INCH-POUND

MIL-DTL-32488
15 January 2014

DETAIL SPECIFICATION

EXPEDITIONARY BARRIER SYSTEM (EBS)

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the procurement requirements for the Expeditionary Barrier System (EBS) which is a cellular welded wire mesh gabion system that is lined with geotextile fabric to contain fill material. The EBS is intended for use as a rapidly deployable force protection barrier that is collapsible for transport and then filled on-site with soil or other material to obtain structural integrity and protective performance. It is designed for use in expedient force protection barrier wall construction for expeditionary and austere environments.

1.2 Classification. The EBS has the following types and classes as specified in the contract or purchase order (see 6.2).

1.2.1 Types. The EBS types are designated from 1 through 12 (see Table III).

1.2.2 Classes. The EBS classes are designated as follows:

Class	Color
B	Beige/Sand
G	Green

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

Comments, suggestions, or questions on this document should be addressed to Defense Supply Center Philadelphia (DSCP), ATTN: DSCP-NASA, 700 Robbins Avenue, Philadelphia, PA 19111-5096 or e-mail to dscpg&ispecomments@dla.mil . Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil .

FEDERAL STANDARDS

MIL-STD-810	Environmental Engineering Considerations and Laboratory Tests

(Copies of these documents are available online at https://assist.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A90/A90M	Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
ASTM A185/A185M	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A856/A856M	Standard Specification for Zinc-5 % Aluminum-Mischmetal Alloy-Coated Carbon Steel Wire
ASTM B750	Standard Specification for GALFAN (Zinc-5 % Aluminum-Mischmetal) Alloy in Ingot Form for Hot-Dip Coatings
ASTM D4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
ASTM D4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D4595	Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D4632/D4632M	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D5035	Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
ASTM D5199	Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
ASTM D5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles
ASTM D6241	Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe
ASTM E8/E8M	Standard Test Methods for Tension Testing of Metallic Materials
ASTM E1348	Standard Test Method for Transmittance and Color by Spectrophotometry Using Hemispherical Geometry
ASTM G31	Standard Guide for Laboratory Immersion Corrosion Testing of Metals

(Copies of these documents are available from www.astm.org or the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

SPANISH ASSOCIATION FOR STANDARDISATION AND CERTIFICATION (AENOR)

UNE-EN ISO 13433	Geosynthetics – Dynamics perforation test (cone drop test)
UNE-EN 14030	Geotextiles and geotextile-related products – Screening test method for determining the resistance to acid and alkaline liquids

(Copies of these documents are available from info@aenor.es or the Spanish Association for Standardisation and Certification, 902 102 201 or 91 432 61 60.

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First Article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Material. The EBS shall be manufactured as a collapsible cellular system that is made from connected weld wire mesh panels and a geotextile fabric liner. A schematic drawing of a typical single EBS cell is shown in Figure 1. The EBS shall consist of the following materials.

3.2.1 Welded Wire Mesh Panel. The EBS shall have welded wire mesh panels made from AISI 1010 carbon steel and meet Table I and paragraph 3.3 requirements. The wire mesh spacing for all panels shall be 3 in ± 0.125 in (76 mm ± 3mm). To maintain squareness, the two measured diagonals of the panels shall not differ by more than 0.125 in (3mm) per foot (0.305m). The panel shall not deviate from plane by more than 1 in (25 mm) for every 3 ft (0.914m) length. Panels smaller than 3 ft (0.914m) shall not deviate more than 0.5 in (13mm) from plane.

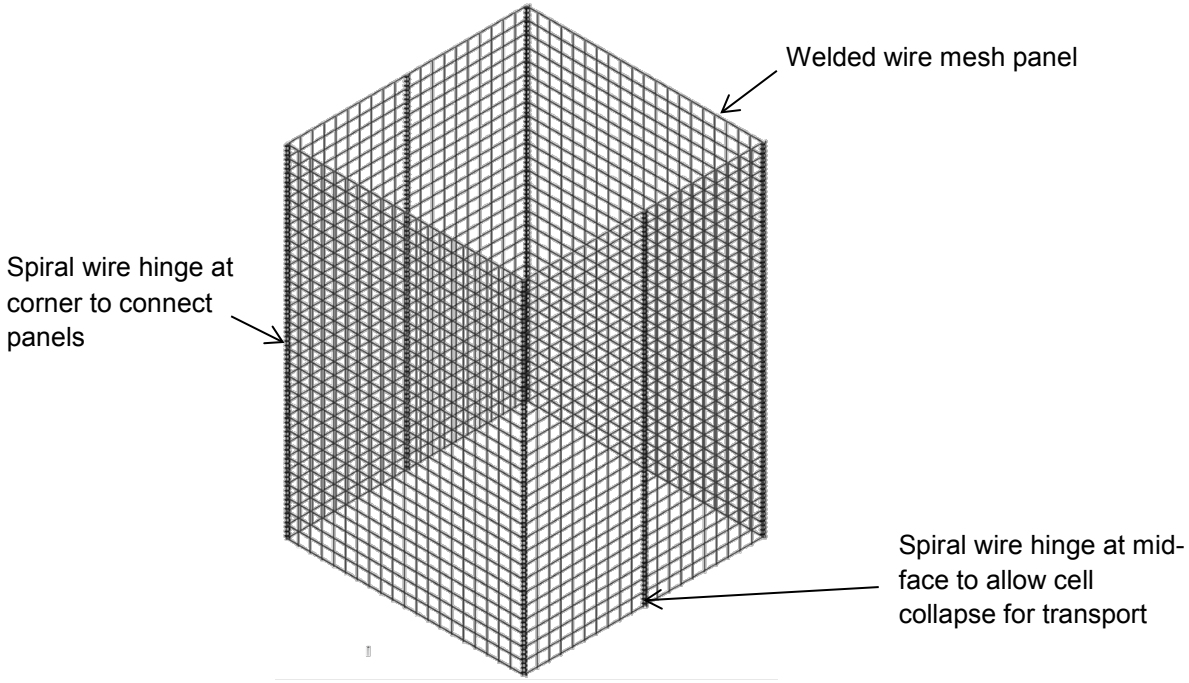

FIGURE 1. Typical EBS cell.

