
USACE / NAVFAC / AFCEC / NASA UFGS-09 30 10 (November 2013)
Change 1 - 02/16

Preparing Activity: USACE Superseding
UFGS-09 30 13 (November 2013)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2017

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CERAMIC, QUARRY, AND GLASS TILING

11/13

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SECTION 09 30 10

CERAMIC, QUARRY, AND GLASS TILING
11/13

NOTE: This guide specification covers the requirements for a variety of types of ceramic tile for walls and floors.

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).

PART 1 GENERAL

NOTE: Tile grouted with epoxy or furan resin is included in this specification, but quarry tile subject to severe chemical exposures is specified in Section 09 35 16 CHEMICAL-RESISTANT QUARRY TILING.

For Army facilities, buildings not excluded by UFC 3-301-01 or TI 800-01 Design Criteria will be accessible in accordance with 36 CFR, Part 1191, Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.

Ensure drawings indicate location, dimensions,

elevations, schedules, content, details and such other information as required to indicate the extent of the work.

Base product selections on esthetic values, function, type of facility, and cost as related to project needs.

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.

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.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A137.1 (2012) American National Standards Specifications for Ceramic Tile

ANSI A137.2 (2012) American National Standards Specifications for Glass Tile

ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M (2016b) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

ASTM C1026 (2013) Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling

ASTM C1027 (2009) Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile

| | |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ASTM C1178/C1178M | (2013) Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel |
| ASTM C144 | (2011) Standard Specification for Aggregate for Masonry Mortar |
| ASTM C150/C150M | (2016; E 2016) Standard Specification for Portland Cement |
| ASTM C206 | (2014) Standard Specification for Finishing Hydrated Lime |
| ASTM C207 | (2006; R 2011) Standard Specification for Hydrated Lime for Masonry Purposes |
| ASTM C241/C241M | (2015) Standard Specification for Abrasion Resistance of Stone Subjected to Foot Traffic |
| ASTM C33/C33M | (2016) Standard Specification for Concrete Aggregates |
| ASTM C373 | (2016; E 2016) Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products |
| ASTM C648 | (2004; R 2009) Breaking Strength of Ceramic Tile |
| ASTM C847 | (2014a) Standard Specification for Metal Lath |
| ASTM D2103 | (2015) Standard Specification for Polyethylene Film and Sheeting |
| ASTM D226/D226M | (2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing |
| ASTM D4068 | (2015) Chlorinated Polyethylene Sheeting for Concealed Water-Containment Membrane |
| ASTM E2129 | (2010) Standard Practice for Data Collection for Sustainability Assessment of Building Products |
| ASTM F446 | (1985; R 2009) Grab Bars and Accessories Installed in the Bathing Area |

BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAAQMD)

| | |
|-----------------------|--------------------------------------|
| BAAQMD Reg 8, Rule 51 | (2002) Adhesive and Sealant Products |
|-----------------------|--------------------------------------|

GREEN SEAL (GS)

| | |
|-------|-----------------------------|
| GS-36 | (2011) Commercial Adhesives |
|-------|-----------------------------|

MARBLE INSTITUTE OF AMERICA (MIA)

MIA Design Manual (2003) Dimension Stone Design Manual

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (1989; R 2005) Adhesive and Sealant Applications

TILE COUNCIL OF NORTH AMERICA (TCNA)

TCNA Hdbk (2013) Handbook for Ceramic, Glass, and Stone Tile Installation

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED BD+C (2009; R 2010) Leadership in Energy and Environmental Design(tm) Building Design and Construction (LEED-NC)

LEED GBDC Ref Guide (2009; R 2010) LEED Reference Guide for Green Building Design, Construction and Major Renovations of Commercial and Institutional Buildings including Core & Shell and K-12 Projects

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

1.2 SUSTAINABILITY REPORTING

NOTE: The bracketed items are representative of LEED material documentation and requirements that may apply to this project. Edit these items to reflect the project requirements.

