

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION

DAM, DIVERSION, GABION

(No.)
CODE 348G

1. MATERIALS

Gabion baskets shall be a minimum of 11 gauge (0.118 in) (3.00 mm) galvanized steel wire, fabricated into hexagonal triple-twist mesh openings no larger than 3.25 inches by 4.5 inches. Selvedge wire running through all edges shall be a minimum of 9 gauge (0.148 in) (3.76 mm) galvanized steel wire.

Lacing, tie, and connecting wire shall be a minimum of 13.5 gauge (0.087 in) (2.21 mm) galvanized steel wire.

All wire shall conform to ASTM specification A 510, grade numbers 1006 through 1020. Wire shall have a minimum tensile strength of 60,000 lb/in² (413 MPa) and a class 3 coating conforming to ASTM A 641. The galvanized coating will be applied by the hot dip process in accordance with ASTM A 385 and ASTM A 386.

Rock size and gradation shall be limited to those shown in **Table 1** for gabion baskets as shown.

Table 1
Rock Size (in.)

Gabion Basket - Depth	Predominant Size	Minimum	Maximum
12"	4 to 8	3	10
18 and 36	4 to 8	3	12

Less than 5% of the rock shall be between 3 and 4 inches in diameter.

Bedding shall be uniformly graded rock and gravel as shown on the drawings.

Filter fabric shall be composed of strong rot-proof fibers consisting of synthetic polymers composed of at least 85 percent by weight polypropylenes, polyesters, polyamides, polyethylene, polyolefins, or polyvinylidene-

chlorides. They shall be formed into a stable network of filaments or yarns retaining dimensional stability relative to each other. The filter fabric shall be free of defects and conform to the other physical requirements of non-woven fabrics, class III, contained in **Table 2**. The filter fabric shall be free of any chemical treatment or coating that significantly reduces its porosity. Fibers shall contain stabilizers and/or inhibitors to enhance resistance to ultraviolet light.

The contractor shall certify that the fabric meets this specification and shall provide information from the manufacturer showing that it equals or exceeds the physical properties in **Table 2**.

2. EXCAVATION

Excavation shall be to the lines and grades shown on the drawings and as staked in the field. To the extent they are needed, suitable excavated materials from the specified excavations shall be used in the construction of required earthfill. The engineer will determine the suitability of materials. All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of at locations designated by the engineer. Waste disposal and borrow areas shall be graded and smoothed to blend with the surrounding terrain.

Excavation shall be done in accordance with all Occupational Safety and Health Act requirements.

3. EARTHFILL

Earth fill shall be to the lines and grades shown on the drawings and as staked in the field. All fill material shall be obtained from required excavations and from borrow areas approved by the engineer. Fill shall be placed carefully against all indicated portions of the works so as not to disturb the finished structure. Compaction will be by hand tamping, hand-operated mechanical tampers, or other methods using selected earth moist enough to form a tight ball when squeezed in the hand, and placed in horizontal layers not exceeding 6 inches in thickness before compaction.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resource Conservation Service.

4. FOUNDATION PREPARATION

The foundation on which the gabions filter fabric, or bedding is to be placed shall be stripped to remove vegetation and shall be cut or filled and graded to the lines and grades shown on the drawings. Surface irregularities and loose materials shall be removed. Excavation beyond the specified lines and grades shall be corrected

by filling the resulting voids with approved compacted earthfill or bedding material.

All water or mud shall be kept out of or removed from the excavated area prior to the placement of the gabions, and the excavated area shall be maintained in this condition during the construction work.

**Table 2
REQUIREMENTS FOR NONWOVEN GEOTEXTILES**

Property	Test Method	Class I	Class II	Class III	Class IV
Tensile Strength (pounds) ^{1/}	ASTM D 4632 Grab Test	180 min.	120 min.	90 min.	115 min.
Bursting Strength <u>1/</u>	ASTM D 3786 Diaphragm tester	320 min.	210 min.	180 min.	NA
Elongation at failure (percent) <u>1/</u>	ASTM D 4632	>50	>50	>50	>50
Puncture (pounds) <u>1/</u>	ASTM D 4833	80 min	60 min.	40 min.	40 min.
Ultraviolet light (percent residual tensile strength)	ASTM D 4355 150 hours exposure	70 min	70 min	70 min	70 min
Apparent Opening Size – AOS	ASTM D4751	As specified, max #40 <u>2/</u>			
Permitivity (l/seconds)	ASTM D 4491	0.70 min	0.70 min	0.70 min	0.10 min

^{1/} Minimum average roll value (weakest principal direction).

^{2/} U.S. standard sieve size.

Gabions, fabric, and bedding shall not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by the engineer.

5. FILTER FABRIC

Prior to use, the filter fabric shall be stored in a clean, dry place, out of direct sunlight, not subject to extremes of either hot or cold, and with the manufacturer's protective cover in place. Receiving, storage, and handling at the job site shall be in accordance with the requirements in ASTM D 4873.

