



MADE FOR BUILDING
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LIFTING SYSTEM VLS S1
FOR THE US



IMPRINT

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PREFACE

LIFTING SYSTEM VLS S1

This brochure provides guidelines for determining the adequacy of the lifting system VLS S1 for slab elements lifted horizontally, as is typically done for floor and roof panels.

Testing was undertaken to determine the breaking load of the lifting system installed in specimens of the KLH 80 mm and 100 mm 3-ply panel types, determined at lifting angles of 90-, 60-, and 45-degrees measured from the surface of the specimens. Then, factors of safety were employed to reduce the breaking loads to safe working loads for use in practice.

The Engineer-of-Record may apply a load duration factor, C_D , as determined in Chapter 2 of the National Design Specification for Wood Construction (NDS), to increase the permissible panel weight. For example, for an assumed 10-minute lifting duration, $C_D = 1.6$. However, note that possible reductions may be indicated depending on dynamic effects or other factors.

Although the maximum panel thickness tested was 100 mm in a 3-ply layup, thicker panels may be lifted using the system VLS S1, so long as the maximum panel weights given are not exceeded.

While very common, the lifting system VLS S1 is one of many options. The KLH USA team is happy to advise you on the choice of a suitable lifting system for your particular situation.

01 GENERAL LIFTING PRINCIPLES

GENERAL LIFTING PRINCIPLES OF CLT SLAB ELEMENTS

Depending on the size and geometry of the CLT panel to be lifted, 1-, 2-, 3-, or 4-lifting points may be employed.

Generally, the lifting points are located such that the lifting forces resolve concentric to the center of gravity of the element to avoid eccentric effects.

The pre-installed lifting slings are often connected to angled cables that slope to meet a single vertical crane cable.

Although less common, spreader beams may be used so that all lifting slings are vertical.



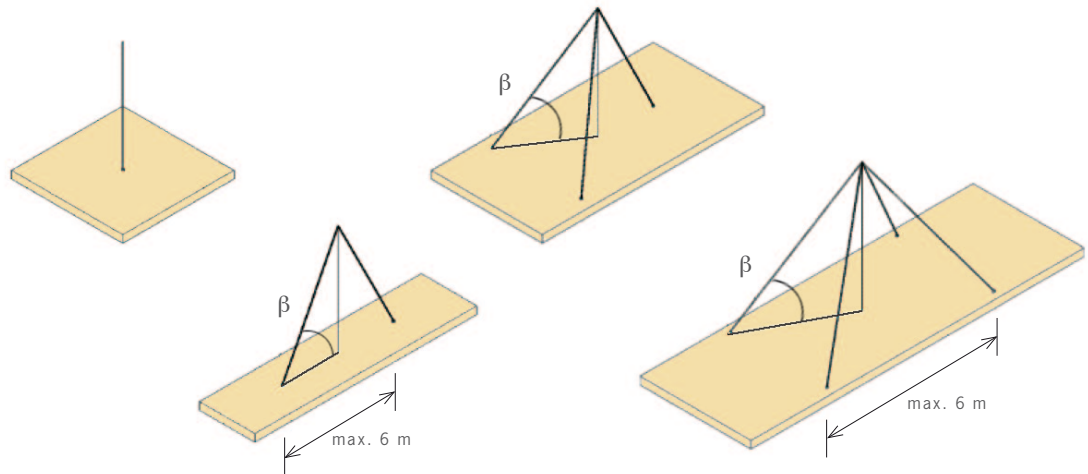
Engberg Anderson Architects



KLH®

02 LAOD TABLE HORIZONTAL LIFTING

LIFTING HORIZONTAL ELEMENTS



RECOMMENDED MAXIMUM PANEL WEIGHTS FOR LIFTING SYSTEM VLS S1

KLH Lifting System	Steel Dowel	Panel Thickness (mm)	Lift angle (deg)	Maximum Panel Weight (lbs)			
				No. of pick points			
				1	2	3	4
VLS S1	16 mm dia. x 250 mm	80 - 95 mm	90	1241			
			60		2149	3224	4299
			45		1946	2919	3892
		100 mm (min.)	90	1546			
			60		3071	4606	6142
			45		2507	3761	5015

Notes:

At the discretion of the Engineer-of-Record:

1. Per NDS Table 2.3.2, a load duration factor C_D may be applied to increase the maximum panel weights shown
2. Possible reductions to the maximum panel weights based on rigging environment (eg., tight-space rigging), dynamic acceleration (impact), or other conditions