Materials in this technical specification may contribute towards contract compliance with sustainability requirements. See Section 01 33 29 SUSTAINABILITY REPORTING for project LEED BD+C [local/regional materials,] [low-emitting materials,] [recycled content,] [____] [rapidly renewable materials] and LEED documentation requirements.

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.

Use the "S" classification only in SD-11 Closeout Submittals. The "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

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

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.] Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G[, [_____]]

SD-03 Product Data

Local/Regional Materials; (LEED BD+C)
[Environmental Data]
Tile; G[, [_____]]
Setting-Bed; G[, [_____]]
Mortar, Grout, and Adhesive; (LEED); G[, [_____]]
Tile; (LEED BD+C)
Reinforcing Wire Fabric; (LEED BD+C)

SD-04 Samples

Tile; G[, [_____]]
Accessories; G[, [_____]]

Transition Strips; G[, [____]]
Grout; G[, [____]]

SD-07 Certificates

Tile
Mortar, Grout, and Adhesive

SD-08 Manufacturer's Instructions

Maintenance Instructions

SD-10 Operation and Maintenance Data

Installation; G[, [____]]

SD-11 Closeout Submittals

Local/Regional Materials; (LEED)
LEED Documentation
Tile; (LEED)
Adhesives; (LEED)

1.4 OTHER SUBMITTAL REQUIREMENTS

1.4.1 Local/Regional Materials

Submit documentation indicating distance between manufacturing facility and the project site and also the distance of raw material origin from the project site. For Tile and Reinforcing Wire Fabric indicate percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.

1.4.2 Environmental Data

NOTE: ASTM E2129 provides for detailed documentation of the sustainability aspects of products used in the project. This level of detail may be useful to the Contractor, Government, building occupants, or the public in assessing the sustainability of these products.

[Submit Table 1 of ASTM E2129 for the following products: [____].]

1.5 QUALITY ASSURANCE

Installers to be from a company specializing in performing this type of work and have a minimum of two years experience. Each type and color of tile to be provided from a single source. Each type and color of mortar, adhesive, and grout to be provided from the same source.

1.6 DELIVERY, STORAGE, AND HANDLING

Ship tiles in sealed packages and clearly marked with the grade, type of tile, producer identification, and country of origin. Deliver materials to the project site in manufacturer's original unopened containers with seals

unbroken and labels and hallmarks intact. Protect materials from weather, and store them under cover in accordance with manufacturer's printed instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

Do not perform ceramic tile work unless the substrate and ambient temperature is at least 10 degrees C 50 degrees F and rising. Maintain temperature above 10 degrees C 50 degrees F while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used, ventilate the area to the outside to avoid carbon dioxide damage to new tilework.

1.8 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period.

1.9 EXTRA MATERIALS

Supply an extra [2][_____] percent of each type tile used in clean and marked cartons.

PART 2 PRODUCTS

NOTE: The surface datum will be established for the
top of the tile floors to indicate to other trades
the required elevation for the top of subfloor.

2.1 TILE

NOTE: Ceramic tile with low absorption rates are
easier to maintain because they are more resistant
to staining. They do not readily absorb grease,
food or beverage spills, or other staining agents.

Not all tiles with a wet dynamic coefficient of friction (DCOF) AcuTest value equal to or greater than 0.42 are suitable for all level interior spaces. Select tiles that are appropriate for specific project conditions, considering by way of example, but not in limitation, type of use, traffic, drainage, how the tiles are profiled or structured, expected contaminants, expected maintenance, expected wear, and manufacturers' guidelines and recommendations. Tiles with a wet DCOF of less than 0.42, should only be installed when the surface will be kept dry when walked upon and proper safety procedures will be followed when cleaning the tiles.

Per TCNA breaking strength is measured in "lbf". This specification uses "pounds" since this is how most manufacturers list the method of measurement.

Take into account expected foot traffic, building

and site conditions and maintenance during selection of tile. In accordance with ANSI 137.1 the visible abrasion classifications for floors are as follows:

Class 0 - Generally used on walls. Not recommended for use on floors. This type of tile should not be exposed to wear, traffic or aggressive maintenance.

