

NOVEMBER 20, 1939**SUPERSEDING Fed. Specs.****SS-P-686, July 3, 1935****and****SS-T-302, June 17, 1935****FEDERAL STANDARD STOCK CATALOG****Section IV****(Part 5)****FEDERAL SPECIFICATION****FOR****ACOUSTICAL-UNITS; PREFABRICATED**

This specification was approved on the above date by the Director of Procurement, for the use of all departments and establishments of the Government, and shall become effective not later than August 15, 1940. It may be put into effect, however, at any earlier date after promulgation.

A. APPLICABLE SPECIFICATIONS.

A-1. There are no other Federal Specifications applicable to this specification.

B. TYPES AND CLASSES.

B-1. Types.—The acoustic materials covered by this specification are of the following 9 types, as specified in the invitation for bids, and are identified by their texture, surface appearance, and composition. (See par. I-1.).

Type I.—Cast units composed of small uniform mineral particles held together with portland cement.

Type II.—Cast units having a surface composed of or resembling small uniform granules. The binder may be gypsum or any other suitable mineral binder.

Type III.—Cast units having a surface composed of or resembling irregular, rough granules. The binder may be gypsum or any other suitable mineral binder.

Type IV.—Units having a mechanically perforated surface which acts as a covering for the sound absorbent material.

Type V.—Units which are mechanically perforated, the perforations extending into the sound absorbent material.

Type VI.—Units having a fissured surface.

Type VII.—Compressed units composed of long wood fibers held together with a mineral binder. This type shall not have a mechanically perforated surface.

Type VIII.—Felted fiber or wood pulp units which have a surface that is not mechanically perforated.

Type IX.—Units of thin shell type which depend principally for their efficiency on diaphragmatic action.

B-2. Classes for auditorium treatment.—

B-2a. For auditorium treatment, acoustic materials shall be classified in regard to their sound absorbing qualities at 512 cycles per second. The limiting values of sound absorption coefficients at this frequency for each class are as follows:

Class	Coefficient at 512 cycles		Class	Coefficient at 512 cycles	
	Less than—	Equal to or more than—		Less than—	Equal to or more than—
A.....		0.90	I.....	0.55	0.50
B.....	0.90	.85	J.....	.50	.45
C.....	.85	.80	K.....	.45	.40
D.....	.80	.75	L.....	.40	.35
E.....	.75	.70	M.....	.35	.30
F.....	.70	.65	N.....	.30	.25
G.....	.65	.60	O.....	.25	.20
H.....	.60	.55	P.....	.20	0

B-2b. For a material to be acceptable the coefficient of sound absorption at 128 cycles must not be less than $\frac{1}{8}$ of the coefficient at 512 cycles and the coefficient at 2,048 cycles must not be less than $\frac{1}{4}$ that of the coefficient at 512 cycles. (See note I-4.)

B-3. Classes for noise reduction.—

B-3a. Where acoustic material is supplied to reduce the noise level, it shall be classified in regard to its sound-absorbing qualities at the four frequencies 256, 512, 1,024, and 2,048 cycles. The average of the sound absorption coefficients at these four frequencies will be called the noise coefficient. For classification purposes the average will be taken to the nearest multiple of 0.05. The values of the noise coefficient for each class are as follows:

Class	Noise coefficient	Class	Noise coefficient
AA.....	0.90	II.....	0.50
BB.....	.85	JJ.....	.45
CC.....	.80	KK.....	.40
DD.....	.75	LL.....	.35
EE.....	.70	MM.....	.30
FF.....	.65	NN.....	.25
GG.....	.60	OO.....	.20
HH.....	.55		

C. MATERIAL AND WORKMANSHIP.

C-1. The acoustic units shall consist of—

C-1a. Cast acoustic units (type I) shall be composed of masonry materials and shall be of portland cement, or of an incombustible granular aggregate mixed with portland cement.

C-1b. Cast acoustic units (types II and III) shall be composed of a suitable granular aggregate of mineral or vegetable origin held together in a permanently effectual manner, or of aerated mineral materials which after being cast have a surface appearance similar to materials containing an aggregate.

