Research Report 20151540-E

Executed by:	PQ-Ki 05.10.2015
Client:	F&A Carlon Clemente GmbH Morsbacher Str. 78 42857 Remscheid
Subject matter:	Comparision of tensile strength and fatigue limit of chipless repaired threads to new threads
Test object:	threaded stud M8 x 300 made of 1.5510 (28B2)
Sampling:	specimen provided by client

This research report has a total of 7 pages.

The research results only refer to the specimen
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1. General Information

This research report is based on a former research report 20122324 and is with regards to ist content unmodified. This new edition is due to change of name of the client.

In many fields of technology bolted connections transfer static as well as dynamic loads. Commonly these are damaged in use. This makes an assembly or a disassembly of component groups often very difficult. A following repair is frequently unavoidable. So far only cutting tools were used for repair, whereby the material is removed from the treads groove. Afterwaqrds the inner thread can move on the outer thread, but the tensile strength as well as the fatigue limit is reduced drastically. As a result the threaded component has to be replaced very often. A replacement is linked often with high expenses and long replenishment lead times. According to the client the SilberTool®-procedure allows for the very first time a forming back of material so the thread has ist original shape.

Aim of these analyses was to clarify whether a thread repaired by SilberTool®-procedure can bear up same static and dynamic loads as a new thread.

2. Testing method

In total four test series have been done. All testings have been done with threaded bolts in dimension M8x300 made of 1.5510 (2B28).

test series	test	thread	property class	fabrication	coating	lubrication
1	Undamaged	M8x300	8.8	tempered	galvanic zinc	degreased
2	repaired	M8x300	8.8	tempered	galvanic zinc	degreased

Table 1: Scheme for tensile test

The tensile test has been done due to DIN EN ISO 898-1 and listed in table 1. In order to test damaged threads one side of the threaded stud was damaged as shown in figure 1 (the first 15 pitches were damaged on the entire circumference). These damages have been repaired by „Silbertool R16“ so that the threads were fully formed back and fit for use as shown in figure 2. Thereafter 12 pitches of the threaded studs were screwed into the testing device.

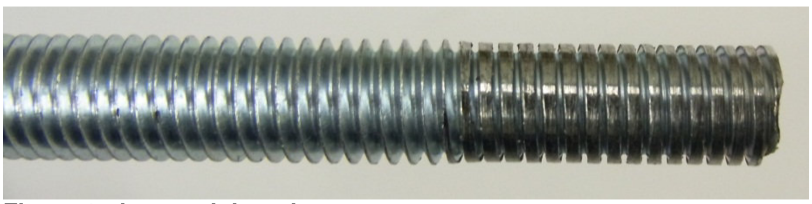

Figure 1: damaged thread

The fatigue tests with lateral load were performed on basis due to DIN 969. Also for this testing one side of the specimen was damaged and repaired by „Silbertool R16“ as mentioned above and shown in figure 1 and figure 2.

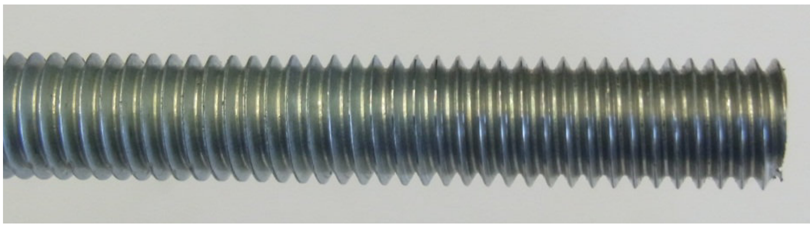

Figure 2: repaired thread

test series	test	thread	property class	fabri-cation	coating	lubrication	average load	pre-tension	fre-quency
3	repaired	M8x300	8.8	tem-pered	galvanic zinc	degreased	50% $F_{0,2}$	axial	70 Hz
4	undamaged	M8x300	8.8	tem-pered	galvanic zinc	degreased	50% $F_{0,2}$	axial	70 Hz

Table 1: Scheme of fatigue test with lateral load

The specimen was bolted into the testing device subsequently pre-stressed. Using an average load of 50 % according to yield point due to DIN EN ISO 898-1 the thread was exposed to a force amplitude of 10 kN and load cycles of 70 Hz until failure.

3. Test Results

3.1 Tensile Test

The tensile test of both test series give equivalent test results (see fig. 4 and fig. 5). Fractures which lead to failures always occurred on the free loaded thread as shown in figure 3.

In both test series the required minimum break force due to DIN EN ISO 898-1 (2009-08) was exceeded and the bolted threads were not been damaged.