3.2.2 Spiral Wire Hinge. As shown schematically in Figure 1, the welded wire mesh panels shall be connected with spiral wire hinges at the corners and mid-face of each cell as appropriate for each type. The spiral wire hinges shall be made from AISI 1010 carbon steel wire and meet all requirements of Table I for nominal 0.157 in (4 mm) diameter wire. The hinges shall be formed with an inside diameter of 0.875 in ± 0.039 in (22 mm ± 1 mm) and pitch of 1 in ± 0.039 in (25 mm ± 1 mm). It is the manufacturer's responsibility to ensure that the exact pitch within the allowable range shall be compatible with the exact wire mesh spacing for easy assembly of the EBS cells and easy collapse of the baskets. The ends of the spiral wire hinges must be crimped in a way so that once assembled they cannot back off of the wire panels. See Figure 2 for an example of an end crimp. Spiral wire hinges shall be long enough to extend the full height of the wire panels for each EBS type.

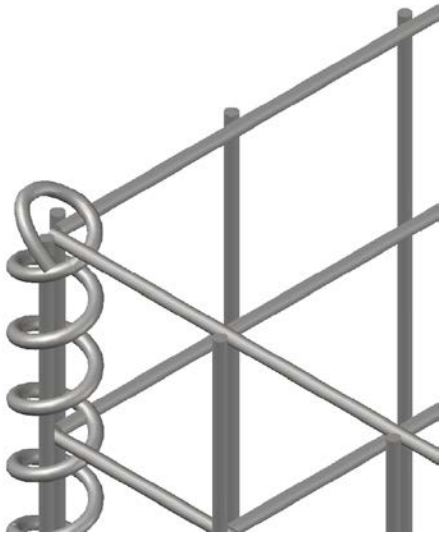

FIGURE 2. Example, crimped end on spiral wire hinge.

3.2.3 Connecting Pin. Connecting pins are used at each corner of the EBS cells to join adjacent cells together. The connecting pins will be made from 1010 carbon steel wire and meet all requirements of Table I for nominal 0.157 in (4 mm) diameter wire. The pins will be hooked on one end for grabbing and removal if desired. The hook will be 1.5 in (38 mm) long and have a radius of 0.687 in (17 mm). Where an EBS type calls for two or more separate sections in Figures 6, 8, 9, 12, 13, 14, 15 and 17, connecting pins shall be provided to join those sections. Further, a minimum of two extra connecting pins will be provided with each EBS unit of issue for connecting to adjacent units. Connecting pins shall be long enough to extend the full height of the wire panels for each EBS type.

3.2.4 Hog Ring. Hog rings are used to connect baskets stacked vertically. The hog rings shall be made from AISI 1010 carbon steel wire and meet all the requirements of Table I for nominal 0.157 in (4mm) diameter wire. The hog rings shall conform to the design, dimensions, and tolerances shown in Figure 3. A sufficient quantity shall be provided to attach hog rings at a spacing not more than 9 in (230 mm) along stacked baskets.

3.2.5 Geotextile Fabric. The inside of the EBS cells shall be lined on all sides with a non woven polypropylene geotextile fabric that meets Table II. The geotextile fabric shall be overlapped over the top of each cell by 3.5 in ± 0.25 in (90 mm ± 6 mm) and shall extend beyond the bottom of each cell by 3.5 in ± .25 in (90 mm ± 6 mm). The top overlaps provide a lap for stapling the fabric inside the cell and the bottom extension provides a skirt that can be placed inside lower cells when the EBS cells are stacked. The two free ends of the fabric inside of each cell will be overlapped by a minimum of 3.5 in (90 mm) so that the inside of the cell is completely lined. The overlap will be placed at the middle of a cell wall that adjoins to an adjacent cell; overlaps will not occur on an exterior face of the EBS cells. The geotextile fabric shall not burn when tested in a filled unit as described in the burn propagation test in paragraph 4.5.5.

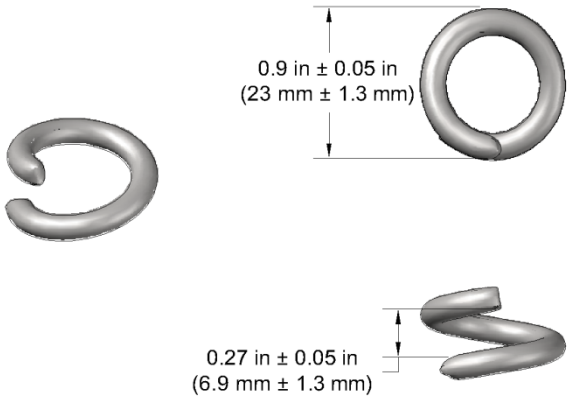

FIGURE 3. Hog ring design and dimensions.

3.2.6 Geotextile Fabric Color. The color of the geotextile fabric shall be either Class B, beige/sand or Class G, green, where the fabric color is determined in accordance with the measurement techniques of ASTM E1348, 10 degree specular excluded, UV included. The Class B, beige/sand geotextile fabric shall conform to the CIELAB color measurement values of L*: 54.57-57.02, a*: 3.79-4.33, and b*: 13.71-15.93. The Class G, green, geotextile fabric shall conform to the CIELAB color measurement values of L*: 31.41-36.70, a*: -8.58- -8.06, and b*: 7.24-8.31.