Class I - Light Residential. Tile may withstand soft-soled foot traffic as long as dirt and/or other abrasives are not present. Tile should not be used in areas with direct access to the outside or in areas with large amounts of foot traffic.

Class II - Residential. Tile may withstand soft-soled and some normal traffic with limited quantities of dirt and/or other abrasives. Tile is not recommended in areas with direct access to the outside or in areas with large amounts of foot traffic.

Class III - Heavy Residential or Light Commercial. Tile may withstand normal footwear and regular traffic with some dirt and/or other abrasives in limited quantities. Tile may be used in light commercial facilities with limited foot traffic and no direct access to the outside. Examples: residential kitchens and hallways with limited outside traffic.

Class IV - Commercial. Tile may withstand heavier amounts of traffic with more dirt and abrasives. Examples: commercial kitchens and spaces with regular outside traffic.

Class V - Heavy Commercial. Tiles may withstand constant foot traffic with larger amounts of dirt and/or other abrasives. Examples: airports, malls, and other commercial walkways subject to high volumes of foot traffic and constant traffic from the outside.

Manufacturers use the aesthetic classification to identify the variation of color, texture, and appearance within a particular line of tile. Delete this requirement if not necessary to express design intent.

Add sentence to mosaic paragraphs if manufacturer recommends tile to be mounted.

Consider ceramic-free recycled glass tile with a minimum of 85 percent post-consumer recycled glass. Preference will be given to ceramic-free recycled glass tile with a minimum of 85 percent post-consumer recycled glass.

Furnish tiles that comply with ANSI A137.1 and are standard grade tiles[,

the exception is glass tile. Furnish glass tiles that comply with ANSI A137.2]. Provide a minimum breaking strength of 57 kg 125 lbs. for wall tile and 113 kg 250 lbs. for floor tile in accordance with ASTM C648. Provide exterior building tile for cold climate projects that is approved by the manufacturer for exterior use when tested in accordance with ASTM C1026. Provide floor tiles with a wet dynamic coefficient of friction (DCOF) value of [0.42][_____] or greater when tested in accordance with ANSI A137.1 requirements. Provide glazed floor tile with a Class [III-Heavy Residential or Light Commercial][IV-Commercial][V-Heavy Commercial][_____] classification as rated by the manufacturer when tested in accordance with ASTM C1027 for visible abrasion resistance as related to foot traffic. [Indicate VOC content.] For materials like tile, accessories, and transition strips submit samples of sufficient size to show color range, pattern, type and joints. Submit manufacturer's catalog data.

2.1.1 Porcelain Tile

Furnish [[unglazed][or][glazed]], [rectified] porcelain tile, [cove][bullnose] base and trim pieces [with color extending uniformly through the body of the tile]. [Provide tile with a [V0][V1][V2][V3][V4] aesthetic classification. Blend tiles in factory and in a packages to have same color range and continuous blend for installation.] Provide nominal tile size(s) of [150 by 150][300 by 300][450 by 450][300 by 450] [_____] mm and [8][10][_____] mm [6 by 6][12 by 12][18 by 18][12 by 24][_____] inch and [3/8][5/16][_____] inch thick. Provide a [0.50][_____] percent maximum water absorption in accordance with ASTM C373.

2.1.2 Quarry Tile

NOTE: Specify abrasive surface quarry tile for vestibules, kitchens, walk-in refrigerators, and work spaces behind serving lanes. Consider abrasive surface quarry tile for other areas which may become slippery due to grease or soapy water spillage or for other reasons. Red quarry tile is the most economical color. If other colors are desired, they should be limited to the darker shades.

Furnish an unglazed quarry tile, [cove][bullnose] base and trim pieces. Provide tile with [smooth][abrasive] surface. Provide nominal tile size(s) of [150 by 150][_____] mm and 13 mm [6 by 6][_____] inch and 1/2 inch thick. Provide a [0.30][_____] percent maximum water absorption in accordance with ASTM C373.