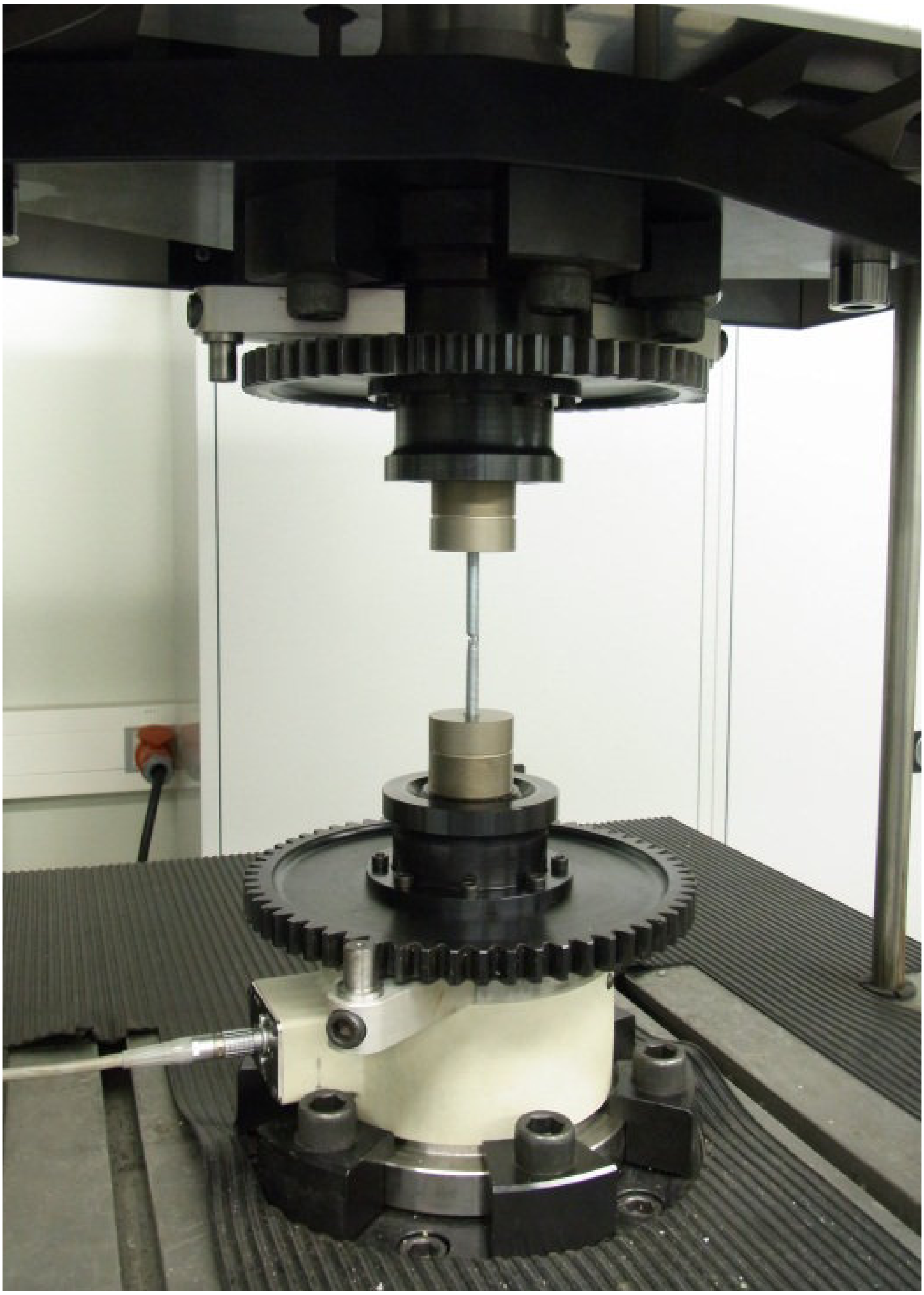

Figure 3: Failure after tensile test

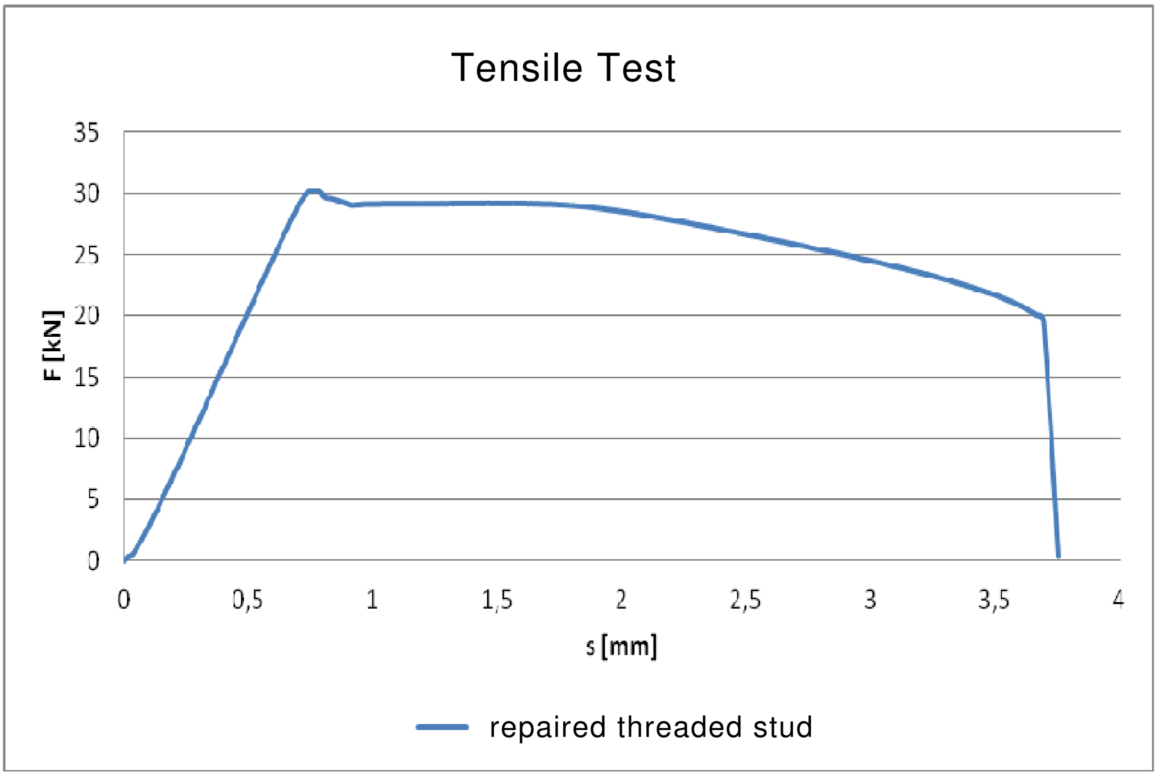

Figure 3: Tensile test of a repaired thread stud

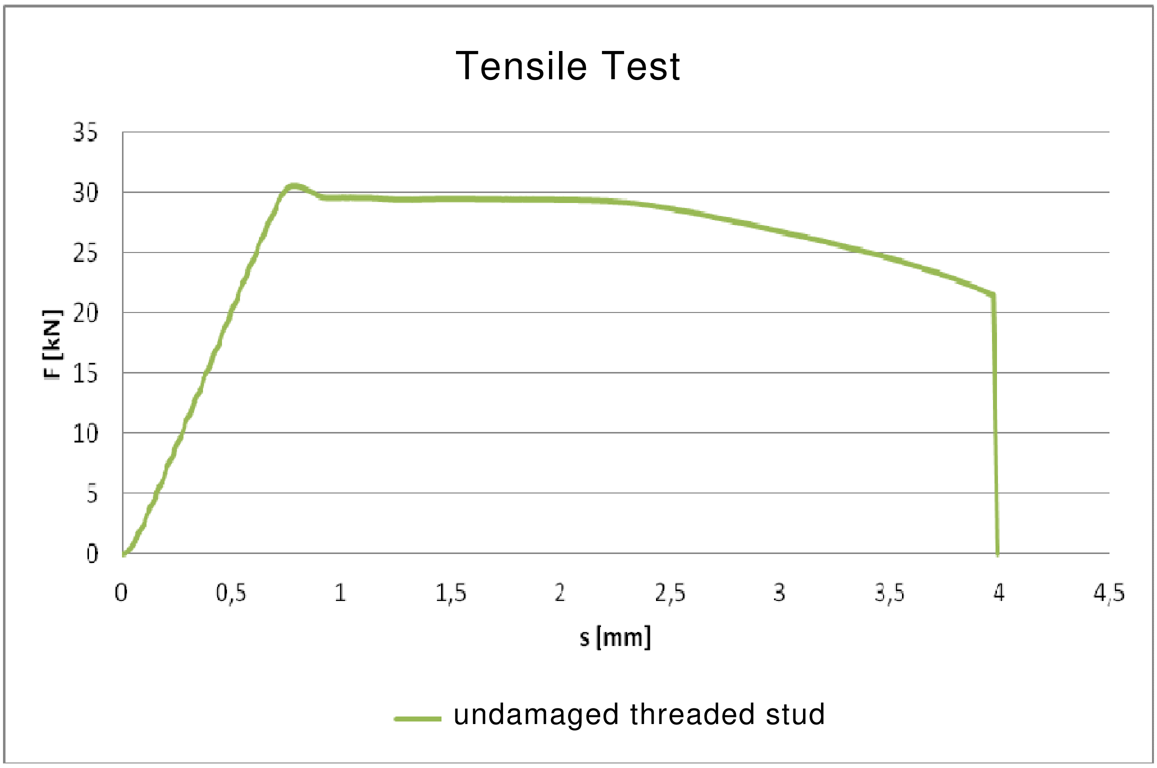

Figure 5: Tensile test of an undamaged thread stud

3.2 Fatigue Test

In order to compare the fatigue limits of an undamaged thread and a repaired thread directly the threaded stud was damaged and repaired again on one end. Afterwards it was screwed into the testing device. A fatigue fracture occurred only on the undamaged (new) end of the threaded stud, not at the repaired end (see fig. 6). Following a validation of this result has been done by testing entirely new threaded studs. The failure fatigue occurred after appr. 15,000 cycles too (see fig. 7).

