FRILO
Software
A NEMETSCHEK COMPANY

HO12 - Timber Construction Details

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Note: *This document describes the **Eurocode-specific application**. Documents containing old standards are available in our documentation archive at www.frilo.eu >> Dokumentation >>Manuals>Archive.*

Contents

Further information and descriptions are available in the relevant documentations:

HO12 Basis of Calculation.pdf

FDC – Basic Operating Instructions	General instructions for the manipulation of the user interface
FDC – Menu items	General description of the typical menu items of Frilo software applications
FDC – Output and printing	Output and printing
FDC - Import and export	Interfaces to other applications (ASCII, RTF, DXF …)
FCC	Frilo.Control.Center - the easy-to-use administration module for projects and items
FDD	Frilo.Document.Designer - document management based on PDF

Application options

The software application is suitable for the structural calculation and design of typical timber beams with

- notches (solid and laminated timber) and

- openings (laminated timber).

Available standards

▪ DIN EN 1995

▪ ÖNORM EN 1995

▪ BS EN 1995

The former standards

- DIN 1052:1996/2006

- DIN 1052:2004/2008

are still available for selection.

(You can find descriptions referring to older standards in our archive at www.frilo.eu
▸ Service ▸ Documentation ▸ Manuals.

Notches

- On bottom, optionally with haunch or reinforcement

- On top

- Slanted on top
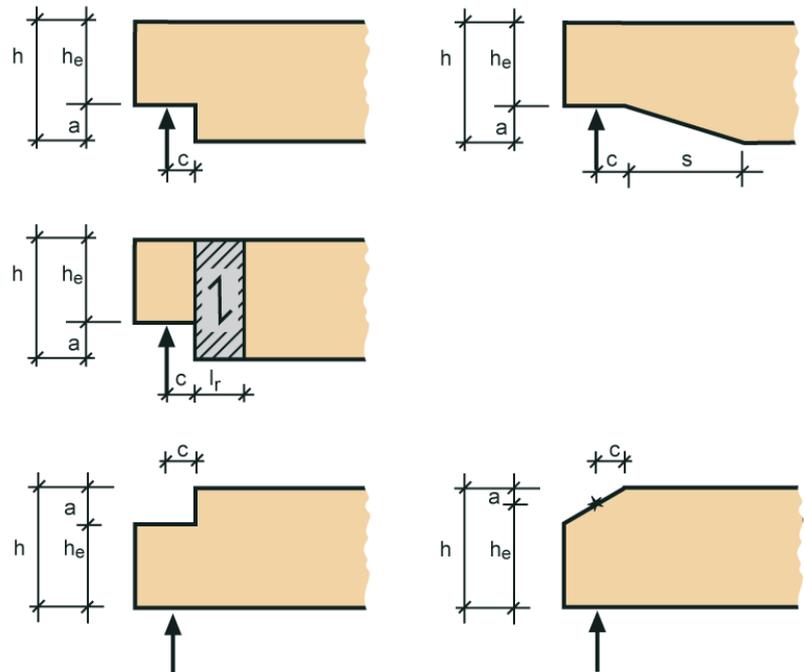
Openings in beams

- Rectangular

- Round

- Optionally with reinforcement:

  - Glued-on butt straps

  - Glued-in threaded rods

  - SPAX
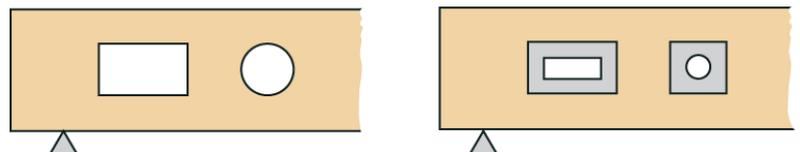
You must enter the internal forces and dimensions required for the verifications.

If the geometrical border conditions are satisfied, the resisting tensile force, the residual cross section and the reinforcement are verified.

Basis of calculation

The basis of calculation is described in the separate document:
HO12-Basis of Calculation.pdf

Definition of the structural system

Select the applicable standard and the structural system in the main menu:

- Notch

- Opening

Marking of required values or limits

When defining notches or openings, there are many dimensions that have an influence on each other. Therefore, the required values or limits are displayed. If the limits are exceeded, the font colour of the displayed value turns to **red**.

Material

Select the timber species, sorting class and usage class. Clicking on the [...] button displays an input window for the material coefficients (specific weight).