3.2.7 Geotextile Fabric Staples. The geotextile fabric is secured inside of each EBS cell by stapling at the top and bottom using the typical staple pattern shown in Figure 4. Staples will be galvanized finished flat steel wire that is minimum 0.098 in (2.5 mm) wide by 0.02 in (0.5 mm) thick. The minimum width of the staple is 0.5 in (13 mm). Length of the staple shall be sufficient to secure the fabric when stapled in the required pattern, see Figure 5.

3.2.8 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3 Protective finish. All steel components of the EBS units shall have a zinc-5% aluminum-mischmetal coating satisfying the requirements of ASTM B750 and the deposition requirements of ASTM A856. An alternative coating composition may be used, however it must provide corrosion protection that is equivalent to or greater than an ASTM B750 GALFAN coating applied at the minimum specified coating weight given in this specification. The protective finish must be provided on the wire and welds of finished product.

3.4 Small scale structural load. The EBS shall be able to withstand a minimum peak load capacity of 53,000 lb (235 kN), see paragraph 4.5.6.

3.5 Design. The EBS shall conform to the design, dimensions, and tolerances specified in Table III and Figures 6 through 17.

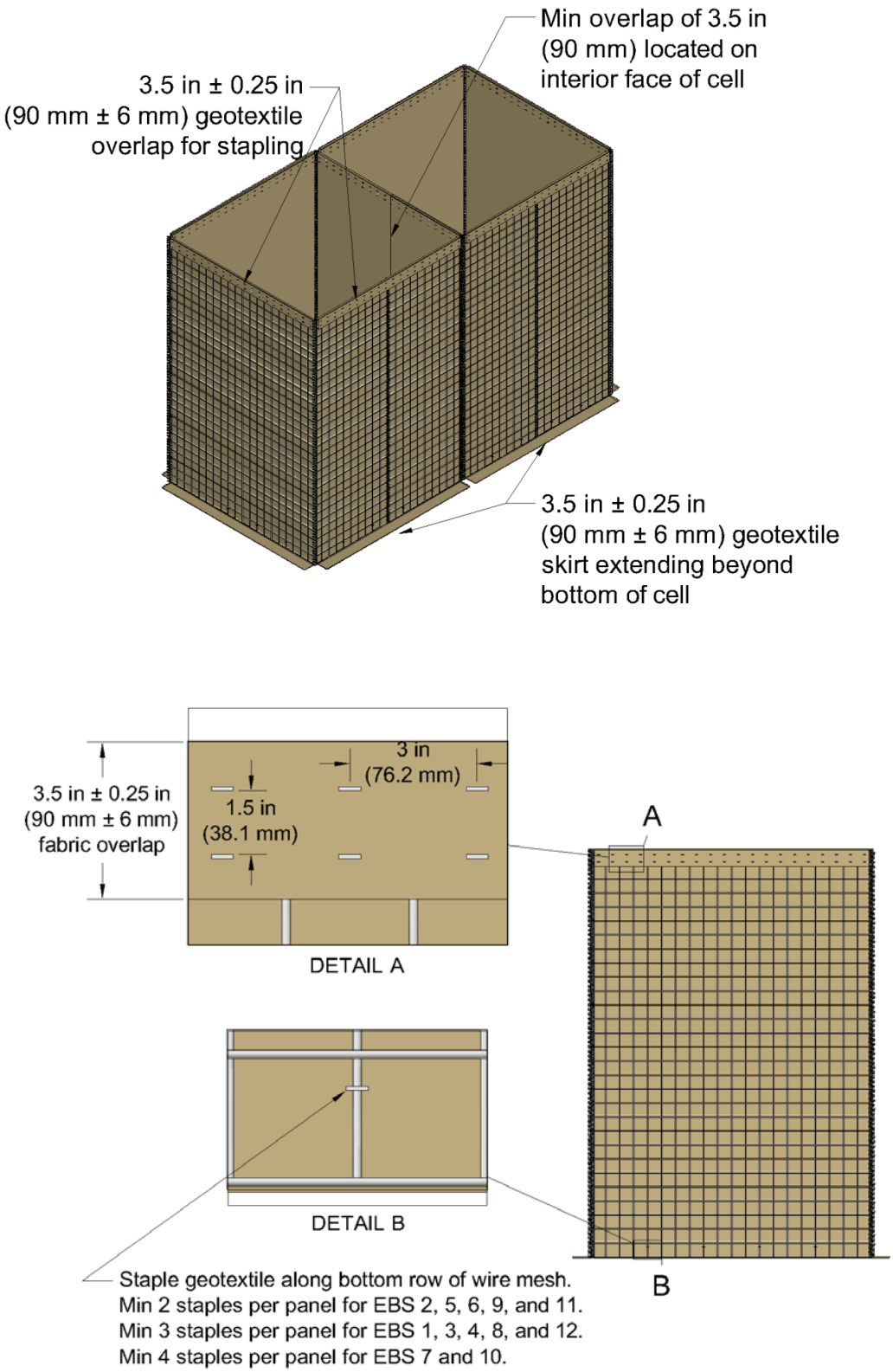

FIGURE 4. Typical geotextile staple pattern

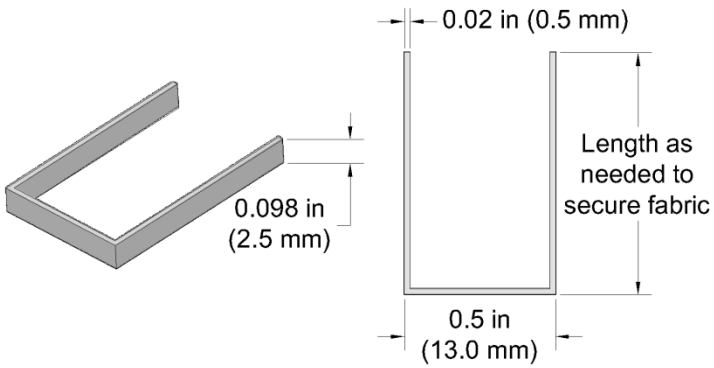

FIGURE 5. Geotextile fabric staple.