Figure 6: Fatigue failure of a threaded stud M8-8.8 in first carrying pitch

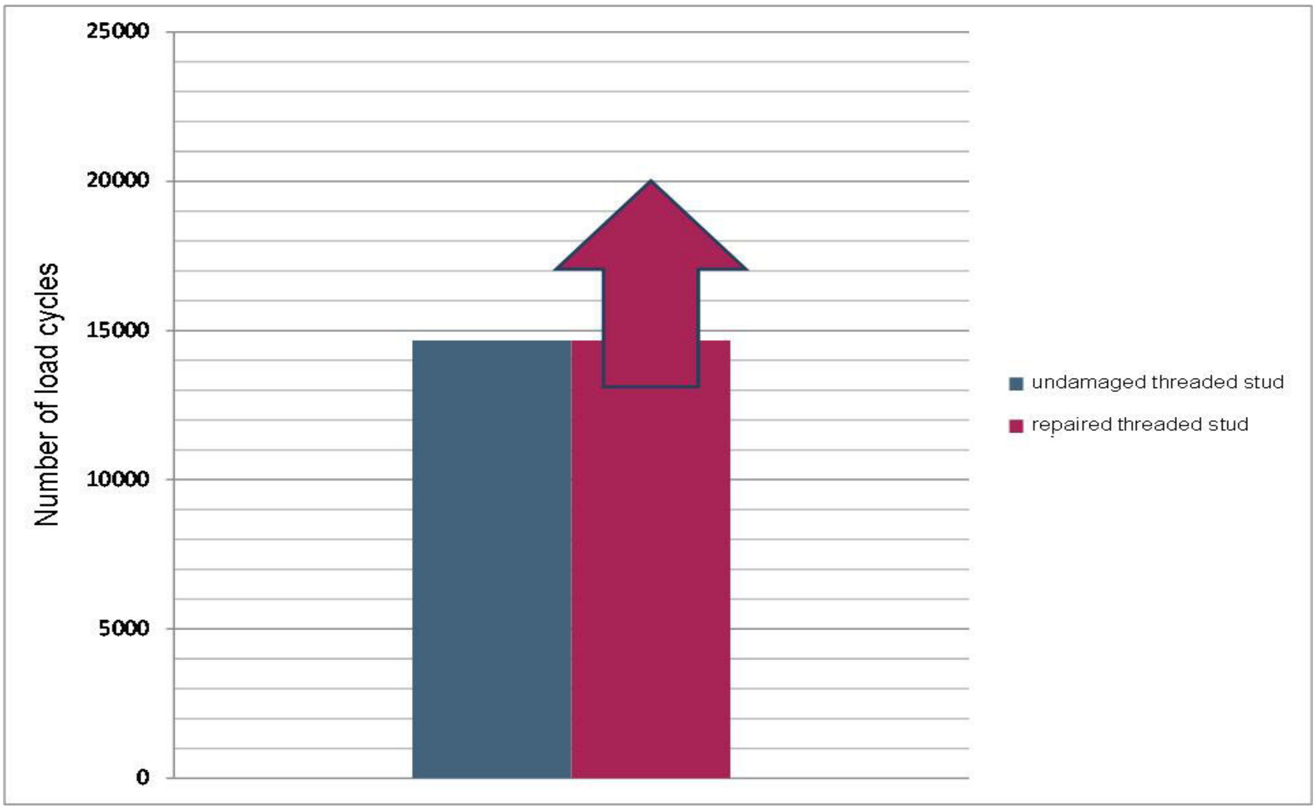

Figure 7: Comparison of fatigue strength of a thread repaired by SilberTool®-procedure with an undamaged thread

4. Summary and Advisory Opinion

A repair by using SilberTool®-procedure does not have a negative effect on the static and dynamic stability of the thread. All obtained results match the required standard values given in DIN ISO 898-1. Threads which have been repaired by SilberTool®-procedure have shown within the tests a higher fatigue limit than new threads. By using the SilberTool®-procedure the threads surface is burnished and the materials surface is cold work hardened. A quantitative conclusion concerning positive effects on fatigue limit has to be ascertained in separate experiments.

Garbsen, 05.10.2015

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