Note: *Softwood and hardwood according to EN 338: 2016 implemented. Glulam according to EN 14080: 2013 implemented for Germany and Italy. The "old" glulam timbers are marked with an asterisk (e.g., GL24c *).*

Notch

Dimensions

h   total height of the beam

b   width of the beam

Notch
    Selection of the type of notch: on top, on bottom, slanted on top

a   height of the notch

L   length of the notch

LP   length of the supporting plate

s   length of the haunch
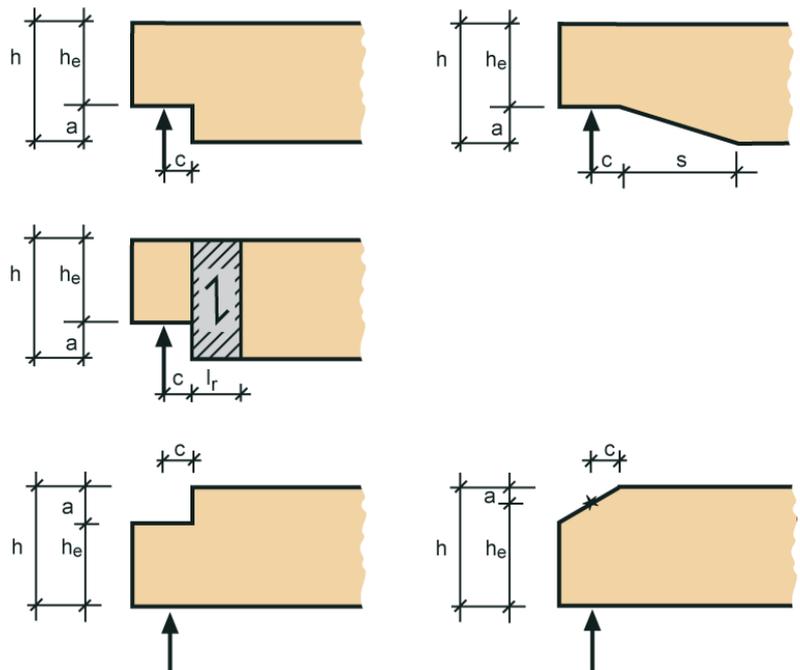
The specified values are shown on the graphic screen so that you can check them.

The software checks whether the minimum distances specified by the standard are complied with. Under particular conditions, the calculation is allowed even in the event of non-compliance (see also Basis of Calculation).

Internal forces

Vd	design value of the shear force = support reaction	
Load-action period	short, medium, long, permanent	
Design situation	permanent, transient, accidental	
c	distance to the edge of the notch	

internal forces
shear force   Vd=   20,80 kN
load duration class   short-ter ▼
design situation   persister ▼
distance   c=   70 mm

Reinforcement

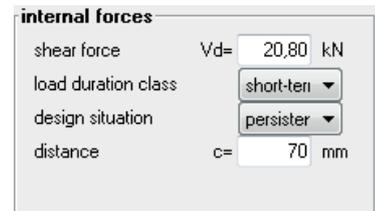In this section, the intermediate results referring to the defined notch are put out for the design load case. These results are

perm.Vd the resisting tensile force
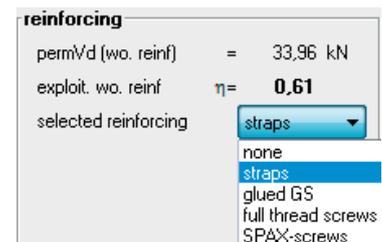
η the utilization ratio
if the existing shear force exceeds the permissible tensile force by more than 5 per cent, the utilization ratio is displayed in red and "> 1" is added to the marked value.

exploit. wo. reinf η=   **1,47** >1

Selection of the reinforcement

The available options depend on the selected standard

- Butt straps

- Glued-in threaded rods

- Fully threaded screws

- SPAX screws

reinforcing
permVd (wo. reinf)   =   33,96 kN
exploit. wo. reinf η=   **0,61**
selected reinforcing   straps ▼
none
straps
glued GS
full thread screws
SPAX-screws

When you select the desired reinforcement, the corresponding input fields are displayed.