C-1c. Acoustic units (type IV) shall consist of a sound absorbent pad covered with a perforated facing of a different material.

C-1d. Acoustic units (types V, VI, VII, VIII) shall be composed of vegetable or mineral fiber suitably felted together or held together with a permanently effectual binding agent.

C-1e. Acoustic units (type IX) shall be composed of sheets of metal, fiber, or synthetic material so shaped that when they are installed they will be vibrated diaphragmatically by the sound waves.

D. GENERAL REQUIREMENTS.

D-1. All units shall be free from defects affecting appearance or serviceability and shall be suitable for use as an interior architectural finish or decoration, as well as a sound absorbent. Tinted products shall contain enough color pigment to give the desired color tone. These color pigments shall not show color reactions with the materials of which the product is composed, shall not move in the product, and shall be light-fast.

D-2. All exposed plain surfaces of acoustic units shall be reasonably straight and true to form.

D-3. The surface of types IV and V shall be of such a nature that it can be either brush painted or spray painted with five coats of washable oil or oil-varnish base paint, conforming to Federal Specification TT-P-51 or TT-E-506 of the revision in effect on date of invitation for bids, without decreasing the sound absorption coefficient at 512 cycles per second more than 0.05. The surface of types II, III, VI, and VII shall be of such a nature that it can be either cleaned with soap and water or brush painted or spray painted with three coats of a commercial brand of paint or non-bridging lacquer recommended by the manufacturer of the unit without decreasing the sound absorption coefficient at 512 cycles per second more than 0.05. The surface of types VIII and IX shall be of such a nature that it can be decorated with a suitable dye without decreasing the sound absorption coefficient at 512 cycles per second more than 0.05.

D-4. Acoustic units shall be either incombustible, fire-retardant, slow burning or combustible, meeting the respective requirements under paragraph F-2c. The degree of fire resistance desired shall be specified.

D-5. Cast acoustic units shall have all exposed plain surfaces true to form. Corners and arrises shall be full and without marred or broken places. Ornamental work shall be done in a correct and artistic manner and shall reproduce the spirit and intent of the details or models furnished. The surface texture shall be as specified.

D-5a. Enriched ornament shall be dressed to remove imperfections in the casting and to show a texture similar to the finish of the adjoining surfaces.

D-5b. All surfaces of the cast acoustic units that will be in contact with mortar shall be without rebates.

D-5c. Setting loops, Lewis holes, sinkages, anchors, dowels, etc., shall be provided wherever required for lifting and anchorage, and shall be so located that they will be concealed when the material is set.

D-5d. Pieces of such size, shape, or weight to make reinforcement necessary shall be reinforced with metal sufficient to insure safe handling and erection.

E. DETAIL REQUIREMENTS.

E-1. Any special requirement of the individual departments of the Government are noted under section H.

E-2. The sound absorption coefficients at 512 cycles per second and noise coefficients for the several classes when determined on samples of 72 square feet area, in accordance with the methods used at the National Bureau of Standards, shall be within the limits specified in B-2 and B-3. (See note I-3.)

E-3. *Type I.*—Cast units having a binder of portland cement.

E-3a. Units shall have a reasonably smooth surface and be composed of small granules of mineral origin of approximately uniform size, held together by portland cement. These units shall be suitably seasoned before installation so the linear shrinkage when tested according to F-2d shall not exceed 0.10 percent.

E-4. *Type II.*—Cast units having a surface composed of or resembling small granules.

E-4a. Units shall have a reasonably smooth surface and be composed of small granules of mineral or vegetable origin, approximately uniform in size, or surface resembling small particles. The binder may be gypsum or any other suitable mineral binder.

E-5. *Type III.*—Cast units having a surface composed of or resembling irregular, rough granules.

E-5a. Units shall have a reasonably level surface but because of the use of the larger aggregates the surface may be comparatively rough. Units shall be composed of large uniformly sized granules of mineral or vegetable origin held together by a suitable, permanent bonding agent.

