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USACE / NAVFAC / AFCEC / NASA | UFGS-09 35 16 (August 2016)
Change 1 - 08/18

Preparing Activity: USACE | Superseding
UFGS-09 35 16 (August 2010)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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08/16, CHG 1: 08/18

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SECTION 09 35 16

CHEMICAL-RESISTANT QUARRY TILING
08/16, CHG 1: 08/18

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NOTE: This guide specification covers the requirements for quarry tile with chemical resistant grout and setting bed for use in medium to large dining facilities and other areas subject to spillage of acids or other chemicals.

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 item(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).
****

PART 1 GENERAL

****
NOTE: On the drawings, show:

1. Rooms, areas, or spaces to have chemical-resistant quarry tile floors including under ranges, kettles, and ovens and areas 600 mm 2 feet beyond such items, as well as 600 mm 2 feet outside trough areas; within dish-and pot-washing areas, food-preparation areas, serving areas, and garbage rooms. If quarry tile with conventional mortar and grout is also included in the project, areas for each type must be clearly indicated.

2. Depressed concrete slabs, 16 mm for 13 mm 5/8 inch for 1/2 inch tile and 22 mm for 19 mm 7/8 inch for 3/4 inch tile so that tile surfaces will align with adjacent finish materials. See detail F 131-15 or F 133-15 in Tile Council of America Inc. Handbook for Ceramic Tile Installation for recommended details.

3. Slope of floors to drain.

4. Treatment at expansion joints in tiled floors.

5. Thresholds at doorways.

6. Details at floor sinks, floor drains, intersections with walls, equipment bases, and trough areas.

****

1.1 REFERENCES

****

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 Reference Identifier (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 C267	(2020) Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes
ASTM C395	(2001; R 2012) Chemical-Resistant Resin Mortars
ASTM C413	(2018) Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes

ASTM C658	(1998; R 2012) Chemical-Resistant Resin Grouts for Brick or Tile

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2017; Version 1.2) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications

TILE COUNCIL OF NORTH AMERICA (TCNA)

TCNA Hdbk	(2017) Handbook for Ceramic, Glass, and Stone Tile Installation

1.2 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Quarry Tile; G[, [_____]]

Recycled Content for Chemical-Resistant Quarry Tile; S

Grout; G[, [_____]]

Indoor Air Quality for Mortar and Grout; S

SD-04 Samples

Quarry Tile; G[, [_____]]

Grout; G[, [_____]]

SD-06 Test Reports

Grout; G[, [_____]]

SD-08 Manufacturer's Instructions

Quarry Tile

Grout; G[, [_____]]

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in manufacturers' original unbroken packages or containers plainly labeled with manufacturers' names and brands. Grade mark tile containers. Store materials in dry locations. Handle materials in a manner that will prevent inclusion of foreign materials and damage by water, dampness, or temperature extremes. Store materials in area in which they will be used at temperatures not lower than 16 degrees C 60 degrees F at least 24 hours before use.

1.4 ENVIRONMENTAL REQUIREMENTS

Do not start tile work unless ambient temperature of work area is at least 16 degrees C 60 degrees F and rising, and slab temperature is not less than 16 degrees C 60 degrees F. Maintain room and slab at these minimum temperatures without interruption while work is in progress and for at least 3 days after completion of work.

PART 2 PRODUCTS

2.1 MATERIALS

Provide materials conforming to the standards, specifications, and other requirements listed below:

2.1.1 Quarry Tile

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NOTE: Check availability of tile colors in the sizes specified before specifying color. Also, check availability of tile thickness before specifying.
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NOTE: Use materials with recycled content where appropriate for use. Verify suitability, availability within the region, cost effectiveness and adequate competition (including verification of bracketed percentages included in this guide specification) before specifying product recycled content requirements.

Research shows the product is available from US national manufacturers above the minimum recycled content percentages shown below. Some manufacturers and regions have higher percentages. Based on research, insert desired minimum percentages into the empty set of brackets.
****

TCNA Hdbk, standard grade, [_____] by [_____] [150 by 150 mm] [6 by 6 inches] by [minimum 13 mm 1/2 inch] [_____] thick, color [indicated] [selected by the Contracting Officer from the manufacturer's standard color samples.] [Minimum thickness in Garbage Room must be 30 by 200 by 200 mm 1-1/4 by 8 by 8 inches.] Quarry tile must have flat or serrated back. Chemical-Resistant Quarry Tiling Materials must contain a minimum of [3][10][_____] percent recycled content. Provide data identifying percentage of recycled content for chemical-resistant quarry tile.

