted on the wall with double-sided element seals.

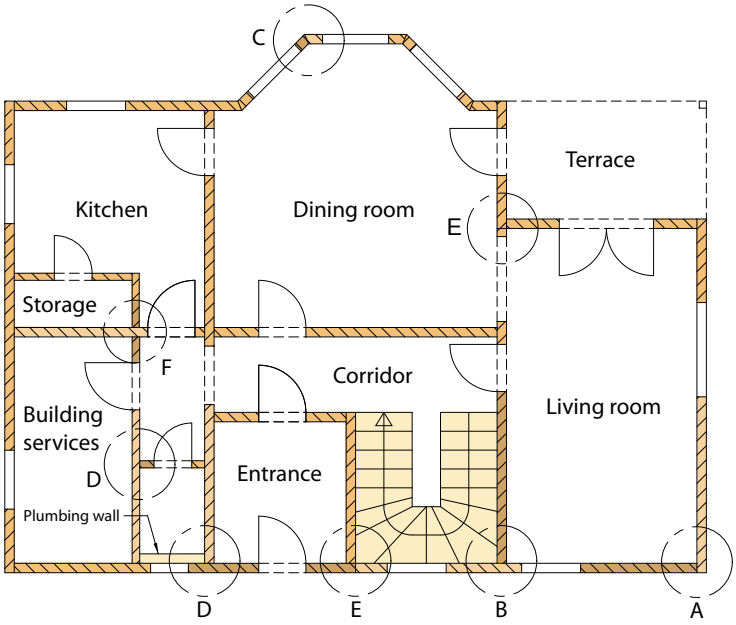
Installation example:
Mounted on the wall element.

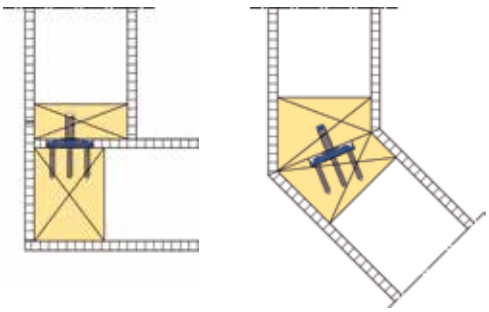
More information:
http://www.knapp-verbinder.com/en/product/walco-v/

*Design values $F_{2,Rd}$ in the insertion direction (k_{mod} = 0,9, GL24h) apply only to the use of original KNAPP® CS-screws according to ETA-10/0189.

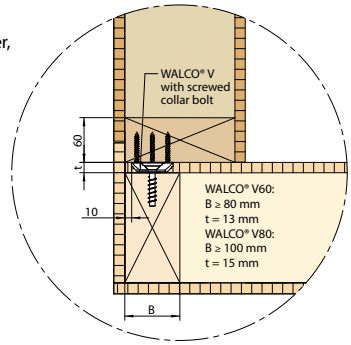
WALCO® V60 / V80

Application examples and connection details

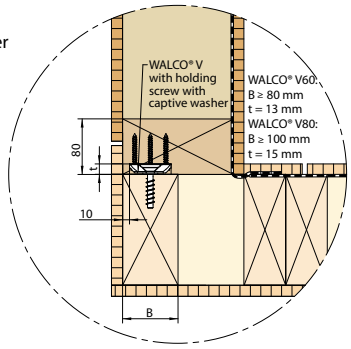




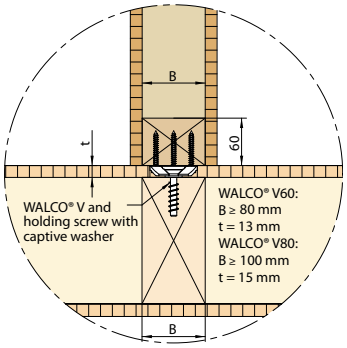
Detail A_1:
External wall corner, planked with wood-based panel



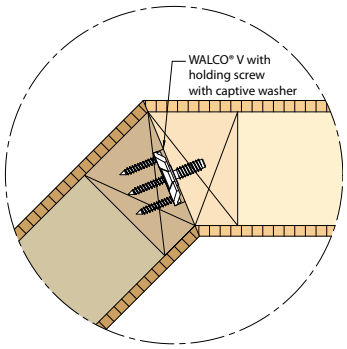
Detail A_2:
External wall corner with vapor barrier (PE- lm)



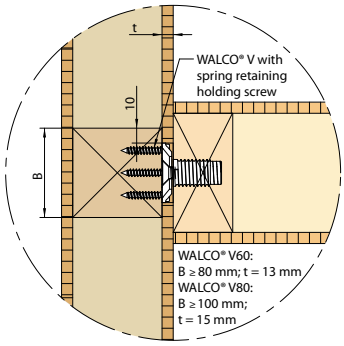
Detail B:
External wall connection
Internal wall connection