E-6. *Type IV.*—Units having a mechanically perforated facing.

E-6a. Acoustic units shall be composed of a vegetable or mineral fiber pad covered with and supported by a perforated facing of a different material which is strong and durable and substantially rigid.

E-7. *Type V.*—Units which are mechanically perforated, the perforations extending into the sound absorbent material.

E-7a. Units shall consist of a suitably felted fiber material which has mechanical perforations extending into the material. These perforations shall have a regular pattern.

E-8. *Type VI.*—Units having a fissured surface.

E-8a. Units shall have a fissured surface resembling travertine.

E-9. *Type VII.*—Compressed wood-fiber units.

E-9a. Units shall be composed of wood fiber which is compressed and held together with an appropriate binder. If a fine fiber is desired it should be so specified. (See note I-2.)

E-10. *Type VIII.*—Felted fiber or wood pulp units.

E-10a. Units shall have a reasonably smooth surface and be composed of any kind of fiber or wood pulp which has been properly felted together.

E-11. *Type IX.*—Units of thin shell type depending upon diaphragmatic action for efficiency.

E-11a. Units shall have a smooth surface and be composed of a material which can be installed in such a manner as to respond diaphragmatically to the energy of sound waves.

F. METHOD OF SAMPLING, INSPECTION, AND TESTS.

F-1. Sampling.—

F-1a. Selection of sample.—Test samples may be selected before or after shipment at the discretion of the inspector. One or more representative samples of each 50,000 square feet shall be selected for test. The inspector shall place on each specimen an identification mark.

F-1b. Size of sample.—

F-1b (1). Each sample for the sound absorption tests shall have dimensions of 1 by 4 feet. It may consist of a single unit or smaller units which together give these dimensions. Units submitted for sound absorption tests may be used for the shrinkage tests.

F-1b (2). Each sample for fire tests shall have dimensions of 3 by 3 feet. It may consist of a single unit or smaller units which together give these dimensions.

F-2. Tests.—

F-2a. Sound absorption tests.—The samples selected by the inspector for each lot shall be submitted to the Government for test to insure that the material submitted complies with the requirement of this specification.

F-2b. The coefficient of sound absorption shall be determined by the method of test in use by the National Bureau of Standards at the time of purchase.

F-2c. Fire tests.—The sample shall be applied to an incombustible backing. Before the test the sample shall be dried to constant weight at a temperature not injurious to the material being tested. For test the sample shall be placed in a horizontal position with the surface to be exposed to the fire facing downward. It shall be supported on the flat surface of 2 by 2 by $\frac{1}{8}$ -inch steel angles framed to form a clear opening of 30 by 30 inches. The flame from a $\frac{3}{4}$ - to $\frac{1}{2}$ -inch gas-air burner shall be directed against the center of the lower surface of the specimen. The top of the burner tube shall be $28\frac{3}{4}$ inches below the specimen. Temperature indications shall be obtained with a chromel-alumel thermoelement made of No. 8 (B. & S. gage) wire placed in a 3-inch horizontal coil 1 inch below the center of the specimen. The wires shall be bare for a distance of 2 inches from the junction. Temperature readings shall be taken at intervals not exceeding 2 minutes.

F-2c (1). For incombustible and fire-retardant materials the test duration shall be 40 minutes and the flame shall be regulated to give temperature indications according to the "Columbia" time temperature curve in figure 1. The flame shall touch the specimen during the entire test period. Exceptions can be made for the first 5 minutes if required for proper temperature regulation. At no time during the test shall the flame cover a greater area on the specimen than a 12-inch diameter circle.