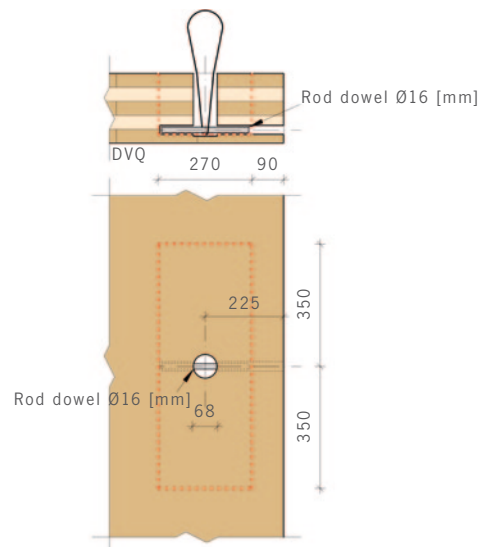
03 FACTORY-INSTALLED LIFTING EQUIPMENT

KLH® LIFTING SYSTEM “VLS S1” (“VISIBLE LIFTING SYSTEM FOR SLAB ELEMENTS”)

Scope of KLH services:

- Blind hole (68 mm diameter)
- Installation of the one-way lifting loop (type Pewag 600) with rod dowel and stowing

Illustration of the edge distances for system VLS S1
(the area marked in red must not be processed)



Description and characteristics:

- Concealed lifting device primarily for slab and roof elements in visible quality
- 1 to max. 4 loops per element (max. distance 6 m)

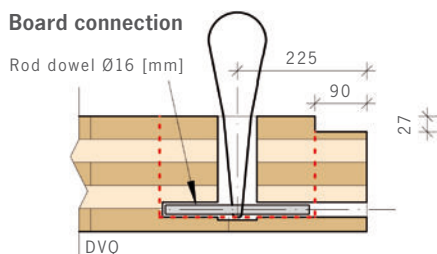
The following load cases can be modelled:

- Lifting horizontal elements
- Assembling horizontal or slightly inclined elements

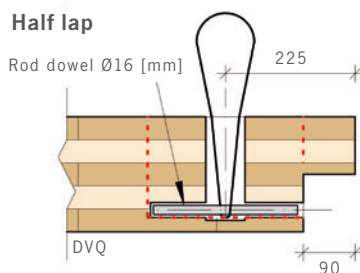
Minimum edge distances:

Examples of permissible edge processing

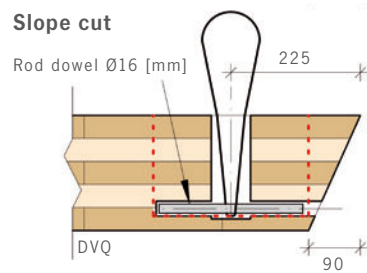
Board connection



Half lap



Slope cut

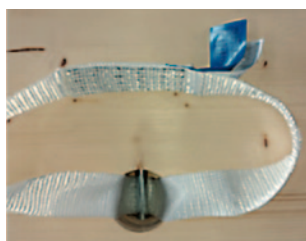


The galvanised rod dowel remains in the KLH element. If necessary, the blind hole must be filled on site in a suitable manner.

Installation of the lifting system:



1. Insert the loop and dowel into the hole



2. Lifting situation with built-in system VLS S1



3. Transport situation with rolled-up loop in the blind hole

04 ELEMENT INSTALLATION

HORIZONTAL ELEMENT INSTALLATION FOR SLAB AND ROOF ELEMENTS

FIX SLAB/ROOF ELEMENT

- Bring the slab/roof element into the installation position
– ensure that the element is secured in position

UNHOOK CRANE HOOKS

- When accessing the slab or roof elements, observe the applicable employee protection regulations and other provisions



CUT THE LIFTING LOOPS

- Wearing safety gloves and using a safety knife in accordance with applicable safety standards



05 FIRE TESTING

FIRE TESTING OF LIFTING SYSTEM VLS S1

The lifting system VLS S1 involves drilling a 68 mm hole from the top to within 19 mm of the bottom of the CLT panel. Therefore, four (4) different firestop strategies were tested to ensure that hot gases and flame would not pass through to the unexposed side of the CLT panel specimen for the fire ratings required, recognizing that the 19 mm of wood left on the exposed face would burn through for fire durations in excess of approximately 30 minutes.

Testing was done in general accordance with ASTM E814-24, Standard Test Method for Fire Tests of Penetration Firestop Systems. However, it is important to note that, since the penetrations did not pass completely through the CLT specimen, the Standard could not be applied. Also, a hose stream test and particular locations of thermocouples are required by the Standard, but these were not relevant to the stated purpose of the testing.

Thermocouples were placed strategically to capture temperatures at the assumed effective char depth as well as at the surface of the specimen at the edge and directly above the center of the hole.