TABLE I. Wire Properties.

Property	0.157 in (4 mm) Requirement	0.197 in (5 mm) Requirement
Coated diameter, min	0.154 in (3.90 mm)	0.195 in (4.95 mm)
Uncoated diameter	0.151 in ± 0.003 in (3.83 mm ± 0.08 mm)	0.191 in ± 0.003 in (4.86 mm ± 0.08mm)
Tensile yield strength	92800 psi ± 8700 psi (640 MPa ± 60 MPa)	85600 psi ± 7250 psi (590 MPa ± 50 MPa)
Tensile ultimate strength	99350 psi ± 15200 psi (685 MPa ± 105 MPa)	94300 psi ± 15200 psi (650 MPa ± 105 MPa)
Elongation at rupture	7% ±2%	7% ±2%
Weld shear strength[1], min	70%	70%
Protective finish weight, min	0.50 oz/ft² (150 g/m²)	0.50 oz/ft² (150 g/m²)
DI mass loss, max	0.02%	0.02%

[1]Percentage of ultimate tensile strength.

TABLE II. Fabric Properties.

Property	Requirement
Thickness, min	54 mils (1.37 mm)
Mass per unit area, min	6.5 oz/yd² (220.39 g/m²)
Grab tensile strength, MD[1]	210 lb / 180 lb (934N / 800 N)
Grab tensile strength, TD[1]	210 lb / 180 lb (934N / 800 N)
Grab elongation, MD[1]	80% / 75%
Grab elongation, TD[1]	80% / 75%
Wide width tensile strength, MD[1]	85 lb/in / 75 lb/in (14.9 N/mm / 13.1 N/mm)
Wide width tensile strength, TD[1]	85 lb/in / 75 lb/in (14.9 N/mm / 13.1 N/mm)
Wide width elongation, MD[1]	70% / 60%
Wide width elongation, TD[1]	70% / 60%
Trapezoidal tear strength, MD[1]	80 lb / 70 lb (356 N / 311N)
Trapezoidal tear strength, TD[1]	80 lb / 70 lb (356 N / 311N)
CBR puncture strength[1]	550 lb / 480 lb (2447 N / 2135 N)
Cone drop test[2]	0.787 in / 0.866 in (20 mm / 22 mm)
Apparent opening size	0.004 in - 0.005 in (0.11 mm - 0.13 mm)
Permittivity	1.1 s^{-1} - 1.6 s^{-1}
Min strength retention (1000 hr UV exposure)	80%
Min strength retention (chemical exposure, diesel fuel and deicing fluid)	90%
Min strength retention (sulfuric acid)	90%
Min strength retention (calcium hydroxide)	80%
Min strength retention (high temperature exposure)	90%
Min strength retention (low temperature exposure)	90%
Min strength retention (blowing sand abrasion)	85%
Burn propagation when filled	no flame spread

[1]Given as min allowable average/min allowable single test value.
[2]Given as max allowable average/max allowable single test value.

TABLE III. EBS Dimensions and Weight.

Type	Height[1]		Width[1]		Length[2]		Wire Diameter[3]		Weight Max	
	ft in	m	ft in	m	ft in	m	in	mm	lb	kg
1	4’ 6”	1.37	3’ 6”	1.06	32’ 9”	10	0.157	4	343	156
2	2’	0.61	2’	0.61	4’	1.22	0.157	4	23	10.5
3	3’ 3”	1	3’ 3”	1	32’ 9”	10	0.157	4	246	112
4	3’ 3”	1	5’	1.52	32’ 9”	10	0.157	4	392	178
5	2’	0.61	2’	0.61	10’	3.05	0.157	4	53	24
6	5’ 6”	1.68	2’	0.61	10’	3.05	0.157	4	101	46
7	7’ 3”	2.21	7’	2.13	91’	27.74	0.197	5	2129	967
8	4’ 6”	1.37	4’	1.22	32’ 9”	10	0.157	4	351	159.5
9	3’ 3”	1	2’ 6”	0.76	30’	9.14	0.157	4	235	107
10	7’ 3”	2.21	5’	1.52	100’	30.5	0.197	5	2275	1034
11	4’	1.22	1’	0.30	4’	1.22	0.197	5	35	16
12	7’	2.13	3’ 6”	1.06	108’	33	0.157	4	1793	815

[1]Tolerance ± 0.25 in (6.35 mm).
[2]Tolerance ± 0.5 in (12.7 mm).
[3]Wire diameters are nominal. See Table II for specific diameter requirements.

