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Date: 5 May 2010
Subject: Comment and Comparison of Previously Performed Tests on GRP Rebar and ASTM 7205/7205D - 06

1. Introduction

Quest Integrity NZL Ltd (formerly Quest Reliability Ltd) conducted mechanical tensile tests on samples of glass reinforced plastic or GRP (composite) reinforcing bar (rebar) supplied by Pultron Composites Ltd. in 2008. Quest Integrity used standards ASTM D638 and D3916 as a guide. Pultron has requested Quest Integrity to comment on and compare the method used in those tests with the standard ASTM D7205/7205D – 06 supplied to Quest Integrity in April 2010.

2. Comments

ASTM 7205/7205D – 06 was reviewed. The following comments address the relevant clauses as they appear in order in this standard.

Clause	Brief description of the clause in ASTM 7205	Quest Integrity test conformance/departure from the standard and comment
1.3	Strength values are static, short term only	Conforms.
4.2	Anchors shown on Annex A1 are recommended but not required	Pultron's anchor design and manufacture was somewhat similar to that shown in Figure A1.2. However, the end plugs were glued and both ends were similar. The anchors are primarily required to ensure that the specimen breaks away from the ends in the preferred tested region. Pultron's anchor design achieved this to a high degree. In this respect, Pultron's anchors were considered to have conformed to this requirement.

5.1	Preparation of test specimens	<p>Since the tensile force was applied to the underside of the inner plug, contacting split tapered jaws whose grip portion was not in contact with the specimen, it was important that the force was applied evenly over the area of the end plugs. Since almost all specimens broke in the preferred region and the strength values were close to the expected values, this is presumed to have been the case and the loading was satisfactory.</p> <p>All specimens were conditioned, as required for composites, see below.</p> <p>It is considered that Quest Integrity's tests conformed to this requirement.</p>
6.2	Gripping	Conforms. No slipping occurred outside normal statistical expectations in the batch.
6.3	System alignment	Conforms.
7.1-7.2.4	Apparatus	Conforms.
7.3	Anchors	<p>The machine used to test the specimens is not fitted with self-aligning jaws and the specimens were not manufactured in a manner suitable to apply the load as shown in Figure A1.3. When the test was performed, the load was applied slowly initially and the specimen aligned so that lateral slippage was largely avoided. While occasional slippage was thought to have occurred (detected by hearing a sound), thereby effecting a degree of self-alignment, this did not appear to adversely affect the test results. The test is considered to have conformed to this requirement.</p>
7.3.1	Attachment	<p>This clause prescribes the method of attachment by using the word "shall". In this respect Quest Integrity's method did not conform to the requirement. However, as mentioned above, almost all of the specimens broke in the expected region and in a manner that indicated that the specimen was appropriately loaded. A composite product of this type cannot be expected to break in a small axial region, evenly through the section.</p>
7.4	Extensometers	Conforms.
8	Sampling and Test Specimens	Conforms.
10 and 7.5	Conditioning	Conforms. An environmentally controlled room was used for conditioning at the prescribed temperature ($23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ and RH $50 \pm 10\%$).
11.1– 11.2	Procedure	Conforms. Specimens were supplied as-manufactured by Pultron.
11.3	Speed of testing	Conforms.
11.4	Testing environment	Considered to conform. The test machine was in a different room to the conditioning room. However, the temperature was within the tolerance given above. All specimens were taken straight to the testing machine and tested within about 10 minutes of their removal from the conditioning room. This would have given very little time for moisture transportation into or out of the samples that would have been in a similar condition to those established in the conditioning room.
12	Validation	Conforms.
13	Calculation	Conforms.
14	Report	<p>Reporting was not as comprehensive as that described in the standard. However, most of the aspects required to be reported were reported. Reporting mostly conformed where appropriate. For example, detailed description of the mode of rupture of the specimens was not requested, nor included.</p>

Clauses omitted from the table above are those to which Quest Integrity's tests either conformed or are considered not to have been relevant or appropriate considering the supply of as-manufactured specimens.

3. Additional comments

A review of ASTM D7205 has found this standard to be the most appropriate of the three standards mentioned above for testing the specimens supplied by Pultron in 2008. At the time of testing, Pultron reported that they had completed exhaustive trials and tests on the GRP rebar product using different design of anchor. The specimens supplied to Quest Integrity represented what was considered by Pultron to be their most successful design to date. Thus, Quest Integrity's tests were required to accommodate this design. Details of the design and manufacture of the specimens are not known.

The supplied specimens were too long for Quest Integrity's testing machine that featured self aligning jaws and the larger diameter bars required a machine with adequate over-capacity in the load required which the self-aligning machine did not have.

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