Technical report No. 5-21
Mechanical Properties of Shear Connector

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Introduction

In order to determine the mechanical properties of Shear Connectors (Type SD1 acc. to DIN EN ISO 13918; Ø 22 x 294 mm), 14 parts totals were delivered to Department of Materials Engineering, CTU in Prague (see **Fig. 1**). 6 parts were intended for tensile test (3 parts marked with crosses) and 6 parts for bend test (see **Fig. 2**). Remaining parts were intended as a spare, one for each test. Shear connectors are made of material S235J2+C450 and the test results were compared with inspection certificate DIN EN 10204 - 3.1.

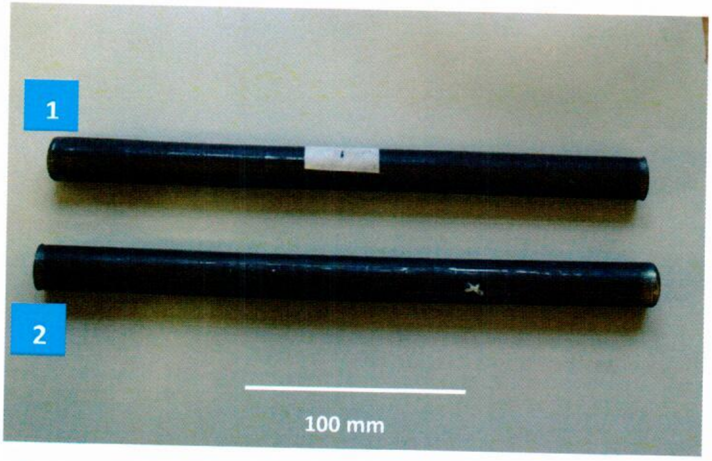
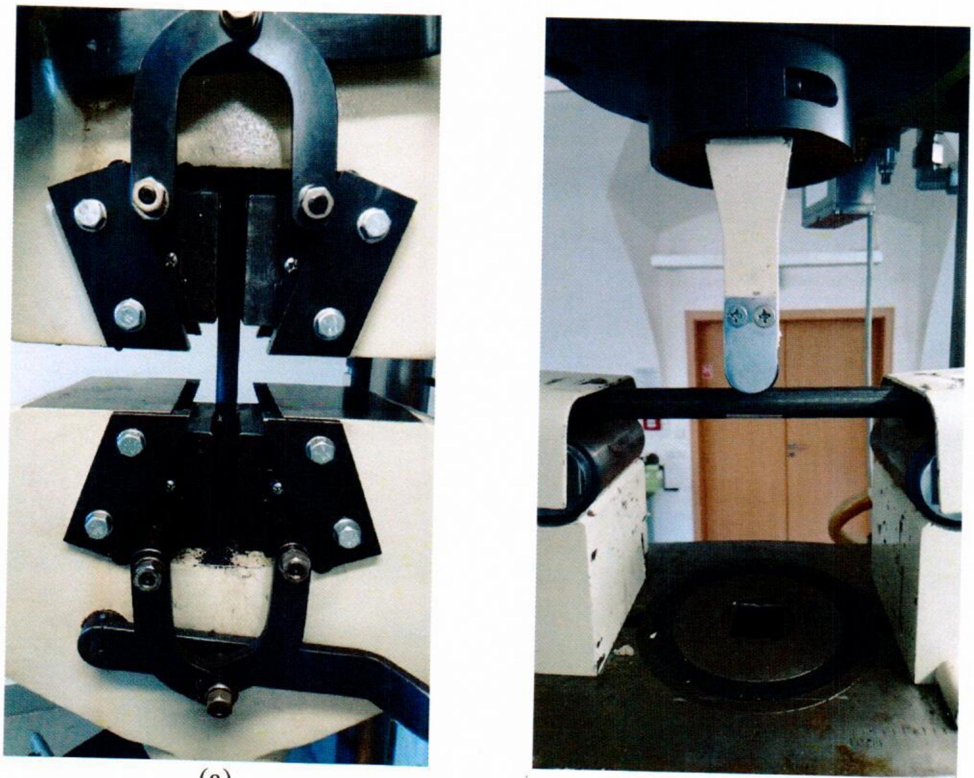


Fig. 1: Delivered testing specimens for bend test (designated 1) and tensile test (designated 2)



(a) (b)

Fig. 2: The processing of mechanical tests: (a) Tensile test, (b) Bend test

Test results

Mechanical testing was done using universal testing machines WEB 30 and WEB 50 under the conditions specified in the following standards:

- **Tensile test**: ČSN EN ISO 6892-1 (42 0310) – Metallic materials – Tensile testing – Part 1: Method of test at room temperature
- **Bend test:** ČSN EN ISO 7438 (42 0401) – Metallic materials – Bend test

The tensile and bend test were performed at laboratory temperatures of 22 °C, the crosshead rate was programmed to a constant value of 10 mm·min^{-1} for tensile test, and 5 mm·min^{-1} for bend test (see **Fig. 3**). For bend test the support distance was set to 218 mm. Working diagrams were obtained from the tests (see **Fig. 4**), from which the maximum achieved load F_m and yield strength were determined. Values were used for calculation of ultimate strength R_m and yield strength R_e. For each test, the arithmetic mean together with standard deviation were calculated.

