CNC MACHINING DESCRIPTION

Version 01/2019

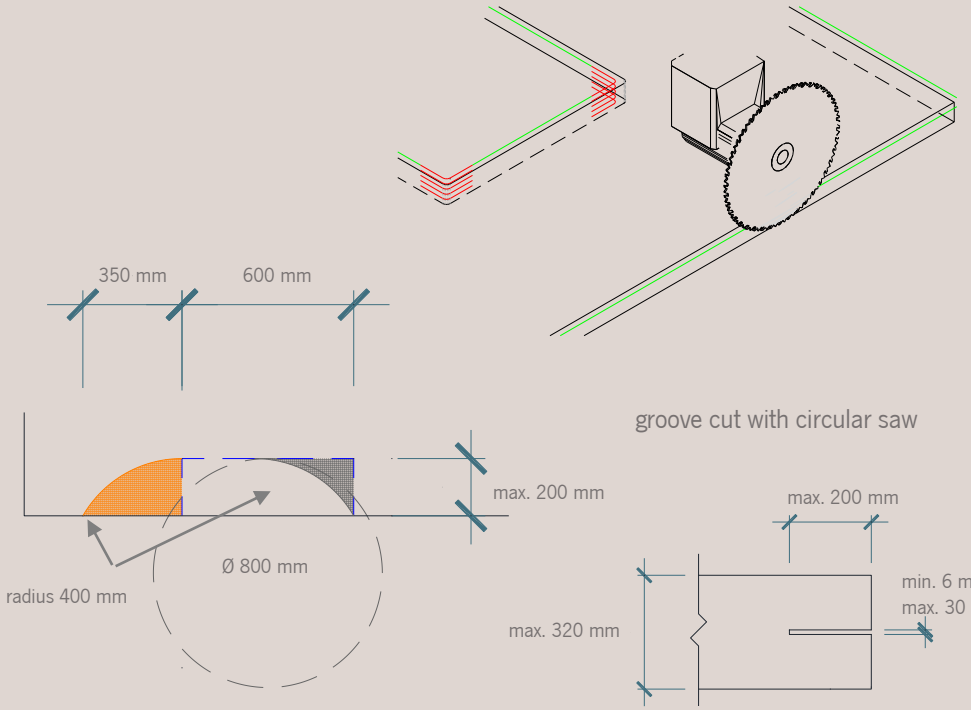
image: 5 axis CNC panel machining center of KLH Massivholz GmbH, Katsch an der Mur

machining tools:

A circular saw B finger router C disk router

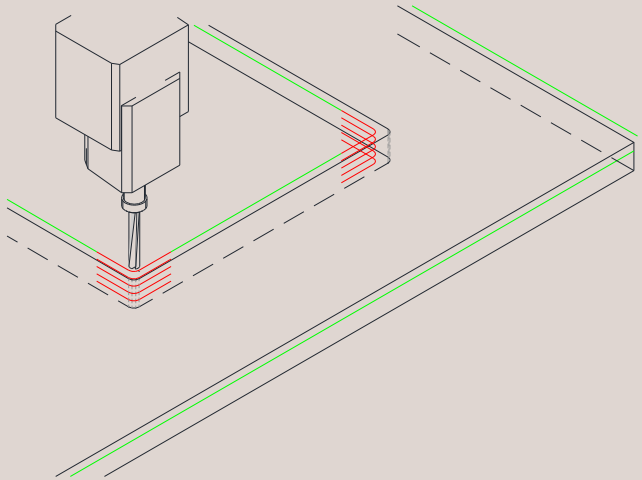
A circular saw

cutting depth / bevel cut depth:	standard up to 320 mm, > 320 mm on request
kerf width:	5.40 mm to 10.00 mm
tilt:	0 to 90 degrees – mind the bevel cut depth
application:	linear cuts for contours and grooves
machining possibilities:	from above and sideways into the plane of the panel

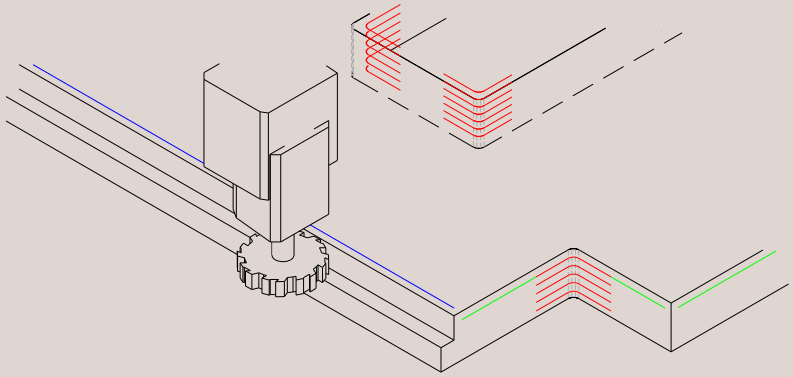


B finger router

Ø 10 mm:	machining length (depth) 40 mm max.
Ø 16 mm:	machining length (depth) 100 mm max.
Ø 30 mm:	machining length (depth) 135 mm max.
Ø 40 mm:	machining length (depth) 200 mm max.
Ø 60 mm:	machining length (depth) 320 mm max.
machining depth per run:	27 mm max.
application:	milling of contours milling of internal corners for panel thicknesses up to 200 mm – radius = 20 mm milling of internal corners for panel thicknesses from 210 to 320 mm – radius = 30 mm
machining possibilities:	from above into the plane of the panel



C disk router



details for the disk router

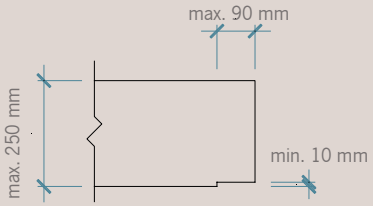
detail A: milling to the underside of the panel without flipping, 90 mm max.

