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USACE / NAVFAC / AFCESA / NASA **UFGS-09 51 00 (August 2010)**

Preparing Activity: USACE **Superseding UFGS-09 51 00 (October 2007)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2012
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DIVISION 09 - FINISHES

SECTION 09 51 00

ACOUSTICAL CEILINGS

08/10

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SECTION 09 51 00

ACOUSTICAL CEILINGS
08/10

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NOTE: This guide specification covers the requirements for conventional and impact/abrasion resistant acoustical ceiling tile and panels, unit acoustical absorbers, hangers, and suspension system grid for installation in commercial-type work.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
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PART 1 GENERAL

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Note: Plaster or gypsum wallboard ceilings, metal faced or ceramic-bonded mineral fiber acoustical ceilings should be used in lieu of mineral fiber, or fiberglass base acoustical ceiling systems, in wet areas such as showers and bathrooms or around grills, in kitchens, and similar facilities where greasy vapors are a problem. Be alert to this fact, however, gypsum board made in other countries may contain asbestos which, of course, is unacceptable.

Drawings should indicate the following:

a. Location of acoustical systems. Arrangement of

acoustical units, panels, light fixtures, and diffusers, other penetrations and exposed suspension grids.

b. Location of systems required to have ceiling attenuation class (CAC).

c. Location and details of system required to have a fire resistive rating.

d. Location and details and material of fire stops above suspended ceilings.

e. Location and details of access panels and maximum spacing of suspension members for concealed grid suspension systems.

f. Location of each different color and pattern when more than one type acoustical unit is specified for a project. Details of special or patterned panels if necessary to describe adequately. If more than one system is used, key to locations by using symbols.

g. Where acoustical ceilings are provided in conjunction with thermal insulation beneath vented attic spaces, careful attention should be given to furnishing the appropriate type ceiling tile, adequate details on the contract drawings, and to including appropriate sections in the specifications. Details on the drawings will cover such features as support of insulation at flush-mounted light fixtures, conduit, acoustical units, suspension system components, heating and air-conditioning units, and other utilities. Installation of insulation over the suspension systems, light fixtures, and other ceiling penetrations will be coordinated with Sections 06 10 00 ROUGH CARPENTRY and 07 21 13 BOARD AND BLOCK INSULATION, and manufacturer's literature.

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1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A489	(2004e1) Standard Specification for Carbon Steel Lifting Eyes
ASTM A580/A580M	(2008) Standard Specification for Stainless Steel Wire
ASTM A641/A641M	(2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B633	(2011) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C635/C635M	(2007) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C636/C636M	(2008) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C834	(2010) Latex Sealants
ASTM E119	(2012) Standard Test Methods for Fire Tests of Building Construction and Materials

ASTM E1264	(2008e1) Acoustical Ceiling Products
ASTM E1414/E1414M	(2011a) Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
ASTM E1477	(1998a; R 2008) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers
ASTM E580/E580M	(2011b) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint
ASTM E795	(2005) Mounting Test Specimens During Sound Absorption Tests
ASTM E84	(2012) Standard Test Method for Surface Burning Characteristics of Building Materials

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-04	(2007; Change 1) Seismic Design for Buildings

UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

****
NOTE: When reflected ceiling plans showing ceiling penetrations are included in the project drawings, it may not be necessary for the Contractor to re-draw and submit as a shop drawing; in such cases, delete the requirement from SD-02. Details not applicable to the project should also be deleted. On simple projects where manufacturer's standard printed data are sufficient, omit this submittal category from SD-03.

Where many different ceiling systems are used, it may be more convenient to schedule STC ratings, fire ratings, panel and suspension types on the drawings, keyed to finish schedules, rather than to include this data in the specification.
****

Provide sound controlling units mechanically mounted on a ceiling suspension system for acoustical treatment. The unit size, texture, finish, and color must be as specified. The Contractor has the option to substitute inch-pound (I-P) Recessed Light Fixtures (RLF) for metric RLF. If the Contractor opts to furnish I-P RLF, other ceiling elements like acoustical ceiling tiles, air diffusers, air registers and grills, shall also be I-P products. Coordinate the whole ceiling system with other details, like the location of access panels and ceiling penetrations, etc., shown on the drawings. The Contractor is responsible for all associated labor and materials and for the final assembly and performance of the specified work and products if I-P products are used. The location and extent of acoustical treatment shall be as shown on the approved detail drawings. Submit drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan. Coordinate with paragraph RECLAMATION PROCEDURES for reclamation of mineral fiber acoustical ceiling panels to be removed from the job site.