2.1.3 Mosaic Tile

NOTE: Glazed porcelain and natural clay mosaic tiles are recommended for walls only.

Furnish [unglazed][glazed], mosaic tile[, [cove][bullnose] base] and trim composed of [natural clay][porcelain]. [Provide tile with a [V0][V1][V2][V3][V4] aesthetic classification. Blend tiles in factory and in a packages to have same color range and continuous blend for installation.] Provide [nominal tile size(s) of [25 by 25][25 by 50][50 by 50][_____] mm [1 by 1][1 by 2][2 by 2][_____] inch][a mixture of

standard sizes in a stock pattern]. [Provide porcelain mosaics with a water absorption up to 0.50 percent][Provide natural clay mosaics with a water absorption up to [3.0][_____] percent] when tested in accordance with ASTM C373.

2.1.4 Glass Tile

NOTE: Verify that tiles specified are made in the USA. Many of these products are made in countries that do not comply with the Buy American Act.

Typically glass mosaic tiles are recommended for walls only.

Furnish glass mosaic tile that complies with ANSI A137.2. Provide nominal tile size(s) of [25 by 25][_____] mm [1 by 1][_____] inch.

2.1.5 Glazed Wall Tile

NOTE: Glazed wall tiles are recommended for walls only.

Furnish glazed wall tile that has cushioned edges and trim with lead-free [bright][matte] finish. Provide nominal tile size(s) of [106 by 106][106 by 150][150 by 150] mm [4-1/4 by 4-1/4][4-1/4 by 6][6 by 6] inch.

2.1.6 Accessories

NOTE: Where glazed accessories are required, add the color, style, and number to the accessories table in this paragraph, unless other wise noted. For Navy projects add a sentence stating that color is as indicated since they provide color information in the drawings. Provide mounting heights for accessories in the drawings. Coordinate this paragraph with Section 10 28 13 TOILET ACCESSORIES.

Provide built-in type accessories of the same materials and finish as the wall tile. Provide accessories as follows:

| | Quantity | Location |
|--------------------------------------------|----------|----------|
| Recessed soap holders | [_____] | [_____] |
| Tumbler holders | [_____] | [_____] |
| Combination tumbler and toothbrush holders | [_____] | [_____] |

| | Quantity | Location |
|--------------------------------------------------------------------------------------------------|----------|----------|
| Towel bars, [stainless steel][ceramic] [600] [750] mm [24] [30] inch long, two towel posts | [_____] | [_____] |
| Robe hooks | [_____] | [_____] |
| Roll paper holder | [_____] | [_____] |
| Recessed soap holder and hand hold combination: support static load in compliance with ASTM F446 | [_____] | [_____] |

2.2 SETTING-BED

Submit manufacturer's catalog data. Compose the setting-bed of the following materials:

2.2.1 Aggregate for Concrete Fill

Conform to ASTM C33/C33M for aggregate fill. Do not exceed one-half the thickness of concrete fill for maximum size of coarse aggregate.

2.2.2 Portland Cement

Conform to ASTM C150/C150M for cement, Type I, white for wall mortar and gray for other uses.

2.2.3 Sand

Conform to ASTM C144 for sand.

2.2.4 Hydrated Lime

Conform to ASTM C206 for hydrated lime, Type S or ASTM C207, Type S.

2.2.5 Metal Lath

Conform to ASTM C847 for flat expanded type metal lath, and weighing a minimum 1.4 kg/square meter 2.5 pound/square yard.

2.2.6 Reinforcing Wire Fabric

Conform to ASTM A1064/A1064M for wire fabric. Provide [50 by 50 mm2 by 2 inch mesh, 16/16 wire] [or] [38 by 50 mm1-1/2 by 2 inch mesh, 16/13 wire].

2.3 WATER

Provide potable water.