detail B: minimum kerf/groove width: 10 mm

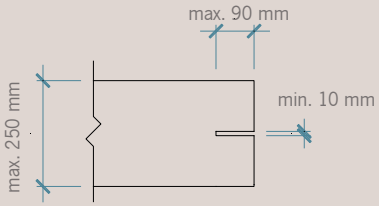
detail C: corner radius when milling to the underside of the panel ends before the element end, radius: 125 mm (without flipping)

detail D: corner radius when milling to the top side of the panel, radius: 20 mm

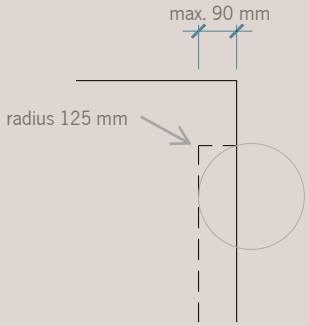
detail A



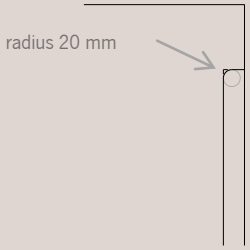
detail B



detail C



detail D



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machining cost assessment

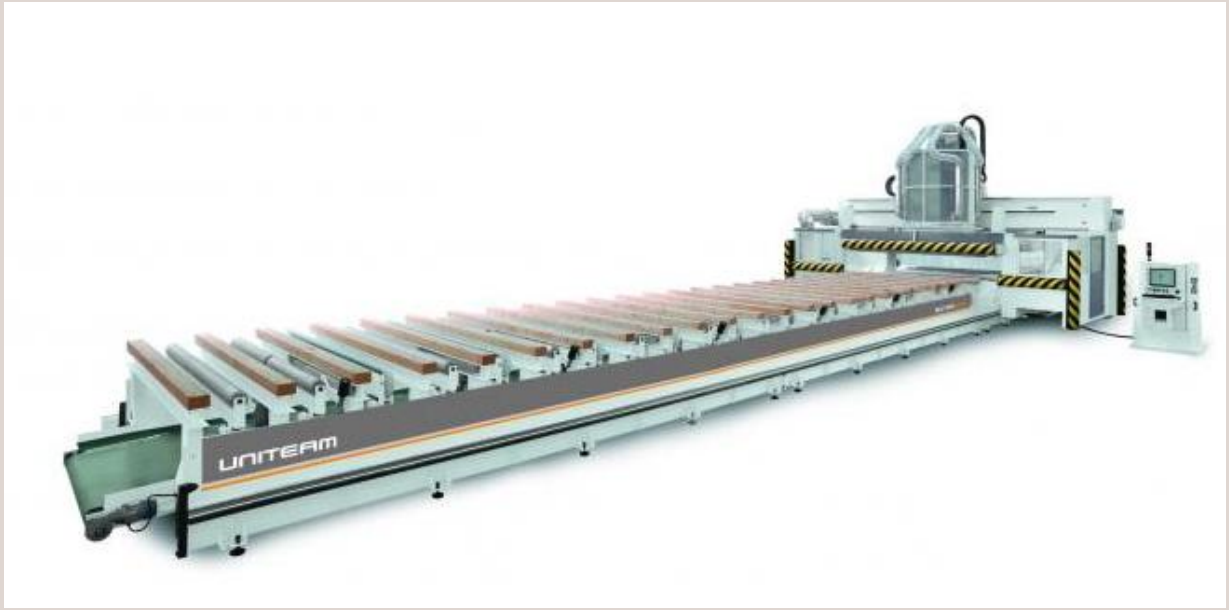
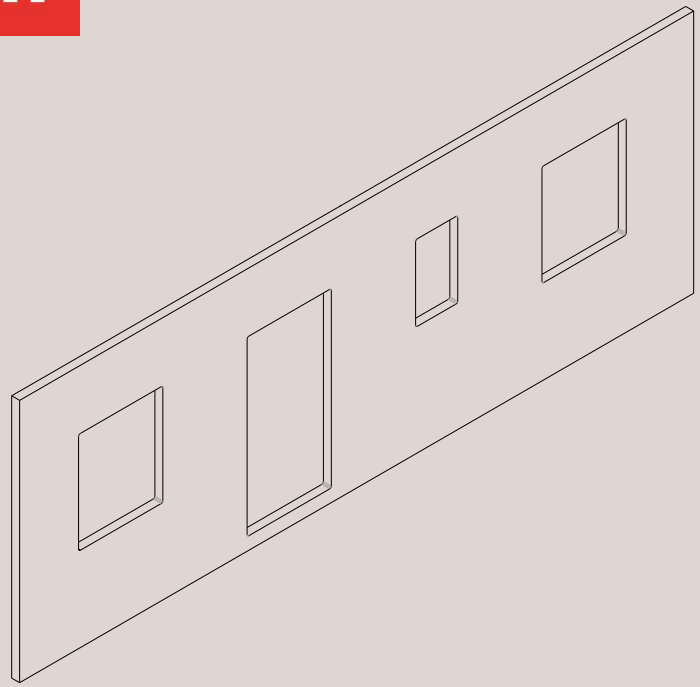