1.2.1 Fire Resistive Ceilings

****

NOTE: Certified laboratory test reports for fire resistance rating and ceiling attenuation class (CAC) cannot be obtained for ceiling assemblies which are nonstandard with the manufacturer. Therefore, where a fire resistance rating and/or ceiling sound transmission class are necessary, do not specify a nonstandard ceiling assembly. Refer to data in the UL Fire Resistance Directory for details.

For Navy projects, delete this paragraph when fire separation is not required by Mil HDBK-1008, Fire Protection for Facilities Engineering, Design, and Construction. Where required, rating applies to total floor-ceiling or roof-ceiling assembly, including mechanical-electrical elements, penetrations, structural system, and deck. If system is required to be fire-endurance rated, show details of recessed fixture enclosures and other penetrations on drawings.

****

Rate acoustical ceiling systems, indicated as fire resistant, for fire endurance as specified when tested in accordance with ASTM E119. Test suspended ceiling with a specimen [roof] [floor] assembly representative of the indicated construction, including mechanical and electrical work within ceiling space openings for light fixtures, and air outlets, and access panels. Provide ceiling assembly rating for [[1] [1-1/2] [2] [3] [4] hour [concealed grid system] [exposed grid system]] [as shown on drawings]. Provide acoustical units with a flame spread of 25 or less and smoke development of 50 or less when tested in accordance with ASTM E84.

1.2.2 Ceiling Attenuation Class and Test

****

NOTE: Ensure that CAC rating chosen is coordinated with rating of walls detailed on the drawings. It is inappropriate to have high CAC rating for

ceilings if walls nullify acoustical benefit.

Where room partitions do not extend to floor or roof deck above, ceiling plenum path may prevent acoustical privacy between rooms. Where required to provide adequate room to room sound attenuation, entire ceiling assembly, including air terminals and light fixtures, should have appropriate Ceiling Attenuation Class (CAC). Any penetration of ceiling assembly will destroy integrity of ceiling in this regard. Verify that other specification sections and drawings include appropriate data to ensure that these requirements are met for air terminals and light fixtures. For standard applications, specify CAC range of 35 - 39. A ceiling CAC range of 40-44 is recommended for all spaces where speech privacy is required and that are surrounded or sub-divided by partitions which do not extend to underside of floor or roof deck above. For classified conference rooms, executive offices, teleconferencing rooms and other occupancies requiring the highest degree of speech privacy, sound attenuation requirements will have to be achieved by other means, most likely by high sound transmission class (STC) partition extending to the underside of floor or roof deck above.

****

Provide a ceiling system with an attenuation class (CAC) of [_____] for [_____] [and _____ for _____] when determined in accordance with ASTM E1414/E1414M. Provide fixture attenuators over light fixtures and other ceiling penetrations, and provide acoustical blanket insulation adjacent to partitions, as required to achieve the specified CAC. Provide test ceiling continuous at the partition and assembled in the suspension system in the same manner that the ceiling will be installed on the project.

1.2.3 Ceiling Sound Absorption

Determine the Noise Reduction Coefficient (NRC) in accordance with ASTM C423 Test Method.

1.2.4 Light Reflectance

Determine light reflectance factor in accordance with ASTM E1477 Test Method.

1.2.5 Other Submittals Requirements

The following shall be submitted:

a. Manufacturer's data indicating percentage of recycle material in acoustic ceiling tiles to verify affirmative procurement compliance.

b. Total weight and volume quantities of acoustic ceiling tiles with recycle material.

c. Manufacturer's catalog showing UL classification of fire-rated ceilings giving materials, construction details, types of floor and roof constructions to be protected, and UL design number and fire

protection time rating for each required floor or roof construction and acoustic ceiling assembly.

Reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified [fire endurance] [and] [sound transmission] requirements. Data attesting to conformance of the proposed system to Underwriters Laboratories requirements for the fire endurance rating listed in UL Fire Resistance may be submitted in lieu of test reports.

Certificate attesting that the mineral based acoustical units furnished for the project contain recycled material and showing an estimated percent of such material.

1.3 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings

SD-03 Product Data

Acoustical Ceiling Systems
Certification

SD-04 Samples

Acoustical Units
Acoustic Ceiling Tiles

SD-06 Test Reports

Fire Resistive Ceilings
Ceiling Attenuation Class and Test

SD-07 Certificates

Acoustical Units
Acoustic Ceiling Tiles

1.4 SUSTAINABLE DESIGN CERTIFICATION

Product shall be third party certified by GEI Greenguard Indoor Air Quality Certified, SCS Scientific Certification Systems Indoor Advantage or equal. Certification shall be performed annually and shall be current.

1.5 DELIVERY, STORAGE. AND HANDLING

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.6 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than 16 degrees C 60 degrees F nor more than 29 degrees C 85 degrees F and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of acoustical units.

1.7 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

1.8 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period. Include an agreement to repair or replace acoustical panels that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

1.9 EXTRA MATERIALS

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NOTE: In order to assure matching acoustical units that may become damaged and require spot replacement, a supply of extra ten percent of units in the original pattern is recommended in order to prevent later replacement of the ceiling in an entire room because of mismatched units. However, the Government facility should be consulted to ensure that adequate warehousing and protection is available for these extra units.

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Furnish spare tiles, from the same lot as those installed, of each color at the rate of [_____] [5] tiles for each 1000 tiles installed.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

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NOTE: Color, class, pattern, NRC, LR coefficient, CAC, and type of acoustical ceiling units must be shown, as required, on the drawings when more than one type acoustical unit is specified for a project.

Color and pattern must be coordinated with the drawings, and this section when more than one type acoustical unit is specified for a project.

When a specific pattern, as shown in ASTM E1264 is required, specify the applicable one and delete other patterns; otherwise, specify all patterns as Contractor's options. Ascertain that a specific pattern required is commercially available in the type unit specified since some type units are available only in certain patterns. Specialized patterns must be described in detail within the bracketed blank space.

Acoustical units will be limited generally to Types III and IV. Metal-faced units (Types V, VI, VII, and VIII), and fabric faced overlay (Type XI), because of the higher cost factor, will not normally be considered.

Composition units with paint finish are lowest in cost and available in widest variety of patterns. Types III and IV are available in three forms: Form 1 (nodulated, cast, or molded) is appropriate for high quality areas such as conference rooms, and officers dining facilities. It is more costly than forms 2 (water-felted) and 3 (dry-felted).

Type I - Cellulose composition with standard washable painted finish

Type II - Cellulose composition with plastic membrane-faced overlay

Type III - Mineral composition with standard washable painted finish

Type IV - Mineral composition with plastic membrane-faced overlay

Type V - Steel facings with mineral composition absorbent backing

Type VI - Stainless steel with mineral composition absorbent backing

Type VII - Aluminum with mineral composition absorbent backing

Type VIII - Cellulose composition with scrubbable pigmented or clear finish

Type IX - Mineral composition with scrubbable pigmented or clear finish

Type X - Mineral composition with plastic/aluminum membrane

Type III or IV units should be used except when any of the following conditions exist, one of the types listed below should be specified:

High Humidity - Aluminum or stainless steel pans with mineral wool pads. Humidity resistant mineral composition units.

Staining or Heavy Soiling - Composition units with plastic film face. Metal pan units. Metal faced composition units.

Impact Abrasion - Metal pan units. Impact resistant composition units. Metal faced composition units.

Metal pan units with pads cannot be used when space above the ceiling is used as an air plenum for heating, ventilating or air conditioning systems.