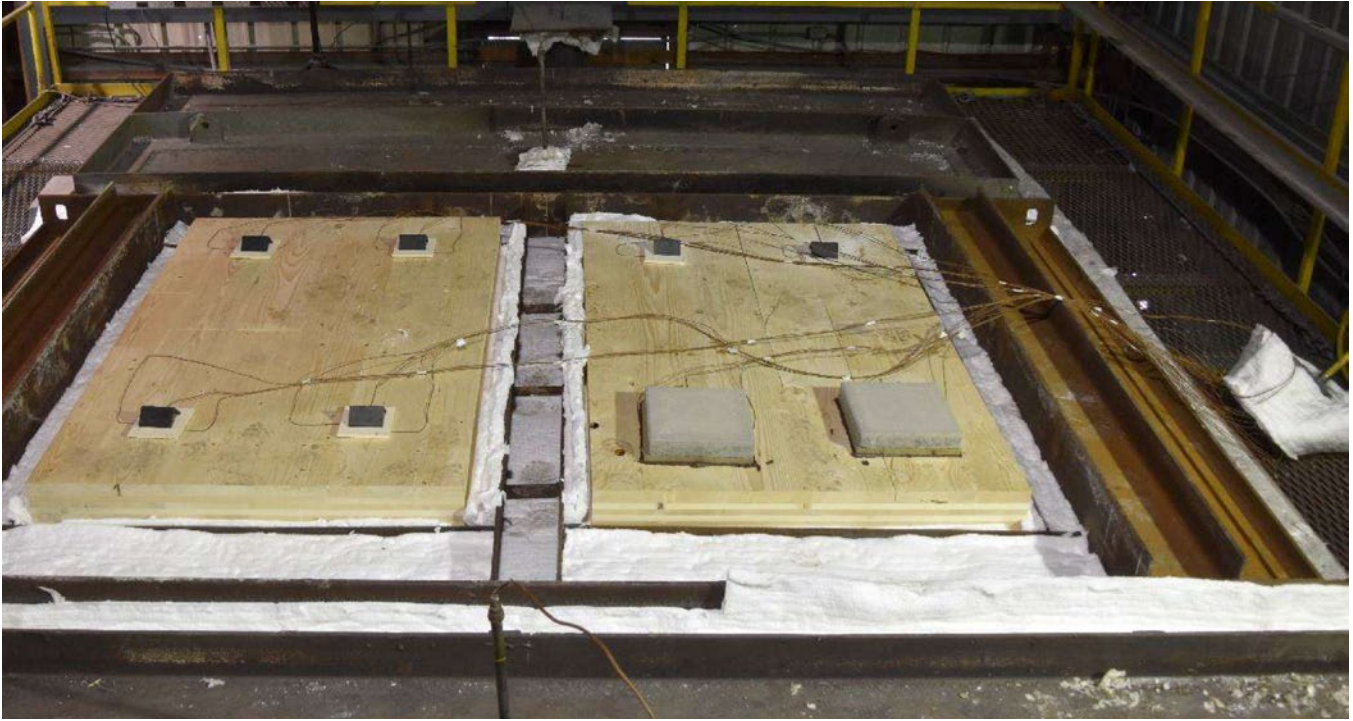
The lifting system's partial penetrations were treated with four (4) firestop strategies as follows.

- Two (2) holes each of four (4) firestop strategies in a 140 mm 5-ply panel for a duration of 90 minutes (8 holes total in test)
- Two (2) holes each of four (4) firestop strategies in a 175 mm 5-ply CLT panel specimen for a duration of 120 minutes (8 holes total in test)

The firestop strategies, Types A - D, are described as follows.

- A Penetration cores filled with densely packed loose mineral wool insulation and covered with two 6-in strips of Rothoblass Speedy Band tape.
- B Penetration cores filled with 3M Fire Barrier Rated Foam FIP (Foam-In-Place) 1 Step, filled flush with top of hole and covered with two 6-in strips of Rothoblass Speedy Band tape.
- C Penetration cores filled with Sakrete high-strength concrete mix and covered with two 6-in strips of Rothoblass Speedy Band tape.
- D Penetration cores left empty, covered with two 6-in strips of Rothoblass Speedy Band tape, then capped with a 1' x 1' x ¾" fiber acoustic mat and a 1' x 1' x 2" concrete paver. The 3M Fire Barrier Foam was used to seal the edges of the acoustic mat to the CLT panel specimen to simulate a continuous concrete slab.

05 FIRE TESTING



Test Setup of Firestop Strategies A - D

In conclusion, all firestop strategies were successful at preventing the pass-through of hot gases and flames, were effective in maintaining surface temperatures well within safe limits to prevent damage to the specimen on the unexposed side.

For these reasons, any of the tested firestop strategies can be employed to ensure that the lifting system VLS S1 does not compromise the required fire rating of the installed CLT panel.

Please note that the test reports are available upon request if additional information is required.



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