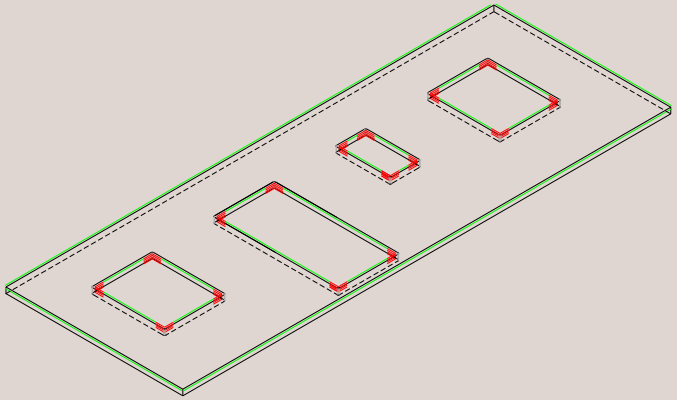
image source: http://www.uniteamcnc.it

1 standard machining – wall



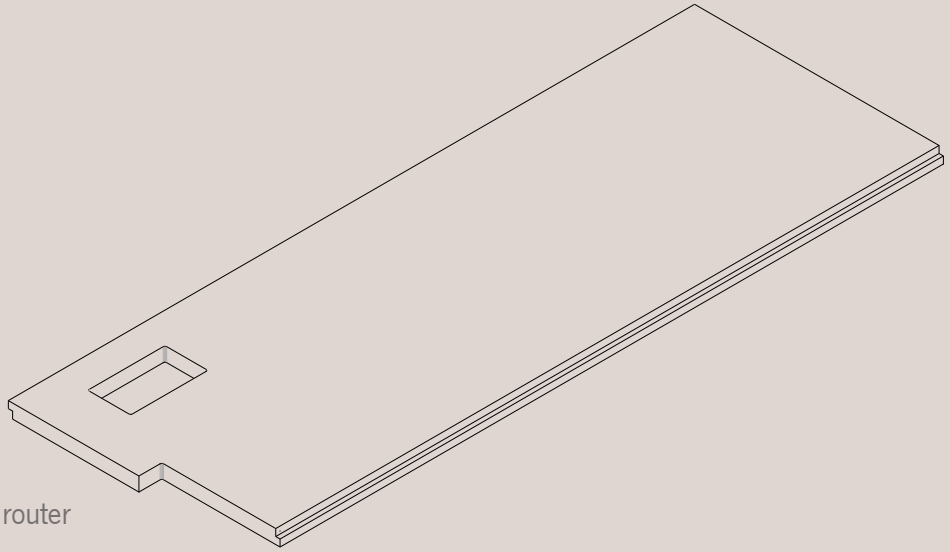
brief description

- linear element contours
- element size 10 - 20 m²/element approx.
- 4 elements max. per master panel
- 4 openings max. per element
- predominantly circular saw machining
- small proportion of machining with finger router



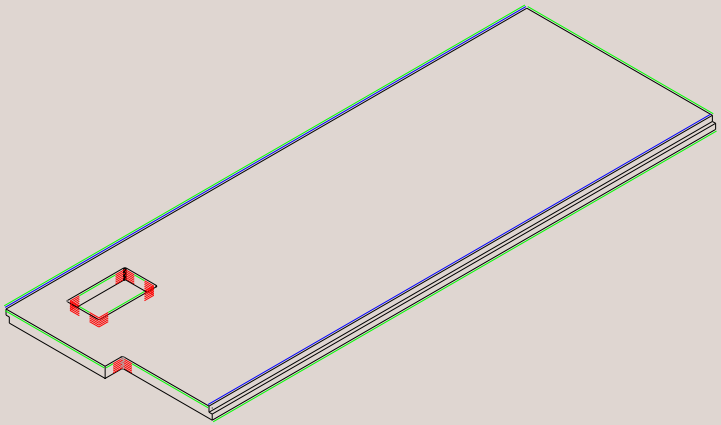
tools used:
finger router
circular saw

2 standard machining – floor



brief description

- linear element contours
- element size 10 - 20 m²/element approx.
- 3 elements max. per master panel
- standard panel connection
- 2 openings max. per element
- predominantly machining with circular saw and disk router
- small proportion of machining with finger router

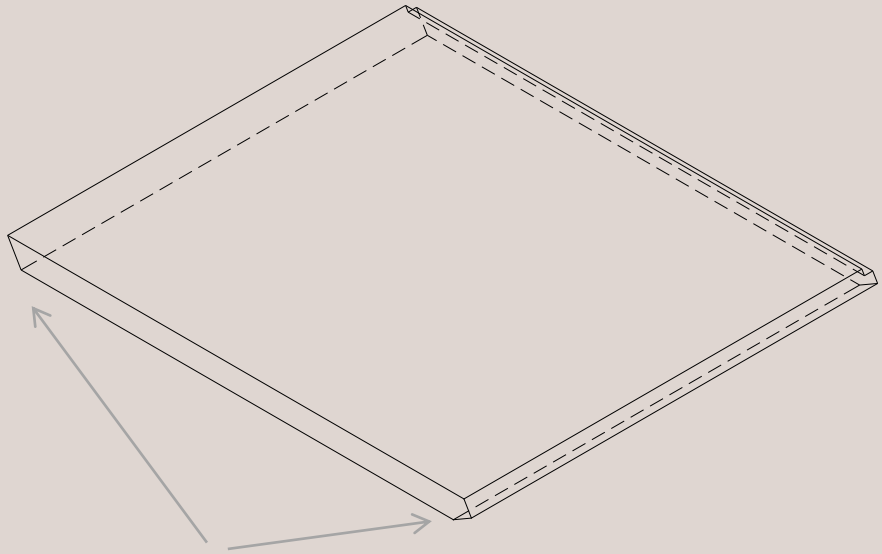


tools used:
finger router
circular saw
disk router

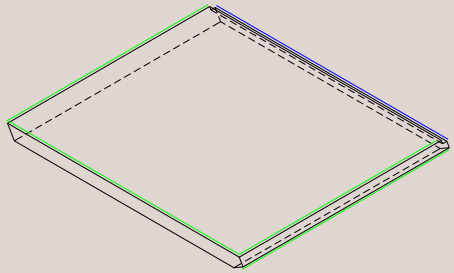
3 standard machining – roof

brief description

- linear element contours
- element size 10 - 20 m²/element approx.
- 3 elements max. per master panel
- standard panel connection
- 2 openings max. per element
- predominantly machining with circular saw
- small proportion of machining with disk router