F-2c (2). For slow burning and combustible material the test duration shall be 20 minutes and the flame shall be regulated to give temperature indications according to the "Standard" time temperature curve in figure 1. The flame shall touch the specimen except during the first 7 minutes when exception may be made if required to prevent

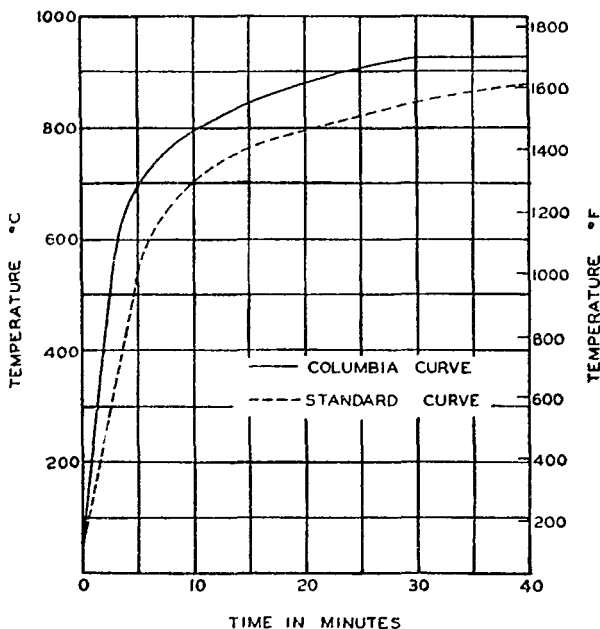


FIGURE 1.—Time temperature curves.

occurrence of temperature higher than those prescribed. At no time during the test shall the flame cover a greater area on the specimen than a circle 8 inches in diameter.

F-2c (3). The area under the time-temperature curve obtained from the thermoclement readings shall be within 5 percent of that of the reference curve being followed.

F-2c (4). The tests shall be conducted in a room which is free from appreciable air current and has a temperature between 60° and 85° F.

F-2c (5). For incombustible, fire retardant, and slow-burning materials, the sample as a whole and the different units or portions thereof shall remain in place until the end of the prescribed flame exposure period. Exception is made for burned, charred, or disinte-

grated material falling in pieces having an area smaller than 50 square inches. No glow during or after the test shall progress to the edge of the 36 by 36 inches specimen at any point.

F-2c (6). Incombustible.—When subjected to the test prescribed in F-2c no flame shall issue from the sample during or after flame application. Glow shall not progress beyond the fire-exposed area.

F-2c (7). Fire retardant.—When subjected to the test prescribed in F-2c no sustained flaming shall issue from the sample. Any flame which occurs shall be limited to intermittent short flames from the area directly exposed to the test flame. No flame from the specimen shall reach the angle frame at any point. No flaming shall occur more than 2 minutes after the test flame is discontinued.

F-2c (8). Slow burning.—When subjected to the test prescribed in F-2c no flame from the specimen shall reach the angle frame at any point during or after the flame application and all flaming shall cease within 5 minutes after the test flame is discontinued.

F-2c (9). Combustible.—Material not conforming with any of the above requirements shall be regarded as combustible.

F-2d. Shrinkage tests.—The shrinkage of acoustical cast products containing portland cement, upon drying after saturation, shall be measured within 0.005 percent of the lengths measured. Metallic plugs or other inserts suitable for reference marks shall be mounted securely in or on the specimen. Provision shall be made for measuring changes in length along at least three gage lines.

F-2d (1). The specimen shall be submerged for 44 to 48 hours in water maintained at a temperature of between 19° and 23° C. Immediately upon removal from the water the lengths along each gage line shall be measured. The specimens shall be placed in a ventilated oven maintained at 108° to 115° C. for 21 to 24 hours. After cooling for 3 to 5 hours in air at a temperature of 19° to 23° C. and a relative humidity between 45 and 65 percent, the lengths along the gage lines shall be measured. The change in length along a gage line, multiplied by the ratio of 100 to the gage length after soaking, shall be taken as linear shrinkage in percent. The average for all gage lines of the sample shall be taken as the linear shrinkage, in percent, of the products.

G. PACKING AND MARKING FOR SHIPMENT.

G-1. Packing.—The material shall be suitably crated or boxed to insure safe transportation by common carrier, at the lowest rate, to the point of delivery.