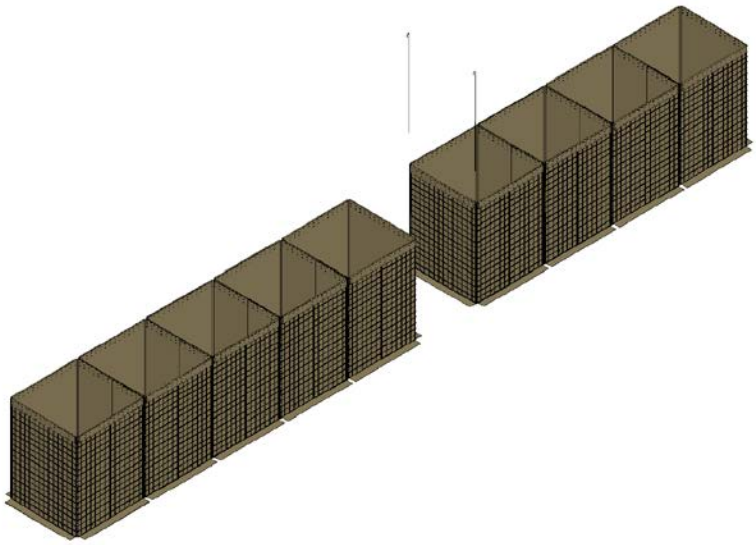

FIGURE 6. Type 1 (9 cells (1x5, 1x4)).

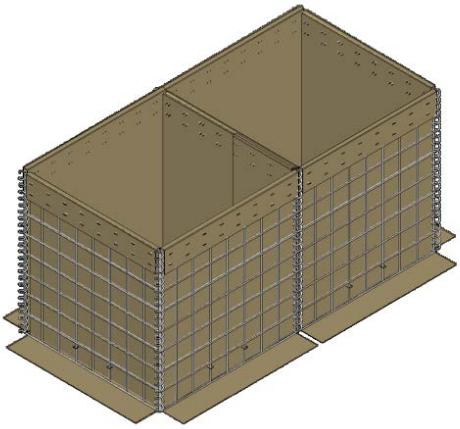

FIGURE 7. Type 2 (2 cells).

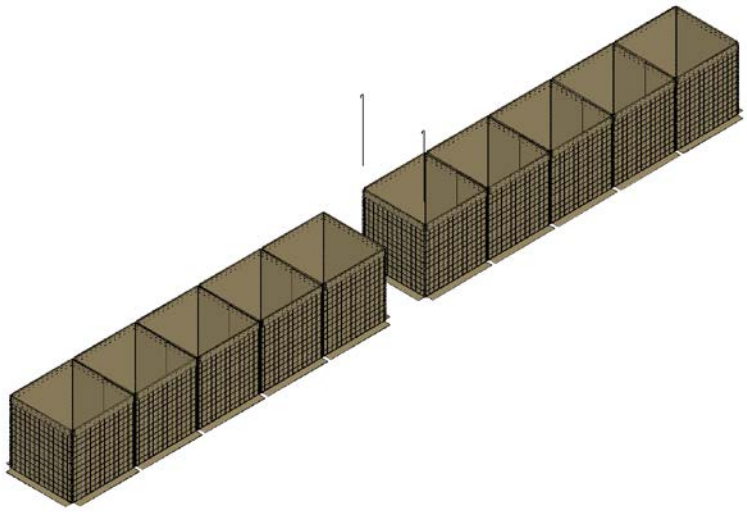

FIGURE 8. Type 3 (10 cells (2x5)).

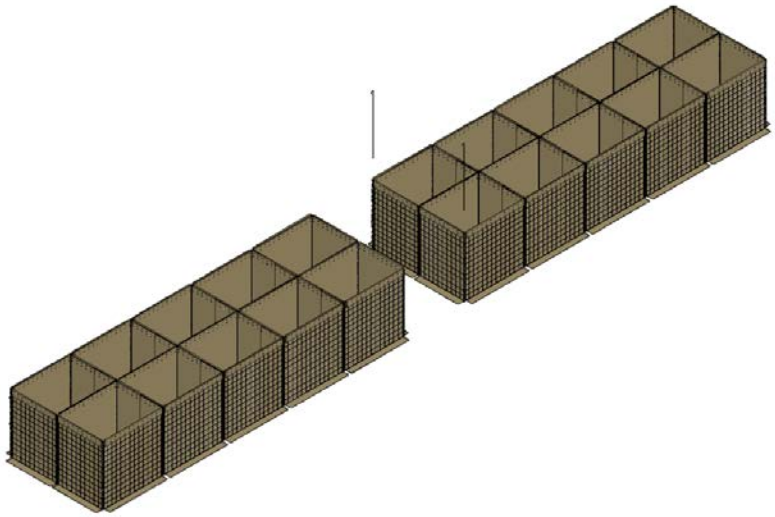

FIGURE 9. Type 4 (20 cells (2x10)).

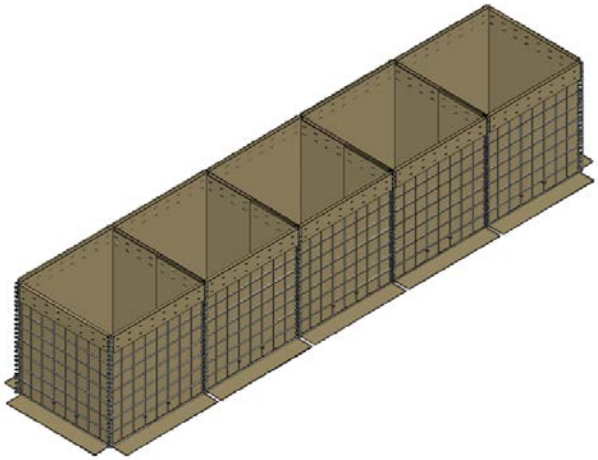

FIGURE 10. Type 5 (5cells (1x5)).

