

Construction Specification 64—Wire Mesh Gabions and Mattresses Twisted (Woven) or Welded Mesh

1. Scope

The work consists of furnishing, assembling, and installing rock filled wire mesh gabion baskets and mattresses.

2. Types

Gabions shall consist of rectangular wire mesh formed containers filled with rock. Gabions will conform to one of the following types:

Woven mesh—Nonraveling, double twisted, hexagonal wire mesh consisting of two wires twisted together in two 180-degree turns.

Welded mesh—Welded-wire mesh with a uniform square or rectangular pattern and a resistance weld at each intersection. The welded wire connections shall conform with the requirements of ASTM A 185, including wire smaller than W1.2 (0.124 in.), except that the welded connections shall have a minimum average shear strength of 70 percent and a minimum shear strength of 60 percent of the minimum ultimate tensile strength of the wire.

Gabions—Gabions shall be furnished as baskets or mattresses as specified in section 8. Baskets and mattresses shall be fabricated within a dimension tolerance of plus or minus 5 percent.

Baskets—Baskets are at least 12 inches high.

Mattresses—Mattresses are no more than 12 inches thick.

3. Material

Gabions shall be fabricated, assembled, and installed in accordance with the nominal wire sizes and dimensions shown in tables 64-1 and 64-2, using the following materials unless otherwise specified in section 8.

Wire for fabrication and assembly shall be hot-dipped galvanized. The wire shall have a minimum tensile strength of 60,000 pounds per square inch. Galvanized steel wire shall conform to ASTM A 641, Class 3, Soft Temper.

When epoxy or polyvinyl chloride (PVC) coated wire is specified in section 8, the galvanized wire shall be coated by fusion bonded epoxy; fusion bonded, extruded; or extruded and bonded PVC material. The wire coating shall be black, gray, green, or silvery, and the initial properties of the PVC coating shall meet the following requirements:

- a. Specific gravity. In the range of 1.30 to 1.40, ASTM D 792.
- b. Abrasion resistance. The percentage of weight loss shall be less than 12 percent when tested according to ASTM D 1242, method B, at 200 cycles, CSI-A abrader tape, 80 grit.
- c. Brittleness temperature. Not higher than 15 °F, ASTM D 746.
- d. Tensile strength. Extruded coating (not less than 2,980 lb/in², ASTM D 412); fusion bonded coating (not less than 2,275 lb/in², ASTM D 638).
- e. Modulus of elasticity. Extruded coating (not less than 2,700 lb/in² at 100 percent strain, ASTM D 412); fusion bonded coating (not less than 1,980 lb/in² at 100 percent strain, ASTM D 638).
- f. Ultraviolet light exposure. An exposure period of not less than 3,000 hours at 63 degrees centigrade, ASTM G 152.

Table 64-1 Minimum requirements***Gabion baskets—height 12, 18, or 36 inches; length as specified**

Type of wire	Mesh size (in)	Wire diameter (in)	PVC coating (in)	Total diameter (in)	Galvanized coating oz./ft ²
Woven mesh	3.25 x 4.5	0.118	None	0.118	0.80
	3.25 x 4.5	0.105	0.02	0.145	0.80
Selvage		0.153	None	0.153	0.80
		0.132	0.02	0.172	0.80
Lacing and internal connecting wire		0.086	0.02	0.126	0.70
Welded Mesh	3 x 3	0.118	None	0.118	0.80
	3 x 3	0.105	0.02	0.145	0.80
Spiral binder		0.105	0.02	0.145	0.80

Table 64-2 Minimum requirements***Gabion mattresses—height 6, 9, or 12 inches; length as specified**

Type of wire	Mesh size (in)	Wire diameter (in)	PVC coating (in)	Total diameter (in)	Galvanized coating oz./ft ²
Woven mesh	2.5 x 3.25	0.086	0.02	0.126	0.70
Selvage		0.105	0.02	0.145	0.80
Lacing and internal connecting wire		0.086	0.02	0.126	0.70
Welded mesh	1.5 x 3	0.080	0.02	0.120	0.70
Spiral binder		0.105	0.02	0.145	0.80

* Note: The wire sizes and PVC coating thickness shown are nominal sizes. The wire sizes include the galvanizing coating thickness.

g. Salt spray test. A test period of not less than 3,000 hours, ASTM B 117.