G-2. Marking.—Shipments shall be marked with the name of the material, the type and the quantity contained therein as defined by the contract or order under which shipment is made, the name of the contractor, and the number of the contract or order. Each shipment shall be certified as to origin.

H. REQUIREMENTS APPLICABLE TO INDIVIDUAL DEPARTMENTS.

H-1. The following departmental specifications, of the issue in effect on date of invitation for bids, shall respectively form a part of this specification.

H-1a. Army.—United States Army Specification No. 100-2D. Standard Specification for marking shipments.

H-1b. Navy.—General Specifications for Inspection of Materials (copies of which may be obtained without cost, upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.).

I. NOTES.

I-1. The list given below indicates the grouping under types of materials which are available as of the date of this specification. This is not a complete list of acoustic materials, but is indicative of the character of the products admitted under the description given in the specification for each of the several types, subject to the specification requirements.

Type I:

Akoustolith.
Basalt rock.
Calistone.
Sphinxstone.

Type II:

Berry-cel.
Calicel (standard).
Ceramacoustic.
Kalite (cast)
KenKoustone.
Muffleton.
Sound-cor.
Trutone.

Type III:

Calicel (tapestry).
Spongeacoustic.

Type IV:

Acousti-Metal.
Acousteel.
Mutetile.
Perfatone units.
Sanacoustic units.
Transite acoustical units.

Type V:

Acousti-celotex.

Type VI:

Acoustone.
Corinco acousticator.
Corkoustic.
Kencoustic.
Muffleton, travertine finish.
Permacoustic.
Rockoustile.

Type VII:

Absorbex.
Acoustex.
Fibretex.
Kencoustex.
Soundex.

Type VIII:

Air-acoustic sheets.
Celotex ductliner.
Firtex.
Gold bond fiber acoustic tile.
Hawaiian cane tile.
Maizewood tile.
Masonite.
Nuwood bevel lap tile
Quietone.
Temcoustic.
Temlok.

Type IX:

Vibrafram.

I-2. Attention is invited to option included in paragraph E-9a.

I-3. It is the intention, but not a requirement, that all new material be tested for its sound absorbing qualities in the reverberation room of a Government laboratory in accordance with the methods used at the National Bureau of Standards to determine in which class it would be placed. After this first test, the sample size required will be only 4 square feet; the intention is to check this sample against a representative 4 square feet of the original sample to determine if the character-

istics of the material supplied are the same as those of the material originally tested.

I-4. The requirements in paragraph B-2b, regarding the sound absorption coefficient at 128 cycles per second, have been made rather liberal, as there have not been sufficient data accumulated, up to the present time, to state definitely what this relative absorption should be in all cases. In many special cases, such as recording studios and rooms where sound motion picture equipment or a public-address system is used, etc., the sound absorption coefficient at 128 cycles should be at least $\frac{1}{4}$ and possibly as much as $\frac{1}{2}$ that of the coefficient at 512 cycles per second.

I-5. Attention is called to the desirability of fastening incombustible, fire retardant, and slow-burning units in such a manner that the means of support may be as fire retardant as the units.

I-6. It is believed that this specification adequately described the characteristics necessary to secure the desired material and that normally no samples will be necessary prior to award to determine compliance with this specification. If, for any particular purpose samples with bids are necessary, they should be specifically asked for in the invitation for bids, and the particular purpose to be served by the bid sample should be definitely stated, the specification to apply in all other respects.

I-7. This specification covers only the types, classes, grades, sizes, etc., of the commodity as generally purchased by the Federal Government, and is not intended to include all of the types, etc., which are commercially available.

I-8. An Index of Federal Specifications may be purchased, as noted in paragraph next below, price to be obtained from the Superintendent of Documents.

I-9. Copies of this specification may be obtained upon application, accompanied by money order, or coupon, or cash, to Superintendent of Documents, Government Printing Office, Washington, D. C. Price 5 cents.

Notice.—When Government drawings, specifications or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded, by implication or otherwise, as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.