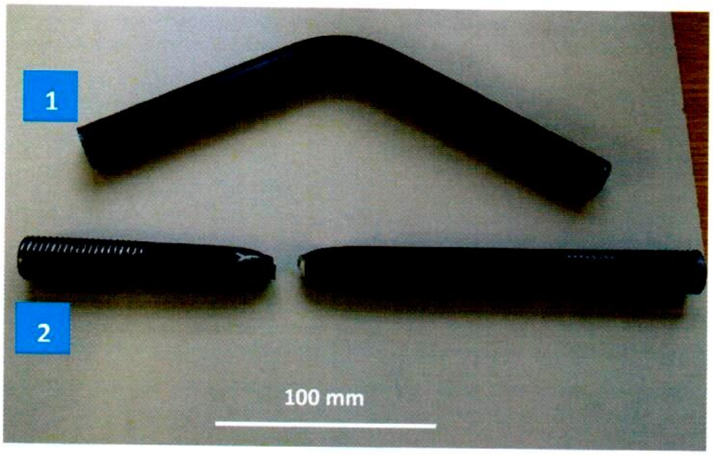
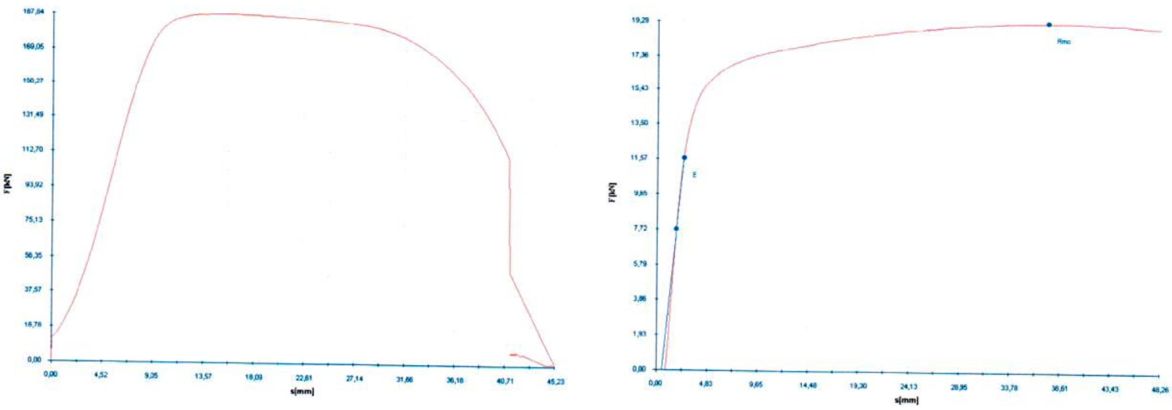


Fig. 3: Testing specimens after the bend test (designated 1) and tensile test (designated 2)



(a) (b)

Fig. 4: Example of working diagrams: (a) The tensile test diagram of specimen No. 2, (b) The bend test diagram of specimen No. 2

The test results (see **Table 1** and **Table 2**) were compared with the inspection certificate DIN EN 10204 - 3.1. Based on the result, it is possible to declare, that mechanical properties determined from the tensile test are in accordance with inspection certificate.

Since bending properties are not standardized, they were not compared to inspection certificate. However, the results are uniform and with minimum deviation. Same goes for the tensile test properties.

Table 1: Results of the tensile test

Specimen No.	Yield strength $R_{p0,2}$ (MPa)	Tensile strength R_m (MPa)	Elongation A_5 (%)
1	444	503	22.0
2	443	501	26.3
3 x	446	504	25.2
4	444	502	24.3
5 x	444	504	25.3
6 x	442	506	26.4
Mean value	***444 ±1***	***503 ±2***	***24.9 ±1.6***

Table 2: Results of the bend test

Specimen No.	Diameter of specimens (mm)	Flexural strength R_{mo} (MPa)
1	21.75	1 037
2	21.75	1 040
3	21.75	1 048
4	21.75	1 039
5	21.75	1 044
6	21.75	1 041
Mean value	***21.75***	***1 042 ±4***

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