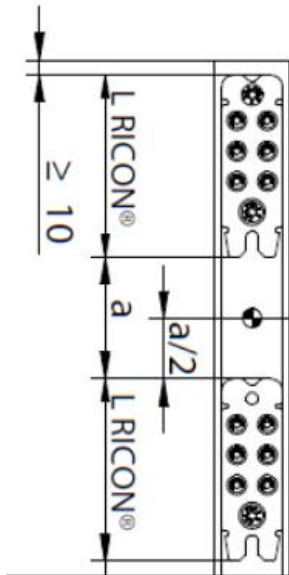


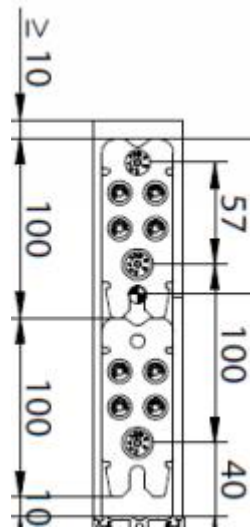
UPDATE: Testing Concealed Double Connections

The currently on-going testing campaign being carried out at a variety of research facilities across Canada aim to provide a more detailed understanding on the performance of concealed, pre-engineered connection systems. Pre-engineered, concealed connection systems are new to the North American timber industry and standard applications are not always the most cost effective solution. Slender beams may not fit the available “off the shelf” connector plate and variations are required. One option is to utilize a double connection on a single cross section as shown below.



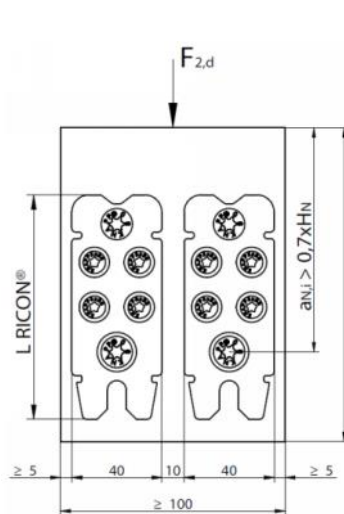
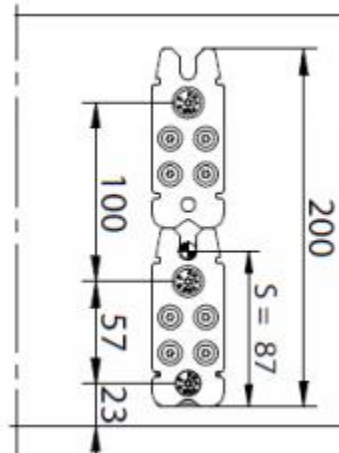
Double RICON

Deep and narrow joist at 100% capacity

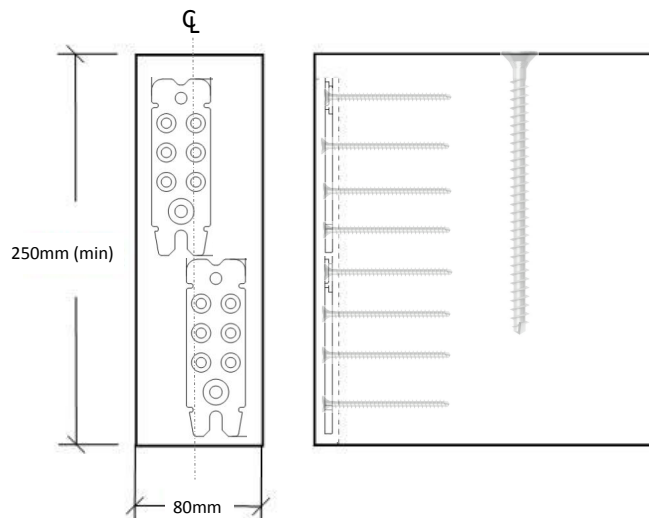


Double RICON

Small and narrow joist at 100% capacity



Double RICON in wide beam
at 200% capacity



**NEW connector layout staggered Double RICON
120/40 in narrow joist at 200% capacity**

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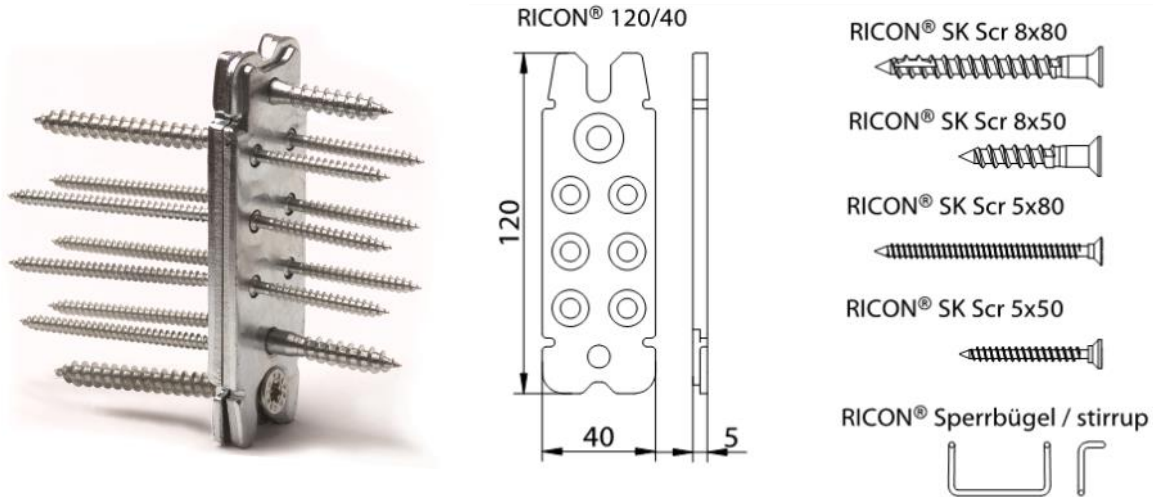


