

Tests and modelling of wood in shear at elevated temperatures

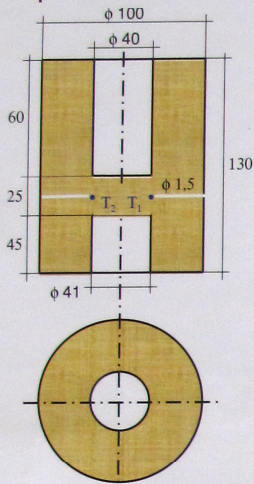
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Introduction

Description of the tested specimens:



Geometry and dimensions of the tested specimens

Geometric properties

The geometry of the specimen allows to take into account a thermal gradient in the specimen with a uniform temperature on the shear section

Measurements and loading

- T_1 and T_2 : thermocouples at the sheared section.
- 3 thermocouples on the surface.
- Load application : steel cylinder (d = 39,8 mm).



General view of a specimen before the test

Material properties

- Glued-laminated wood
- Class GL 24 h
- Average moisture content before test : 8%

Testing program

Four different tests are carried out:

Tests 1 to 4

- Temperature of the furnace = 250 °C
- Load applied when $T_1 = T_2 = 100$ °C
- Presence of a thermal gradient inside the specimen

Tests 5 and 6

- Temperature of the furnace = 105 °C
- Load applied when $T_1 = T_2 = 100$ °C
- Dry specimen before the test (H = 0%)

Test 7

- Temperature of the furnace = 250 °C
- Load applied when T_1 and $T_2 = 150$ °C
- Dry specimen before the test (H = 0%)

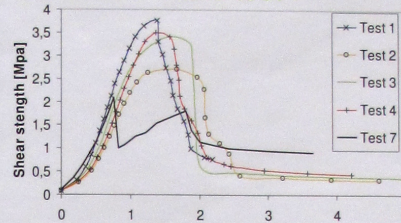
Tests 8 and 9

- Cold tests: ambient temperature (20 °C)

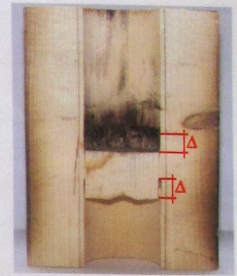
Results and discussion

Load-displacement results:

Tests 1-4 and test 7

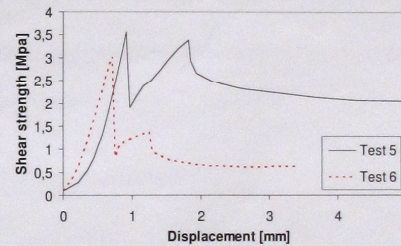


Load-displacement curves (tests 1-4 and test 7)



Cut section of specimen 2 after test

Tests 5 and 6

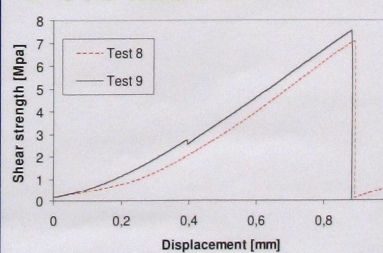


Load-displacement curves (tests 5 and 6)



Cut section of specimen 5 after test

Cold tests 8 and 9



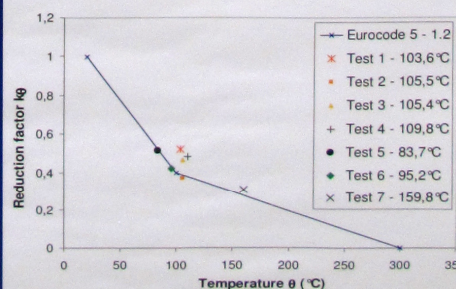
Load-displacement curves (tests 8 and 9)

Tests observations:

- Same level of strength for specimens 1 to 4 and 5 to 6.
- Brittle failure with a smooth surface at the shear section for the dry specimens
- Brown colour observed inside specimens 1 to 4 due to the migration of water against the steel cylinder.

- Decrease of 40 to 50% of the shear strength at 100 °C.
- Decrease of 65% of the shear strength at 150 °C.

Comparison of the results to Eurocode 5:



Reduction factors of the shear strength

Homogeneous results and good agreement with the values given by the Eurocode.

Further developments: integration of the shear properties of wood in the modeling of thermo-mechanical behaviour of timber connections