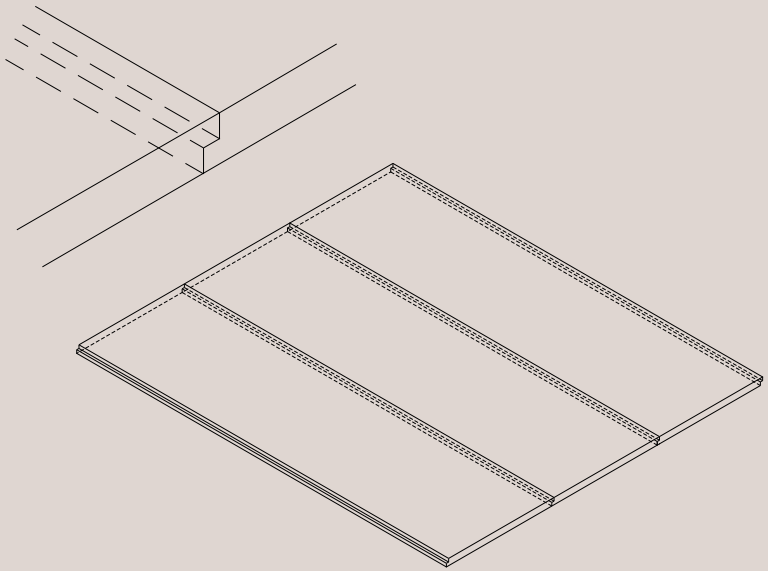
max. bevel cut length 270 mm



tools used:
circular saw
disk router

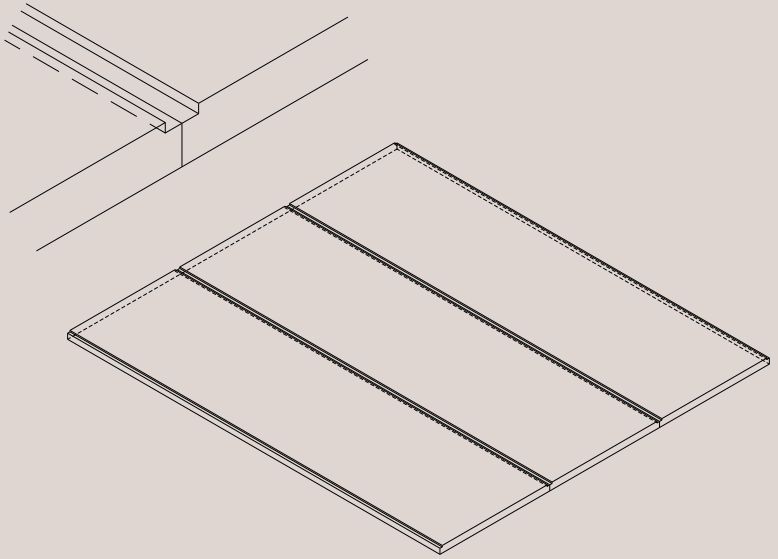
5 standard panel connections

half lap connection



half lap connection:	depth: half the panel thickness (refer to tolerances) width: 50 mm overlap, half lap principle, top/bottom either end of panel
machining costs:	for the widths 240, 250, 273 and 295 cm up to a panel thickness of 320 mm included in the standard machining costs
panel thickness:	up to 320 mm

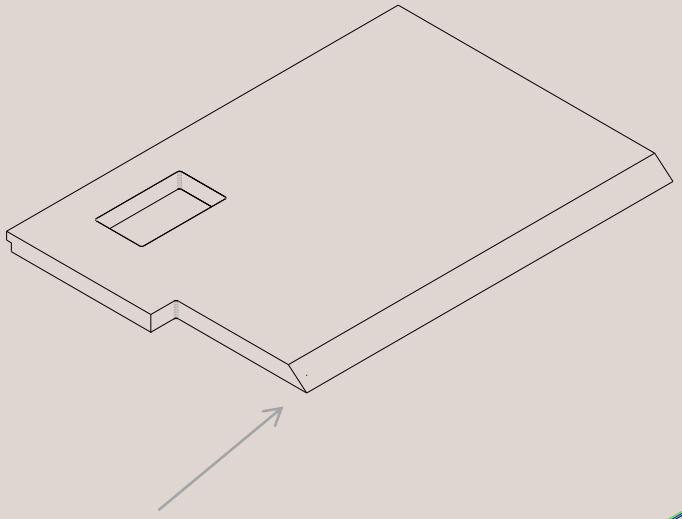
joint board connection



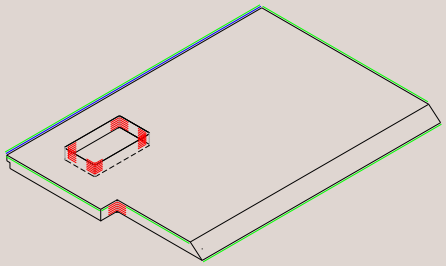
joint board connection:	depth: 20 mm or 28 mm (refer to tolerances) width: 50 mm either side
joint board width:	98 mm recommended (2 mm clearance)
machining costs:	for the widths 240, 250, 273 and 295 cm up to a panel thickness of 320 mm included in the standard machining costs
panel thickness:	up to 320 mm

6 linear bevel and compound cuts

Linear bevel and compound cut contours are machined with the circular saw.
Angled cuts from 0 to 90 degrees relative to the flat plane of the panel can be machined. The maximum bevel/compound cut depth is 270 mm.
Cuts deeper/wider than 270 mm on request.
Bevel/Compound cuts ending in inner corners will be finished with the finger router. Short bevel/compound cuts in areas inaccessible to the circular saw are machined with the finger router.



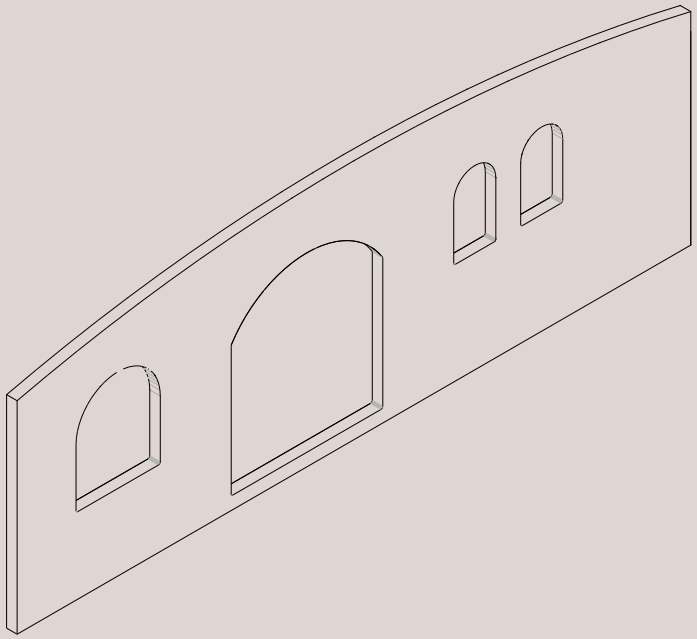
bevel cuts 0 – 90°
max. bevel cut depth 270 mm

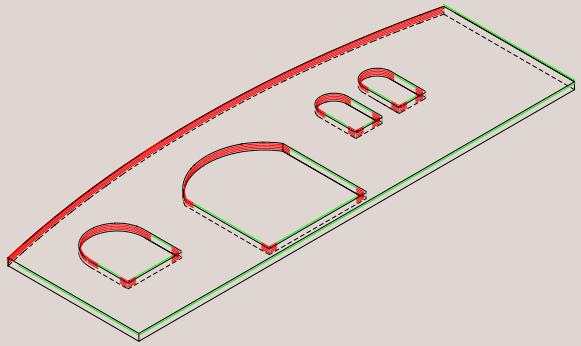


tools used:
finger router
circular saw
disk router

7 simple circular contours

Circular contours perpendicular to the plane of the panel are machined with the finger router.