Pattern -

1. Regularly large hole perforated
2. Randomly large hole perforated
3. Finely perforated
4. Fissured
5. Textured light to medium
6. Textured heavy
7. Smooth
8. Printed
9. Embossed
10. Embossed-in-register
11. Other (specify)

Mineral fiber Type III, IV, IX, and XI acoustical ceiling units offer a combination of rated fire resistance, flame spread classification, acoustical performance, and design versatility. Units are available in a variety of configurations ranging from flat panels with simple textured surfaces to panels with detailed edges or carved patterns and motifs. Cost generally increases with the complexity of design and increase of thickness and/or unit weight.

Fiberglass Type XII acoustical ceiling units are available cloth-faced and vinyl-faced. The fiberglass units have high acoustical performance, thermal insulation value, and moisture resistance ratings. The cloth faced units are good for open-office installations and areas such as libraries that require high acoustical absorption. The vinyl-faced fiberglass units, because of their washable vinyl face, are good for use in buildings with supply and return-air ducts in the ceiling.

Minimum ceiling attenuation class (CAC) formerly called ceiling sound transmission class (CSTC), requirement may be modified to minimum CAC rating of 35 or omitted for suspended ceiling systems where room-to-room sound attenuating requirements are less critical or are achieved by other means.

NRC Rating - Use NRC of 0.50 minimum only in spaces where sound control is not critical. For conference rooms, executive offices, teleconferencing rooms, and other occupancies where sound control is critical, use NRC 0.60 minimum. For open office environments, use NRC of 0.75 minimum.

Light Reflectance - A lower light reflectance may be specified when desired for special architectural or lighting effects. The available LR (light reflection factor) are LR-1 (0.75 minimum), LR-2 (0.70 minimum), LR-3 (0.65 minimum), LR-4 (0.60 minimum).

Edge Detail - Rabbeted edges may be specified to permit face of panels to project below surface of exposed grid system. Strong sidelighting at low angle of incidence in concealed suspension systems will greatly exaggerate surface irregularities; beveled edge tiles are suggested for such locations.

Review manufacturer's literature and edit the following paragraphs.

****

Comply with EPA requirements in accordance with Section 01 62 35 RECYCLED / RECOVERED MATERIALS. Submit two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color. Conform acoustical units to ASTM E1264, Class A, and the following

requirements:

2.1.1 Affirmative Procurement

****
NOTE: If the Architect/Engineer determines that use of certain materials meeting the CPG content standards and guidelines a) would result in inadequate competition, b) do not meet quality/performance specifications, c) are available at an unreasonable price or d) are not available within a reasonable time frame, the Architect/Engineer may submit to the Contracting Officer a written justification and supporting documentation for not procuring designated items containing recovered material using the Recovered Materials Determination Form.
****

Mineral Wool, Cellulose, and Laminated Paperboard used in acoustic ceiling tiles are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (http://www.epa.gov/cpg/). EPA's recommended Recovered Materials Content Levels for Mineral Wool, Cellulose, Structural Fiberboard and Laminated Paperboard are:

Product	Material	Percent of Post Consumer Materials	Percent of Total Recovered Materials
Laminate Paperboard	Post Consumer Paper	100	100
Rock Wool	Slag	75	
Cellulose	Post Consumer Paper	75	75

a. The recommended recovered materials content levels are based on the weight (not volume) of materials in the insulating core only.

b. Submit recycled material content data for acoustic ceiling tiles indicating compliance with affirmative procurement.

c. Submit total weight and volume quantities of acoustic ceiling tiles with recycle material.

2.1.2 Units for Exposed-Grid System [A] [_____]

****
NOTE: In facilities where several different NRC values are specified, clearly indicate which room or areas should receive lay-in panels of a specific NRC value.
****

a. Type: [I (cellulose composition)] [III (non-asbestos mineral fiber with painted finish)] [IV (non-asbestos mineral fiber with membrane-faced overlay)] [IX (mineral fiber with scrubbable finish)] [X (mineral composition with plastic membrane)] [XI (mineral fiber with fabric faced overlay)] [XII (fiberglass base with membrane-faced overlay)].

b. Flame Spread: Class A, 25 or less

c. Pattern: [A] [B] [C] [D] [E] [F] [G] [I] [J] [K] [_____].

d. Minimum NRC: [0.75] [_____] in open office areas; [0.60] [_____] in conference rooms, executive offices, teleconferencing rooms, and other rooms as designated; [0.50] [_____] in all other rooms and areas when tested on mounting Type E-400 of ASTM E795.

e. Minimum Light Reflectance Coefficient: [LR-1, 0.75 or greater] [_____].

f. Nominal size: [600 by 1200] [_____] mm [24 by 48] [_____] inch.

g. Edge detail: [Square] [Reveal] [Trimmed and butt] [_____].

h. Finish: Factory-applied [standard finish] [color finish].

i. Minimum CAC: [40] [_____].

