

**Specification Item No. 594S
 Gabions and Revet Mattresses**

594S.1 Description

The work to be performed under this specification shall include furnishing, assembling, filling, and tying rock-filled wire mesh compartmented gabions and revet mattresses in accordance with the lines, grades, and dimensions shown on the Drawings or otherwise established in the field by the Engineer or designated representative. The type of construction (i.e. twisted woven mesh, welded mesh or both) and wire sizes [i.e. 13.5 gage (2.2 mm), 12 gage (2.7 mm) or 10 gage (3.4 mm)] shall be as defined in the Drawings or otherwise established by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

594S.2 Materials

Gabions and revet mattresses shall be constructed of galvanized steel wire with polyvinyl-chloride (PVC) flexible coating. The gabions and revet mattresses shall be of the construction and sizes specified in the Drawings and shall meet the specifications presented herein. Unless otherwise specified in the Drawings or approved by the Engineer or designated representative, the gabions and revet mattresses may be constructed of either double twist woven mesh or welded wire mesh.

Gabions shall be furnished in the specified dimensions within a tolerance of ± 5 percent. Revet mattresses shall be furnished in the specified dimensions within a tolerance of ± 5 percent for the length and width and ± 10 percent for the height. For each individual gabion or revet mattress, the same mesh style shall be used for the base, front, ends, back, diaphragms and lid panels. Each gabion or revet mattress shall be manufactured and divided into cells of equal length, no greater than 3 feet (0.9 meter), by diaphragm panels.

(1) Gabion and Revet Mattress Wire

Gabion wire shall be galvanized steel, Class 3 or A coating, soft temper conforming to ASTM A 641, and shall specifically meet the requirements given below for gabions (12 gage wire) and/or revet mattresses (13.5 wire gage) as called for in the Drawings. PVC coating of the wire may be fuse-bonded or extruded onto the wire. Galvanization of welded wire shall be performed either before or after welding.

Table 1: Requirements – Mesh Wire for Gabions and Revet Mattress Units

Characteristic	Gabions	Revet Mattresses
Wire Gage	12 gage	13.5 gage
Maximum Tensile Strength (ASTM 641)	70,000 psi (483 mPa)	75,000 psi (517 mPa)
Nominal Wire Diameter (ASTM A 641)	0.106 inch (2.7 mm)	0.0866 inch (2.2 mm)
Minimum Diameter (ASTM A 641, Table 3)	0.102 inch (2.6 mm)	0.0826 inch (2.9 mm)
Galvanizing, Zinc (ASTM A 641, Table 1)	0.80 oz/ft ² (245 gr/m ²)	0.70 oz/ft ² (215 gr/m ²)

(2) Gabion Mesh

(A) Woven Mesh

Woven mesh shall be of a uniform non-raveling, double twist hexagonal pattern nominally of dimensions 3.25 inches by 4.5 inches (83 mm by 114 mm). Selvedge wire shall be 10 gage (nominal diameter of 3.4 mm).

(B) Welded Mesh

Mesh opening shall be nominally 3 inches by 3 inches (75 mm by 75 mm). Strength of welds shall meet the following requirements when tested in accordance with section 13.4 of ASTM A-974:

Table 2: Minimum Weld Strength Requirements

Type of Structure	Wire Size (Diameter)	Minimum Average Weld Shear Strength English Units (SI Units)
	Gage (mm)	
Gabions	12 (2.7)	472 lbf (2.10 kN)
Revet Mattress	13.5 (2.2)	292 lbf (1.30 kN)

(C) Manufacturing

Twisted wire mesh gabions shall be manufactured in conformance with ASTM A-975, while welded wire mesh gabions shall be manufactured in conformance with ASTM A-974.

(3) Revet Mattresses

(A) Woven Mesh

Woven mesh shall be of a uniform non-raveling, double twist hexagonal pattern, nominally of dimensions 2.5" x 3.25" (64 mm by 83 mm). Selvedge wire shall be 12 gage (nominal diameter of 2.7 mm).