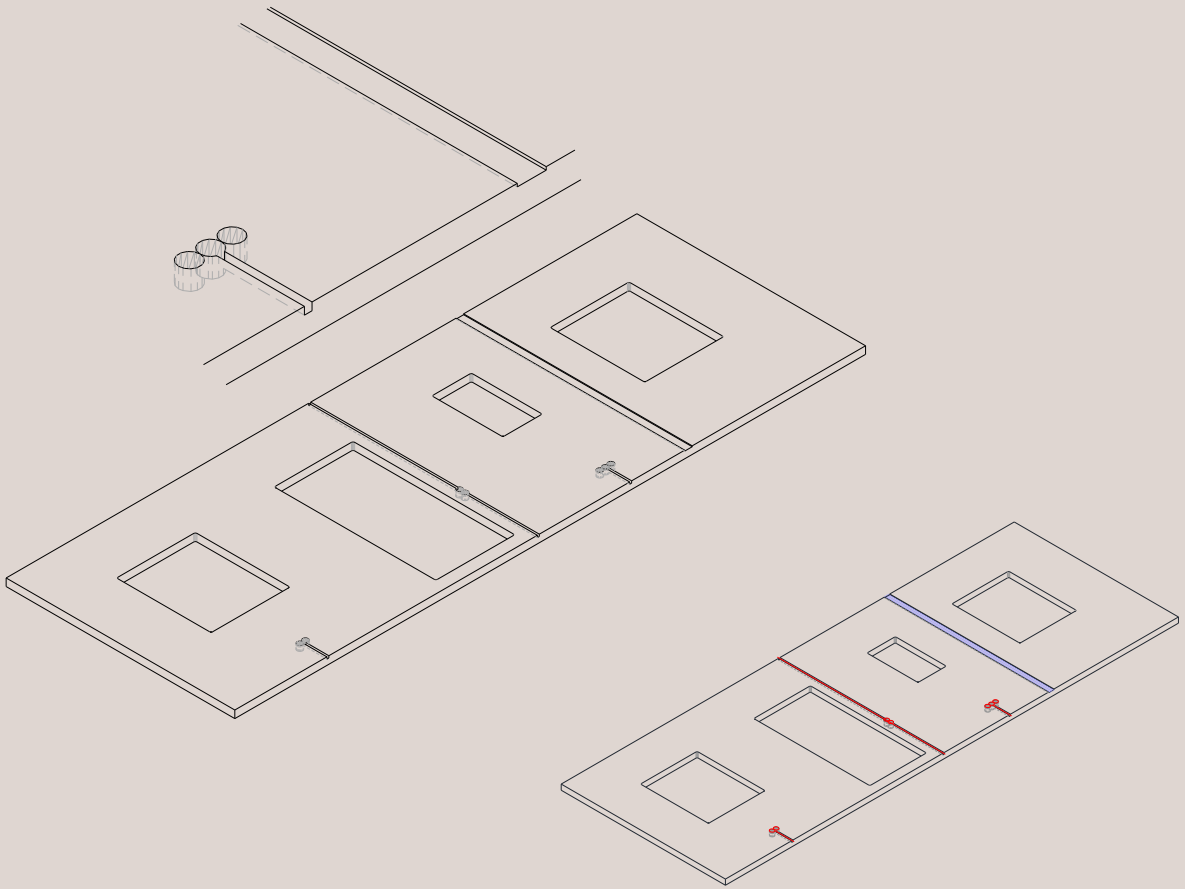




tools used:
finger router
circular saw

8 machining with finger router and disk router

Small recesses, channels and slots – e.g. for electrical installations – are machined with the finger router or vertical disk router. These machining processes are very time consuming. The maximum panel thickness for them is 320 mm.

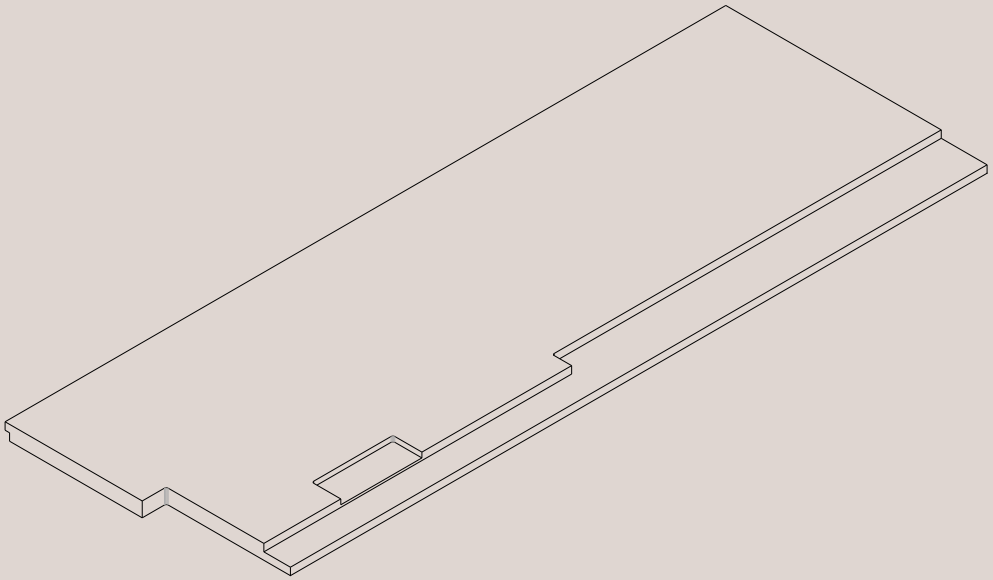


tools used:
finger router / disk router

9 surface milling and recesses

The term surface milling describes a reduction of the panel thickness in a certain contiguous area, which is 0.75 m² minimum.