2.1.3 Units for Concealed-Grid System [A] [_____]

a. Type: [I (cellulose composition)] [III (non-asbestos mineral fiber with painted finish)] [IV (non-asbestos mineral fiber with membrane-faced overlay)] [IX (mineral fiber with scrubbable finish)] [X (mineral composition with plastic membrane)] [XI (mineral fiber with fabric faced overlay)] [XII (fiberglass base with membrane-faced overlay)].

b. Flame Spread: Class A, 25 or less.

c. Pattern: [A] [B] [C] [D] [E] [F] [G] [I] [J] [K] [_____].

d. Minimum NRC: [0.50] [_____] when tested on mounting Type B or Type E-400 of ASTM E795.

e. Minimum Light Reflectance Coefficient: [LR-1, 0.75 or greater] [_____].

f. Nominal size: [300 by 300] [_____] mm [12 by 12] [_____] inch.

g. Edge detail: [beveled] [square].

h. Joint detail: [kerfed and rabbeted] [tongue and grooved].

i. Finish: Factory-applied [standard finish] [color finish].

j. Minimum CAC: [40] [_____].

2.1.4 Metal Pans [A] [_____]

a. Type: [V, steel] [VI, ASTM A167 stainless steel] [VII, aluminum] perforated pans with acoustical, non-asbestos, insulation backing.

b. Flame Spread: Class: A, 25 or less.

c. Pattern: [A] [C] [I] [_____].

d. Minimum NRC: [0.75] [_____] in open office areas; [0.60] [_____] in conference rooms, executive offices, teleconferencing rooms, and other rooms as designated; [0.50] [_____] in all other rooms and areas when tested on mounting Type E-400 of ASTM E795.

e. Minimum Light Reflectance coefficient: [LR-1, 0.75 or greater] [_____].

f. Nominal size: [600 by 600] [_____] mm [24 by 24] [_____] inch.

g. Edge detail: Manufacturer's standard.

h. Joint detail: [Beveled] [_____].

i. Finish: Factory-applied standard finish.

j. Pads: [Completely enclosed, of material and thickness required for acoustical and fire test ratings] [_____].

2.1.5 Impact/Abrasion Resistant Units

a. Type: Non-asbestos mineral composition with a hardened mineral surface and factory applied white paint finish. Provide a surface resistant to impact and abrasion.

b. Flame Spread: Class: A, 25 or less.

c. Pattern: [_____].

d. Minimum NRC: [0.50] [_____] when tested on Mounting Type E-400 of ASTM E795.

e. Minimum Light Reflectance Coefficient: LR-1, 0.75 or greater.

f. Nominal Size: [300 by 300] [600 by 600] [600 by 1200] mm [12 by 12] [24 by 24] [24 by 48] [_____] inch.

g. Edge Detail: [Square] [Beveled].

h. Joint Detail: [Trimmed and butted] [Kerfed and rabbeted].

2.1.6 Humidity Resistant Composition Units

a. Type: Non-asbestos mineral or glass fibers bonded with ceramic, moisture resistant thermo-setting resin, or other moisture resistant material and having a factory applied white paint finish. Provide panels that do not sag or warp under conditions of heat, high humidity or chemical fumes.

b. Flame Spread: Class: A, 25 or less.

c. Pattern: [_____].

d. Minimum NRC: Minimum [0.50] [_____] when tested on Mounting Type E-400 of ASTM E795.

e. Minimum Light Reflectance Coefficient: LR-1, 0.75 or greater.

f. Nominal Size: [600 by 1200] [_____] mm [24 by 48] [_____] inch.

g. Edge Detail: Square.