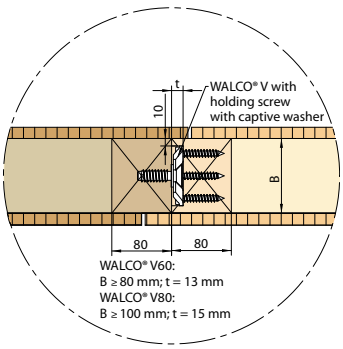
Detail C:
External wall mitre corner



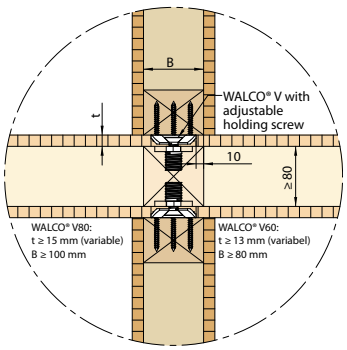
Detail D:
Internal wall connection (e. g. plumbing wall)



Detail E:
External wall straight joint
Internal wall straight joint



Detail F:
Internal wall crossing



WALCO® V60 / V80

Load capacity

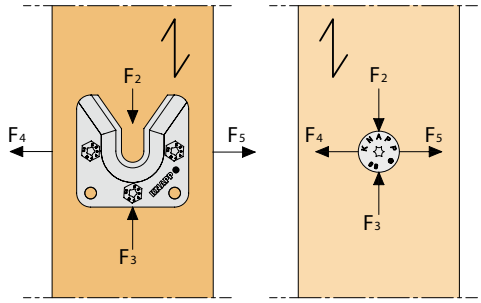
Connector	Wood quality	Charact. values		Design values $F_{2,Rd}$ [kN]		Design values $F_{3,Rd}$ [kN]		Design values $F_{45,Rd}$ [kN]	
				k_{mod} [service class 1+2]		k_{mod} [service class 1+2]		k_{mod} [service class 1+2]	
		$F_{2,Rk}$ kN]	$F_{45,Rk}$ kN]	0,6	0,9	0,6	0,9	0,6	0,9
WALCO® V60 KS	C24	5,94	3,88	2,74	4,11	1,3	1,3	1,79	2,69
	GL 24h	6,53	4,27	3,01	4,52			1,97	2,96
	CLT	6,45	4,22	2,98	4,47			1,95	2,92
WALCO® V80 KS	C24	7,10	4,46	3,28	4,92	1,3	1,3	2,06	3,09
	GL 24h	7,81	4,91	3,60	5,41			2,27	3,40
	CLT	7,71	4,85	3,56	5,34			2,24	3,36

$F_{2,Rd}$ Design values in direction of insertion
$F_{3,Rd}$ Design values against the direction of insertion
$F_{45,Rd}$ Design values perpendicular to the direction of insertion

k_{mod} Modification factors for duration of load and moisture content
$k_{mod} = 0,6$ => Permanent (more than 10 years for example self weight)
$k_{mod} = 0,8$ => Medium term (1 week - 6 months for example imposed floor load, snow load)
$k_{mod} = 0,9$ => Short term (shorter than one week, for example snow- and wind load)

ETA

Values can be found on the website.



Characteristic values, permissible load values and design values refer to wood material and direction of stress.

Practical examples

The values listed below are given as an example and calculated according to EN 1991-1-4. The following table gives you recommendations regarding the wall length B in addition to the wind load w_d and also the number of installed connectors. The wind load w_d=0,6 kN/m² to the designed wind load of German midland wind area 1 (impact pressure q = 0,5 kN/m², aerodynamics factor c_{pe}=0,8, v=102 km/h). The listed wind loads are referring to the following wind areas:

$w_d = 1,0$ kN/m² (q = 0,8 kN/m², $c_{pe} = 0,8$, v = 129 km/h)
$w_d = 1,5$ kN/m² (q = 1,25 kN/m², $c_{pe} = 0,8$, v = 160 km/h)
$w_d = 1,9$ kN/m² (q = 1,55 kN/m², $c_{pe} = 0,8$, v = 179km/h) 18 m < H <= 25 m
Derivation: $w_d = \gamma_Q \cdot c_{pe} \cdot q = \gamma_Q = 1,5$

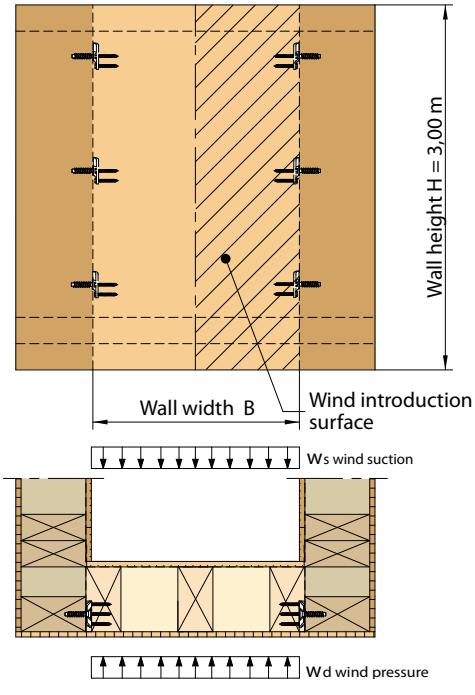


Table 1: Wall width B in dependence of the number of connectors and wind load.
We recommend min. 3 WALCO® V connectors for external wall corner.