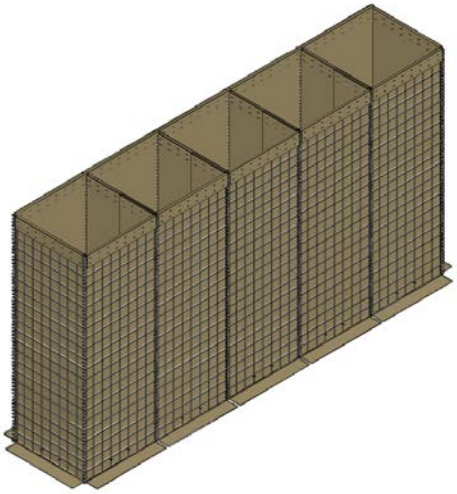

FIGURE 11. Type 6 (5 cells (1x5)).

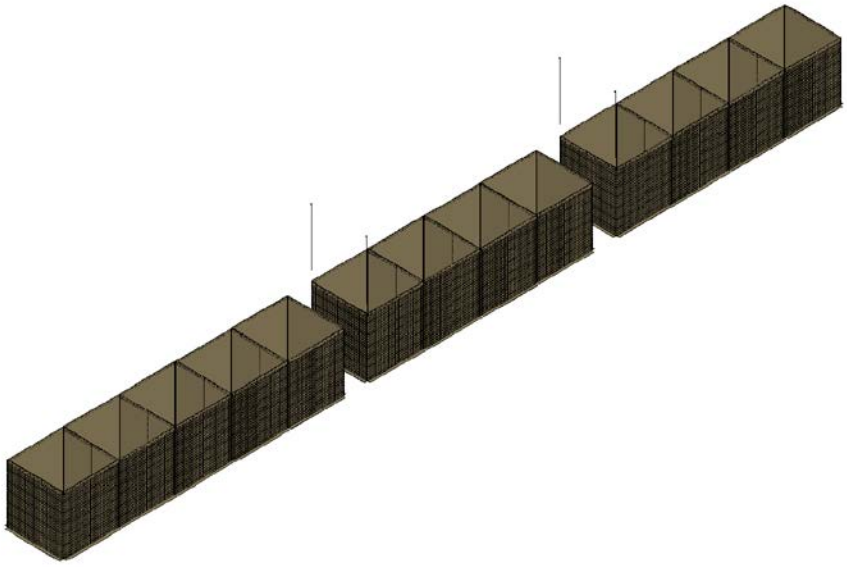

FIGURE 12. Type 7 (13 cells (1x5, 2x4)).

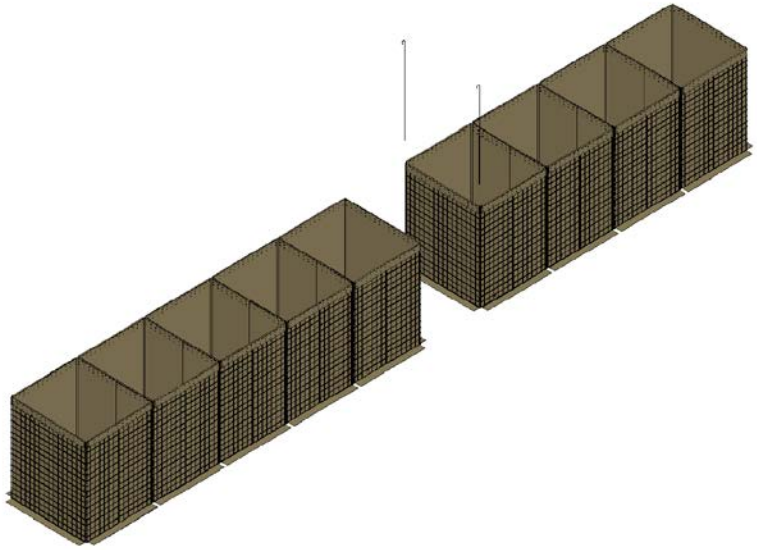

FIGURE 13. Type 8 (9 cells 1x4, 1x5)).

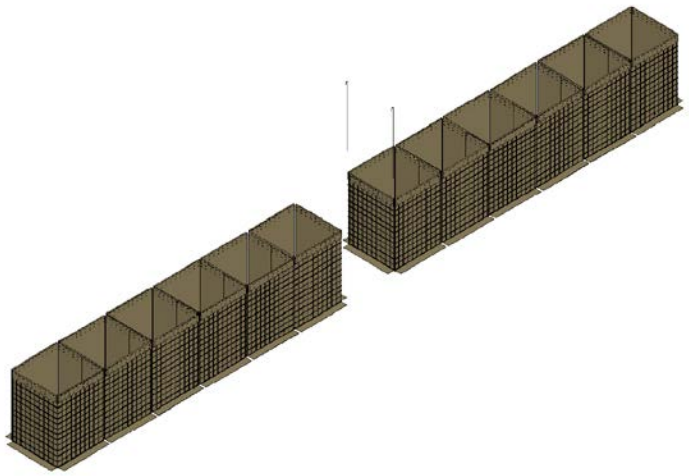

FIGURE 14. Type 9 (12 cells 2x6)).