For the cost assessment the surface milling is calculated in €/m².
The maximum panel thickness for this machining process is 320 mm.



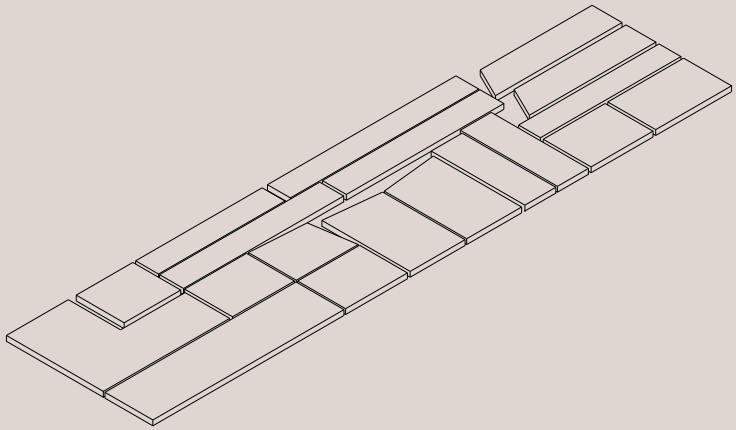
10 small elements

Principally the standard machining costs include an allowance for plan transfer, handling, machining and loading of the elements. This calculation allowance includes for 40 to 45 elements per truck, i.e. 3 to 4 single elements per master panel. A large number of (small) elements generates additional handling time and expenses. Many elements of the same size and format allow a symmetric and straightforward arrangement in the nesting process, resulting in straight linear cutting lines that can be easily machined with the circular saw tool.

However, if the panels are of varying sizes and shapes the machining process is more time consuming as it may also involve the use of the finger router tool.

The machining tolerances of KLH solid wood slabs are defined on the KLH website. The smaller the elements, the less precise the machining result will be, which can lead to exceedance of the tolerances.

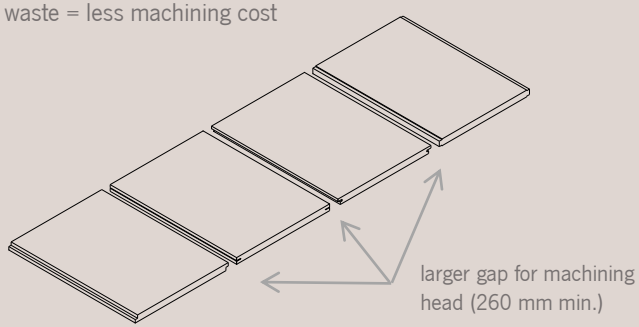
Therefore the minimum element size should not be less than 1.0 m^2. The maximum panel thickness for this machining process is 250 mm.

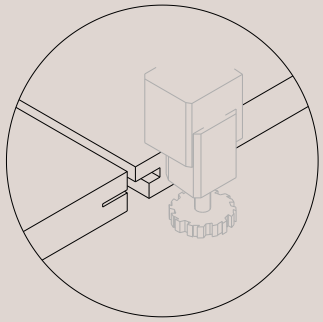


11 “hidden machining”

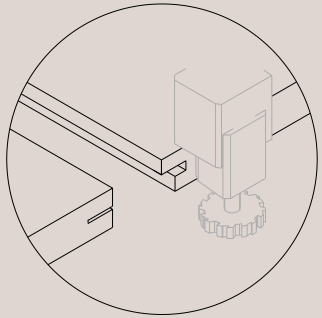
Hidden machining describes machining of element edges and details that are not freely accessible for the machining head of the CNC machine. There are two options to deal with this problem. The maximum panel thickness for this machining process is 320 mm.

1 Increase the gap between elements during the nesting process
allowing enough space for the machining head.
more waste = less machining cost



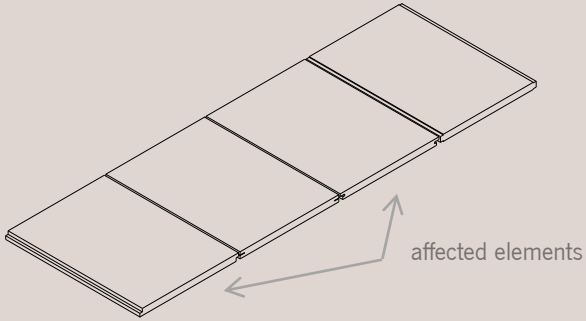


hidden machining
machining requires increased effort



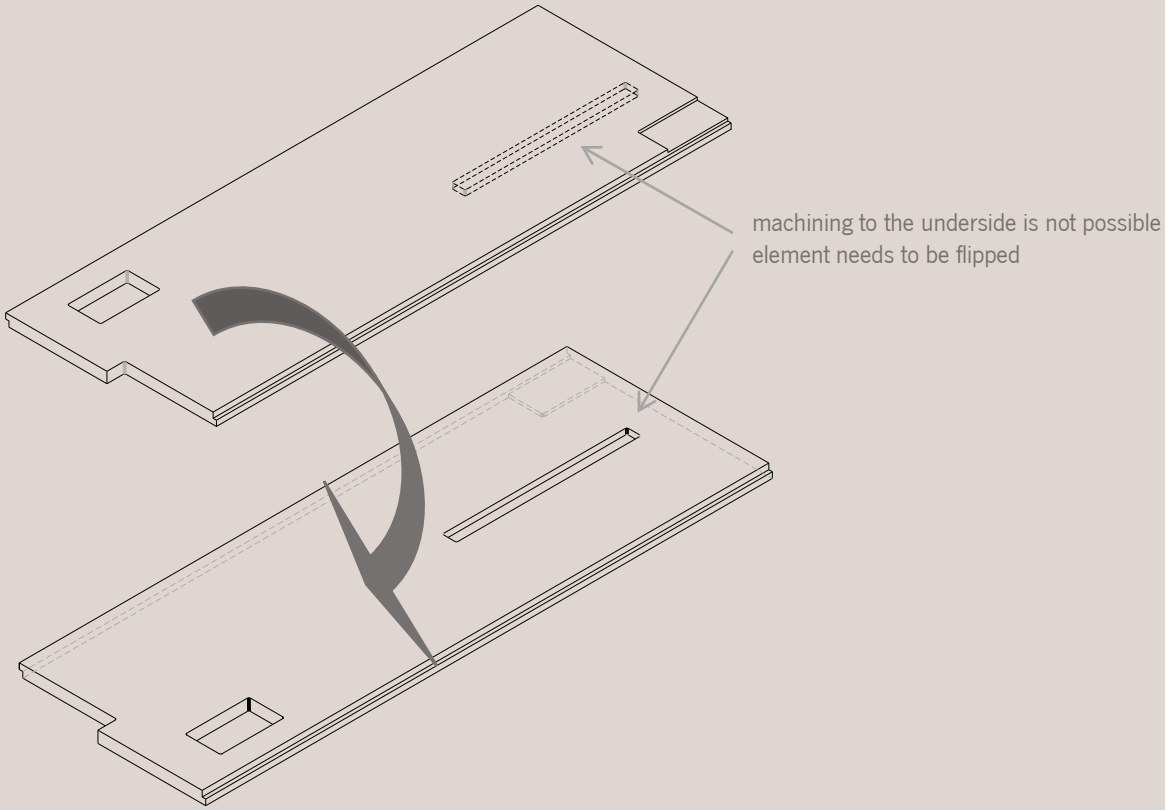
no hidden machining
less machining effort