2.4 MORTAR, GROUT, AND ADHESIVE

Submit certificates indicating conformance with specified requirements. Submit LEED documentation relative to low-emitting materials credit in accordance with LEED GBDC Ref Guide. Include in LEED Documentation Notebook. [Interior adhesives, sealants, primers and sealants used as filler must meet the requirements of LEED low emitting materials credit.] Submit manufacturer's catalog data. Conform to [SCAQMD Rule 1168 and BAAQMD Reg 8, Rule 51], and to the following for mortar, grout, adhesive, and sealant:

2.4.1 Dry-Set Portland Cement Mortar

TCNA Hdbk.

2.4.2 Latex-Portland Cement Mortar

TCNA Hdbk.

2.4.3 Ceramic Tile Grout

TCNA Hdbk; petroleum-free and plastic-free [sand portland cement grout] [dry-set grout] [latex-portland cement grout] [commercial portland cement grout].

2.4.4 Organic Adhesive

TCNA Hdbk, Type I. Water-resistant. Comply with applicable regulations regarding toxic and hazardous materials[, GS-36,] and as specified.

2.4.5 Epoxy Resin Grout

**NOTE: Use resin grout only where chemical
resistance is required.**

TCNA Hdbk. Prohibited unless specifically indicated otherwise.

2.4.6 Furan Resin Grout

TCNA Hdbk and consist of an intimate mixture of furfuryl-alcohol resin with carbon filler and catalyst. Prohibited unless specifically indicated otherwise.

2.4.7 Sealants

Comply with applicable regulations regarding toxic and hazardous materials and as specified. Grout sealant must not change the color or alter the appearance of the grout.

2.4.8 Cementitious Backer Board

Provide cementitious backer units, for use as tile substrate over wood sub-floors, in accordance with TCNA Hdbk. Furnish [6.35] [12.7] mm [1/4] [1/2]inch thick cementitious backer units.

2.4.9 Glass Mat Gypsum Backer Panel

NOTE: Additives used to produce water-resistant gypsum board ("green board") may include VOCs. Water-resistant types may be difficult to recycle. Glass-fiber reinforced types may be difficult to recycle.

Provide glass mat water-resistant gypsum backer board, for use as tile substrate over wood subfloors, in accordance with ASTM C1178/C1178M. Provide [6.35] [12.7] mm [1/4] [1/2] inch thick glass mat gypsum backer board.

2.5 TRANSITION STRIPS

NOTE: Provide transition strips where the top of tile floors will occur at a different elevation from the top of finished floors in adjoining spaces and to transition between different flooring materials.

Provide [[clear][_____] anodized aluminum transitions between tile and carpet or resilient flooring. Provide types as recommended by flooring manufacturer for both edges and transitions of flooring materials specified][marble transitions appropriate for conditions. Categorize marble Group A as classified by MIA Design Manual. Provide a fine sand-rubbed finish marble, [[white][pink][gray][beige] in color][, color as specified in [Section 09 06 00 SCHEDULES FOR FINISHES][the drawings]]. Provide minimum 12.0 marble abrasion when tested in accordance with ASTM C241/C241M][solid surface transitions appropriate for conditions. Reference SECTION 06 61 16 SOLID SURFACING FABRICATIONS for specifications]. Provide transition strips that comply with 36 CFR 1191 requirements.

2.6 MEMBRANE MATERIALS

Conform to ASTM D226/D226M, Type 1 for 33 kg 15 pound waterproofing membrane, asphalt-saturated building felt. Conform to [ASTM D2103] [ASTM D4068] 0.0102 4 mil for polyethylene film.

2.7 COLOR, TEXTURE, AND PATTERN

NOTE: Editing of color reference sentence(s) must be coordinated with the Government. Generally Section 09 06 00 SCHEDULES FOR FINISHES or drawing is used when the project is designed by an Architect or Interior designer. Color should be selected from manufacturers standard colors or identified in this specification only when the project has minimal finishes.

When the government directs that color be located in the drawings add a note that states: "Where color is shown as being specific to one manufacturer, an equivalent color by another manufacturer may be

submitted for approval. Manufacturers and materials specified are not intended to limit the selection of equal colors from other manufacturers. The word "color" as used herein includes surface color and pattern."

When more than one type, pattern or color is specified identify location and extent of work for each.