2.1.7 Metal Faced Composition Units

a. [Type V (Steel facings with non-asbestos mineral composition absorbent backing).]

b. [Type VI (Stainless steel facings with non-asbestos mineral composition absorbent backing)]

c. [Type VII (Aluminum facings with non-asbestos mineral composition absorbent backing) with [anodized] [baked enamel] [acrylic] finish color [white] [_____].]

d. Flame Spread: Class: A, flame spread 25 or less.

e. Pattern: [_____].

f. Minimum (NRC): [0.75] [____] in open office areas. [0.60] [____] in conference rooms, executive offices, teleconferencing rooms, and other rooms as designated. [0.50] [____] in all other rooms and areas. Base the tested NRC value on Mounting Type E-400 of ASTM E795.

g. Minimum Light Reflectance Coefficient: LR-1, 0.75 or greater.

h. Nominal Size: 600 by [600] [1200] mm 24 by [24] [48] inch.

i. Edge Detail: Square.

j. Joint Detail: Trimmed and butted.

2.1.8 Unit Acoustical Absorbers

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NOTE: Unit acoustical absorbers should be used in high noise areas such as bowling alleys, industrial areas or in other locations when recommended by an acoustical consultant. Quantity and spacing should be shown on the drawings.
****

Absorbers shall be individually mounted sound absorbing plaques composed of glass fibers or non-asbestos mineral fibers and having a NRC range of not less than 0.60 - 0.70 when tested in accordance with ASTM C423 and reported as a 4 frequency average.

2.2 SUSPENSION SYSTEM

****
NOTE: If more than one type of acoustical unit is required, a separate paragraph for that type unit will be used. Each unit type will be designated with a letter or number symbol, such as A, B, etc. Use the same letters or numbers to key unit types to locations listed or shown on the drawings and in Section 09 06 90 COLOR SCHEDULE.

Each different type of suspension system must be

shown on the drawings.

Generally, lay-in panels supported by exposed grid suspension system provide most economical installation and allow greatest access to space above ceiling. Where lay-in panels are subject to displacement by building occupants or where ceiling must be directly attached to underside of structural system, concealed framing system may be more appropriate. In lobbies, auditoriums, chapels or clubs where a monolithic appearance may be desired, greater expense of concealed suspension system may be justified. Downward access concealed systems should not be specified in areas of high seismic activity.

An intermediate-duty suspension system should be specified when the minimum load-carrying capacity of the main runner is 175 N per m (12 pounds per linear foot) on a simple span of 1200 mm (4 feet) without the mid-span deflection exceeding 1/360th of the span. Intermediate-duty systems are used primarily for ordinary commercial structures where some ceiling loads, due to light fixtures and air diffusers are anticipated.

A heavy-duty suspension system should be specified when the above described minimum load-carrying capacity is 230 N per m (16 pounds per linear foot). Heavy-duty systems are used when ceiling loads are greater than ordinary commercial construction. See ASTM C635/C635M for load testing methods for metal suspension systems for acoustical tile and lay-in panel ceilings.

Select classification required to support ceiling load including acoustical units, lights and other items supported by suspension system. Light duty should be specified for residential construction only. Load carrying capacities based on 1200 mm (4 foot) hanger spacing:

Classification	kg/meter (lb/Linear Foot) of Main Runner		
	Direct Hung	Indirect Hung	Furring Bar
Light Duty	7.38 (5.0)	2.95 (2.0)	6.64 (4.5)
Intermediate Duty	17.72 (12.0)	5.17 (3.5)	9.6 (6.5)
Heavy Duty	23.62 (16.0)	11.81 (8.0)	-

Corner caps are not available in all types of wall moldings and are an extra cost item when available.

Provide seismic details, if a Government designer (either Corps office or A/E) is the Engineer of

Record, and show on the drawings. Delete the second bracketed phrase, in the last sentence, if no seismic details are provided.