2 Move every other element to create a gap for the machining head.
less waste = increased machining cost



12 panel flipping – double sided machining

Depending on the tools used (circular saw, finger router, disk router) the machining is done from above, sideways or in some cases close to the edges from below into the panel.
For machining to the underside the panel has to be flipped.
After flipping the panel needs to be realigned on the CNC machine. This process can lead to increased tolerances. The maximum panel thickness for this machining process is 320 mm.



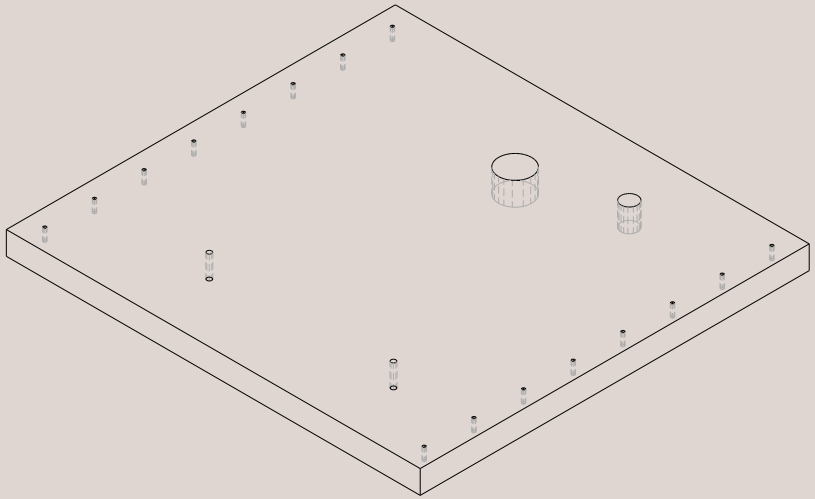
13 holes and circular openings

holes: → holes with a diameter from 8 mm to 30 mm
small circular openings: → holes with a diameter from 30 mm to 60 mm
larger circular openings: → holes with a diameter greater than 60 mm

holes:
Ø 8 mm, 10 mm, 12 mm → machining depth: max. 100 mm
Ø 14 mm, 16 mm, 18 mm → machining depth: max. 110 mm
Ø 20 mm, 25 mm, 28 mm, 30 mm → machining depth: max. 210 mm
manual reworking of higher depths on request

small circular openings:
can be machined in any diameter from 30 mm to 60 mm
Ø 30 to 40 mm → machining depth: max. 135 mm
Ø 40 to 60 mm → machining depth: max. 200 mm

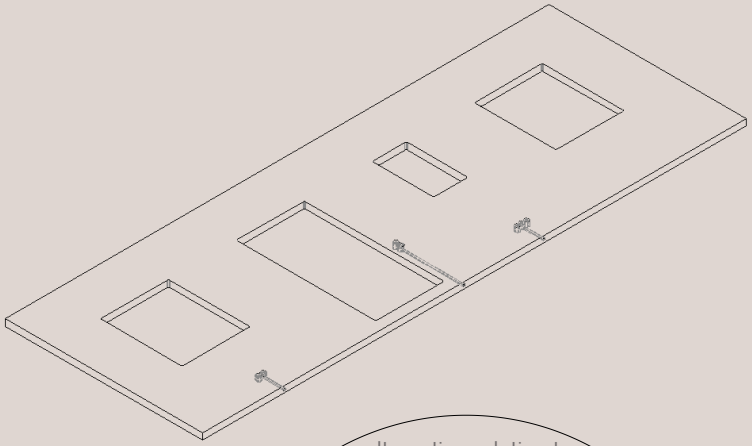
larger circular openings:
can be machined in any diameter greater than 60 mm
Ø > = 60 mm → machining depth: up to 320 mm max.

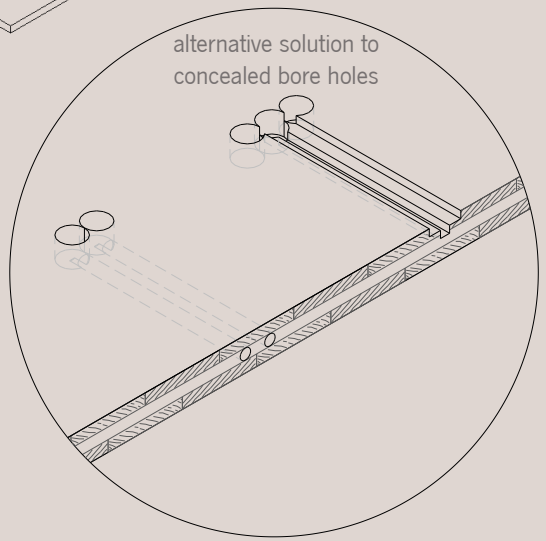


14 concealed bore holes

Concealed bore holes are usually required to hide electrical installation in elements with double sided visual surface qualities. The holes have to be located in the very center of the panel. As they are created manually, higher tolerances may occur.

hole diameter:	30 mm
minimum panel thickness:	100 mm





Note: when using 3s panels there is a risk of panel breaking!!!