When a manufacturer's name, stock number, pattern, and color is used, be certain that the product conforms to this specification, as edited.

NOTE: Drawings are required for projects with floor patterns.

Provide color, pattern and texture in accordance with [Section 09 06 00 SCHEDULES FOR FINISHES][as indicated][[_____]. Color listed is not intended to limit the selection of equal colors from other manufacturers]. [Provide floor patterns as specified on the drawings.]

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

NOTE: When using the dry-set method to install tile on concrete or masonry surfaces, coordinate Section 03 30 00.00 10 CAST-IN-PLACE CONCRETE and Section 04 20 00 UNIT MASONRY, as applicable, to require (1) steel trowel and fine broom-finished concrete floors free of curing compounds and waxes, (2) masonry surfaces that are level and plumb with struck joints and square openings.

Inspect surface to receive tile in conformance to the requirements of TCNA Hdbk for surface conditions for the type setting bed specified and for workmanship. Provide variations of tiled surfaces that fall within maximum values shown below:

| TYPE | WALLS | FLOORS |
|------------------------------|------------------------------------|-------------------------------------|
| Dry-Set Mortar | 3 mm in 2.4 meter1/8 inch in 8 ft. | 3.0 mm in 3 meter1/8 inch in 10 ft. |
| Organic Adhesives | 3 mm in 2.4 meter1/8 inch in 8 ft. | 1.5 mm in 1 meter1/16 inch in 3 ft. |
| Latex Portland Cement Mortar | 3 mm in 2.4 meter1/8 inch in 8 ft. | 3.0 mm in 3 meter1/8 inch in 10 ft. |
| Epoxy | 3 mm in 2.4 meter1/8 inch in 8 ft. | 3.0 mm in 3 meter1/8 inch in 10 ft. |

3.2 GENERAL INSTALLATION REQUIREMENTS

Do not start tile work until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane

waterproofing have been installed and tested. Close space, in which tile is being set, to traffic and other work. Keep closed until tile is firmly set. Do not start floor tile installation in spaces requiring wall tile until after wall tile has been installed. Apply tile in colors and patterns indicated in the area shown on the drawings. Install tile with the respective surfaces in true even planes to the elevations and grades shown. Provide special shapes as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Solidly back tile bases and coves with mortar. Do not walk or work on newly tiled floors without using kneeling boards or equivalent protection of the tiled surface. Keep traffic off horizontal portland cement mortar installations for at least 72 hours. Keep all traffic off epoxy installed floors for at least 40 hours after grouting, and heavy traffic off for at least 7 days, unless otherwise specifically authorized by manufacturer. Dimension and draw detail drawings at a minimum scale of 6 mm = 300 mm 1/4 inch = 1 foot. Include drawings of pattern at inside corners, outside corners, termination points and location of all equipment items such as thermostats, switch plates, mirrors and toilet accessories mounted on surface. Submit drawings showing ceramic tile pattern [elevations][and][floor plans]. Submit manufacturer's preprinted installation instructions.

3.3 INSTALLATION OF WALL TILE

NOTE: This paragraph covers three different methods of installing tile on walls: the mortar bed method W211, W221, W222, W231, and W241; direct to masonry with dry-set mortar W202; and the organic adhesive method W223, and W242, 243 or 244. See TCNA Hdbk for detailed guidance.

General guidance is as follows:

Use the mortar bed method or cementitious backer board method for all prolonged wet areas such as showers. Use ceramic tile over gypsum board only in dry areas.

Dry-set mortar applied direct to masonry is suitable for all but prolonged wet areas such as showers.

The organic adhesive method will be limited to dry areas and will generally be used over gypsum wallboard.

Where more than one method is used for the same project, care must be taken to ensure that the drawings clearly indicate the various substrates and where each method is used. Where only one method is used on a project, clearly specify that method only.

Install wall tile in accordance with the TCNA Hdbk, method [_____] and with grout joints [[as recommended by the manufacturer for the type of tile][of [_____] mm][of [_____] inch]. [Install thinner wall tile flush with thicker wall tile applied on same wall and provide installation materials as recommended by the tile and setting materials manufacturer's to achieve flush installation.]]