*Note: You should note that the new standards DIN 1052:08/2004 / DIN 1052:12/2008 and
DIN EN 1995-1-1/NA:2010 imperatively require reinforcements for notches in usage class 3.*

But straps

First select the strap material:
coniferous timber, deciduous timber, laminated timber, plywood

with glued straps
material of straps   Conifer ▼   C 24 ▼
width   tr=   20 mm   req tr=   9 mm
length   lr=   200 mm   req lr=   56 mm
min lr=   75 mm   max lr=   150 mm
$\eta\sigma$=   0,45 $\eta\tau$=   0,28

tr	thickness of the butt strap
lr	length of the butt strap in the axial direction of the beam
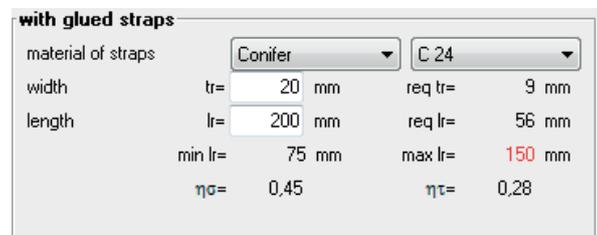
If you enter "0", the corresponding required value is set by the software.

The required values, the utilization ratios for the stress resistance verification of the butt straps and the shear stress resistance verification of the glued joints are displayed.

Glued-in threaded rods

Parameters

- Number of threaded rods
- Selection of the diameter
- Selection of the strength class of the threaded rods (4.8, 5.8, 8.8)

L   gluing-in length

cf   countersinking depth

a4   distance to the edge perpendicular to the beam axis. The threaded rods are evenly distributed over the residual cross section. The graphical representation allows you to control the effects of your settings.

η**Ft/τ**   indication of the utilization ratios of the selected threaded rods and the glued joint.

Fully threaded screws / self-tapping screws - SPAX

Parameters:

Number of screws

d1   screw diameter

d3   root diameter of the screw

L   screw length/screwing-in depth (if you specify "0", the minimum value is set by the software)

SPAX   selection of the screw type and length

cf   countersinking depth

a4   distance to the edge perpendicular to the beam axis. The screws are evenly distributed over the residual cross section. The graphical representation allows you to control the effects of your settings.

η**FT**   display of the utilization ratio of the selected screws.

Note: *The distance to the notch is automatically set by the software (and displayed on the graphic screen).*

Opening (hole)

Note: *Openings in the sense of the standard are holes with a diameter greater than 50 mm. The rules for weakened cross sections should be observed.*

The specified values are shown on the graphic screen so that you can check them.

Opening (hole)

You can define multiple openings for a beam.

To define an additional opening, click on the **+** button

To toggle between the defined openings, use the "<<" and ">>" buttons.

To delete the currently active opening, click on the ☒ button. The number (No.) of the currently active opening is displayed.
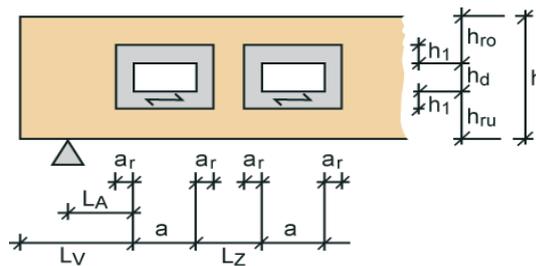

You can select among the following options:

- Rectangular opening
- Round opening

Beam dimensions

l	length [mm]
h	height
b	width
a	projection (distance of the support to the beam edge)

Distances and dimensions of the opening

LV	distance to the edge
LA	distance to the support
LZ	display of the clear distance between the openings
a	length of the opening
hd	height of the opening
hru	distance of the opening edge to the bottom edge of the beam
hru	distance of the opening edge to the top edge of the beam
r	radius of the rounding in the opening corners
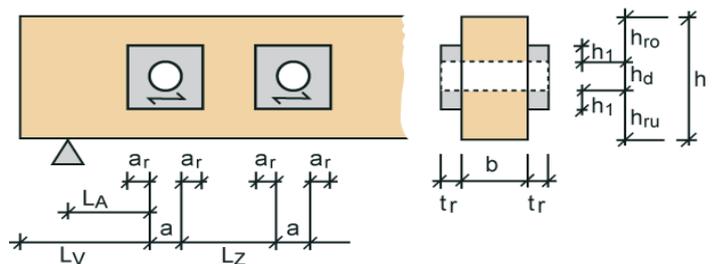
### Additional parameters

Design situation	permanent, transient, accidental
Load-action period	very short, short, medium, long, permanent
Reinforcement	glued-on butt straps, glued-in threaded rods, SPAX
	Note: Particular standards always require imperatively reinforcements for openings in beams of usage class 3.