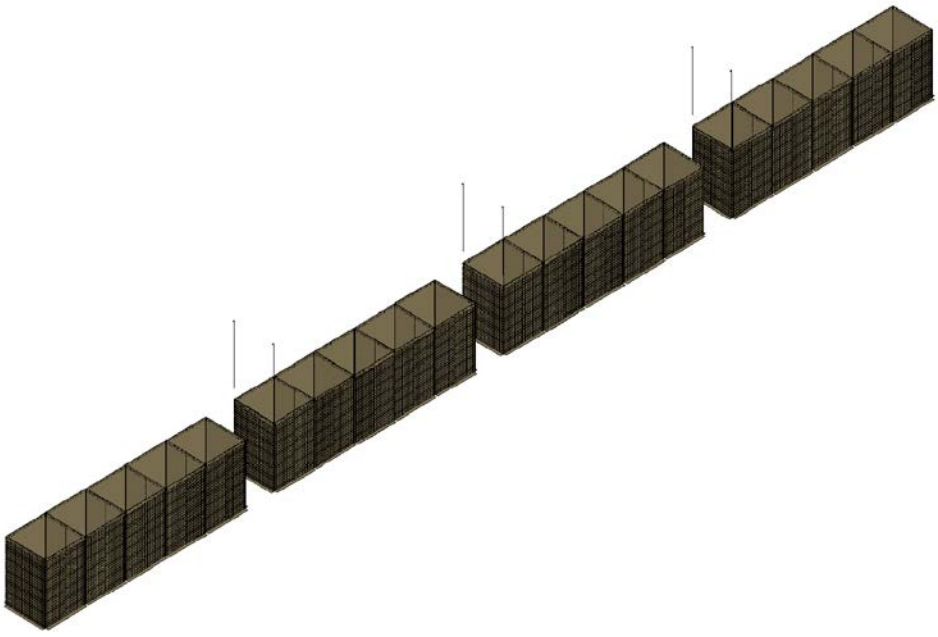

FIGURE 15. Type 10 (20 cells (4x5).

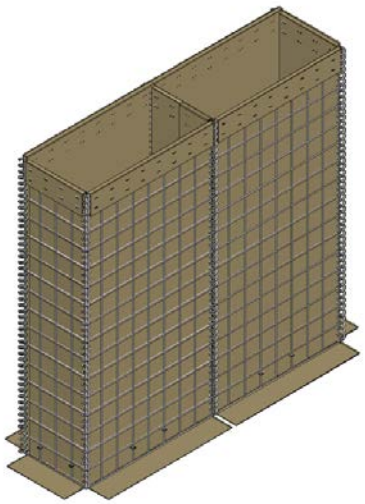

FIGURE 16. Type 11 (2 cells).

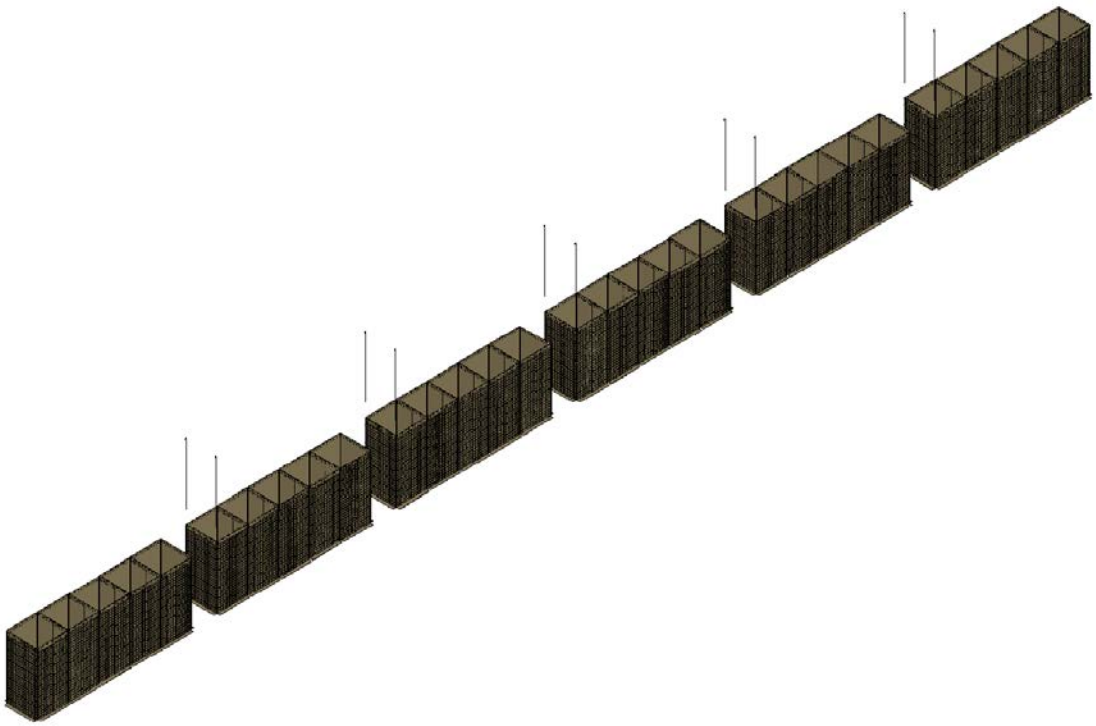

FIGURE 17. Type 12 (30 cells (6x5)).

4. VERIFICATION

4.1 Classification of inspection. The inspection and testing of the EBS shall be classified as follows:

a. First article inspection (see 4.2)
b. Conformance inspection (see 4.3)

4.2 First article inspection. First article inspection shall consist of all the tests specified (see 4.5).

4.3 Conformance inspection. Conformance inspection shall include the following tests.

4.3.1 Welded Wire Mesh Panel. The conformance tests for the welded wire mesh panels shall include protective finish, First Article Tests (paragraph 4.5.3), and the following tests from Table IV: wire coated diameter, wire uncoated diameter, wire galvanic coating weight, wire tensile yield strength, wire tensile ultimate strength, wire elongation at rupture, and weld shear strength.

4.3.2 Geotextile Fabric. The conformance tests for the geotextile fabric shall include the following tests from Table IV: fabric thickness, fabric mass per unit area, fabric grab elongation, and geotextile fabric tensile strength.

4.4 Sampling. One barrier shall be taken from each lot and used for each conformance inspection.

4.4.1 Lot Size. A lot shall consist of all barriers of the same type and class, manufactured under essentially the same conditions and submitted for inspection at one time.