(B) Welded Mesh

Mesh opening shall be nominally 1.5" x 3.0" (38 mm by 76 mm). Strength of welds shall meet the requirements listed in Table 2 for 13.5 gage (2.2 mm) wire, when tested in accordance with section 13.4 of ASTM A-974:

(C) Manufacturing

Twisted wire mesh revet mattresses shall be manufactured in conformance with ASTM A-975, while welded wire mesh revet mattresses shall be manufactured in conformance with ASTM A-974.

(4) PVC Coating

All wire used in fabrication of the gabions, revet mattresses and wiring operations during construction shall, after zinc coating, have a fuse-bonded or extruded coating of PVC. The coating shall be gray in color. The thickness shall be nominally 0.020 inch (0.5 mm), and shall not be less than 0.015 inch (0.38 mm) in thickness. It shall be capable of resisting deleterious effects of natural weather exposure, and immersion in salt water.

For PVC-coated welded wire fabric panel, cutting of the panels shall not be allowed closer than 1/4 inch \pm 1/8 inch (6 mm \pm 3.18 mm) after fabrication in order to prevent exposure near the welds.

(A) Initial Properties:

1) Woven Mesh:

The initial properties of the PVC coating material shall have a demonstrated ability to conform to the following requirements specified in ASTM A-975:

a) Specific Gravity:

The specific gravity as determined in accordance with ASTM D-792 shall be between 1.3 to 1.35.

b) Durometer Hardness:

The hardness as determined in accordance with ASTM D-2240 shall be between 50 to 60, Shore D.

c) Tensile Strength:

The tensile strength when tested in accordance with ASTM D-412 shall not be less than 2985 psi (20.6 mPa).

d) Modulus of Elasticity at 100% Elongation:

The Modulus of Elasticity when determined in accordance with ASTM D-412 shall not be less than 2700 psi (18.6 mPa).

e) Resistance to Abrasion:

The percentage loss in weight (mass) during abrasion testing in accordance with ASTM D-1242 shall be less than 12%.

f) Brittleness Temperature:

The brittleness temperature shall not be higher than 15⁰F (-9.0⁰C) or a lower temperature specified by the Engineer, when tested in accordance with ASTM D-746. The maximum brittleness temperature should be at least 15⁰F (8⁰C) below the minimum temperature at which the gabion will be handled or filled.

2) Welded Mesh:

The initial properties of the PVC coating material shall have a demonstrated ability to conform to the following requirements specified in ASTM A-974:

a) Specific Gravity:

The specific gravity as determined in accordance with ASTM D-792 shall be between 1.20 and 1.40.

b) Durometer Hardness:

The hardness as determined in accordance with ASTM D-2240 shall not be less than 75, Shore A.

c) Tensile Strength:

The tensile strength when tested in accordance with ASTM D-638 shall not be less than 2275 psi (15.7 mPa).

d) Modulus of Elasticity:

The Modulus of Elasticity when determined in accordance with ASTM D-638 shall not be less than 1980 psi (13.7 mPa).

e) Resistance to Abrasion:

The percentage loss in weight (mass) shall be less than 12 % during abrasion testing in accordance with ASTM D-1242, Method B, at 200 cycles, CSI-A abrader tape, 80 grit.

f) Brittleness Temperature:

The brittleness temperature shall not be higher than 15⁰F (-9.0⁰C) or a lower temperature specified by the Engineer, when tested in accordance with ASTM D-746. The maximum brittleness temperature should be at least 15⁰F (8⁰C) below the minimum temperature at which the gabion will be handled or filled.

g) Adhesion:

The PVC coating on the wire shall adhere to the wire such that the coating breaks rather than separates from the wire, when tested in accordance with the PVC Adhesion Test described in Section 13.3 of ASTM A-974.

h) Mandrel Bend:

The PVC-coated wire, when subjected to a single 360⁰ bend at 0⁰F (-18⁰C) around a mandrel ten times the diameter of the wire, shall not exhibit breaks or cracks in the PVC coating.

(B) Performance Tests:

The PVC coating shall have the demonstrated ability to withstand the specified exposure testing.

- 1) Exposure to Salt Spray: The PVC shall show no effect after 3000 hours of salt spray exposure in accordance with ASTM Test Method B-117.
- 2) Exposure to Ultraviolet Rays: The PVC shall show no effect of exposure to ultraviolet light with test exposure of 3000 hours, using apparatus Type E and 145⁰F (63⁰C), when tested in accordance with ASTM Practice D-1499 and G-23.