3.3.1 Workable or Cured Mortar Bed

Install tile over workable mortar bed or a cured mortar bed at the option of the Contractor. Install a 0.102 mm 4 mil polyethylene membrane, metal lath, and scratch coat. Conform to TCNA Hdbk for workable mortar bed, materials, and installation of tile. Conform to TCNA Hdbk for cured mortar bed and materials.

3.3.2 Dry-Set Mortar and Latex-Portland Cement Mortar

Use [Dry-set] [or] [Latex-Portland Cement] to install tile in accordance with TCNA Hdbk. Use Latex Portland Cement when installing porcelain ceramic tile.

3.3.3 Organic Adhesive

Conform to TCNA Hdbk for the organic adhesive installation of ceramic tile.

3.3.4 Furan Mortar and Grout

Conform to TCNA Hdbk for furan mortar and grout installation.

3.3.5 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with TCNA Hdbk. [Provide and apply manufacturer's standard [_____] product for sealing grout joints in accordance with manufacturer's recommendations.]

3.4 INSTALLATION OF FLOOR TILE

NOTE: This paragraph covers two different methods of installing tile on floors. The mortar bed method F111, F112, F114, and F121 and direct to concrete with dry-set mortar method F113 and F115. See TCNA Hdbk for detailed guidance.

General guidance is as follows:

Use the mortar bed method for areas having a floor drain.

Dry-set mortar direct to concrete is suitable for areas without a floor drain or when it is not practical to recess the slab.

Where more than one method is used for the same project, care must be taken to ensure that the drawings clearly indicate the various substrates and where each method is used. Where only one method is used on a project, clearly specify that method only.

Install floor tile in accordance with TCNA Hdbk method [_____] and with grout joints [as recommended by the manufacturer for the type of tile][of [_____] mm][of [_____] inch]. Install shower receptors in accordance with TCNA Hdbk method [B414] [B415].

3.4.1 Workable or Cured Mortar Bed

Install floor tile over a workable mortar bed or a cured mortar bed at the option of the Contractor. Conform to TCNA Hdbk for workable mortar bed materials and installation. Conform to TCNA Hdbk for cured mortar bed materials and installation. Provide minimum 6.35 mm 1/4 inch to maximum 9.53 mm 3/8 inch joints in uniformed width.

3.4.2 Dry-Set and Latex-Portland Cement

Use [dry-set] [or] [Latex-Portland cement] mortar to install tile directly over properly cured, plane, clean concrete slabs in accordance with TCNA Hdbk. Use Latex Portland cement when installing porcelain ceramic tile.

3.4.3 Resinous Grout

NOTE: Use resin grout where chemical resistance is required. For quarry tile subject to severe chemical exposure conditions, use Section 09 35 16 CHEMICAL-RESISTANT QUARRY TILING.

Ensure the areas to receive resin grout are clearly indicated on the drawings or defined in the specifications. Due to the higher cost of this grout, its use will generally be limited to areas such as:

a. Within the areas bounded by a line 600 mm 2 feet outside of the trough areas for ranges, kettles, and ovens.

b. Within the areas of pot washing and dish washing. In small kitchens where it may be impracticable to subdivide areas for grouting, resin grout method F114 or F133 may be used throughout.

For severe chemical exposure such as meat packing plants and photo labs, resin grout method F134 will be used throughout and a resin setting-bed will be required. Wherever resin setting-bed is used, the concrete slab will be steel-troweled finished to the final slope of the finished floor. Set tile in a 3 mm 1/8 inch thick layer of epoxy-or furan-resin mortar. When using furan resins, the concrete slab will be neutralized or painted in accordance with the resin manufacturer's directions.