2.1.1.1 Slip-Resistant Quarry Tile

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NOTE: Slip-resistant quarry tile should be specified for areas where food and water spillage cause the floors to be slippery and hazardous (e.g., dishwashing areas, sculleries, food-preparation areas).
****

Provide quarry tile for floors [of [_____]] that contain an abrasive aggregate uniformly embedded into face surface of tile. Abrasive aggregate must be fused aluminum oxide or other rustproof aggregate of comparable hardness having a grain size smaller than 1.18 mm 16 mesh and larger than 150 micrometers 100 mesh (US Standard Sieve Sizes). Tile provided must contain grains in the surface between 50 percent and 150 percent, on the average by count, and as much aggregate as the approved samples.

2.1.1.2 Quarry Tile Trim Units

TCNA Hdbk standard grade. Provide cove base around perimeter of floors and at vertical projections through floors. Provide bullnose trim around depressions in floors. Provide rounded internal and external corners with

13 mm 1/2 inch minimum radius using appropriate matching corner units.

2.1.2 Chemical-Resistant Mortar and Grout

****
NOTE: Insert other items or areas subject to heat beyond 54 degrees C 130 degrees F.

If a project design includes use of mortar and grout products on the building interior (inside the weatherproofing system), include the bracketed paragraph requiring products with low emissions or VOC content properties.
****

Provide chemical-resistant grout for quarry tile floors [in [_____]]. Provide a compatible system of setting bed and joint material from a single source. In addition to the chemical resistance and physical properties specified, conform mortar and grout to the following:

[Provde mortar and grout products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide validation of indoor air quality for mortar and grout from certification body.]

2.1.2.1 Furan Mortar

ASTM C395. Either two-component or three-component is acceptable.

2.1.2.2 Furan Grout

ASTM C658.

2.1.2.3 Epoxy

ASTM C395 for setting tile grouted with furan.

2.1.2.4 Epoxy Mortar and Grout

TCNA Hdbk.

2.2 FACTORY TESTS

2.2.1 Chemical Resistance

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NOTE: The chemicals and strengths are those considered necessary for use in food preparation and serving areas of medium to large dining facilities. For other types of projects modify the list of chemicals to reflect the exposure likely to be encountered.
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Test mortar and grout in accordance with ASTM C267 except as modified herein. Immerse test specimens in the test solutions for 28 days, and maintain solutions continuously at 79 degrees C 175 degrees F for furan and

60 degrees C 140 degrees F for epoxy. The test specimens must not change in weight more than 5 percent after immersion, or exhibit a compressive strength of less than 90 percent of the compressive strength of specimens that have aged in air at 21 to 26 degrees C 70 to 80 degrees F during conditioning period. Test for chemical resistance to the following solutions:

a. Acetic acid, 5 percent

b. Citric acid, 5 percent

c. Lactic acid, 5 percent

d. Sodium hypochlorite, 5 percent

e. Trisodium phosphate, 5 percent

f. Household ammonia (test at room temperature)

g. Sugar, saturated solution

h. Vegetable oil

2.2.2 Physical Properties

After curing for 7 days at 21 to 26 degrees C 70 to 80 degrees F, the mortar must:

a. have a water absorption of not more than 0.5 percent when tested in accordance with ASTM C413;

b. have a hardness of not less than 90 percent of its initial hardness immediately before exposure, when tested after being exposed for 6 hours at 54 degrees C 130 degrees F for epoxy resin mortar and 93 degrees C 200 degrees F for furan resin mortar. Conduct hardness tests on 10 by 19 mm 3/8 by 3/4 inch samples with a Barcol Hardness Tester, within 30 seconds after the samples are removed from the oven.

PART 3 EXECUTION

3.1 PREPARATION

Do not start tile work until rough-in for plumbing, heating, ventilating, air conditioning, and electrical work has been completed and tested [and membrane waterproofing has been installed and tested]. Protect the work of other trades in area where tile work is to be done.

3.1.1 Preparation of Tile

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NOTE: According to manufacturers, the prefinished wax surface is no longer available. Factory-coated units should be specified, if available, when experience indicates that application of wax in the field is unsatisfactory. Used as a protector for epoxy or furan grout - verify with the tile manufacturer if this is avaialble. Once grouting is complete, wax should be steamed off and removed.