(C) Properties After Exposure Tests:

After conclusion of the salt spray and exposure to ultraviolet light tests, the PVC shall not show cracks, blisters or splits, nor any noticeable change in color. In addition the PVC coating shall not show cracks or breaks after the wires are twisted in the fabrication of the mesh, nor shall there be any moisture intrusion under the PVC coating as a result of the test.

After completion of the exposure tests the following criteria shall also be met:

1) Woven Mesh:

- a) The Specific Gravity shall not change more than 6% of its initial value.
- b) The Durometer Hardness shall not change more than 10% of its initial value.

- c) The Tensile Strength shall not change more than 25% of its initial value.
- d) The Resistance to Abrasion shall not change more than 10% of its initial value.

2) Welded Mesh:

- a) The Specific Gravity shall not change more than 6% of its initial value.
- b) The Modulus of Elasticity shall not change more than 25% of its initial value.
- c) The Tensile Strength shall not change more than 25% of its initial value.
- d) The Resistance to Abrasion shall not change more than 10% of its initial value.

(D) Salt Spray Resistance for Fastener:

The fasteners for twisted mesh wire gabions and revet mattresses shall be subjected to Salt Spray Test of Test Method B-117 for a period of not less than 48 ± 1 hour cycle length. After testing the fasteners, the selvedge, or mesh wire confined by the fasteners shall show no rusty spots on any part of the surface excluding the cut ends.

(5) Stone

(A) Gabion Basket Stones

Stone fill shall be durable and of suitable quality to ensure permanence in the structure. The stone used to fill the gabion baskets shall be a clean, sound, and durable rock meeting the following requirements. It shall have a wearing loss less than 35 percent when the stone is tested with the Los Angeles Abrasion Machine in accordance with ASTM Test Method C535 (TxDOT Test Method Tex-410-A). The loss of material experienced during five cycles of magnesium sulfate exposure conducted in accordance with TxDOT Test Method Tex-411-A for Rock RipRap shall not exceed 18 percent. The stone shall be well graded to produce a dense fill, angular in texture, while meeting the following gradation requirements:

Table 3: Gabion Stone Gradation Requirements

Sieve Size US (SI)	Percent by Weight (Mass) % Passing Each Individual Sieve
8 Inch (200 mm)	100
4 Inch (100 mm)	0 - 5
3 Inch (75 mm)	0

The minimum unit weight (unit mass) of a rock-filled gabion shall be 120 pcf [1.92 megagrams (mg) per cubic meter]. Verification of unit weight (mass) shall be performed when ordered by the Engineer, by constructing a test gabion with materials supplied for construction with the same effort and method intended for production gabions.

(B) Revet Mattress Stone:

The stone used to fill the revet mattresses shall be as specified for gabions except that it shall have a maximum dimension of 5 inches (125mm) and a minimum dimension of 3 inches (75 mm). The majority of the stone shall be in the 3 to 4 inch (75 to 100 mm) range; cubical or rounded in shape. A tolerance of 5% shall be allowed on the upper and lower dimensions of the rock.

(6) Connections

(A) Wire

Lacing wire and connecting wire shall be 13.5 gage [0.087 inch (2.20 mm)] PVC coated galvanized steel, Class 3, soft temper, conforming to ASTM A-641. During testing, any separation of 2 inches (50 mm) or more between connecting wires shall be considered as a failure.

(B) Spiral Binder for Welded Wire Mesh

Spiral binders shall consist of 0.106 inch (2.7 mm) PVC coated wire for the gabion and 0.087 inch (2.2 mm) PVC coated wire for the revet mattresses. Spiral binders shall have a 3.0 inch (75 mm) maximum separation between continuous successive loops (3 inch or 75mm pitch).

The binder shall be made of galvanized steel, Class 3, soft temper, conforming to ASTM A-641.

(C) Alternate Fasteners for Twisted Woven Mesh

Alternate fasteners, acceptable for use by the intended gabion basket manufacturer, may be submitted to the Engineer for consideration and approval prior to construction. The fasteners may consist of split ring or interlocking fasteners. Alternate fasteners systems shall produce a joint that meets the requirements of ASTM A-975, Section 7, Table 2.