Qty/joint	Connector	Max. length of wall B [m]			
		Designed wind load [kN/m²]			
		$w_d = 0,6$	$w_d = 1,0$	$w_d = 1,5$	$w_d = 1,9$
3	WALCO® V60 KS	9,0	5,4	3,6	2,8
4		12,0	7,2	4,8	3,8
5		14,9	9,0	6,0	4,7
3	WALCO® V80 KS	10,3	6,2	4,1	3,3
4		13,7	8,2	5,5	4,3
5		17,2	10,3	6,9	5,4

The graph shows the load directions and installation. Design values given in the table below should be used for structural analysis according to EC5 (EN 1995-1-1).
The values listed below are given as examples and valid for Germany only!

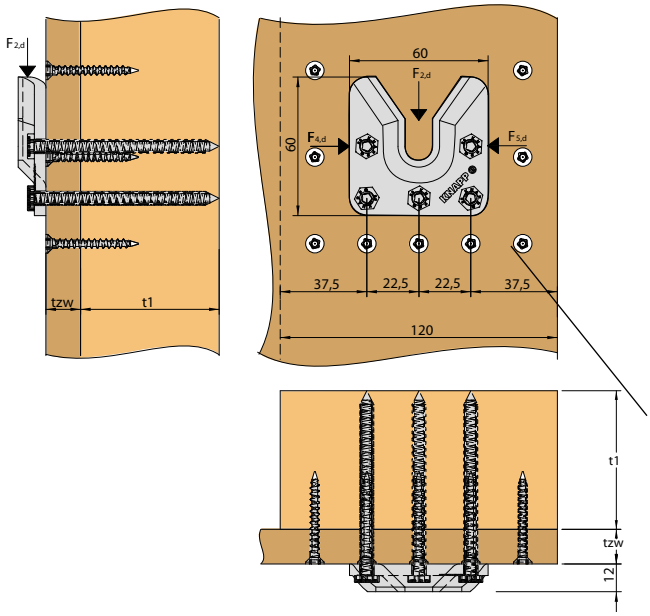
WALCO® V60 / V80

Permissible load values with interlayer

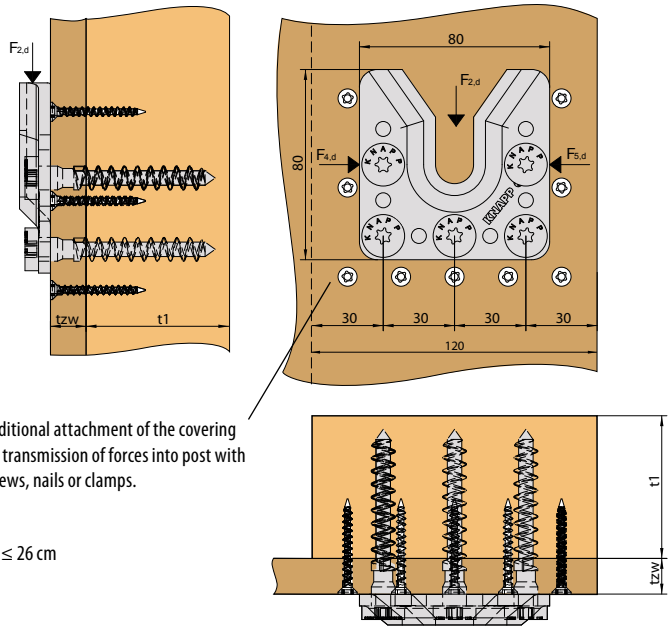
Thickness t_{zw} [mm]	Interlayer/ Stud	WALCO® V60 5 screws 6x80 1 screw 12x60				WALCO® V80 3 screws 10x80 1 screw 16x60			
		Design values of load-bearing capacity F_{Rd} [kN]				Design values of load-bearing capacity F_{Rd} [kN]			
		$F_{2,Rd}$ [kN] [permanent]	$F_{2,Rd}$ [kN] [medium]	$F_{2,Rd}$ [kN] [short]	$F_{45,Rd}$ [kN] [short]	$F_{2,Rd}$ [kN] [permanent]	$F_{2,Rd}$ [kN] [medium]	$F_{2,Rd}$ [kN] [short]	$F_{45,Rd}$ [kN] [short]
12	Plasterboard / C24	1,4	2,8	3,4	2,7	2,1	4,2	4,9	3,1
15		1,5	3,0	3,7		2,3	4,4		
12	OSB Plate / C24	2,4	3,7	4,1	2,7	2,8	4,4	4,9	3,1
15		2,2	3,7	4,1		2,8	4,4		
13	Particleboard / C24	1,9	3,3	4,0	2,7	2,3	3,9	4,8	3,1
19		1,8	3,1	3,8		2,3	4,0	4,8	
13	Sheetrock / C24	2,7	3,7	4,1	2,7	3,3	4,4	4,9	3,1
15						3,3	4,4		

ETA

WALCO® V60



WALCO® V80



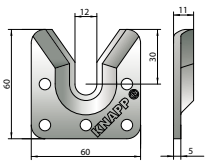
Additional attachment of the covering for transmission of forces into post with screws, nails or clamps.

$t_{zw} \leq 26$ cm

WALCO® V directly to intermediate layer (cladding) attached:
When screwing the WALCO® V connector directly to an intermediate layer, the design values listed below come into force, these relate to the Construction Licensing ETA-10/0189 and on the DIN 1995-1-1 (EC5). The values in the different load duration classes and the action directions are divided. Additionally, note that the interlayer force-fits with screws, nails or staples is fastened with a wooden stand (see picture above: auxiliary screwed).