****

Provide [[standard] [fire-resistive] [snap-in metal pan]] [[exposed-grid] [indirect hung concealed H and T or Zee] [direct hung, concealed, downward access] [direct hung, concealed, upward access]] [[standard width flange] [narrow width flange] [narrow width slotted flange]] [as shown on drawings] suspension system conforming to ASTM C635/C635M [for intermediate-duty systems] [for heavy-duty systems]. Provide surfaces exposed to view of [aluminum or steel with a factory-applied [white] [black] [color] baked-enamel finish] [aluminum with a clear anodized finish] [aluminum with colored factory-applied vinyl paint finish]. Provide wall molding having a flange of not less than [23 mm 15/16 inch] [_____]. Provide [inside and outside corner caps] [[standard] [overlapped] [mitered] corners]. Suspended ceiling framing system must have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. Provide a suspension system with a maximum deflection of 1/360 of the span length. Conform seismic details to the [guidance in UFC 3-310-04 and ASTM E580/E580M] [contract drawings].

2.3 HANGERS

****

NOTE: Construction drawings should include a detail drawing showing splayed and countersplayed suspension system hanger wires.

****

Provide hangers and attachment capable of supporting a minimum 1330 N 300 pound ultimate vertical load without failure of supporting material or attachment.

2.3.1 Wires

****

NOTE: Select stainless steel or nickel copper alloy wire for facilities where high humidity can be expected such as large kitchens, dishwashing areas, indoor swimming pools, etc. Select zinc-coated steel wire for other locations.

When spacing of hanger wires exceeds 1200 mm (4 feet) or when heavy loads are supported, 3.4 or 4.1 mm (8 or 10 gage) wire should be specified.

****

Conform wires to [ASTM A641/A641M, Class 1, [2.7] [_____] mm [0.11] [_____] inch in diameter.] [ASTM A580/A580M, composition 302 or 304, condition annealed stainless steel, [2.7] [_____] mm [0.11] [_____] inch in diameter.]

2.3.2 Straps

****

NOTE: Normally wire hangers should be used. If the project is in an area subject to violent storms, steel strap or rod hangers should be specified.

****

Provide straps of 25 by 5 mm 1 by 3/16 inch galvanized steel conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008M with an electrodeposited zinc coating conforming to ASTM B633, Type RS.

2.3.3 Rods

****
NOTE: Normally wire hangers should be used. If the project is in an area subject to violent storms, steel strap or rod hangers should be specified.
****

Provide 5 mm 3/16 inch diameter threaded steel rods, zinc or cadmium coated.

2.3.4 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with ASTM A489. Eyebolt size must be a minimum [_____] [7] mm [1/4] inch, [zinc coated][cadmium plated].

2.3.5 Masonry Anchorage Devices

Comply with [ASTM C636/C636M] [_____] for anchorage devices for [eyebolts] [machine screws] [wood screws].

2.4 ACCESS PANELS

****
NOTE: Include this paragraph only when access panels are specified in paragraph titled SUSPENSION SYSTEM. Delete identification code numbers and systems not applicable to the particular project and add additional numerical codes and system descriptions if necessary. Code numbers and corresponding system descriptions shall remain unchanged, i.e., if "sprinkler system" is omitted, the code number "6" will also be omitted from the listing.
****

Provide access panels that match adjacent acoustical units, designed and equipped with suitable framing and fastenings for removal and replacement without damage. Size panel to be not less than 300 by 300 mm 12 by 12 inch or more than 300 by 600 mm 12 by 24 inch.

a. Attach an identification plate of 0.8 mm 0.032 inch thick aluminum, 19 mm 3/4 inch in diameter, stamped with the letters "AP" and finished the same as the unit, near one corner on the face of each access panel.

b. Identify ceiling access panel by a number utilizing white identification plates or plastic buttons with contrasting numerals. Provide plates or buttons of minimum 25 mm 1 inch diameter and securely attached to one corner of each access unit. Provide a typewritten card framed under glass listing the code identification numbers and corresponding system descriptions listed above. Mount the framed card where directed and furnish a duplicate card to the Contracting Officer. Code identification system is as follows:

1 Fire detection/alarm system

2 Air conditioning controls

3 Plumbing system

4 Heating and steam systems

5 Air conditioning duct system

6 Sprinkler system

7 Intercommunication system

8 Nurse's call system

9 Pneumatic tube system

10 Medical piping system

11 Program entertainment

12 Telephone junction boxes

13 Detector X-ray

14 [_____]

2.5 ADHESIVE

****
NOTE: Tiles larger than 300 by 600 mm (12 by 24 inch) should not be attached by adhesive method.
****

Use adhesive as recommended by tile manufacturer.