(7) Fastener System

The Contractor shall provide a complete description of the fastener system, including the number of fasteners required for all vertical and horizontal connections for single- and multiple-basket joinings, as well as the number and size wires the fastener is capable of properly joining. The Contractor shall provide a description of a properly installed fastener, including test reports, drawings and/or photographs. Properly formed fasteners shall meet the requirements of ASTM A-974 for welded wire mesh or ASTM A-975 for twisted woven mesh.

(A) Each interlocking fastener shall be locked and closed.

(B) Each overlapping ring fastener shall be closed and the free ends shall overlap an average of 1 inch (25 mm).

(C) Spiral binders shall be screwed into position such that they pass through each mesh opening along the joint. In order to prevent unraveling, both ends of the spiral shall be crimped back around itself.

(D) Wire fasteners shall not be used to join more wires, or larger wires, than tested and approved for the application.

(8) Panel to Panel Joint Strength

The minimum strength of the joined panels shall be as specified in Section 7.3 of ASTM A-974 for Welded wire panels or Section 7.3 of ASTM A-975 for twisted woven mesh.

(9) Miscellaneous

Aggregate bedding, geotextiles or other materials shall conform to the requirements established on the Drawings.

(10) Certificate of Compliance

The Contractor shall submit Certificates of Compliance for all materials proposed for use to the Engineer for review and approval one week prior to construction.

594S.3 Construction

Twisted wire mesh Gabon's and revote mattresses shall be supplied in the forms allowed in ASTM A-975, while welded wire mesh Gabon's and revote mattresses shall be supplied in a form allowed in ASTM A-974.

The Gabon/revote mattress manufacturer/supplier will be required to have a qualified representative on site at the start of gabion/revet mattress construction. The Contractor shall submit work experience documentation of the representative for review/approval by the Engineer or designated representative. The representative shall be available for consultation as needed throughout the gabion construction.

Gabions and revet mattresses shall be constructed to the lines and grades shown on the Drawings. Individual or groups of gabions or revet mattresses, which deviate from line and grade, shall, at the direction of the Engineer or designated representative, be removed and replaced at no cost to the owner. Gabions or revet mattresses, which are constructed with bulges, and/or underfilled, loosely filled, or otherwise lacking a neat and compact appearance shall, at the direction of the Engineer or designated representative, be repaired/replaced at no cost to the owner. Underfilling of gabion/revet mattress corners to facilitate insertion of spirals shall not be permitted.

(1) Foundation Preparation

The foundation shall be excavated to the extent shown on the Drawings or as directed by the Engineer or designated representative. All loose or otherwise unsuitable materials shall be removed. All depressions shall be carefully backfilled to grade. The depressions shall be backfilled with suitable materials from adjacent required excavation, or other approved source, and compacted to a density at least equal to that of the adjacent foundation. If pervious materials are encountered in the foundation depressions, the areas shall be backfilled with free draining materials.

Any buried debris protruding from the foundation that will impede the proper installation and detrimentally impact the final appearance of the gabion, shall also be removed, and the voids carefully backfilled and compacted as specified above. Immediately prior to gabion or revet mattress placement, the prepared foundation surface shall be inspected and approved by the Engineer and no material shall be placed thereon until that area has been approved.

Placement of filter material and/or filter fabric shall be as shown on the Drawings or directed by the Engineer.

(2) Gabion/Revet Mattress Basket Assembly

No work shall take place using PVC coated materials unless both the ambient air temperature and the temperature of the PVC materials are at least 15°F (8°C) above the brittleness temperature of the PVC materials.

Assembly of gabions and revet mattresses shall consist of shaping and tying each individual basket. Baskets shall be assembled by connecting all untied edges including

diaphragms with lacing wire, spirals or approved fasteners. The connections for the completed assemblies shall conform to the requirements of Section 7 of ASTM specifications A-974 (welded wire) and Section 7.3 and Table 2 of A-975 (double twisted).