WALCO® V60 incl. holding screw and hex-head wood screws

Art.-Nr. **KS:** K102 / **EH:** K104 / **GH:** K106 / **VK:** K108

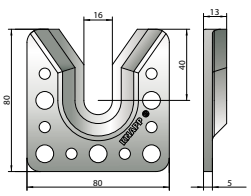


Holding screw wall 1	Screwing wall 2	Charact. values [C24]		
		$F_{2,Rk}$ [kN]	$F_{45,Rk}$ [kN]	$F_{1,Rk}$ [kN]
KS 12x60	3 pcs. 6x50	5,9	3,9	6,5
EH M12	3 pcs. 6x50	5,1	3,0	4,7
VK D12	3 pcs. 6x50	3,9	3,9	3,9
GH M12	3 pcs. 6x50	6,5	4,3	6,9

Minimum timber cross section: WxD = 80 x 60 mm

WALCO® V80 incl. holding screws and hex-head wood screws

Art.-Nr. **KS:** K103 / **EH:** K105 / **GH:** K107 / **VK:** K109



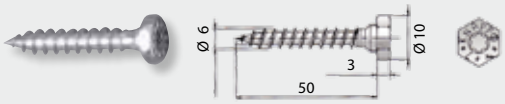
Holding screw wall 1	Screwing wall 2	Charact. values [C24]		
		$F_{2,Rk}$ [kN]	$F_{45,Rk}$ [kN]	$F_{1,Rk}$ [kN]
KS 16x60	3 pcs. 10x60	7,1	4,5	7,1
EH M16	3 pcs. 10x60	6,7	3,9	6,4
VK D16	3 pcs. 10x60	5,9	5,1	6,5
GH M16	3 pcs. 10x60	13,7	7,2	14,1

Minimum timber cross section: WxD = 100 x 60 mm

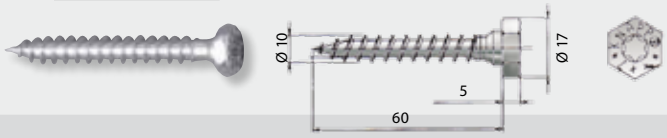
WALCO® V60 / V80

WALCO® V hex-head wood screws

Art.-No. Z550 V60 Hex-head wood screw 6x50



Art.-No. Z551 V80 Hex-head wood screw 10x60

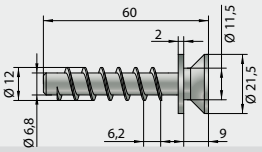


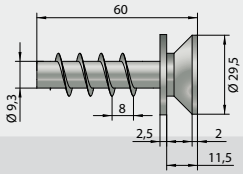
Application: To screw on WALCO® V.

WALCO® V holding screws — WALCO® V60 / V80

Holding screw with captive washer (KS)

Art.-No Z552 V60 KS 12x60
Art.-No. Z553 V80 KS 16x60

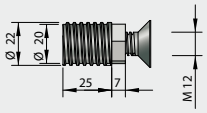


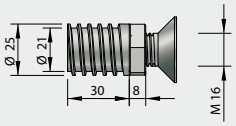


Application: For prefabrication of timber frame walls.

Retaining holding screw (EH)

Art.-No. Z554 V60 EH M12
Art.-No. Z555 V80 EH M16

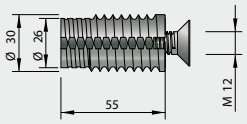


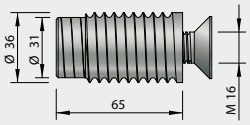


Application: For prefabricated walls in frame constructions and halls.

Retaining spring holding screw (GH)

Art.-No. Z566 V60 GH M12
Art.-No. Z567 V80 GH M16

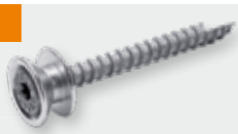


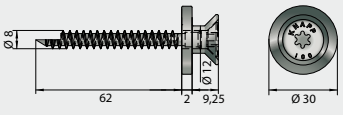


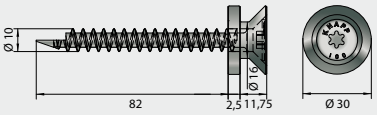
Application: For insertion between two fixed walls (for example installation walls).

Collar bolt holding screw (VK)

Art.-No. Z556 V60 VK D12
Art.-No. Z557 V80 VK D16





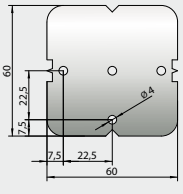


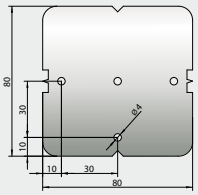
Application: For plywood and interlayers, length of the screws as necessary.

Accessories

WALCO® V drilling-jig (made of steel) — WALCO® V60 / V80

Art.-No. K578 Drilling-jig WALCO® V60
Art.-No. K579 Drilling-jig WALCO® V80

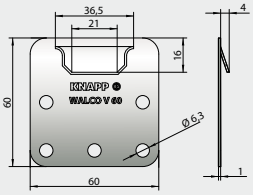


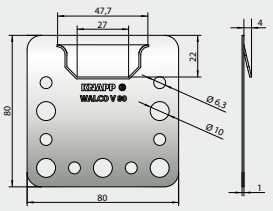


Application: For marking and copying pilot drills connector and holding screws.