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Campaign #1: Testing Concealed Double Connections

Utilizing the staggered connector pattern on a cross section allows to double the capacity of a single connector while keeping the joist and beam cross section width to a minimum.



Ricon® 120/40 hardware set



Typical assembly



Typical concealed install

Campaign #1: Testing Concealed Double Connections

Connections with Double Ricon Connectors: Background Information

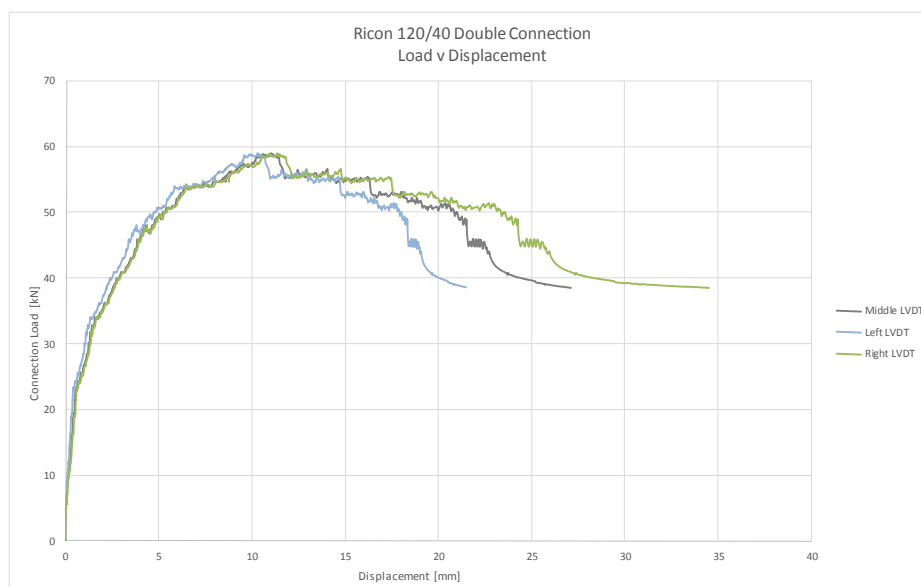
The primary goal of this ongoing testing campaign is to verify the load bearing capacity of a concealed double connection with a staggered configuration. The testing is intended to prove that mechanical design models established in Europe in the past decade can be applied for design. This testing is also intended to prove the efficiency of perpendicular to grain reinforcements with full thread screws which is required with the selected connection layout. The purpose of the small series testing exercise is also meant to determine if there is a discernible linear load-sharing relationship between the double connectors in the same joint. The system under examination is the Ricon 120/40 which has an individual design capacity of 12.8kN under standard load duration and moisture conditions in D.Fir Glulam.

Testing Campaign

Previous testing indicated that connectors placed directly above one another (in one row) exhibit some sort of group interaction effect, which reduces the capacity from what would be expected based on the capacity of an individual connector. Following European design methodology a double Ricon 120/40 connection, considering standard load duration factors and standard material and condition factors, is estimated at 25kN in vertical shear resistance in D.Fir Glulam. As it can be seen in the provided load displacement curve for one of these tests, the ultimate load bearing capacity is about 50kN and is still within the linear elastic range. Furthermore, the connection ultimately failed after significant deformation of the steel connector plate in combination with shear bending, splitting, crushing and pull-out. From these preliminary results it appears that double the capacity of a single connector may be used in a staggered connector setup. A factor of safety over 2.0 for ultimate (linear) capacity to design capacity would be apparent. Further testing will be performed to reinforce the observed conditions.



Double Ricon Joint Configuration
(Matthew Ficara©)



Courtesy of: Matthew Ficara ©

REFERENCES:

- [1] KNAPP Connectors Design Guide, MyTiCon Timber Connectors, *Surrey, Canada*.
- [2] ASTM D7147-11. *Standard Specification for Testing and establishing Allowable Loads of Joist Hangers*. ASTM International, 2011. West Conshohocken, PA, United States.
- [3] Ficara, M. and MacDougall, C. (2016) *Preliminary Report: Timber Connectors, Design Capacity and Failure Mechanisms*. Queen's University. Kingston, Ontario, Canada.

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