After the exposure to ultraviolet light and the salt spray test as specified above, the PVC coating shall not show cracks, blisters, splits, nor noticeable change of coloring (surface chalk). In addition, the specific gravity shall not change more than 6 percent, resistance to abrasion shall not change more than 10 percent, tensile strength shall not change more than 25 percent, and modulus of elasticity shall not change more than 25 percent from their initial values.

The wire sizes shown in tables 64-1 and 64-2 are the size of the wire after galvanizing and before coating with PVC.

Spiral binders are the standard fastener for welded-mesh gabion baskets and mattresses, and shall be formed from wire meeting the same quality and coating thickness requirements as specified for the gabion baskets and mattresses.

Alternate fasteners for use with wire mesh gabions, such as ring fasteners, shall be formed from wire meeting the same quality and coating thickness requirements as specified for the gabions and, as a minimum, shall conform to the manufacturer's recommendations.

Standard fasteners and alternate fasteners must provide a minimum strength of 1,400 pounds per lineal foot for gabion baskets and 900 pounds per lineal foot for gabion mattresses. When used to interconnect gabion baskets or mattresses with PVC coating, ring fasteners shall be made of stainless steel and spiral fasteners will be PVC coated. All fasteners shall meet all of the closing requirements of the gabion manufacturer in addition to any requirements specified in section 8.

Rock shall conform to the quality requirements in Material Specification 523, Rock for Riprap, unless otherwise specified in section 8. At least 85 percent of the rock particles, by weight, shall be within the predominant rock size range.

Gabion basket or mattress height	Predominant rock size (in)	Minimum rock dimension (in)	Maximum rock dimension (in)
12-, 18-, or 36-inch basket	4 to 8	4	8
6-, 9-, or 12-inch mattress	3 to 6	3	6

At least 30 days before delivery to the site, the contractor shall inform the engineer in writing of the source from which the rock will be obtained. The test data and other information by which the material was determined by the contractor to meet the specification are included. The contractor shall provide the engineer free access to the source for the purpose of obtaining samples for testing and source approval.

Bedding or filter material, when specified, shall meet the gradation shown on the plans, or as specified in section 8, and the requirements of Material Specification 521, Aggregates for Drainfill and Filters. Geotextile, when specified, shall conform to the requirements specified in section 8 and those of Material Specification 592.

4. Foundation preparation

The foundation on which the gabions are to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. Surface irregularities, loose material, vegetation, and all foreign matter

shall be removed from the foundation. When fill is required, it shall consist of material conforming to the specified requirements. Gabions and bedding or specified geotextiles shall not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by the COTR.

Compaction of bedding or filter material is required as specified in section 8. The surface of the finished material shall be to grade and free of mounds, dips, or windrows. Geotextile shall be installed in accordance with the requirements of Construction Specification 95.

5. Assembly and placement

Unless otherwise specified in section 8, the assembly and placement of gabions shall be in accordance with the following procedures:

Assembly—Rotate the gabion panels into position and join the vertical edges with fasteners for gabion assembly. Where lacing wire is used, wrap the wire with alternating single and double half-hitches at 4- to 5-inch intervals. Where spiral fasteners are used for welded-wire mesh, crimp the ends to secure the spirals in place. Where ring type alternate fasteners are used for basket assembly, install the fasteners at a maximum spacing of 6 inches. Use the same fastening procedures to install interior diaphragms where they are required.

Interior diaphragms are required where any inside dimension exceeds 3 feet. Diaphragms are installed to assure that no open intervals are present that exceed 3 feet.