WALCO® V clip lock (made of stainless steel)

Art.-No. K112 Clip lock WALCO® V60
Art.-No. K113 Clip lock WALCO® V80





Application: Locks and is loadable counter to the insertion direction, for example tensile forces in the connection of anchor.

WALCO® V PH-screws

Art.-No. Z521 PH-screw 10x80
Art.-No. Z522 PH-screw 10x120

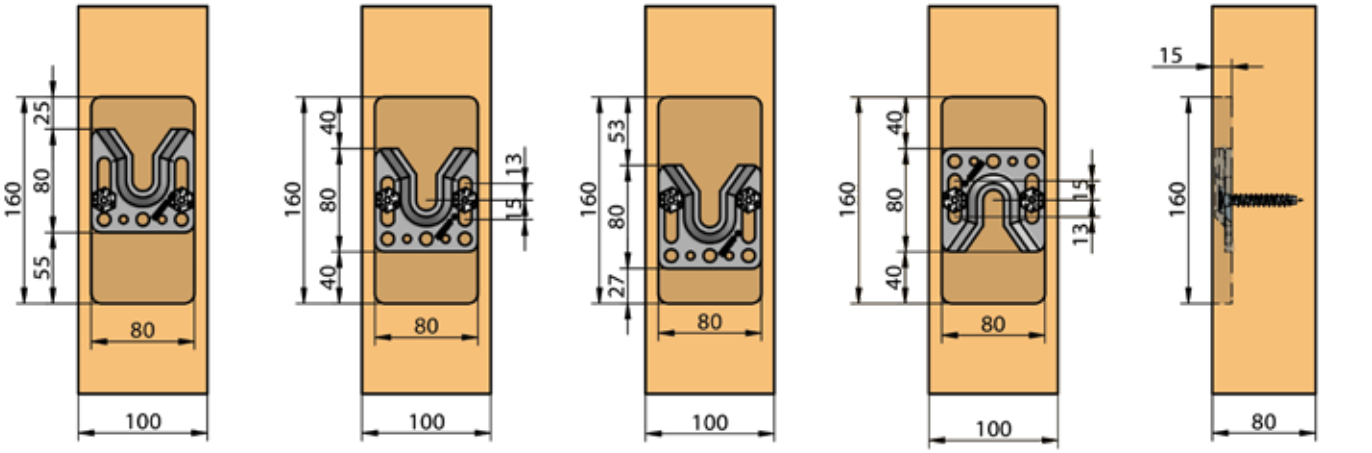
Application: With special solutions, such as planking or oblique gland.

WALCO® V 80 Oblong-hole | The tolerance compensation wall connector for prefab walls

Features:

- Solid and non-visible connector for joining prefabricated timber frame and CLT walls together, as well as steel and concrete.
- The WALCO® V Oblong-hole version provides more flexible, faster and accurate installation and assembly on site.
- To compensate possible lack of precision, it can be flexibly positioned +/- 15 mm in height and +/- 2 mm in width.
- WALCO® V Oblong-hole connector is load-bearing on traction, as well as horizontal direction.

Adjustability



Connector plate – top

Connector plate – center

Connector plate – bottom

Connector plate – center180° turned

Routing dimensions

Load values

Connector	Wood quality	Min. cross section of square timber	Charact. values	Design values $F_{45,Rd}$ [kN]	
				k_{mod} [service class 1+2]	
			$F_{45,Rk}$ [kN]	0,9	1,0
WALCO® V 80 oblong hole	C24	100x60 for KS and 100x80 for oblong hole plate	4,46	3,09	3,43
	GL24h		4,91	3,40	3,78
	CLT		4,85	3,36	3,73

CLT with characteristic bulk density ρk ≥ 380 kg / m^3
Load direction F_2 and F_3 cannot be used due to the connector's adjustability.

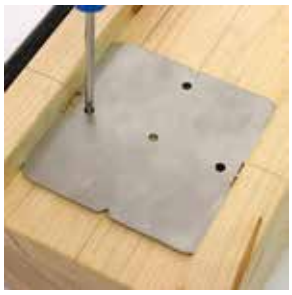
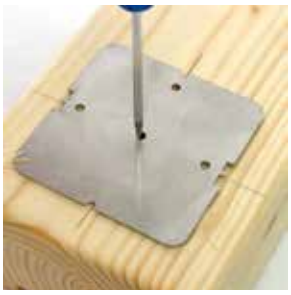
Installation example: WALCO® V Oblong-hole directly bolted on a OSB board

WALCO® V

Installation

- Simple and fast installation with routing machine and optional KNAPP® template.
- Installation with CNC joinery machine possible – all data for the standard CNC joinery machine programs is included.
- Recommended software partners for machine processing:

Milling dimensions WALCO® V			
	Width	Length	Depth
V60	60 mm	80 mm	13 mm
V80	80 mm	100 mm	15 mm
V80L	80 mm	160 mm	15 mm

1) If necessary make milling, mark drilling.

CNC joinery machine


2) Pre-drill screws (see installation instructions).



3) Screw on WALCO® V with the provided screws and retaining screw in counterpart.