2.6 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

2.7 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components [as specified in Section 09 06 90 COLOR SCHEDULE] [_____].

2.8 ACOUSTICAL SEALANT

Conform acoustical sealant to ASTM C834, nonstaining.

PART 3 EXECUTION

3.1 INSTALLATION

****
NOTE: Adhesive method of application should not be

used for new construction. It may be used for application to existing ceiling surfaces in remodel work.

****

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Rid areas, where acoustical units will be cemented, of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Complete and dry interior finish work such as plastering, concrete, and terrazzo work before installation. Complete and approve mechanical, electrical, and other work above the ceiling line prior to the start of acoustical ceiling installation. Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object with the hanger wires, install a subsuspension system so that all hanger wires will be plumb.

3.1.1 Suspension System

Install suspension system in accordance with ASTM C636/C636M and as specified herein. Do not suspend hanger wires or other loads from underside of steel decking.

3.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than 150 mm 6 inch from each corner of each fixture.

3.1.1.2 Splayed Hangers

****

NOTE: The designer will add a detail to the construction drawings detailing the proper method of splaying and countersplaying hangers when hangers must be splayed (sloped or slanted) around obstructions.

****

Where hangers must be splayed (sloped or slanted) around obstructions, offset the resulting horizontal force by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Secure wall molding not more than 75 mm 3 inch from ends of each length and not more than 400 mm 16 inch on centers between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

****
NOTE: In areas where the ceiling will be subject to impact or where lay-in ceiling units are subject to pressure differentials between the air plenum above the ceiling and the space below, units will be specified to be held in place with manufacturer's standard hold-down clips.

If the ceiling has a fire endurance rating or the panels weigh less than 4.9 kilograms per square meter (1.0 pound per square foot), hold down clips are required. Hold down clips may also be specified where frequent cleaning is required to prevent displacement during cleaning.
****

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 5 kg/square meter 1 psf or if required for fire resistance rating.

3.1.4 Caulking

****
NOTE: Specify caulking only when the space above the ceiling will be used as an air plenum, or when required to reduce sound transmission between rooms.
****

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

3.1.5 Adhesive Application

****
NOTE: Adhesive method of application should not be used for new construction. It may be used for application to existing ceiling surfaces in remodel work. Tiles larger than 300 by 600 mm (12 by 24 inch) should not be attached by the adhesive method.
****

Wipe back of tile to remove accumulated dust. Daub acoustical units on back side with four equal daubs of adhesive. Apply daubs near corners of tiles. Ensure that contact area of each daub is at least 50 mm 2 inch diameter in final position. Press units into place, aligning joints and abutting units tight and uniform without differences in joint widths.

3.2 CEILING ACCESS PANELS

Locate ceiling access panels directly under the items which require access.

3.3 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

3.4 RECLAMATION PROCEDURES

****

NOTE: If the job requires removal of acoustical ceiling systems, or acoustical units are left over from new construction, the decision to recycle must be weighed against the cost of packaging and transportation, especially in remote areas. Most mineral fiber and fiberglass ceilings can be recycled. The following ceiling tiles cannot be recycled: 1) Faced materials (vinyl faced, mylar, metal faced). 2) Molded or cast ceiling products and glue up ceiling tiles (either 305 by 305 mm (12 by 12 inch) or 305 by 610 mm (12 by 24 inch) panels). 3) Fiberglass panels. 4) Ceramic based tiles. 5) Some proprietary products.

****

Neatly stack ceiling tile, designated for recycling by the Contracting Officer, on 1220 by 1220 mm 4 by 4 foot pallets not higher than 1220 mm 4 foot. Panels must be completely dry. Shrink wrap and symmetrically stack pallets on top of each other without falling over.

-- End of Section --