Underwriters Laboratories Inc.®

Northbrook Division
333 Pfingsten Road
Northbrook, IL 60062-2096
www.ul.com
tel: 1 847 272 8800
fax: 1 847 272 8129
Customer service: 1 877 854 3577

January 4, 2006

Waco Composites I Ltd.
Mr. W. C. Hampton
481-A Texas Central Pky.
PO Box 21223
Waco, TX 76702

Our Reference: File BP8910, Vol. 1
Tag No(s). F283180 through F283185 & F283200

Subject: Conforming Follow-Up Test Results On Bullet-Resisting Metals and Plastics, CCN: CNLW

Dear Mr. Hampton:

The Follow-Up Service Testing has been completed on the Armor Core Levels 1, 3, 4, 5, 6, 7 & 8 selected by our UL Representative at your Waco, TX factory on September 29, 2005 and received at our testing office on November 28, 2005.

The results of the testing conform with the provisions of the Follow-Up Service Program.

Your continued cooperation in maintaining conformance with the applicable test requirements is appreciated.

If we can be of any further assistance, please do not hesitate to contact us.

Very truly yours,

Debra Villarreal

Deborah Villarreal, (Ext. 43392)
Project Handler II
Follow-Up Testing Group
E-mail: Deborah.L.Villarreal@us.ul.com
Fax: (847) 313-3392

Reviewed by:

Lee Cetrone (DV)

Lee Cetrone
Section Manager II
Follow-Up Testing Group

File BP8910
Project 99NK09073

April 1, 1999

REPORT

On

BULLET-RESISTING MATERIALS AND PLASTICS

Waco Composites
Waco, TX

DESCRIPTION

PRODUCT COVERED:

Bullet resisting fiberglass material Models ArmorCore Level 1 rated Level 1, ArmorCore Level 2 rated Level 2, ArmorCore Level 3 rated Level 3, ArmorCore Level 4 rated Level 4. **ArmorCore Level 5 rated Level 5, ArmorCore Level 6 rated Level 6, ArmorCore Level 7 rated Level 7 and ArmorCore Level 8 rated Level 8.**

ENGINEERING CONSIDERATIONS (NOT FOR FIELD REPRESENTATIVE'S USE):

The products covered are bullet-resisting plastic armor materials intended for use indoors or outdoors. These materials are intended to be used in bullet-resisting enclosures, armored vehicles and teller fixtures. This material is a fiber reinforced plastic comprised of a number of fabric plies bonded with a rigid plastic resin.

CONSTRUCTION DETAILS:

General - ArmorCore is a fiberglass reinforced plastic material consisting of multiple layers of Woven Roving fiberglass cloth impregnated with a thermoset polyester resin and compressed into rigid flat sheets.

Model	Rating	Thickness (in.), min.
ArmorCore Level 1	Level 1	0.288
ArmorCore Level 2	Level 2	0.404
ArmorCore Level 3	Level 3	0.478
ArmorCore Level 4	Level 4	1.341
ArmorCore Level 5	**Level 5**	**1.4375**
ArmorCore Level 6	**Level 6**	**0.375**
ArmorCore Level 7	**Level 7**	**1.125**
ArmorCore Level 8	**Level 8**	**1.4375**

Minimum Size - The minimum overall dimensions shall not be less than 12 by 12 in.

Marking - Each product shall be marked with the manufacturer's name and/or identifying symbol, date of manufacture, model number, and bullet-resisting rating.

TEST RECORD NO. 1

SAMPLE:

Four samples of Models ArmorCore Level 1, Level 2 and Level 3 material rated for Level 1, Level 2, and Level 3, respectively, were submitted by the manufacturer and subjected to the following test program.

General – The ammunition used for the investigation was:

Level 1 – 124 grain (8g) 9mm full metal copper jacket with lead core, minimum velocity 1175 fps (358 mps)

Level 2 – 158 grain (10.2g) .357 Magnum jacketed soft point, minimum velocity of 1250 fps (381 mps)

Level 3 – 240 grain (15.6g) .44 Magnum lead semi-wadcutter gas checked, minimum velocity of 1350 fps (411 mps)

All tests were conducted at close range, approximately 15 ft (4.6 m), using the ammunition and weapon specified. The test samples were mounted in a rigidly fixed frame, with 1/8 in. (3.2 mm) thick corrugated cardboard indicator panels placed approximately 18 in. (467 mm) behind the protected side of each test sample. During the test, each bullet velocity was monitored and recorded.

The samples were subjected to two different shot patterns: 2-shot and 3-shot.

The 2-shot pattern consists of two shots fired at the approximate center of the test sample, with the shots spaced between 1-1/4 to 1-3/4 in. (31.8 to 44.5 mm) apart. For both the single-shot and 2-shot pattern, spalling of bullet-resisting material from the protected side of the test sample is acceptable. However, there shall be no penetration of the projectile through the material such that damage to the indicator panels occurs, nor breaking apart of the sample which allows an unobstructed path for additional projectiles through the sample.

The 3-shot pattern consists of three shot spaced 4-1/2 in. (102-12.7 mm) apart in a triangular pattern in the approximate center of the test sample. With this shot pattern, there shall be no penetration of the projectiles through the test sample, nor spalling of the material on the protected side of the test sample, to the extent that fragments embed in or damage the cardboard indicators.

OUTDOOR RATING:

METHOD

Four samples were subjected to various ambient conditions. Two separate samples at room temperature, 22 ± 3ºC (72 ± 5ºF), were subjected to the 2-shot and 3-shot patterns. A third sample, after exposure to a temperature of 49ºC (120 ºF) for a period of 3 h to the complete sample, and a fourth sample after exposure to -32ºC (-25ºF) to the side receiving the shots for a period of 3 h were subjected to the 3-shot pattern. The sample were tested immediately following the exposure to the indicated temperature conditions.

The velocity of each bullet was recorded during the test. The velocity values as recorded for multiple shot tests consist of the first value of the 2-shot pattern being the top point, and the second being the bottom point, the first value of the 3-shot pattern is the top point of the triangle, with the next values going in a clockwise direction around the triangle.

RESULT

Acceptable results were recorded for all shot patterns at all ambient conditions as outlined above.

ARMORCORE (LEVEL 1)

Bullet Velocities (fps)	First	Second	Third
2-Shot	1265	1295*	
3-Shot (Room Temperature)	1244	1196	1262
3-Shot (High Temperature)	1267	1267	1221
3-Shot (Low Temperature)	1250	1231	1251

ARMORCORE (LEVEL 2)

Bullet Velocities (fps)	First	Second	Third
2-Shot	1293	1283	
3-Shot (Room Temperature)	1395	1343	1336
3-Shot (High Temperature)	1294	1286	1316
3-Shot (Low Temperature)	1270	1342	1375

ARMORCORE (LEVEL 3)

Bullet Velocities (fps)	First	Second	Third
2-Shot	1455	1443	
3-Shot (Room Temperature)	1422	1426	1437
3-Shot (High Temperature)	1422	1437	1417
3-Shot (Low Temperature)	1435	1435	1432

*** -** Excessive velocity. However, no spalling or penetration of the projectile. Therefore, fair shot.

TEST RECORD NO. 2

SAMPLES:

Three samples of Model ArmorCore Level 4 material rated for Level 4 were submitted by the manufacturer and subjected to the following test program.

BALLISTIC TEST:

Level 4 – The ammunition used for the investigation was 180 grain (11.7 g) .30 caliber rifle lead core soft point, minimum velocity of 2540 fps.

All tests were conducted at close range, approximately 15 ft (4.6 m), using the ammunition and weapon specified. The test samples were mounted in a rigidly fixed frame, with 1/8 in. (3.2 mm) thick corrugated cardboard indicator panels placed approximately 18 in. (467 mm) behind the protected side of each test sample. During the test, each bullet velocity was monitored and recorded.

The samples were subjected to a 1-shot test.

The 1-shot pattern consists of a single shot in the approximate center of the test sample. With this shot pattern, there shall be no penetration of the projectile through the test sample, to the extent that fragment embed in or damage the cardboard indicators.

OUTDOOR RATING:

METHOD

Three samples were subjected to various ambient conditions. One sample at room temperature, 22 ± 3ºC (72 ± 5ºF), was subjected to a 1-shot pattern, center. A second sample, after exposure to a temperature of 49ºC (120ºF) for a period of 3 h to the complete sample, and a third sample, after exposure to -32ºC (-25ºF) to the side receiving the shot for a period of 3 h were subjected to the 1-shot pattern in the approximate center of the sample. The samples were tested immediately following the exposure to the indicated temperature conditions.

RESULTS

Acceptable results were recorded for all shot patterns at all ambient conditions as outlined above.

ARMORCORE (LEVEL 4)

Bullet Velocities (fps)

Single Shot – Center (Room Temperature)	2577
Single Shot – Center (High Temperature)	2588
Single Shot – Center (Low Temperature)	2609

CONCLUSION

Sample of the products covered by this Report have been found to comply with the requirements covering the class and the products are judged to be eligible for listing and Follow-Up Service. The manufacturer is authorized to use the Laboratories' Mark on such products which comply with the Follow-Up Service Procedure and any other applicable requirements of Underwriters Laboratories Inc. Only those products which properly bear the Laboratories' Mark are considered as Listed by Underwriters Laboratories Inc.

Report by:
C. A. Prosser
Engineering Assistant

Reviewed by:
R. L. Gray
Staff Engineer