- center distance between holes at least 80 mm
- the holes have to be located in the very center of the panel thickness

15 machining of internal corners

Internal corners are machined with a 40 or 60 mm diameter finger router, resulting in rounded corners with a radius of 20 or 30 mm.

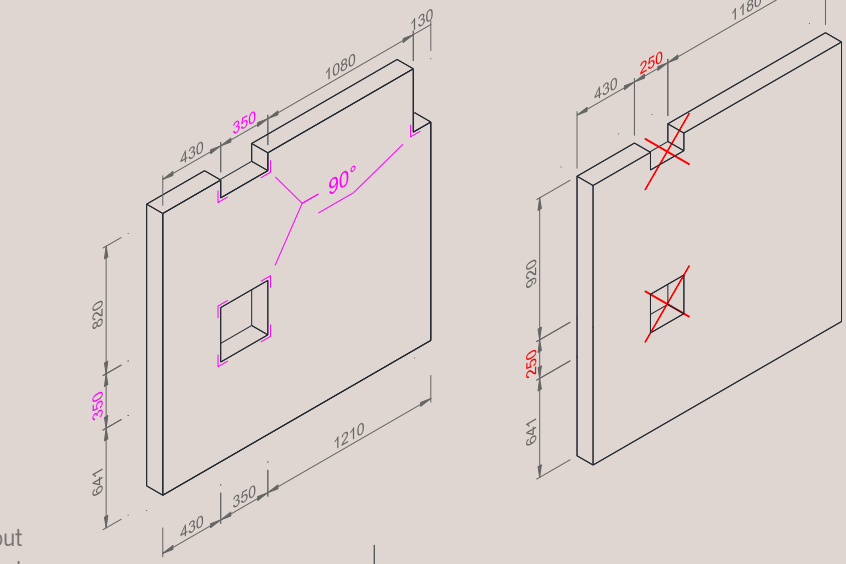
sharp internal corners

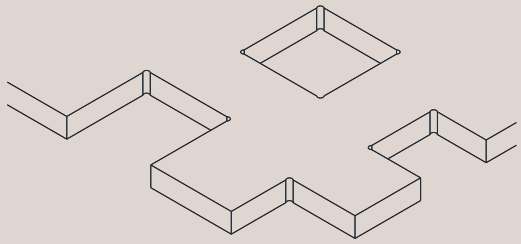
Upon request internal corners with a sharp 90 degree angle can be created by manual reworking, up to a panel thickness of 320 mm.

corner drillings

Upon request internal corners can be reworked by means of corner drillings throughout the whole panel thickness by machine. The corner drillings are located in a way, so that the reach as far as the vertex, resulting in small exceedance of the opening contour.

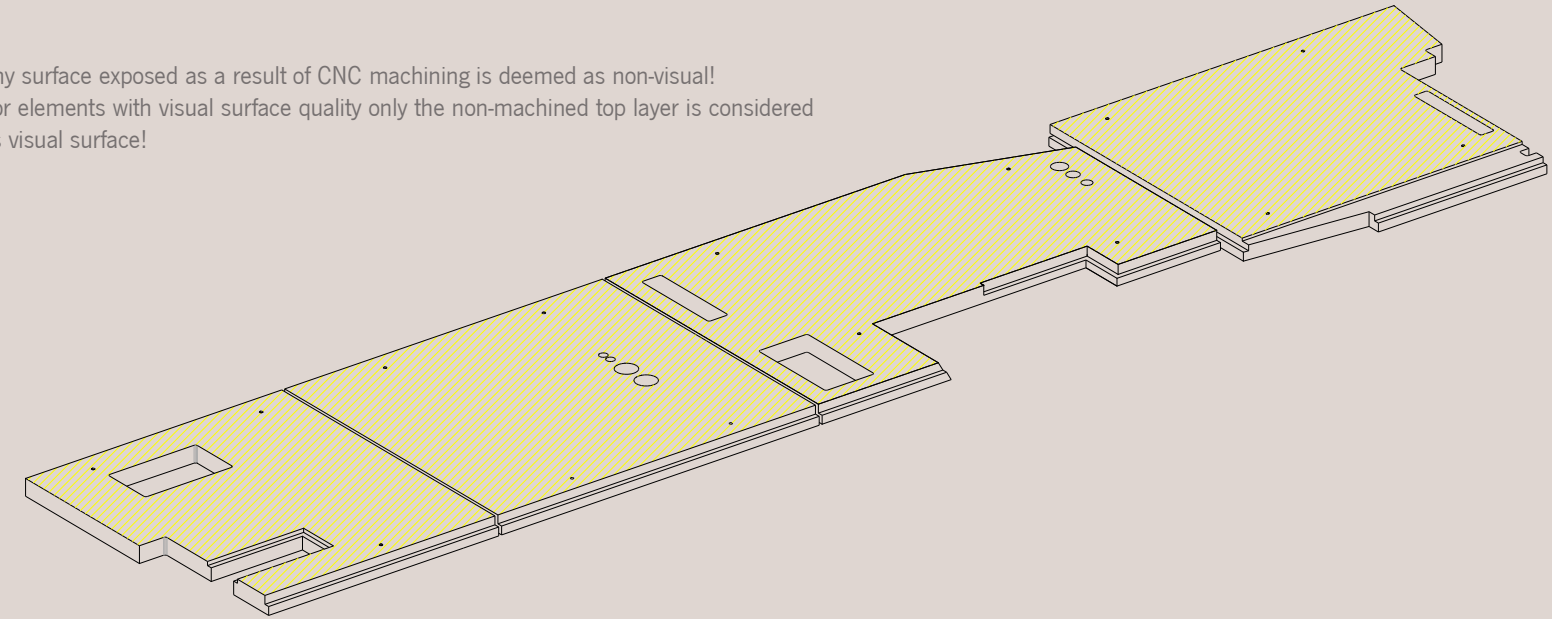
recommendation:	for double sided NVQ surface quality
angle:	only 90° to panel surface
panel thickness up to 200 mm	corner drilling radius 20 mm
panel thickness from 210 to 320 mm	corner drilling radius 30 mm





16 CNC machined surfaces

Any surface exposed as a result of CNC machining is deemed as non-visual!
For elements with visual surface quality only the non-machined top layer is considered as visual surface!



17 machining tolerances

refer to our website – www.klh.at