The surface on which the filter fabric is to be placed shall be graded to the neat lines and grades as shown on the drawings. The surface shall be reasonably smooth and free of loose rock and clods, holes, depressions, projections, muddy conditions and standing or flowing water.

Prior to placement of the filter fabric, the soil surface will be inspected for quality assurance of design and construction. The filter fabric shall be placed on the approved prepared surface at the locations and in accordance with the details shown on the drawings and specified. The filter fabric shall be unrolled along the placement area and loosely laid (not stretched) in such a manner that it will conform to the surface irregularities when material is placed on or against it. The filter fabric may be folded and overlapped to permit proper placement in the designated area.

The filter fabric shall be joined by overlapping a minimum of 18 inches (unless otherwise specified) and secured against the underlying foundation material. Securing pins, approved and provided by the filter fabric manufacturer, shall be placed along the edge of the panel or roll material to adequately

hold it in place during installation. Pins shall be made of steel or fiberglass formed into a “U”, “L”, or “T” shape or contain “ears” to prevent total penetration. Steel washers shall be provided on all but the “U” shaped pins. The upstream or upslope fabric shall overlap the abutting downslope fabric. At vertical laps, securing pins shall be inserted through both layers along a line through approximately the midpoint of the overlap. At horizontal laps and across the slope laps, securing pins shall be inserted through the bottom layer only. Securing pins shall be placed along a line approximately 2 inches in from the edge of the placed filter fabric at intervals not to exceed 12 feet unless otherwise specified. Additional pins shall be installed as necessary and where appropriate to prevent any undue slippage or movement of the fabric. The use of securing pins will be held to the minimum necessary. Pins are to be left in place unless otherwise specified.

Should the filter fabric be torn or punctured, or the overlaps or sewn joint disturbed—as evidenced by visible fabric damage, subgrade pumping, intrusion, or grade distortion—the backfill around the damaged or displaced area shall be removed and restored to the original approved condition. The repair shall consist of a patch of the same type of fabric being used, overlaying the existing fabric. When the filter fabric seams are required to be sewn, the overlay patch shall extend a minimum of 1 foot beyond the edge of any damaged area and joined by sewing as required for the original filter fabric, except that the sewing shall be a minimum of 6 inches from the edge of the damaged fabric. Filter fabric panels joined by overlap shall have the patch extend a minimum of 2 feet from the edge of any damaged area.

The filter fabric shall not be placed until it can be anchored and protected with the specified covering within 48 hours or protected from exposure to ultraviolet light. In no case shall material be dropped on uncovered filter fabric from a height greater than 3 feet.

Any damaged filter fabric shall be replaced and paid for by the contractor.

6. BEDDING

When bedding is specified beneath the gabions, the bedding material shall be spread uniformly on the

prepared foundation surface to the depth specified and shall be free of mounds, dips, or windrows. Compacting of bedding will not be required. The surface of the bedding shall be approved by the engineer prior to the placement of the gabions.

7. GABION FABRICATION AND INSTALLATION

The assembly of gabions shall consist of shaping and tying each individual basket. Where the length of the gabion exceeds its horizontal width, the gabion shall be equally divided by diaphragms into cells whose length does not exceed the basket horizontal width. Diaphragms shall be fabricated of the same mesh and gauge as the body of the gabions. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying at this juncture will be necessary. Each gabion basket shall be assembled by tying all untied edges, including diaphragms, with lacing wire.

Lacing shall be used for both the assembly of baskets and connecting baskets together. The lacing procedure consists of cutting a length of lacing wire approximately 1.5 times the distance to be laced (not to exceed 5 feet), securing one end of the wire at the corner by looping and twisting, alternately lacing with single and double loops at approximately 4-inch intervals, and securing the other end of the wire to selvages by looping and twisting.

Gabions shall be installed to the lines and grades shown on the drawings. Gabions shall be securely tied to each adjoining gabion with lacing wire along the vertical reinforced edges and the top selvages. Empty gabion sections stacked on a filled line of gabions shall be tightly laced to the latter along the front and back. When the upper section only partially overlaps the lower section, the lacing shall be done along the line where the front edge of the upper section meets the lower section, and where the back edge of the lower section meets the base of the upper section. For the end sections only, the layer of empty gabions placed on top of filled gabions must be wired to the latter at the front, back, and external lateral edge.

Prior to placement of rock, the baskets used in retaining walls shall be stretched. If necessary, the gabions shall be temporarily staked to maintain proper alignment. Staking through filter fabric

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material will not be allowed. Connecting wires shall be attached during the filling operation to preserve the strength and shape of the structure.