Material	material selection in line with the selected reinforcement
Vd	design value of the shear force in the respective location (on the left, in the middle, on the right)
Md	design value of the moment
ar	projection of the reinforcing butt strap in the direction of the beam axis
h1	vertical projection of the reinforcing but strap
tr/2	thickness of the butt strap

Please note that the internal edge forces with round openings must be defined at the distance $\pm a \cdot \dfrac{\sqrt{2}}{2}$ from the centre of the opening.

The software calculates the utilization ratio of the tensile force (ηFt) and the verification of the bending edge stress ($\eta\sigma$R) on the basis of the specified opening dimensions.
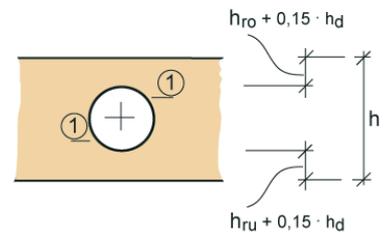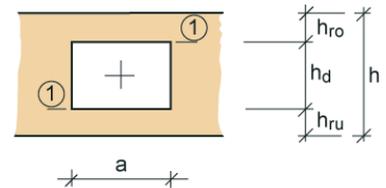
Reinforcement

But straps

Parameters:

- Material of the butt straps
- Projections of the strap in axial direction and in height
- Total strap thickness of both butt straps

$\eta\sigma$	indicates the stress utilization of the butt straps
$\eta\tau$	indicates the shear stress utilization of the glued joints

Glued-in threaded rods

Parameters:

- Number of threaded rods per opening edge
- Selection of the diameter (12 mm to 36 mm)
- Selection of the strength class of the threaded rods (4.8, 5.8, 8.8)

L	gluing-in length
cf	countersinking depth
a4	distance to the edge perpendicular to the beam axis The threaded rods are evenly distributed over the residual cross section. The graphical representation allows you to control the effects of your settings.
ηFt/τ	indicates the maximum utilization ratio of the selected threaded rods/glued joint.

Self-tapping screws - SPAX

Parameters:

- Number of screws

SPAX	selection of the screw type and length
cf	countersinking depth
a4	distance to the edge perpendicular to the beam axis. The threaded rods are evenly distributed over the residual cross section. The graphical representation allows you to control the effects of your settings.
ηFT	displays the utilization ratio of the selected screws.

Output

The user can launch the output of system data, results and graphical representations on the screen or the printer via the Output menu item → See also the document Output and Printing - FDC and output in the Frilo.Document.Designer

Word	If installed on your computer, the text editor MS Word is launched and the output data are transferred. You can edit the data in Word as required.
Screen	displays the values in a text window on the screen
Printer	starts the output on the printer
Page view	(file menu) displays a Print preview.

The results that are put out include the geometrical border conditions, the resisting tensile force, the verifications of the residual cross section and the selected reinforcements as well as their utilization ratios.

Reference literature

/1/   DIN 1052: 04.88, Teil 1, Holzbauwerke, Berechnung und Ausführung

/2/   DIN 1052: 10.96, Teil 1 A1, Holzbauwerke, Berechnung und Ausführung, Änderungen

/3/   Erläuterungen zur DIN 1052: 04.88

/4/   DIN 1052: 08.2004

/5/   Erläuterungen zur DIN 1052: 08.2004

/6/   Zulassung Z-9.1-519, SPAX-Vollgewindeschrauben

/7/   Blaß, Steck, Querzugverstärkungen von Holzbauteilen aus Bauen mit Holz, 03/99, 04/99, 05/99

/8/   Blaß, Bejtka, Selbstbohrende Holzschrauben und ihre Anwendungsmöglichkeiten, Holzbau Kalender 2004

/9/   Informationsdienst Holz, Teil 5 Konstruktionsbeispiele

/10/   Brüninghoff, Schmidt ,Wiegand, „Praxisnahe Empfehlung zur Reduzierung von Querzugrissen" aus Bauen mit Holz, 11/93

/11/   DIN EN 20898-1: Mechanische Eigenschaften von Verbindungselementen

/12/   DIN 18800-1: Stahlbauten

/13/   Anpassungsrichtlinie zur DIN 18800

/14/   DIN 1052: 12/2008