Helicopter assembly | House on the Rigi (CH)

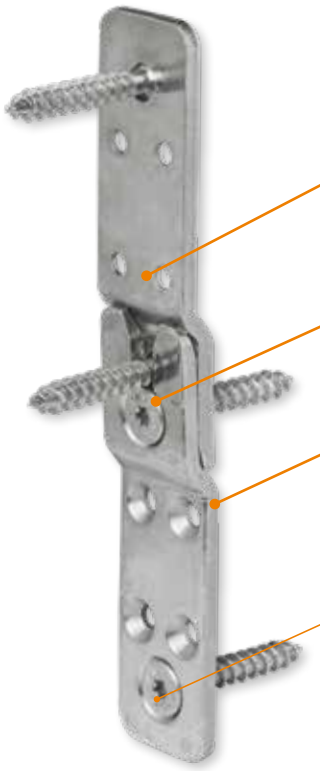
For construction manuals, .DXF drawings for WALCO® V-System or to find a KNAPP personal consultant in your area, please visit:

www.knapp-connectors.com/downloads

WALCO® 40 | The wall connector for timber frame construction up to 11 kN*

Features:

- Efficient wall connectors in timber frame and wood panels
- For timber width from 60 mm up
- For timber according to DIN 1052 and Eurocode 5 (EN 1995-1-1)
- High degree of prefabrication – no screwing on-site is necessary
- Plug connection – the wall parts are assembled without screwing
- Self-tightening, stable and invisible – the structure is stable from the first corner on
- Wood frame and plywood board walls frictionally interconnected
- ETA includes hardwood components and BauBuche



The starting angle and the guide slot for the KNAPP® CS-retaining screws bring the connector pieces into position and draw them tight.

The KNAPP® CS-retaining screw allows for adjustments to the compression of joints.

WALCO® 40 is comprised of two structurally identical connector pieces and is made from high-quality, blue galvanized steel.

The 10 mm CS-screws with integrated drilling tip enable rapid fastening with screws; the reinforced shaft provides connections to be made in a force-locking manner.

Installation example:
Mounted on the wall with double-sided element seals.

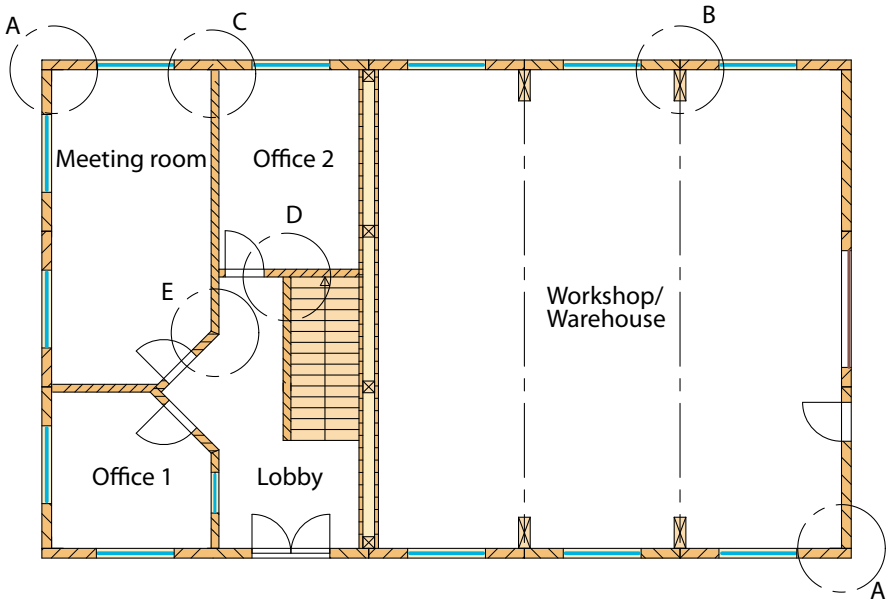
More information:
www.knapp-connectors.com/walco40

*Characteristic values $F_{2,Rk}$ in direction of insertion (k_{mod} = 0,9, GL24h) are only valid when using KNAPP® CS-screws and relate to the type of wood under C24 according to ETA-10/0189. The figures relate to the use of 2 pcs. KNAPP® CS-screws 10x60 mm.

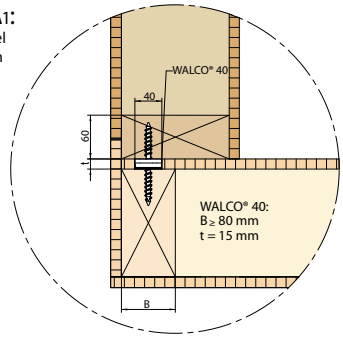
WALCO® 40

Application examples and connection details

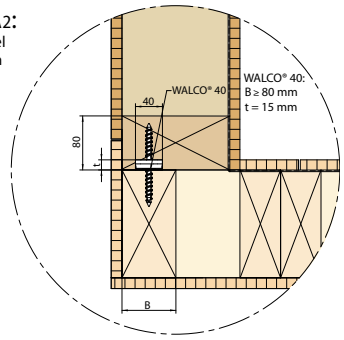
Timber frame construction



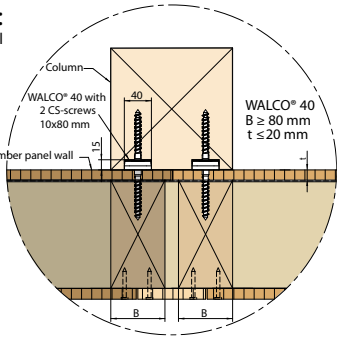
Detail A1:
Timber panel construction external wall corner