Assembly of baskets, connection of baskets together and lid closures shall be accomplished in accordance with one of the following approved procedures:

(A) Lacing Wire:

Using lacing wire of appropriate length, secure one end of the wire onto the basket corner by looping and twisting the lacing wire together. Proceed along the joint by tying with double loops every other mesh opening at intervals not more than 6 inches (150 mm) apart, while pulling the basket elements tightly together. Secure the other end of the lacing wire again by looping and twisting the wire around itself.

(B) Spiral Binders for Welded Wire Mesh:

Spiral binders, meeting the minimum acceptance criteria of article 594S.2 (6) c) shall be screwed into position such that they pass through each mesh opening along the joint. To prevent unraveling, each end of the spiral binder shall be crimped back against itself.

C) Alternate Fasteners for Twisted Woven Mesh:

Interlocking fasteners meeting the minimum acceptance criteria of article 594S.2 (6) c), shall be installed with, as a minimum, one interlocking fastener in every other opening.

Ring fasteners meeting the minimum acceptance criteria of 594S.2 (6)c), shall be installed with, as a minimum, one split ring fastener in every opening, having a minimum 1 inch (25 mm) total overlap and securing only the number and diameter of wires for which tested.

Placing of gabions and revet mattresses shall consist of installing baskets to the lines and grades shown on the Drawings. Gabions and revet mattresses shall be securely fastened to each adjoining unit along the vertical and top reinforced edges of all contact surfaces. Overlying rows of baskets shall be staggered appropriately. Empty sections stacked on a filled line of gabions and revet mattresses shall be securely fastened to the bottom unit along the front, back and ends.

Prior to the placement of rock, the baskets used in the front vertical exposed faces of retaining walls shall be aligned. To facilitate alignment, tension may be applied to empty units at the direction of the Engineer or designated representative.

(3) Filling of Gabions and Revet Mattresses

The gabions and revet mattresses may be filled by machine, in maximum lifts of 12 inches (300 mm). The machine work shall be supplemented with handwork to avoid bulges and provide a compact mass with a minimum of voids. Care will be exercised so as not to damage the gabion/revet mattress elements or wire coating by limiting height of drop during filling to 3.0 feet (0.9 meter) for Gabions and 1.5 feet (0.5 meter) for revet mattresses. Undue deformation or bulging of the mesh shall be corrected prior to further stone filling. Where specified on the Drawings, select large stone shall be hand placed on vertical outside faces to achieve a desired neat appearance.

During placement, the depth of stone in any cell shall not exceed the depth in an adjoining cell by more than one foot (300 mm). Stone smaller than the mesh opening found against vertical faces shall be removed.

Two connecting wires in each direction for end units and two parallel connecting wires perpendicular to the exposed face for exposed face units shall be installed at every 12 inch (300 mm) lift. The connecting wires shall loop around two mesh openings, and the ends of wires shall be securely twisted with a minimum of three twists after looping. Prefabricated connecting wire may be used in lieu of connecting wire.

Connecting wires associated with 18-inch (450 mm) gabions shall be installed when and as specified on the Drawings or as recommended by the gabion/revet mattress manufacturer.

The gabion or revet mattress unit shall be overfilled by 1 1/2 to 2 inches (37.5 to 50 mm) and the lid shall be bent and stretched until it meets the perimeter edges of the front and end panels. The stretching shall be accomplished using an approved lid closing tool in order to prevent damage to the PVC coating. Crow bars or similar single point leverage devices will not be allowed. The lid shall then be securely tied with lacing wire, spirals or approved fasteners to the fronts, ends and diaphragms. Excessive deformation of the lid panel to facilitate closing of a bulging gabion or revet mattress will not be permitted.

All backfill shall be placed and compacted in sequence with the filling of the baskets; however, care shall be exercised in compacting the fill behind a single row of baskets since excessive compaction effort can displace the gabions/revet mattresses from the desired alignment.

Gabion or revet mattress units may be cut or shaped to fit odd length or odd shaped areas. They shall be cut at least 6" to 8" (150 mm to 200 mm) larger than the opening to allow sufficient material for overlap and lacing. All edges or faces formed in this manner shall be adjusted to present a finished and pleasing appearance.

At all times, care shall be taken to turn all loose and projecting ends of wire into the gabion units to prevent injury.