When factory coated units are not selected, add language to require the application of a sealer and grout release agent per manufacturer's recommendations.
****

[Factory coat] [Coat] with hot paraffin wax to produce a thin continuous film on the face surfaces only of quarry tile units to be installed and grouted with furan. Apply wax in such manner that it will not get on edges or backs of tile. Handle tile in a manner that will prevent waxed surfaces of units from touching the backs or edges of other units. Remove from the job tile with wax on edges or backs. Verify that wax used is acceptable to grout manufacturer. With flatback or serrated back tile use 6 mm 1/4 inch square notched trowel with notches on 13 mm 1/2 inch centers.

3.1.2 Preparation of Concrete Floors for Setting Beds

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NOTE: Where tile is to be installed, concrete slabs should not have air entrainment or other additives in the mix, nor sealers or curing compounds applied without specific approval of mortar and grout manufacturer. Slabs should have steel trowel and fine broom finish and be free of laitance. In case of any question on condition of slab, it should be tested for bondability with a Dillon Dynamometer and show a tensile bond of not less than 2068 kPa 300 psi. These requirements should be incorporated in Section 03 30 00 CAST-IN-PLACE CONCRETE
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Before tile is applied, test structural floor for levelness or uniformity of slope by water. Fill, level, and retest areas as required to meet tolerances specified in TCNA Hdbk and retest. When specified levelness or uniformity of slope is obtained, prepare floors for setting bed in accordance with TCNA Hdbk. Free floors of sealers, coatings, oil, dirt, and dust. Prepare floors before application of resin mortar in accordance with printed instructions and recommendations of the mortar manufacturer.

3.2 INSTALLATION

Except where specified otherwise herein, apply materials in accordance with manufacturer's printed instructions, including recommended safety requirements.

3.2.1 Setting Bed

Using a plain (not serrated) trowel, apply a continuous setting bed of chemical-resistant mortar, not less than 3 mm 1/8 inch thick. Apply only over a floor area that can be tiled during "open time" of mortar. Place tile into setting bed and tap lightly to a true plane. Level tile as it is placed. Maintain uniform tile joints of 6 mm 1/4 inch minimum and 10 mm 3/8 inch maximum width. Allow the setting bed to cure sufficiently to anchor tile in place, but not less than 24 hours, at a floor temperature of not less than 16 degrees C 60 degrees F. When furan setting bed is used, first install a glass reinforced asphalt membrane. With flatback or serrated back tile use trowel with 6 mm 1/4 inch square notches on 13 mm 1/2 inch centers.

3.2.2 Tile Joints

After the setting bed has cured, fill tile joints with chemical-resistant grout. Spread grout on surface of tile and work it into the open joints with a trowel. Fill joints flush with top surfaces of tile. Remove excess grout with one pass of a trowel or squeegee pulled diagonally across joints in order to prevent imperfect filling and low joints. Immediately fill voids, pinholes, and depressions with additional grout. Protect completed joints from dampness. Permit grout to harden for not less than 72 hours. Flush cure joints with tile edges; contour depression must not exceed 1.2 mm for 6 mm 3/64 inch for 1/4 inch wide joints or 2 mm for 10 mm 1/16 inch for 3/8 inch wide joints. Sealants for expansion joints provided by the grout manufacturer must be compatible with grout and setting mortars. Completely fill joints with no back up foam or rope. Install joints maximum 6000 mm 20 feet on center above slab around room peripheries and columns but not at drains.

3.2.3 Tile Installation

Install and grout tile with water cleanable tile setting and grouting epoxy in accordance with TCNA Hdbk.

3.3 CLEANING

After grout has hardened, scrub and wash tile surfaces with steam or hot water to melt wax coating and remove excess grout. Remove remnants of grout with wide-bladed paint scraper or other tool that will not damage tile. Rinse tile with clean warm water applied with a flat sponge. Remove excess water from floor, and leave floor dry when work is completed. Remove tile from which surface grout cannot be removed without damage to tile. Remove damaged tile and provide new tile.

3.4 PROTECTION

Cover finished tile floors with clean building paper before permitting foot traffic on them. Place board walkways on floors that are to be continuously used as passageways by workmen.

-- End of Section --