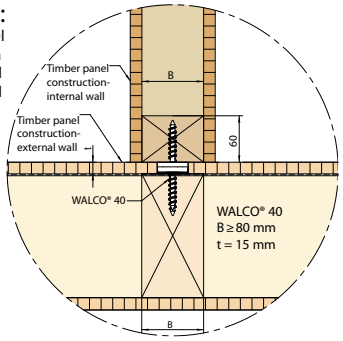
Detail A2:
Timber panel construction external wall corner



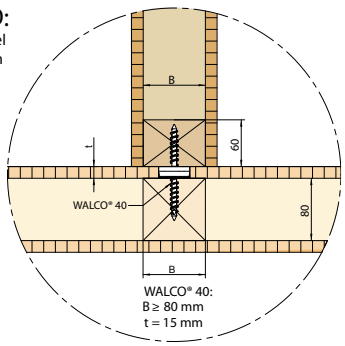
Detail B:
Timber panel construction external wall column joint



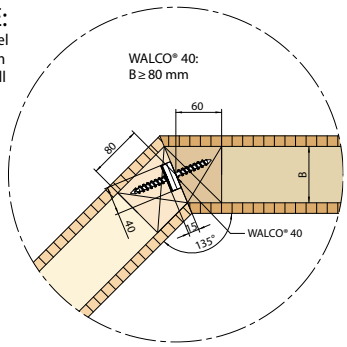
Detail C:
Timber panel construction external wall joint internal wall joint



Detail D:
Timber panel construction internal wall joint

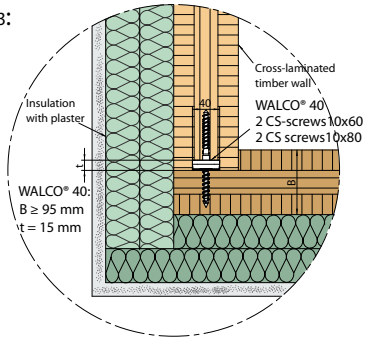


Detail E:
Timber panel construction external wall mitre joint

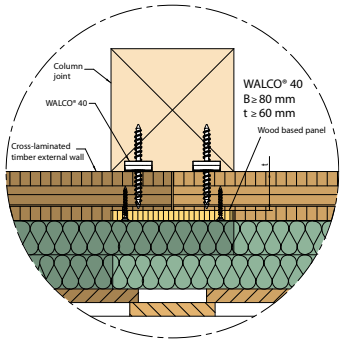


Precast walls with plywood board

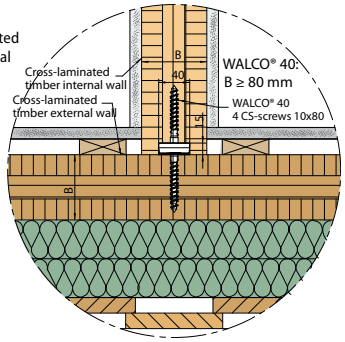
Detail A3:
Timber panel construction external wall corner



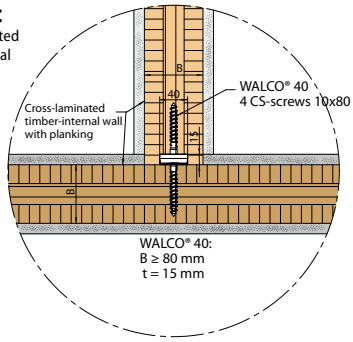
Detail B:
Timber panel construction external wall column joint



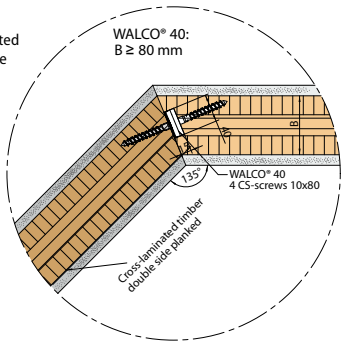
Detail C:
Cross-laminated timber internal wall joint/ external wall joint



Detail D:
Cross-laminated timber internal wall joint



Detail E:
Cross-laminated timber double side planked



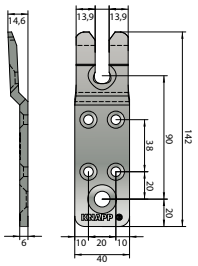
WALCO® 40

Wall connection system with KNAPP® CS-screws

Art.-No. K072

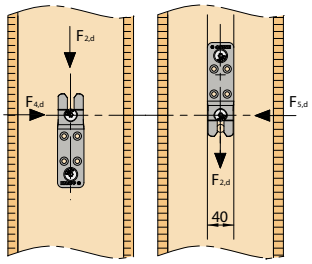
Screwing	
Wall 1	Wall 2
2 pcs. SK 10x60 mm	2 pcs. SK 10x60 mm

Minimum timber cross section: WxD = 60 x 60 mm



Load capacity

Connector	Wood quality	Min cross section of square timber	Charact. values F_{Rk} [kN]			Design value of load bearing capacity F_{Rd} [kN]			
			$F_{1,Rk}$ [kN]	$F_{2,Rk}$ [kN]	$F_{45,Rk}$ [kN]	$F_{1,Rd}$ k_{mod}= 0,9	$F_{2,Rd}$ k_{mod}= 0,6	$F_{2,Rd}$ k_{mod}= 0,9	$F_{45,Rd}$ k_{mod}= 0,9
WALCO® 40	C24	Internal wall: 60x60 External wall: 100x60	4,70	11,40	7,94	3,25	5,26	6,70	5,50
	GL24h		5,08	12,00	7,94	3,30	5,54	6,70	5,50
	CLT		5,02	11,90	7,94	3,30	5,49	6,70	5,50



Connector / joint	Max. wall length B [m]			
	Design value for wind load [kN/m²]			
	w_d = 0,6	w_d = 1,0	w_d = 1,5	w_d = 1,9
3	10,8	6,8	4,3	3,5
4	14,5	9,0	5,8	4,7

$F_{2,Rk}$ Characteristic resistance in the insertion direction
$F_{45,Rk}$ Characteristic resistance perpendicular to the insertion direction
$F_{1,Rk}$ Characteristic resistance perpendicular to the plane connector (pull load)

$F_{2,Rd}$ Design resistance in the insertion direction
$F_{45,Rd}$ Design resistance perpendicular to the insertion direction
$F_{1,Rd}$ Design resistance perpendicular to the connector level (pull load)

k_{mod} Modification factors for duration of load and moistrure content 1 and 2
k_{mod} = 0,6 => Permanent, k_{mod} = 0,8 => Medium term, k_{mod} = 0,9 => Short term

The values of the indexes refer to a wall hight of 3 m.
(Indications about wind loads on page 5)

Design values of the load F_d (connection power of dead load, live load, wind and snow), according to EN 1991-1-4, the table shows the ratings of load resistance R_d (capacity of the connector) represents the ultimate limit states for Eurocode 5.

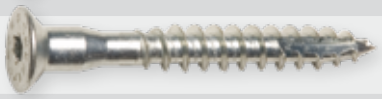
Values can be found on the website.

KNAPP® CS-screws (WALCO® 40 will supplied with the appropriate CS-screws)

Art.-No. Z519 KNAPP® CS-screw 10x60 with cut-point and reinforced shank

Utilisation : To screw on connector on stud.

Art.-No. Z523 KNAPP® CS-screw 10x80 with cut-point and reinforced shank



Utilisation : To screw on connector in use of additional wood-based panel layer (detail B, page 9) and connection of cross-laminated timber.

WALCO® 40

Drilling-jig WALCO® 40 (Aluminium)

Art.-No. K466

Application: Pre-drilling of screw holes.

WALCO® 40

Installation

- Easy and fast processing with machining center or portable woodworking router.
- Installation with CNC joinery machine possible – all data for the standard CNC joinery machine programmes are included
- Recommended software partners for machine processing:

1) Predrilling with drilling-jig

Size of rebate WALCO® 40		
Width	Length	Depth
40 mm	continuous	15 mm

2) Screw on

3) Screw on counter part

Construction manuals, .DXF drawings for WALCO® 40 as well as your personal consultant in your area, please visit:
www.knapp-connectors.com/downloads

WALCO® V / WALCO® 40

Selected reference project

Object: Wood constructed house in Bad Aibling (DE); **Planner:** SCHANKULA Architekten/Diplomingenieure, www.schankula.com;
Wood Constructions: Huber & Sohn GmbH & Co. KG, www.huber-sohn.de

Object: Family house on the Rigi (CH); **Architect + Planner:** Schweizer Naturhaus CH-Koblenz, www.natur-haus.ch;
Timber construction: Die Holzwerkstatt Matthias Ebi, Nöggenschwiel, www.ebi-holzwerkstatt.de; **Static:** Ingenieurbüro Rotkamm Albbruck, www.rotkamm.de; **Method of construction:** Stand-plank wood construction; **Energy Standard:** Low energy according to Swiss standard

Object: 9 apartment units in a backyard, London-Harlesden; **Construction time**: Decembre 2008 - Decembre 2010;
Architect: SUSD, GB-London W11 1HG, www.susd.co.uk; **Statics**: Dr. Dubslaff & Rosenkranz, D-59939 Olsberg, www.rdr-energie.de

WALCO® V / WALCO® 40

Selected reference project

Object: Floor heightening in Rosenheim (DE); **Construction time:** 2014; **Architect:** Architekturbüro Anselm Kanno, http://www.architekt-kanno.de/; **Timber builder:** Holzbau Schröder, http://www.holzbau-hschroeder.de/; **Connection system:** WALCO® V

Object: McCube, Winklarn (AT); **Construction time:** 2014; **Builder:** Martina Kies; **Architect:** Mc Cube Homes GesmbH www.mccube.at; **Timber builder:** Fahrenberger GmbH www.zimmerei-f.at; **Connection system:** WALCO ® V

Object: Charlets in Waidring (AT); **Construction time:** 2016; **Builder/Project developer/Architect:** Holzbau Foidl, Rosenegg 36, 6391 Fieberbrunn, http://www.holzbau-foidl.at/; **Connection system:** WALCO® 40

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