When resinous grout is indicated, grout quarry tile with either furan or epoxy resin grout. Rake and clean joints to the full depth of the tile and neutralize when recommended by the resin manufacturer. Install epoxy resin grout in conformance with TCNA Hdbk. Install resin grout in accordance with manufacturer's printed installation instructions. Provide a coating of wax applied from the manufacturer on all tile installed and furan resin. Follow manufacturer's printed installation instructions of installed resin grout for proportioning, mixing, installing, and curing. Maintain the recommended temperature in the area and on the surface to be

grouted. Protect finished grout of grout stain.

3.4.4 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with TCNA Hdbk. Provide and apply manufacturer's standard [_____] product for sealing grout joints in accordance with manufacturer's recommendations.

3.4.5 Waterproofing

Shower pans are specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE. Conform to the requirements of Section 07 12 00 BUILT-UP BITUMINOUS WATERPROOFING for waterproofing under concrete fill.

3.4.6 Concrete Fill

**NOTE: Select the first sentence in areas to receive
conductive ceramic tile.**

Provide a 24.1 MPa 3500 psi concrete fill mix to dry as consistency as practicable. [Compose concrete fill by volume of 1 part Portland cement to 3 parts fine aggregate to 4 parts coarse aggregate, and mix with water to as dry a consistency as practicable.] Spread, tamp, and screed concrete fill to a true plane, and pitch to drains or levels as shown. Thoroughly damp concrete fill before applying setting-bed material. Reinforce concrete fill with one layer of reinforcement, with the uncut edges lapped the width of one mesh and the cut ends and edges lapped a minimum 50 mm 2 inch. Tie laps together with 1.3 mm 18 gauge wire every 250 mm 10 inch along the finished edges and every 150 mm 6 inch along the cut ends and edges. Provide reinforcement with support and secure in the centers of concrete fills. Provide a continuous mesh; except where expansion joints occur, cut mesh and discontinue across such joints. Provide reinforced concrete fill under the setting-bed where the distance between the under-floor surface and the finished tiles floor surface is a minimum of 50 mm 2 inches, and of the same thickness that the mortar setting-bed over the concrete fill with the thickness required in the specified TCNA Hdbk method.

3.5 INSTALLATION OF TRANSITION STRIPS

**NOTE: Where the top of tile floors will occur at a
different elevation from the top of finished floors
in adjoining spaces, provision for marble thresholds
or saddles will be edited appropriately.**

Install transition strips where indicated, in a manner similar to that of the ceramic tile floor and as recommended by the manufacturer. Provide thresholds full width of the opening. Install head joints at ends not exceeding 6 mm 1/4 inch in width and grouted full.

3.6 EXPANSION JOINTS

**Note: Indicate expansion-joint details on the
drawings. Location of expansion joints should,
insofar as practical, be located outside the areas**

of tile finishes.

Form and seal joints as specified in Section 07 92 00 JOINT SEALANTS.

3.6.1 Walls

Provide expansion joints at control joints in backing material. Wherever backing material changes, install an expansion joint to separate the different materials.

3.6.2 Floors

NOTE: Delete the second sentence for projects where the use of tile is limited to small areas or long narrow corridors or where chemical resistant grouts are used.

Provide expansion joints over construction joints, control joints, and expansion joints in concrete slabs. Provide expansion joints where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 7 to 11 m 24 to 36 feet each way in large interior floor areas and 3 to 5 m 12 to 16 feet each way in large exterior areas or areas exposed to direct sunlight or moisture. Extend expansion joints through setting-beds and fill.

3.7 CLEANING AND PROTECTING

Upon completion, thoroughly clean tile surfaces in accordance with manufacturer's approved cleaning instructions. Do not use acid for cleaning glazed tile. Clean floor tile with resinous grout or with factory mixed grout in accordance with printed instructions of the grout manufacturer. After the grout has set, provide a protective coat of a noncorrosive soap or other approved method of protection for tile wall surfaces. Cover tiled floor areas with building paper before foot traffic is permitted over the finished tile floors. Provide board walkways on tiled floors that are to be continuously used as passageways by workmen. Replace damaged or defective tiles. Submit copy of manufacturer's printed maintenance instructions.

-- End of Section --