Placement—Place the empty gabions on the foundation and interconnect the adjacent gabions along the top, bottom, and vertical edges using lacing wire. Wrap the wire with alternating single and double half-hitches at 4- to 6-inch intervals. Unless otherwise specified in section 8, lacing wire will be the only fastener allowed for interconnecting woven mesh gabions. Spiral fasteners are commonly used for the assembly and interconnection of welded mesh gabions. Spirals are screwed down at the connecting edges then each end of the spiral is crimped to secure it in place. Lacing may be used as needed to supplement the interconnection of welded mesh gabions and the closing of lids.

Interconnect each layer of gabions to the underlying layer of gabions along the front, back, and sides. Stagger the vertical joints between the gabions of adjacent rows and layers by at least half of a cell length.

6. Filling operation

After adjacent empty woven wire gabion units are set to line and grade and common sides properly connected, they shall be placed in straight line tension and stretched to remove any kinks from the mesh and to gain a uniform alignment. Welded-mesh gabions do not require stretching. The gabions may be staked to maintain the established proper alignment before the rock is placed. No stakes shall be placed through geotextile material. Connecting lacing wire and other fasteners (as allowed) shall be attached during the filling operation to preserve the strength and shape of the structure.

Internal connecting crosstie wires shall be placed in each unrestrained gabion cell of more than 18 inches in height, including gabion cells left temporarily unrestrained. Two internal connecting wires shall be placed concurrently with rock placement at each 12-inch interval of depth. In woven mesh gabions these crossties are placed evenly spaced along the front face and connecting to the back face. All crosstie wires shall be looped around two mesh openings and each wire end shall be secured by a minimum of five 180-degree twists around itself after looping.

In welded mesh gabions these crossties or stiffeners are placed across the corners of the gabions (at 12 inches from the corners) providing diagonal bracing. Lacing wire or preformed hooked wire stiffeners may be used.

The gabions shall be carefully filled with rock by machine or hand methods to ensure alignment, avoid bulges, and provide a compact mass that minimizes voids. Machine placement requires supplementing with hand work to ensure the desired results. The cells in any row shall be filled in stages so that the depth of rock placed in any one cell does not exceed the depth of rock in any adjoining cell by more than 12 inches. Along the exposed faces, the outer layer of stone shall be carefully placed and arranged by hand to ensure a neat, compact placement with a uniform appearance.

The last layer of rock shall be uniformly leveled to the top edges of the gabions. Lids shall be stretched tight over the rock filling using only approved lid closing tools as necessary. The use of crowbars or other single point leverage bars for lid closing is prohibited as they may damage the baskets. The lid shall be stretched until it meets the perimeter edges of the front and end panels. The gabion lid shall then be secured to the sides, ends, and diaphragms with spiral binders, approved alternate fasteners, or lacing wire wrapped with alternating single and double half-hitches in the mesh openings.

Any damage to the wire or coatings during assembly, placement, and filling shall be repaired promptly in accordance with the manufacturer's recommendations or replaced with undamaged gabion baskets.

7. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the volume of rock is measured within the neat lines of the gabion structure and computed to the nearest cubic yard. Payment for gabions is made at the contract unit price and includes the wire mesh and rock. Such payment is considered full compensation for all labor, material, equipment, and all other items necessary and incidental to completion of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the volume of the gabions is measured within the neat lines of the gabion structure and computed to the nearest cubic yard. Payment for the gabions is made at the contract unit price and includes the wire mesh, rock, and specified bedding material or geotextile. Such payment is considered full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work.

Method 3—For items of work for which specific unit prices are established in the contract, the surface area is measured within the neat lines of the gabion mattress structure and computed to the nearest square yard. Payment for the gabion mattress is made at the contract unit price and includes the wire mesh and rock. Such payment is considered full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work.

Method 4—For items of work for which specific unit prices are established in the contract, the surface area is measured within the neat lines of the gabion mattress structure and computed to the nearest square yard. Payment for the gabion mattress is made at the contract unit price and includes the wire mesh, rock, and specified bedding material or geotextile. Such payment is considered full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work.

All methods—The following provisions apply to all methods of measurement and payment. Unless otherwise specified in section 8, no deduction in volume is made for any void or embedded item. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Each item and the items to which they are made subsidiary are identified in section 8 of this specification.

8. Items of work and construction details