594S.4 Quality of Work

Wire of proper grade and quality, when fabricated and installed in the manner herein required, shall result in a strong, serviceable mesh-type product having substantially uniform openings. It shall be fabricated and finished properly, as determined by visual inspection, and shall conform to this specification.

594S.5 Measurement

Measurement of acceptable "Gabions and Revet Mattresses", complete in place, will be made on the basis of volume determined by the actual length, width and height.

594S.6 Payment

The Gabion and revet mattress quantities, measured as described above, will be paid for at the unit bid prices per cubic yard (cubic meter: 1 cubic meter equals 1.308 cubic yards) of the various types indicated. The price shall include full compensation for furnishing, hauling and placing all materials, including filter fabric, wire containers, connectors, reinforcement stones and backfill; for all labor, tools, equipment and incidentals needed to complete the work.

Excavation and all subgrade preparation required for shaping the foundation for the wire containers shall be included in the unit bid price for "Gabions and Revet Mattresses".

Payment will be made under one of the following:

- Pay Item No. 594S-A: Gabions, Twisted Woven Wire -----Per Cubic Yard.
- Pay Item No. 594S-B: Gabions, Welded Wire ----- Per Cubic Yard.
- Pay Item No. 594S-C: Revet Mattresses, Twisted Woven Wire --- Per Cubic Yard.
- Pay Item No. 594S-D: Revet Mattresses, Welded Wire----- Per Cubic Yard.

End

<u>SPECIFIC</u> CROSS REFERENCE MATERIALS
Specification Item 594S, "GABIONS and REVET MATTRESSES"

City of Austin Environmental Criteria Manual

<u>Designation</u>	<u>Description</u>
Section 1.4.3.E	Permanent Structural Practices-Gabions
Figure 1.23	Gabions

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
594S-1	Gabions
594S-2	Gabion Details

American Society for Testing and Materials (ASTM)

<u>Designation</u>	<u>Description</u>
A-974	Standard Specifications for Welded Wire Fabric Gabions and Gabion Mattresses (Metallic-Coated or Polyvinyl Chloride (PVC) Coated)
A-975	Standard Specifications for Double-Twisted Hexagonal Mesh Gabions and Revet Mattresses (Metallic-Coated Steel Wire or Metallic-Coated Steel with Poly (Vinyl Chloride)(PVC) Coating)

<u>RELATED</u> CROSS REFERENCE MATERIALS

City of Austin Technical Specifications

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 220S	Sprinkling for Dust Control
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 236S	Proof Rolling
Item No. 510	Pipe
Item No. 601S	Salvaging and Placing Topsoil
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 605S	Soil Retention Blanket

Item No. 606S Fertilizer
Item No. 607S Slope Stabilization
Item No. 608S Planting

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
642S-1	Silt Fence

Texas Department of Transportation: Manual of Testing Procedures

<u>Designation</u>	<u>Description</u>
410-A	Abrasion of Coarse Aggregate Using The Los Angeles Machine
411-A	Soundness of Aggregate By Use of Sodium Sulfate or Magnesium Sulfate

RELATED CROSS REFERENCE MATERIALS - Contibued
Specification Item 594S, "GABIONS and REVET MATTRESSES"

American Society for Testing and Materials (ASTM)

<u>Designation</u>	<u>Description</u>
A-313	Standard Specification for Stainless Steel Spring Wire
A-370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
A-641	Specification for Zinc Coated (Galvanized) Carbon Steel Wire
A-853	Standard Specification for Steel Wire, Carbon, for General Use
B-117	Test Method of Salt Spray (Fog) Testing
C-535	Standard Test Method for Resistance of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
D-412	Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension
D-638	Test Method for Tensile Properties of Plastics
D-746	Test Methods for Brittleness Temperature of Plastic and Elastomers by Impact
D-792	Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement
D-1203	Standard Test Methods for Volative Loss from Plastics Using Activated Carbon Methods
D-1242	Test Methods for Resistance of Plastics Materials to Abrasion
D-1499	Practice for Operating Light and Water Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics
D-2240	Test Method for Rubber Property-Durometer Hardness
D-2287	Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
G-23	Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Non-metallic Materials