The gabions shall be carefully filled with rock, by either hand or machine placement to ensure proper alignment, avoid bulges, and provide a compact mass with a minimum of voids. Machine placement may have to be supplemented with handwork to ensure a neat, compact, square appearance. Rock shall not be dropped more than 3 feet above the basket or mattress.

Cells in rows shall be filled in stages such that the depth of rock placed in any cell does not exceed the depth in an adjoining cell by more than 1 foot. Rock smaller than 4 inches showing on visible faces shall be rodded into or removed from the gabion prior to any earth backfilling.

The placement of rock in gabions, including the installation of connecting wires, shall be performed in the following sequence for the depth of gabions indicated.

a. 36-Inch-Deep Gabions

- Fill gabions to a depth of 12 inches.
- Tightly tie one connecting wire in each direction to opposite faces of each gabion cell at a 12-inch height above the base, except for exposed cell faces. Two connecting wires evenly spaced shall be used in lieu of one between an exposed front face and the opposite back face.
- Fill gabions another 12 inches and tightly tie connecting wires to opposite faces of each gabion at this level as described in step 2 above.
- Complete filling of gabions to the top.

b. 18- and 12-Inch-Deep Gabions

- Connecting wires are not necessary in the 12-inch size.
- Connecting wires are necessary in the 18-inch-deep gabions only when it is used to construct vertical structures.
- When connecting wires are required, tightly tie connecting wires to the opposite face, at 9 inches above the base as described for the 36-inch-deep gabions, after filling with rock to this level.

All connecting wires shall be looped around two mesh openings and the ends of the wires shall be

securely twisted with a minimum of five twists after looping.

When the gabion has been filled, the lid shall be bent and stretched until it meets the perimeter edges of the front and end panels. To assist in closing and lacing, a pinch bar or special closing tool may be used. The lid shall then be tightly laced with lacing wire to the edges of the front and end panels. The lids shall also be securely tied to each adjoining gabion with lacing wire along all contact edges. Lacing adjacent lids to the vertical panels in one operation is acceptable. Lacing the back edge of the lid to adjoining gabions shall be done prior to filling the gabion. The lid shall be tied to each diaphragm by lacing wire. Lacing shall be performed in the same manner as previously described for assembly.

8. FINISHING

The gabion structure shall be constructed in a neat and workmanlike manner, with not more than 1-inch displacement of vertical or horizontal adjoining edges. The area adjacent to the structure shall be graded to eliminate low areas or channels, as specified by the engineer. Any gabion damaged during construction shall be removed and replaced as directed by the engineer.

9. MEASUREMENT AND PAYMENT

Method 1. For items of work for which specific unit prices are established in the contract, the volume of rock will be measured within the neat lines of the gabion structure and computed to the nearest one-tenth cubic yard. Payment for wire mesh gabions will be made at the contract unit price, including gabions, rock, excavation, earthfill, foundation preparation, bedding or filter fabric (if specified), and finishing. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work.

Method 2. For items of work for which specific unit prices are established in the contract, the volume of rock will be measured within the neat lines of the gabion structure and computed to the nearest one-tenth cubic yard, and the excavation will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. Payment for wire mesh gabions will be made at the contract unit price, including gabions, rock, earthfill, foundation

preparation, bedding or filter fabric (if specified), and finishing. Payment for excavation will be made at the contract unit price. Such payment will be considered full compensation for all labor, materials, 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 volume of rock will be measured within the neat lines of the structure and computed to the nearest one-tenth cubic yard, and the volume of excavation and earthfill will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. Payment for wire mesh gabions will be made at the contract unit price, including gabions, rock, foundation preparation, bedding or filter fabric (if specified), and finishing. Payment for excavation and earthfill will be made at the contract unit price for each item. Such payment will be considered full compensation for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work.

10 OPERATION AND MAINTENANCE PLAN

A properly operated and maintained structure is an asset to your operation. It is designed and installed to divert water from a watercourse to where it may be utilized beneficially or reduce damage potential of potentially damaging flows. The estimated life span of this installation is at least 15 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require periodic maintenance and may also require operational items to maintain satisfactory performance. The following are some recommendations that may help develop a good operation and maintenance program.

- Avoid excessive travel on any portion of the system that will harm or destroy vegetative cover.
- Periodically check the elevation of fill and restore material to the as-built height if necessary.
- Maintain growth of desirable vegetative cover. This includes reseeding, fertilization, and controlled application of approved

- herbicides when necessary. Periodic mowing may be needed to control growth.
- Periodically remove the sediment or soil that is deposited in the channel and restore to original dimensions.
- Remove any obstructions or blockages around the structure to also include debris on the trash rack, weir, or pipe inlets.
- Determine and eliminate causes of settlement or cracks in the earthen and concrete portions of the structure.
- Eradicate or otherwise remove rodents or burrowing animals and repair damage caused by their activity.
- Immediately repair any vandalism, vehicular, or livestock damage to any portions of the structure.
- Remove woody vegetation from around the structure.