4.5 Tests.

4.5.1 Material. The contractor shall furnish certification that the material complies with the requirements specified in 3.2, excluding the burn propagation test.

4.5.2 First article test samples. The contractor shall provide to the government three Type 1 and three Type 7 barriers to perform the burn propagation (paragraph 4.5.5) and small scale structural load (paragraph 4.5.6) tests. Samples must include at least one Class B(beige/sand) and one Class G(green) barrier for visual color confirmation. See paragraph 6.4 for test laboratory address.

4.5.3 First article tests. The first article tests shall include paragraphs 4.5.4, 4.5.5 and 4.5.6 and tested as specified in Table IV. Any barrier which fails one or more tests shall be rejected.

4.5.4 Protective finish. The contractor shall furnish certification that the protective finish conforms to the requirements of the specifications referenced in 3.3.

4.5.5 Burn propagation test. The burn propagation test shall be conducted by exposing a filled EBS cell to an open flame and assessing the burn potential of the fabric. The EBS cell is filled with a clean concrete sand with moisture content of 5 to 7.5 percent. A gas flame (equivalent to propane gas with flow rate of 1600 ml/min.) is then applied to the wall of the cell, with the flame source not more than 1 in (25 mm) away from the wall. The flame is applied for 20 seconds and then removed. After removal of the flame, any fabric that had begun to burn must be self-extinguishing within 20 seconds.

4.5.6 Small scale structural load test. The small scale structural load test is conducted to evaluate the composite performance of the EBS cell under application of a vertical load. To perform the test a single EBS 1 cell is filled with a coarse sand (Runyon sand or equivalent) that is hand tamped in approximate 12 in (30 cm) lifts. The filled cell is then tested to failure by applying an increasing vertical load with a structural load testing device. A spreader plate is used to apply the

load uniformly over the top of the entire cell. Three cells shall be tested and have a minimum average peak load capacity of 53,000 lb (235 kN).

TABLE IV. First Article Tests.

Property	Test Method	Requirement
Wire coated diameter, min	-	Table I
Wire uncoated diameter	-	Table I
Wire tensile yield strength	ASTM E8	Table I
Wire tensile ultimate strength	ASTM E8	Table I
Wire elongation at rupture	ASTM E8	Table I
Weld shear strength, min	ASTM A185	Table I
Wire galvanic coating weight, min	ASTM A90	Table I
Coil coated diameter, min	-	Table I
Coil uncoated diameter	-	Table I
Coil galvanic coating weight, min	ASTM A90	Table I
Connecting pin coated diameter, min	-	Table I
Connecting pin uncoated diameter	-	Table I
Connecting pin galvanic coating weight, min	ASTM A90	Table I
DI mass loss[1]	ASTM G31	Table I
Fabric thickness, min	ASTM D5199	Table II
Fabric mass per unit area, min	ASTM D5261	Table II
Fabric grab tensile strength, MD	ASTM D4632	Table II
Fabric grab tensile strength, TD	ASTM D4632	Table II
Fabric grab elongation, MD	ASTM D4632	Table II
Fabric grab elongation, TD	ASTM D4632	Table II
Fabric wide width tensile strength, MD	ASTM D4595	Table II
Fabric wide width tensile strength, TD	ASTM D4595	Table II
Fabric wide width elongation, MD	ASTM D4595	Table II
Fabric wide width elongation, TD	ASTM D4595	Table II
Fabric trapezoidal tear strength, MD	ASTM D4533	Table II
Fabric trapezoidal tear strength, TD	ASTM D4533	Table II
Fabric CBR puncture strength	ASTM D6241	Table II
Fabric cone drop test	UNE-EN ISO 13433	Table II
Fabric apparent opening size	ASTM D4751	Table II
Fabric permittivity	ASTM D4491	Table II
Fabric min strength retention (1000 hr UV exposure)[2]	ASTM D4355	Table II
Fabric min strength retention (chemical exposure, diesel fuel and deicing fluid)[3]	UNE-EN 14030	Table II
Fabric min strength retention (sulfuric acid)[2]	UNE-EN 14030	Table II
Fabric min strength retention (calcium hydroxide)[2]	UNE-EN 14030	Table II
Fabric min strength retention (high temperature exposure)[2]	MIL-STD-810 Method 501.5	Table II
Fabric min strength retention (low temperature exposure)[2]	MIL-STD-810 Method 502.5	Table II
Fabric min strength retention (blowing sand abrasion)[2]	MIL-STD-810 Method 510.5	Table II
Fabric color	ASTM E1348	par. 3.2.6
Burn propagation	par. 4.5.5	Table II
Small scale structure load	par. 4.5.6	par. 3.3

[1]Test performed with coated wire for a testing time of 14 days on deionized water.
[2]Strength retained measured using Strip Tensile test from ASTM D5035.
[3]Strength retained measured using Wide Width Tensile test from ASTM D4595.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The EBS specified herein is intended to provide protection from visual detection, small arms fire, indirect fire, perimeter intrusion and the like.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number and date of this specification.
b. Type and class (see 1.2).
c. If first article samples are required (see 3.1).
d. Packaging requirements (see 5.1).

6.3 Subject term (key word) listing.

Connecting pin
Gabion
Geotextile fabric
Spiral wire hinge
Welded wire mesh panel

6.4 First article test laboratory. First article test samples should be sent to:

U.S. Army Research and Development Center
CEERD-GS-V
3909 Halls Ferry Road
Vicksburg, MS 39180

Custodian:
Army - CE
Navy - AS
Air Force - 99

Preparing Activity:
DLA - IS

(Project 5450-2014-002)

Review Activity:
Army – AV, GL, TE
Navy – MC, YD
Air Force – 03, 84

NOTE: The activities listed above were interested in this document as of the date of document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil.