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Hilti MT system fastened on timber with Hilti S-WWP and S-WDF screws

Dear customer,

Hilti conducted investigations to evaluate the performance of the support systems consisting of MT system portfolio fastened on timber with Hilti screws S-WWP and S-WDF.
Two main installation types have been analyzed and a recommendation on appropriate screws is provided in order to ensure the overall system integrity under static loads:

A) Fastening of MT channels to timber, as headrail application
B) Fastening of MT welded brackets and MT base connectors to timber

A) Fastening on MT channels to timber for headrail applications with S-WWP screws

The Hilti screws S-WWP are qualified for use in timber construction under the scope of ETA-22/0772 [1]. In such documents [1] a clearance hole diameter in the fixture is prescribed, based on the nominal diameter of the fastener.
The fastening of Hilti MT channels MT-30, MT-40, MT-50 and MT-60 with the above-mentioned screws does not deviate from the requirements for clearance hole diameter specified in [1] when the round holes are used.
Hilti conducted investigations to evaluate the performance of the system consisting of MT channels with screws as described in Table 1. The recommended tensile and shear load resistances as stated in [1] are always governing over the steel resistance for fixations through the round-holes in the back of the channels.
Therefore, only the capacity of the screw must be evaluated by the application designer. When distance from screw to the edge of the profile is more than 50 mm (like for additional fastening point in the middle of the channel) potential prying forces on the screw are to be considered. Bending performance of the headrail resulting in the necessary number of screws must be considered via PROFIS MSE equal to fixation to concrete with anchors where prying for middle supports is considered.

Table 1. Product designations for headrail applications

Hilti MT channels	MT-30, MT-40, MT-50, MT-60
Hilti timber screws	S-WWP-S-8x80/50 Z, S-WWP-S-8x120/80 Z

Table 2. Exemplary design and characteristic resistance of S-WWP screws used with MT channels based on [1] fastened perpendicular to the grain into timber C24 (ρk = 350 kg/m³) **for permanent loads**

S-WWP-S-8x80/50 Z	Recommended tension load $F_{ax,Rec}$ [kN]	1.38
	Design tension load $F_{ax,Rd}$ [kN]	1.94
	Characteristic tension loads $F_{ax,Rk}$ [kN]	4.36
	Recommended tension load $F_{v,Rec}$ [kN]	1.13
	Design shear load $F_{v,Rd}$ [kN]	1.58
	Characteristic shear loads $F_{v,Rk}$ [kN]	3.56
S-WWP-S-8x120/80 Z	Recommended tension load $F_{ax,Rec}$ [kN]	2.22
	Design tension load $F_{ax,Rd}$ [kN]	3.10
	Characteristic tension loads $F_{ax,Rk}$ [kN]	6.98
	Recommended tension load $F_{v,Rec}$ [kN]	1.13
	Design shear load $F_{v,Rd}$ [kN]	1.58
	Characteristic shear loads $F_{v,Rk}$ [kN]	3.56

*Recommended value = Design value / 1,4 (Design value iht. DS/EN 1995-1-1 DK NA:2019
γ_M = 1,35 iht DS/EN 1995-1-1 DK NA:2019 Tabel 2.3 med γ_0 = 1,0 for lastkombination 1 og 2 (alle konstruktioner over jorden) og γ_3 = 1,0 for normal kontrolklasse.
K_{mod} = 0,6 iht DS/EN 1995-1-1 Tabel 3.1 for permanent last i anvendelsesklasse 1 og 2.).
Detailed calculation for timber fasteners needs to be done with PROFIS Engineering.

Table 3. Item numbers of fastening elements for headrail applications

Product designation	Item number
S-WWP-S-8x80/50 Z	2363524
S-WWP-S-8x120/80 Z	2363526

B) Fastening on MT brackets and MT base connectors on timber with S-WDF screws

Hilti conducted investigations to evaluate the performance of the system consisting of MT brackets and base connectors with timber screws and additional flat washer as described in Table 4 based on physical tests, finite element analysis and analytical calculations. These results lead to resistance values for brackets and base connectors, which include the allowable pull-through of the specified screw heads through the oversized anchoring hole.

With the given resistances of these installation connection elements, this tensile failure mode, pull-through of the screw head through the steel base plate, is captured and does not need to be further considered in the screw design.

Pull-out forces per individual screw fastener are to be calculated by the designer and to be compared with the individual screw resistances as per Table 5.

If shear loads are applied to the base connectors, shear forces can only be carried perpendicular to the direction of long hole-axis. In case of more than two oversized round holes along the load path, only one screw is to be considered to carry the shear load. In e.g., for a square anchor setup two screws must be validated for the total load.

Table 4. Product designations for brackets and base connectors

Hilti MT brackets	MT-BR-30, MT-BR-40, MT-BR-40D
Hilti MT base connectors	see Annex B
Hilti timber screws	S-WDF-S-12x80/68 Z, S-WDF-S-12x100/85 Z
Hilti washer	flat washer A13/24

Table 5. Exemplary design and characteristic resistance of S-WDF screws used with MT brackets and base connectors based on [1] fastened perpendicular to the grain into timber C24 (ρk = 350 kg/m³) **for permanent loads**

S-WDF-S-12x80/68 Z	Recommended tension load $F_{ax,Rec}$ [kN]	2.90
	Design tension load $F_{ax,Rd}$ [kN]	4.06
	Characteristic tension loads $F_{ax,Rk}$ [kN]	9.14
	Recommended tension load $F_{v,Rec}$ [kN]	1.85
	Design shear load $F_{v,Rd}$ [kN]	2.59
	Characteristic shear loads $F_{v,Rk}$ [kN]	5.83
S-WDF-S-12x100/85 Z	Recommended tension load $F_{ax,Rec}$ [kN]	3.62
	Design tension load $F_{ax,Rd}$ [kN]	5.07
	Characteristic tension loads $F_{ax,Rk}$ [kN]	11.4
	Recommended tension load $F_{v,Rec}$ [kN]	2.26
	Design shear load $F_{v,Rd}$ [kN]	3.16
	Characteristic shear loads $F_{v,Rk}$ [kN]	7.12

*Recommended value = Design value / 1,4 (Design value iht. DS/EN 1995-1-1 DK NA:2019
γ_M = 1,35 iht DS/EN 1995-1-1 DK NA:2019 Tabel 2.3 med γ_0 = 1,0 for lastkombination 1 og 2 (alle konstruktioner over jorden) og γ_3 = 1,0 for normal kontrolklasse.
K_{mod} = 0,6 iht DS/EN 1995-1-1 Tabel 3.1 for permanent last i anvendelsesklasse 1 og 2.).
Detailed calculation for timber fasteners needs to be done with PROFIS Engineering.

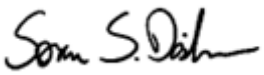
Table 6. Item numbers of fastening elements for brackets and base connectors

Product designation	Item number
Flat washer A 13/24	2184512
S-WDF-S-12x80/68 Z	2363667
S-WDF-S-12x100/85 Z	2363668

The statement mentioned above is valid only if the following conditions are fulfilled:

- headrail channels are installed according to relevant Instructions for Use (IFU) - see Annex A;
- environment conditions with corrosion classes C1/C2, according to ISO 9223:2012;
- no fire resistance is considered;
- only static loads are applied;
- screws fastened according to [1] ETA-22/0772.

Yours sincerely,



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Marketing Director
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[1] ETA-22/0772, Austrian Institute of Construction Engineering, Vienna, Apr. 04, 2023 or later versions

Annex A:
Instructions For Use (IFU) of MT channels and MT base connectors fastened on timber.

The fastening of Hilti MT system installation channels, MT brackets and MT base connectors to timer shall be done according to the procedure described in the Instructions For Use (IFU) reported in Figure A.1.

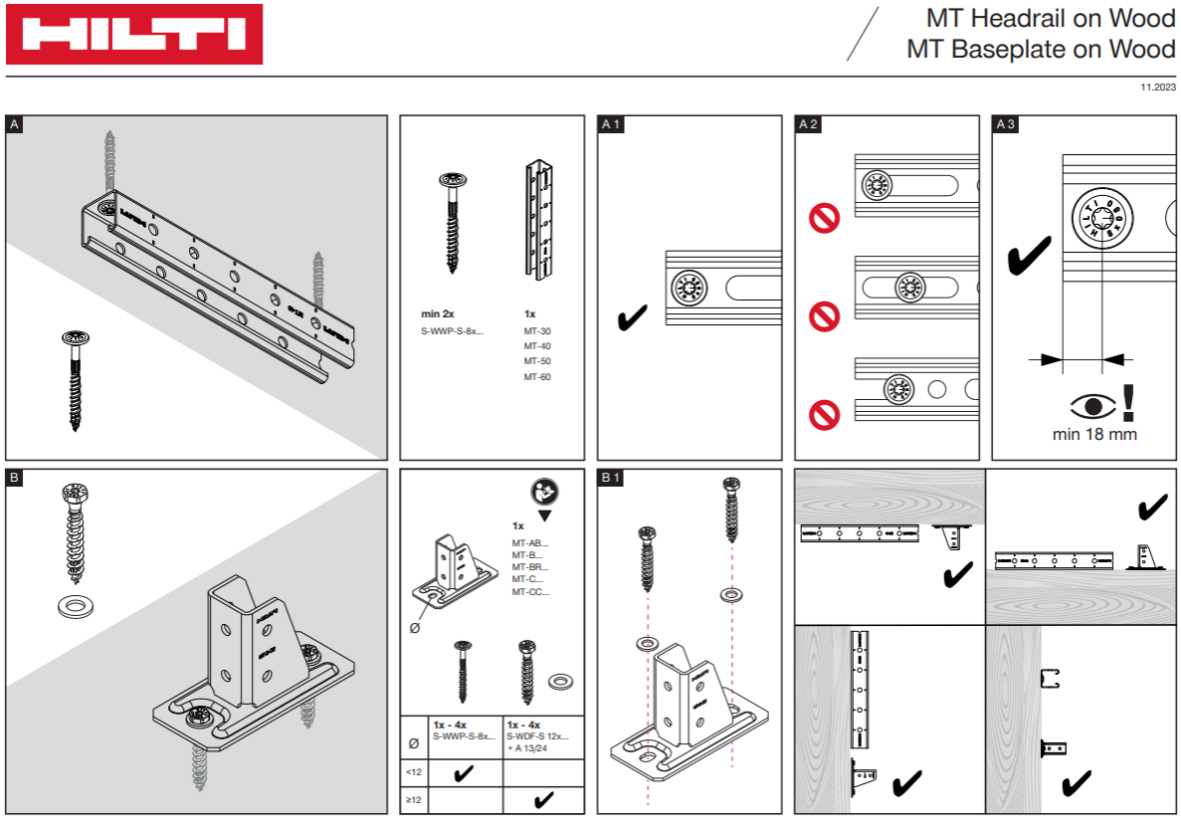

Figure A.1: Instruction for Use (IFU) of MT system fastened on timber. Pre-drilling recommended in hard wood.

Annex B: MT bracket and MT base connectors

Product name	Recommended timber screw
MT-B-L	S-WDF-S-12 + washer A13/24
MT-B-T	S-WDF-S-12 + washer A13/24
MT-B-O2	S-WDF-S-12 + washer A13/24
MT-B-O2B	S-WDF-S-12 + washer A13/24
MT-B-O4	S-WDF-S-12 + washer A13/24
MT-BR-30 300	S-WWP-S-8
MT-BR-30 450	S-WWP-S-8
MT-BR-40 300	S-WDF-S-12 + washer A13/24
MT-BR-40 450	S-WDF-S-12 + washer A13/24
MT-BR-40 600	S-WDF-S-12 + washer A13/24
MT-BR-40 1000	S-WDF-S-12 + washer A13/24
MT-BR 40 O4 600 OC	S-WDF-S-12 + washer A13/24
MT-BR 40 O4 1000 OC	S-WDF-S-12 + washer A13/24
MT-BR-40D 600	S-WDF-S-12 + washer A13/24
MT-BR-40D 1000	S-WDF-S-12 + washer A13/24
MT-BR-40D O4 600 OC	S-WDF-S-12 + washer A13/24
MT-BR-40D O4 1000 OC	S-WDF-S-12 + washer A13/24
MT-BR-40D O4 1500 OC	S-WDF-S-12 + washer A13/24
MT-AB A	S-WDF-S-12 + washer A13/24
MT-AB-L 45	S-WDF-S-12 + washer A13/24
MT-CC-BC 40/50	S-WDF-S-12 + washer A13/24
MT-CC-BS 40/50	S-WDF-S-12 + washer A13/24
MT-C-GS OC	S-WDF-S-12 + washer A13/24
MT-C-GL OC	S-WDF-S-12 + washer A13/24
MT-B-GS T OC	S-WDF-S-12 + washer A13/24
MT-B-GS O4U OC	S-WDF-S-12 + washer A13/24
MT-B-GL O4C OC	S-WDF-S-12 + washer A13/24
MT-B-GL O4C OC	S-WDF-S-12 + washer A13/24
MT-B-GS AB OC	S-WDF-S-12 + washer A13/24
MT-B GL AB OC	S-WDF-S-12 + washer A13/24
MT-B-G AS OC	S-WDF-S-12 + washer A13/24
MT-B-GL EDB OC set	S-WDF-S-12 + washer A13/24
MT-B-GS EDB OC set	S-WDF-S-12 + washer A13/24
MT-B-GL EDB A OC	S-WDF-S-12 + washer A13/24
MT-B-GS EDB A OC	S-WDF-S-12 + washer A13/24
MT-B-EDB A OC	S-WDF-S-12 + washer A13/24
MT-B-O2B 60D	S-WDF-S-12 + washer A13/24

Annex complementary portfolio – Base plates, Sliders, Fixpoints, …

Product name	Recommended timber screw
All MGM 2	S-WDF-S-12 + washer A13/24
MGM 4	S-WDF-S-12 + washer A13/24
GF 45/M12-F	S-WDF-S-12 + washer A13/24
MGL 2	S-WWP-S-8
MGL 3	S-WWP-S-6
MGS 2	S-WWP-S-8
MGS 2-I	S-WWP-S-8
MP-M8	S-WWP-S-8
MSG 1,2 M8/M10	S-WWP-S-8
MSG 1,0 M12/16	S-WWP-S-8
MSG 1,0 ½“	S-WWP-S-8
MSG 1,0 ¾“	S-WWP-S-8
MSG 175 M8/10D	S-WWP-S-8
MSG 175 M12/16D	S-WWP-S-8
MSG-UK D1,75	S-WWP-S-8
MRG 2,0 M10/12	S-WWP-S-8
MRG 4,0 M12/16	S-WDF-S-12 + washer A13/24
MRG-UK D6	S-WDF-S-12 + washer A13/24
MSG-D 200	S-WWP-S-8
MRG-D 225	S-WDF-S-12 + washer A13/24
MFP-V/100-150	S-WWP-S-8
MFP-GP M16	S-WDF-S-12 + washer A13/24
MFP-GP M20	S-WDF-S-12 + washer A13/24
MFP-L / MFP-LD / MFP-L2 / MFP-LD2	S-WDF-S-12 + washer A13/24
MFP-L-I / MFP-LD-I / MFP-L2-I / MFP-LD2-I	S-WDF-S-12 + washer A13/24
MFP-UL / MFP-ULD / MFP-UL2 / MFP-ULD2	S-WDF-S-12 + washer A13/24
MFP-UL-I / MFP-ULD-I / MFP-UL2-I / MFP-ULD2-I	S-WDF-S-12 + washer A13/24
MFP-UM / MFP-UM2 / MFP-UM-I / MFP-UM2-I	S-WDF-S-12 + washer A13/24
MFP-UHD / MFP-UHD2	S-WDF-S-12 + washer A13/24
MFP-CSL / MFP-CSL-I	S-WDF-S-12 + washer A13/24
MFP-CL-I / MFP-CLD-I	S-WDF-S-12 + washer A13/24
MFP-CH / MFP-CHD	S-WDF-S-12 + washer A13/24
MP-PS 1-1 / 2-2 / 4-2	S-WDF-S-12 + washer A13/24